COMMONLY ACCEPTED AND APPLIED SINGLE LCA APPROACH FOR ZERO-EMISSION ROAD TRANSPORT

Introduction to the project and update on TranSensus LCA future methodology

Transensus LCA Consortium

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13/11/2024, EMES Workshop, DAY 2: AUTOMOTIVE LIFE CYCLE ASSESSMENT

www.lca4transport.eu

Funded by the European Union

GA # 101056715

The Coordinated and Support Action (CSA) TranSensus LCA

EU Funding **~3,7M€**

30 Months
Started in **January 2023**

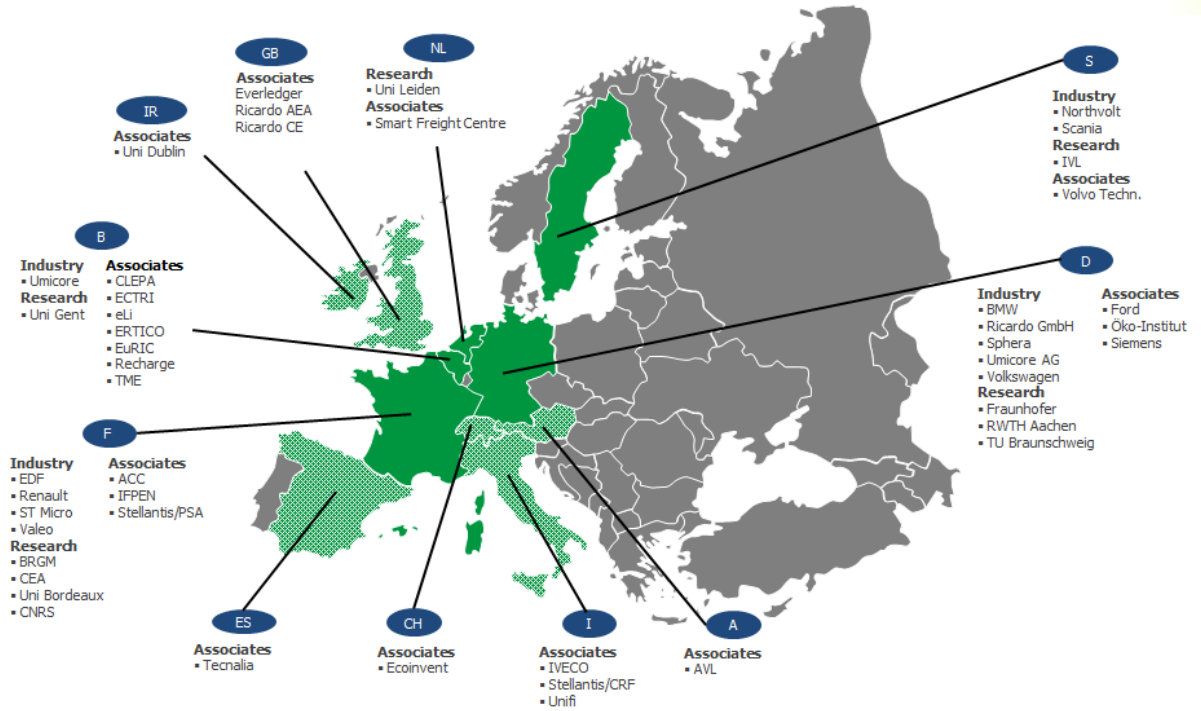
20 Beneficiaries
11 Industrial Partners
9 Research Partners

24 Associated Partners

4 Wider consultation groups

Commonly accepted and applied single LCA approach for zero-emission road transport

- Conceptualize and demonstrate a single, European-wide real-data LCA approach for zero-emission road transport
- Harmonization of methodologies, tools and datasets
- Elaborate an ontology and framework for a European-wide LCI database
- Conceptualize LCI data management and update along the life cycle and along the supply chain
- Paving the way for LCA-based product and business development
- Consensus building across all stakeholders



Draft of full methodology ~ Dec. 24
Finish June 25

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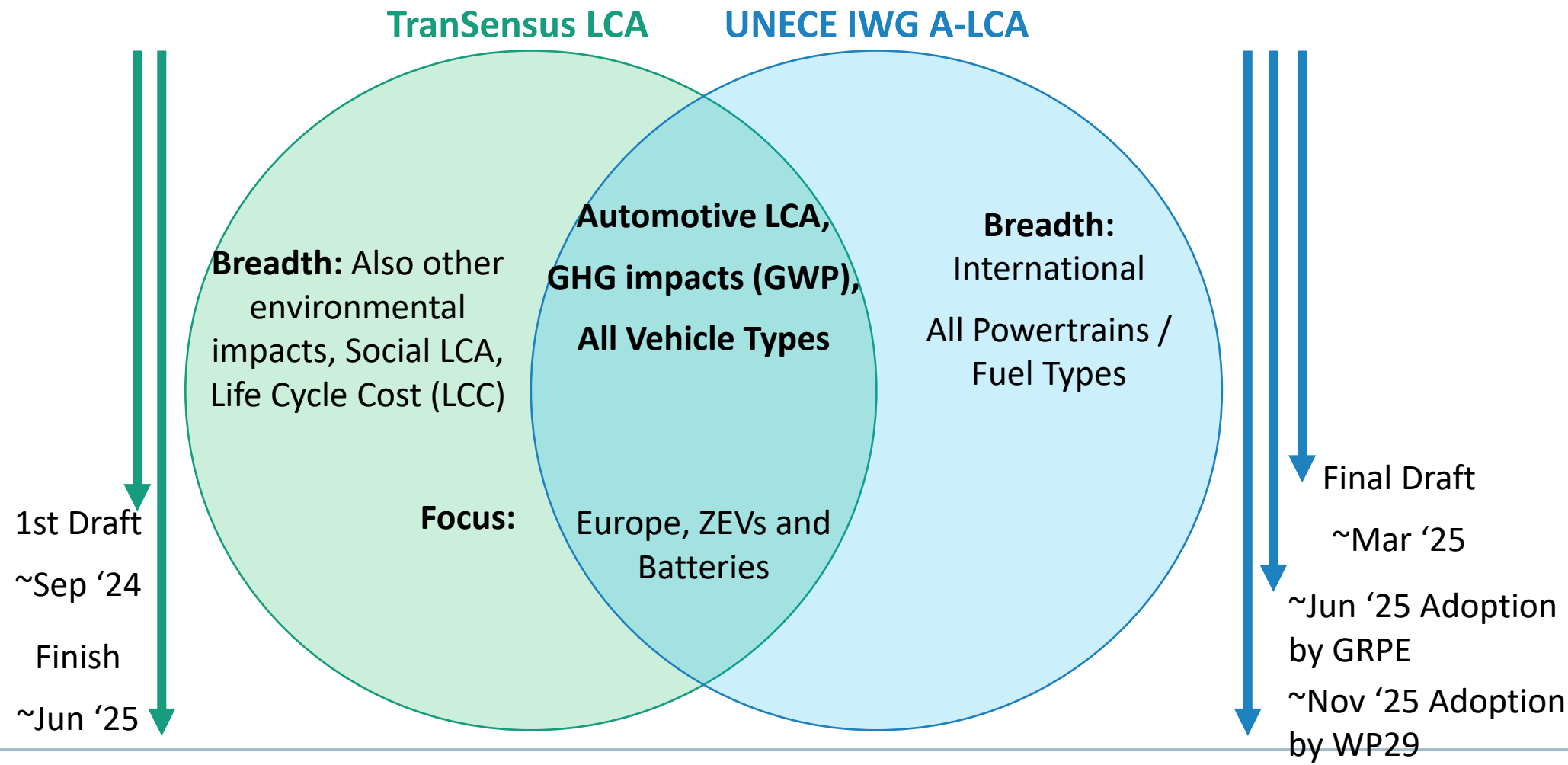
G&S Overlap: TranSensus LCA and UNECE IWG A-LCA



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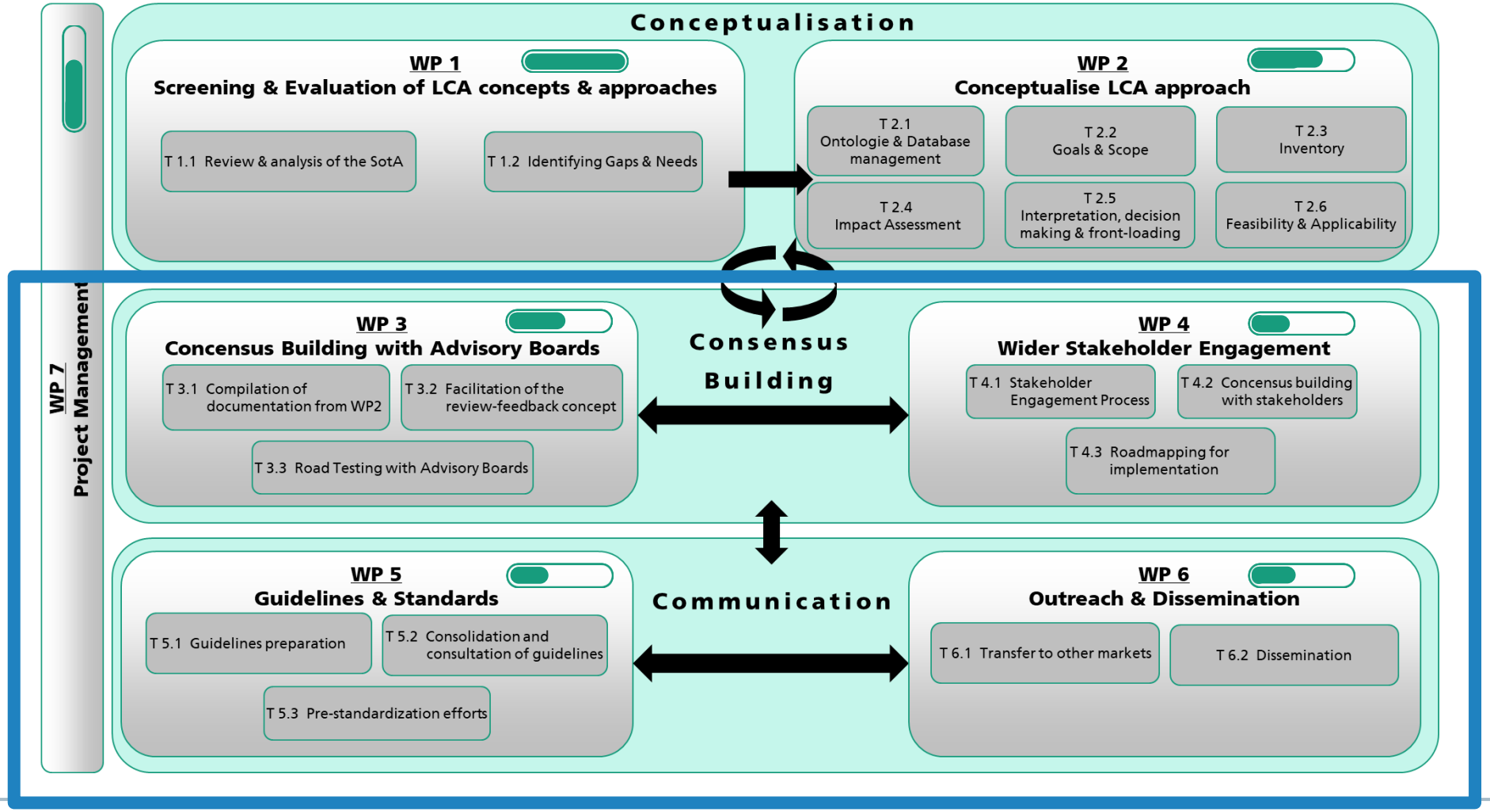
Perspectives

Consensus building and methodology editing



Progress indicator

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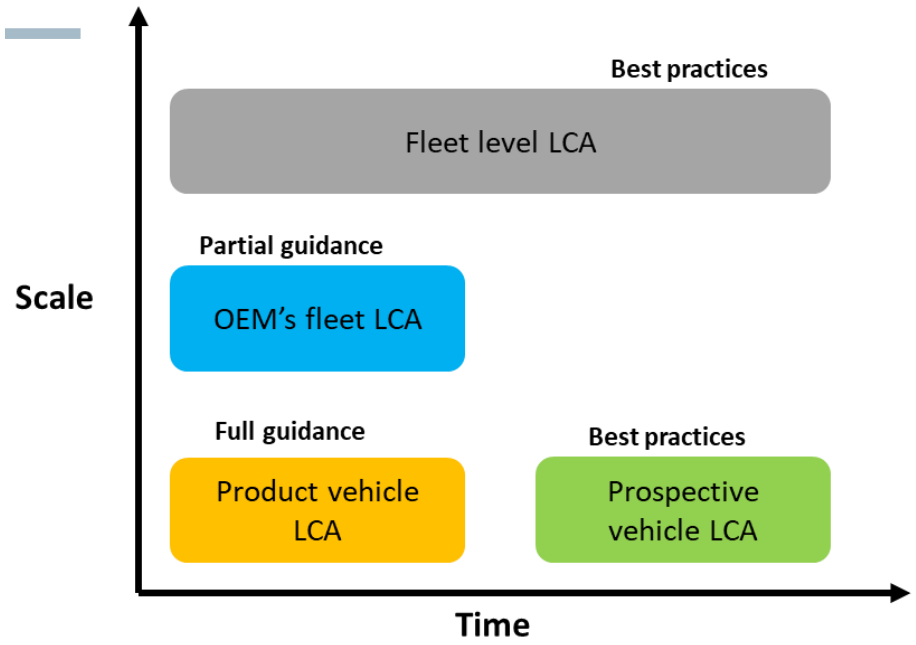
Type of LCA and level of guidance



Type	Definition
Product vehicle LCA	Evaluation of Vehicle's impacts **slightly before** or **after the start of production** . A **nearly finalised bill of materials of all parts** is available to the OEM.
Prospective vehicle LCA	Conducted in the development stage and aims to estimate **impacts before the start of production (several years)** . The **TRL is low** (TRL<6) and the BOM is not completely defined .
OEM's fleet LCA	Aims to evaluate the **weighted impact of a series of different products introduced by a single manufacturer** . Typically it is based on a **extrapolation** of vehicle LCAs .
Macro level fleet LCA	Conducted at the **sub, national or international level** to support **economy - scale strategies .** Fleet is typically generic, i.e. representative of a variety of manufacturers

Type of LCA	Degree of guidance	Level of constraint on requirements
Product vehicle LCA	Full guidance	Mandatory by default, unless it is expressively qualified as recommended or optional
OEM's fleet LCA	Detailed guidance (baseline = product LCA + specific guidance when needed)	Recommended by default unless it was explicitly built upon product LCA (LCIA, Interpretation)
Prospective LCA	Best practices (baseline = product LCA + best practices to deviate when needed)	Recommended by default unless it was explicitly built upon product LCA (LCIA, Interpretation)
Macro-Fleet LCA	Best practices (baseline = product LCA + best practices to deviate when needed)	Recommended by default unless it was explicitly built upon product LCA (LCIA, Interpretation)

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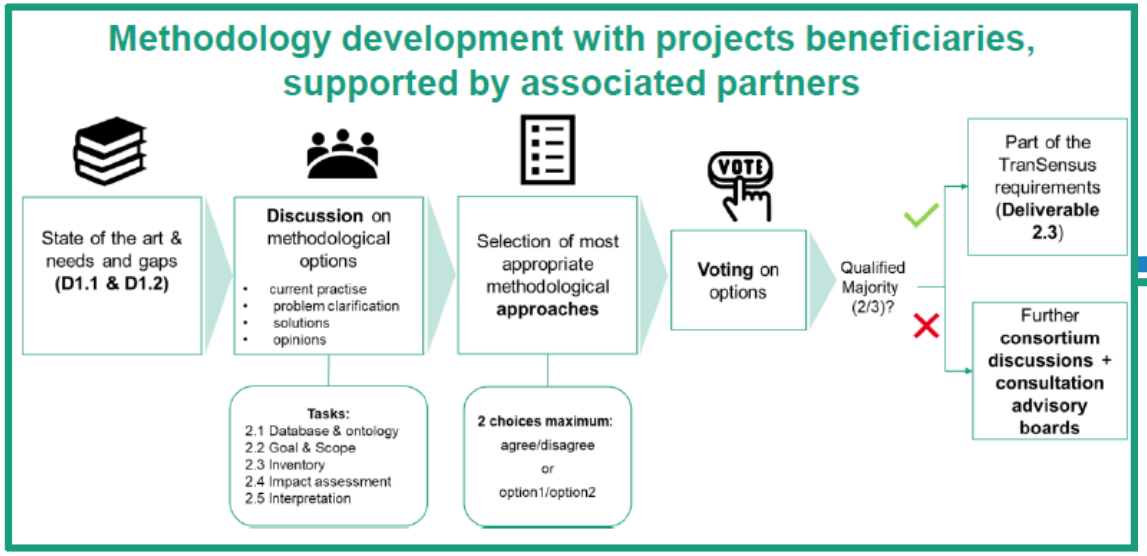
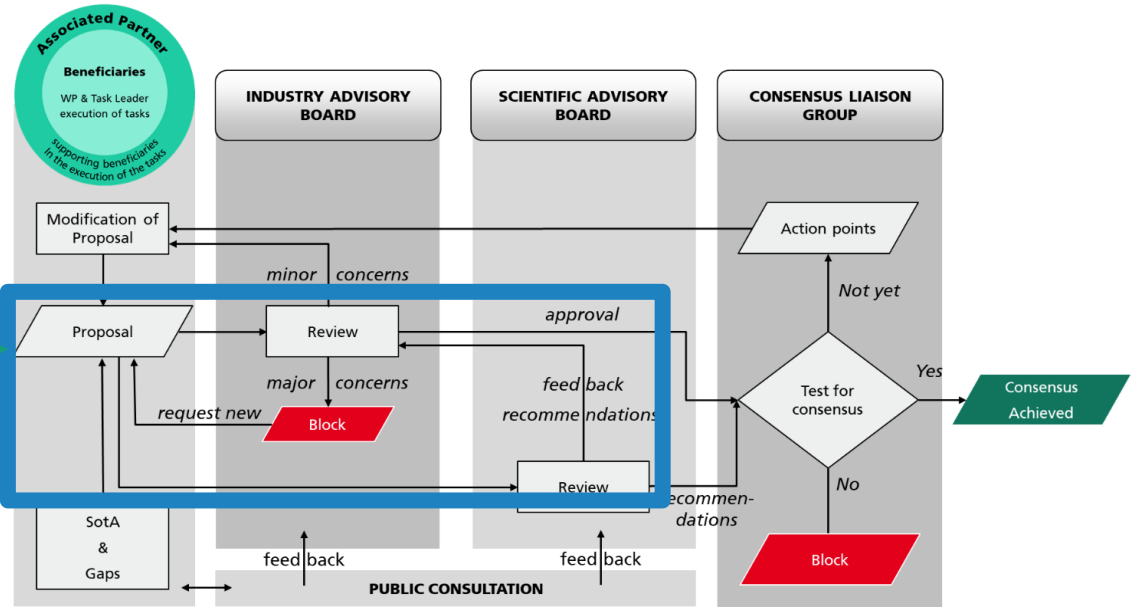
TSLCA iterative approach to develop the full methodology and seek wide concensus in parallel



1st Draft of the full methodology (D2.3) -> Dec. 24
Full guidance -> Jun. 25



Consensus building process in parallel until the end of the project (Jun ;'25)

Our 3rd "small" loop sine
Jan '23 closed end Sep '24

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Perspectives

Last iteration to integrate new requirements (on-going -> full draft Dec. 24)

Task 2.1 : Ontology LCI database

- Deliverable 2.1 submitted on time
- TLCAO files & the decomposition tree are available
- Task finalized (some updates on going)
- Further refinement of the ontology needed

Meetings on demand

Task 2.2 : G&S

1st recommendation of :
- LCA typologies
- Technology coverage
- System boundary
- Functional unit

New topics:
- Default values
- OEM fleet LCA
- Fleet level LCA
- Prospective LCA

Task 2.3 : Inventory

1st recommendation of :
- Data collection
- Multifunctionality

Discussion on going
- Iry vs IIry data
- Electricity modeling
- Multifunctionality

New topics:
- Fleet level and prospective LCA
- Data quality, H_2 etc.

Task 2.4 : Impact assessment

1st recommendation of :
- Set of IC

Discussion on going
- Restrictive set of IC
- Normalisation & weighting

New topics:
- Dissipation
- Testing of software
- Fleet and Propective LCIA

Extra S-LCA task

1st recommendation of :
- G&S: UNEP guidelines
- Multifunctionality
- Pedigree matrix
- Ref scale approach

Discussion on going:
- Data collection

New topics:
- Interpretation S-LCA

T2.5 Interpretation

- Discussion on going: Uncertainty, sensitivity & scenario analysis – parameters list
- New topics: Integration in product. Dev; Reporting

T2.6. Viability

New topic : Feasibility (POC with OEM and real data)

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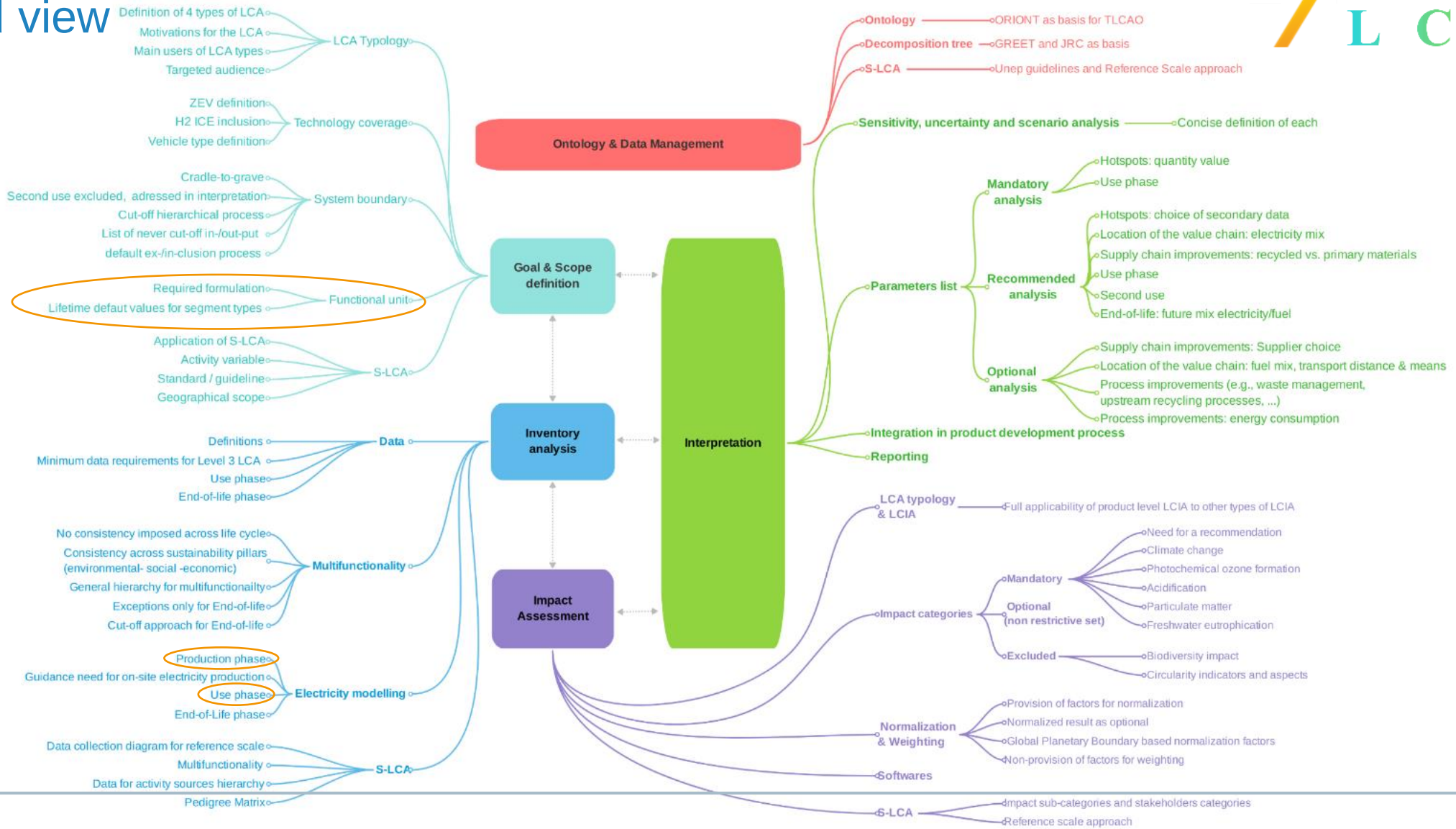
TSLCA methodology – requirements already integrated

Simplified view



Examples of on-going topic work given in this presentation

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Example of requirement

Functional unit for Product vehicle LCAs

- **The functional unit of different vehicle types for the retrospective vehicle LCA is based on the lifetime of the vehicle stated as kilometers. The following functional units shall be used:**
  - tonne*km for freight vehicles
  - passenger*km for busses and
  - passenger*km for passenger cars with the default assumption of one passenger which then equals to vehicle*km for passenger cars. Occupancy rates for the passenger car are to be addressed as part of a sensitivity analysis.

- **For the lifetime kilometers assumptions, following hierarchy shall be followed:**

1. Shall use lifetime kilometers on a segment basis

Table: example of default values for passenger cars & LCV, based on PRIMES-TREMOVE

Lifetime activity, km	Passenger car					LCV		
	Small A/B	Lower medium C	Upper medium D	Large Others	All*	Small	Medium	Large
All powertrains	190,000	202,000	205,000	257,000	203,000	236,000		

2. Different lifetime assumptions allowed if sufficiently justified (with recommended process for justifications)
3. OEMs may opt to use a more generic approach:

   generic lifetime for passenger cars of all segments: 203,000 km above can be rounded to 200,000 km

4. Same approach for explicitly comparative studies.

In addition, TSLCA proposes to perform a mandatory analysis on the vehicle lifetime in the interpretation phase of the conducted LCA.

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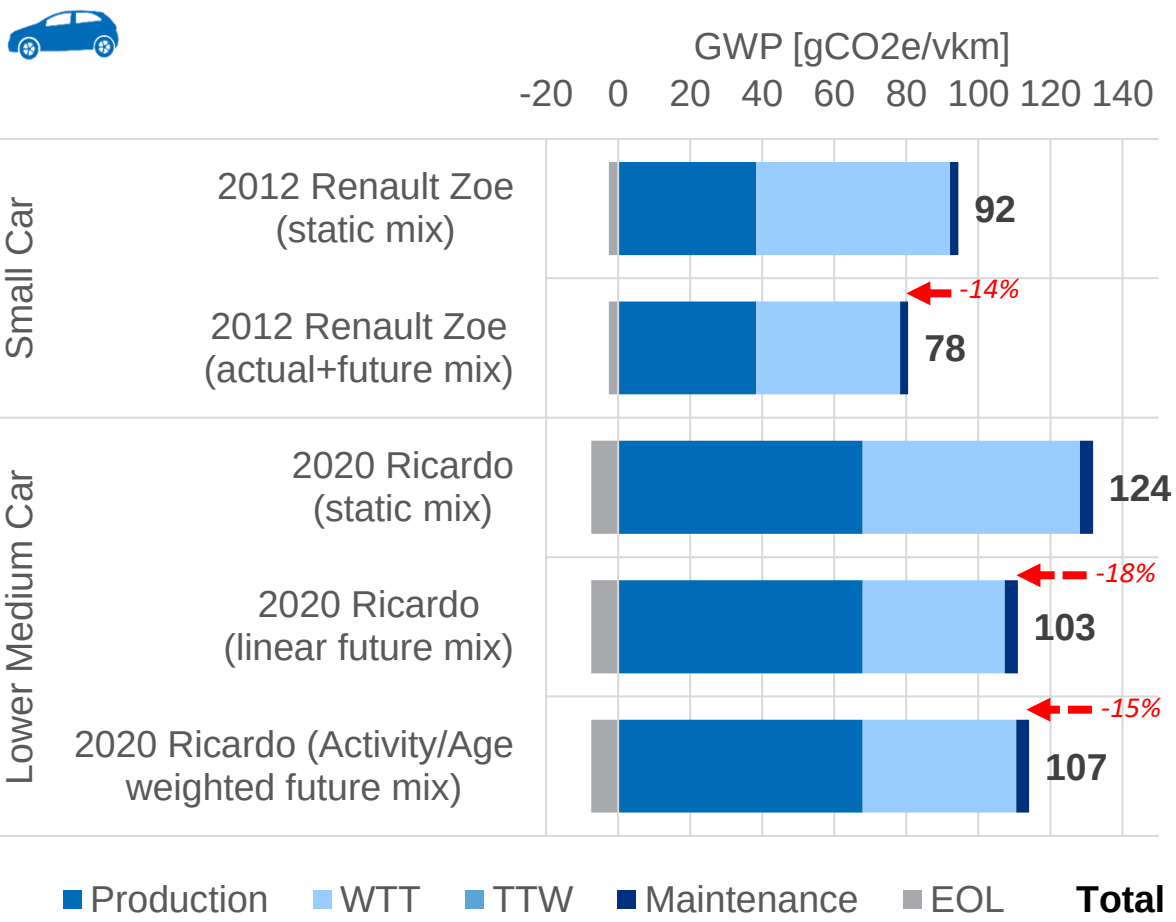
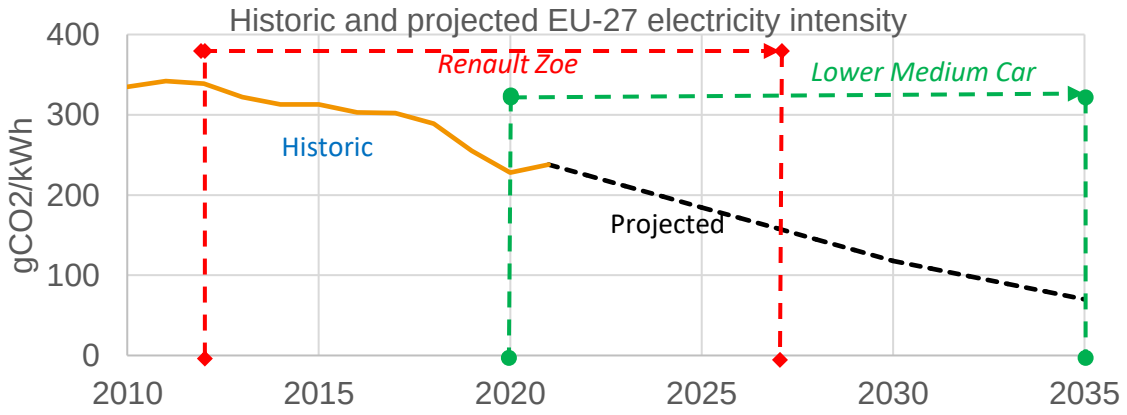
Example of requirement

Electricity modelling for the use phase - background



- Dynamic mix is demonstrably more accurate than using a static mix from an historical perspective, and for future performance based on current policy projections
- GHG emissions intensity of electricity have been steadily reducing since 1990 (from ~500 gCO_2e/kWh)
- Illustration shows the effects considering historical examples (i.e. based LCA of a real vehicle model) and current projections
  - Using a static mix overestimates total lifecycle GWP
  - Weighting by age-dependant km has smaller effect



Source: (1) Renault_ZOE_LCA_Report_2012.pdf (gronamobilister.se); (2) Ricardo vehicle LCA modelling, October 2023; (3) EEA , 2023: Greenhouse gas emission intensity of electricity generation in Europe (europa.eu) -

Notes: 2012 vehicle energy consumption based on NEDC; adjusted to WLTP (via official data for Wh/km NEDC and WLTP from CO2 monitoring); 2020 generic vehicle based on WLTP average for segment; Normalised to 200,000 km lifetime over 15 year life.

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Example of requirement

Electricity modelling for the use phase

- TSLCA proposes following approach to model the electricity input to the use phase of BEVs:
  1. TranSensus LCA **SHALL use a "dynamic" modelling approach**, informed by a reputable energy futures scenario (to be determined - e.g., IEA WEO STEPS) in order to model the electricity input to the use phase of BEVs.
  2. **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 to model the electricity input throughout the entire use phase of BEVs.
  3. The **same approach SHALL be used in all instances of explicitly comparative LCAs**, which are aimed at making "comparative assertions", as defined by ISO 14044.

- In addition, TSLCA proposes performing an analysis in the interpretation phase of the LCA on:
  - The quantity of energy consumed during the use phase using real world (RW) factors
  - Geographical variation of the energy consumed (electricity mix or H2 mix) during usage

- On-going iteration:
  - Precise guidance to support harmonized dynamic modelling
  - Performing and analysis of dynamic modelling approach influence on results if static modelling was used, in LCA interpretation phase
  - Guidance to account for RW effects and degradation in energy consumption calculation for the use phase

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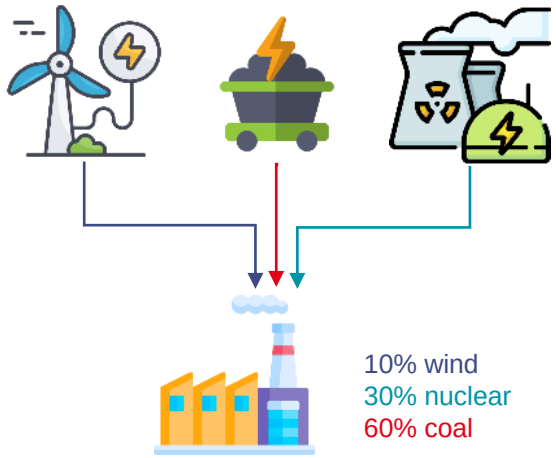
Example of on-going work to reach a requirement

Electricity modelling for the production phase

- **Challenge:**
  Consistency to **avoid double counting** of the renewable energy generation and **accurately represent** environmental impact of the product.

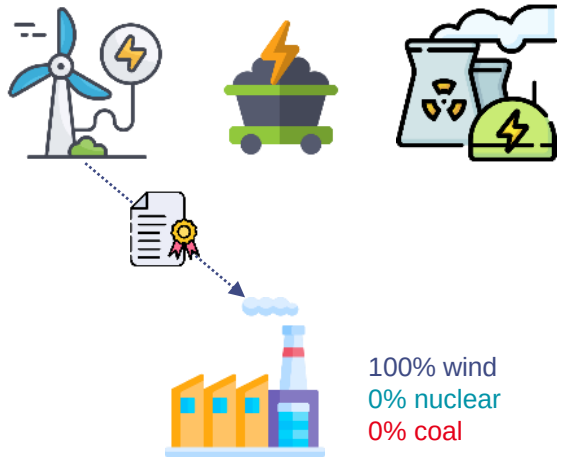
- **It exists two main approaches to tackle electricity consumption modelling within a product LCA production phase:**

Location-based approach



Based on the physical average consumption mix of a country or region electricity-consuming facilities

Market-based approach



Use EACs and country/region residual mixes for processes without EACs

Figure from [Pinochet., 2024] M. Pinochet, E. Monnier, F. Perdu, A-L. Bui Van, European-wide harmonized, commonly accepted and applied single life cycle assessment (LCA) approach for a zero-emission road transport system - Pre-standardizing results of the TranSensus LCA project, Battery 2030+ conference, 28-29 May 2024, Grenoble, France

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Example of on-going work to reach a requirement

Electricity modelling for the production phase

- **Problem**
  - No risk of double counting with a systematic and consistent approach (location-based or a 100% market-based electricity modelling)
  - Location-based actual use and practices face very low probability of double counting
  - Location-based approach prevents voluntary individual approach purchasing low-carbon energy to promote it and derive credit from it.
  - Market-based approach actual use and practices face high probability of double counting because residual mixes modelling and actual databases leads to mixing location-based modelling within the overall system modelling

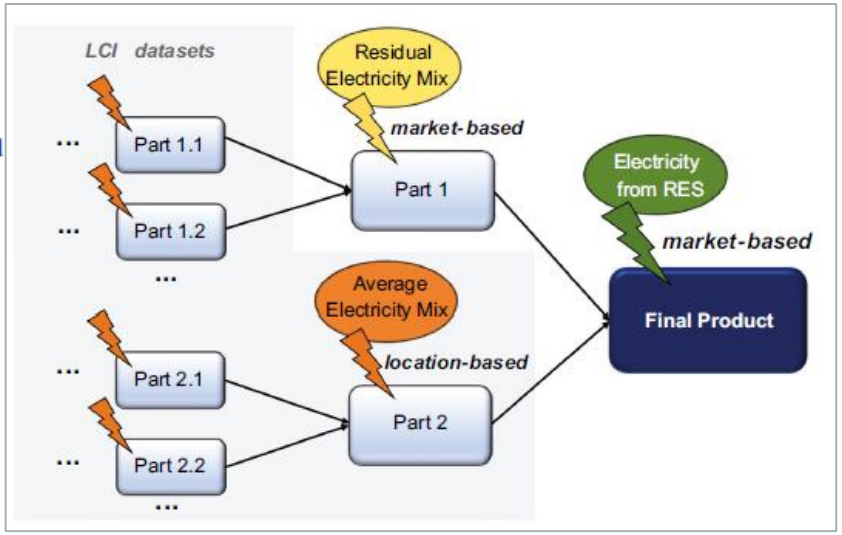

Fig. 3 Overview of simplified example illustrating the parallel use of location- and market-based electricity mixes in one LCA and GHG accounting, when including both market-based electricity and average LCI datasets with location-based electricity inputs

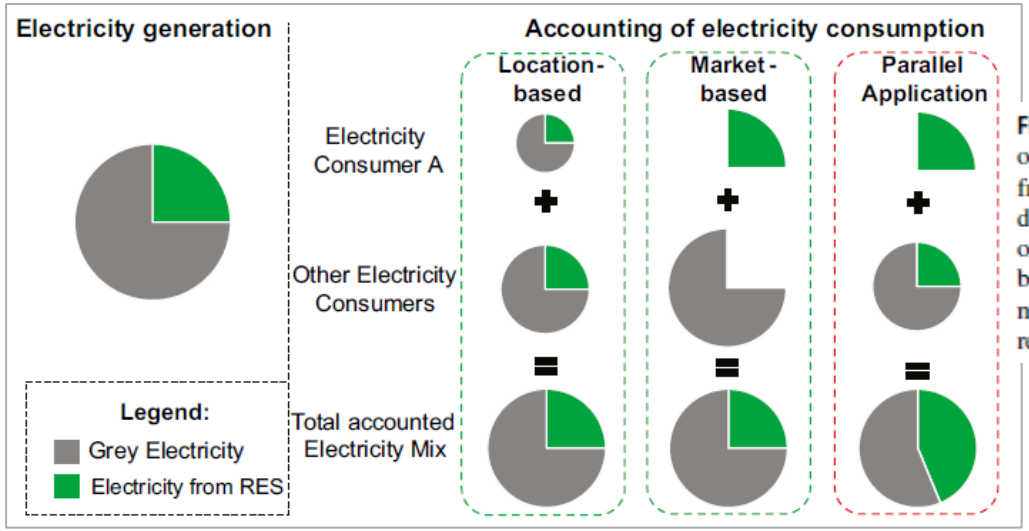

Fig. 2 Illustration of challenges of double counting electricity from specific energy sources due to a parallel application of location-based and market-based electricity accounting method, based on a hypothetical region

Figures from [Holzapfel et.al., 2023] Peter Holzapfel, Vanessa Bach and Matthias Finkbeiner. Electricity accounting in life cycle assessment: the challenge of double counting, published in April 2023, in The International Journal of Life Cycle Assessment. Electricity accounting in life cycle assessment: the challenge of double counting | The International Journal of Life Cycle Assessment (springer.com)

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Example of on-going work to reach a requirement

Electricity modelling for the production phase

- **Already integrated developments to address our problem**
  - We propose a **hierarchy** to use for market-based electricity modelling:
    1. Supplier-specific contracts ▸ 2. Supplier-specific total mix ▸ 3. Residual mix in the country ▸ 4. Regional residual mix
  - We agreed on the importance of **safeguards** developments to guide 100% market-based approach to guarantee
    - **Additionality** (e.g. promoting only EACs that support effectively new decarbonisation efforts)
    - Bundling with production or production/consumption **physical link**
      (e.g. EACs used in Europe claiming Iceland electricity not physically linked to the continent)
    - Synchronicity or Production/consumption **time synchronization**
      (e.g. production times of some renewable energy plants are determined by natural conditions and not by manufacturing schedules)
    - **No negative emissions** or impacts from excess of production not consumed

- On-going iteration:
  - Decision tree to guide overall electricity modelling approach to follow in TSLCA, location-based and market-based are both considered
  - Guidance to ensure needed safeguards
  - Supported with:
    - Documentation of the actual industrial practices of the mixed-approach thanks to our industrial partners.
    - Feasibility assessment of 100% market-based approach with data availability and effort needed

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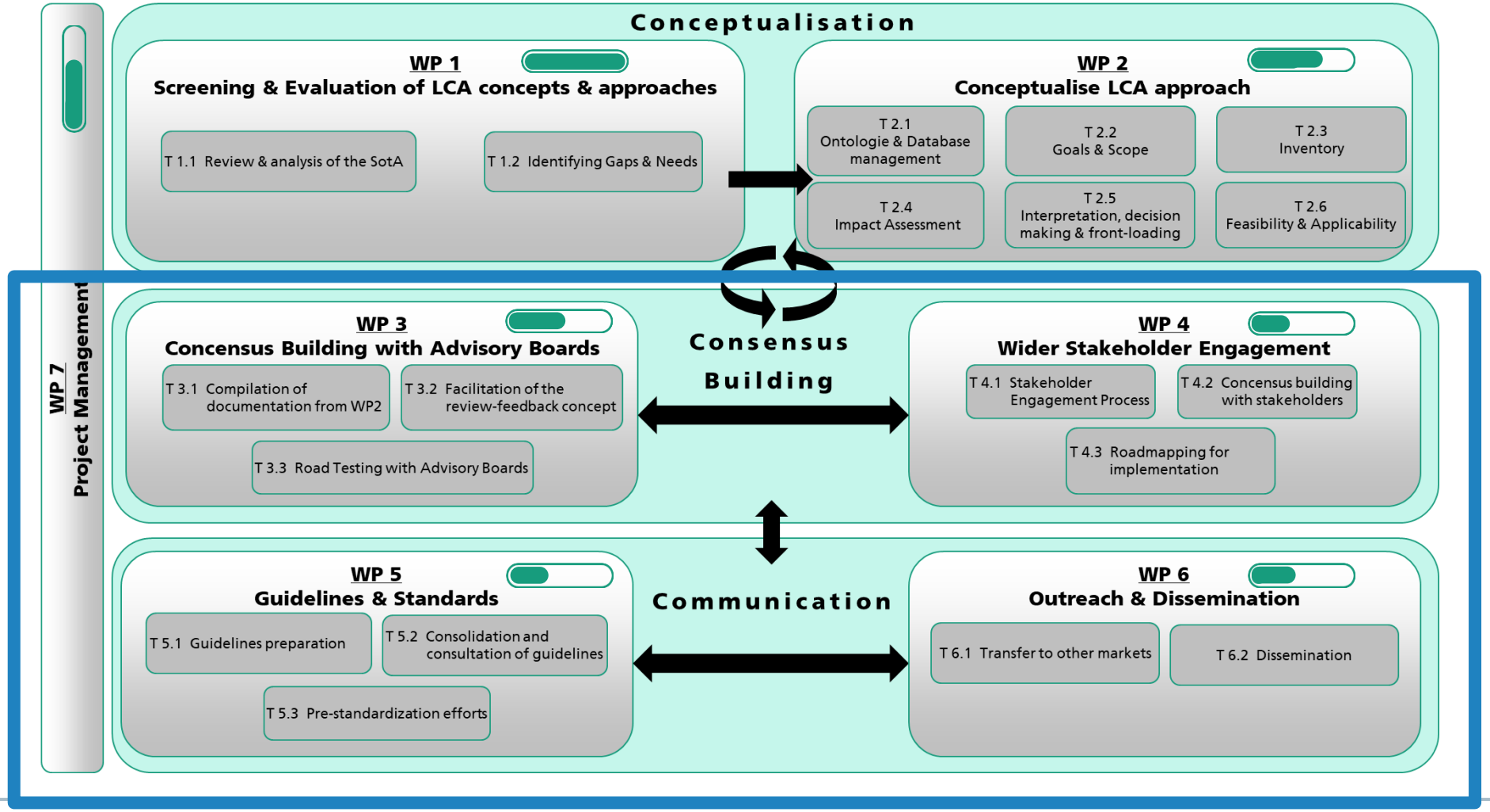
Perspectives

Consensus building and methodology editing



Progress indicator

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More information

- www.lca4transport.eu

- **Please register to our newsletter to recieve all public consultations invitations**

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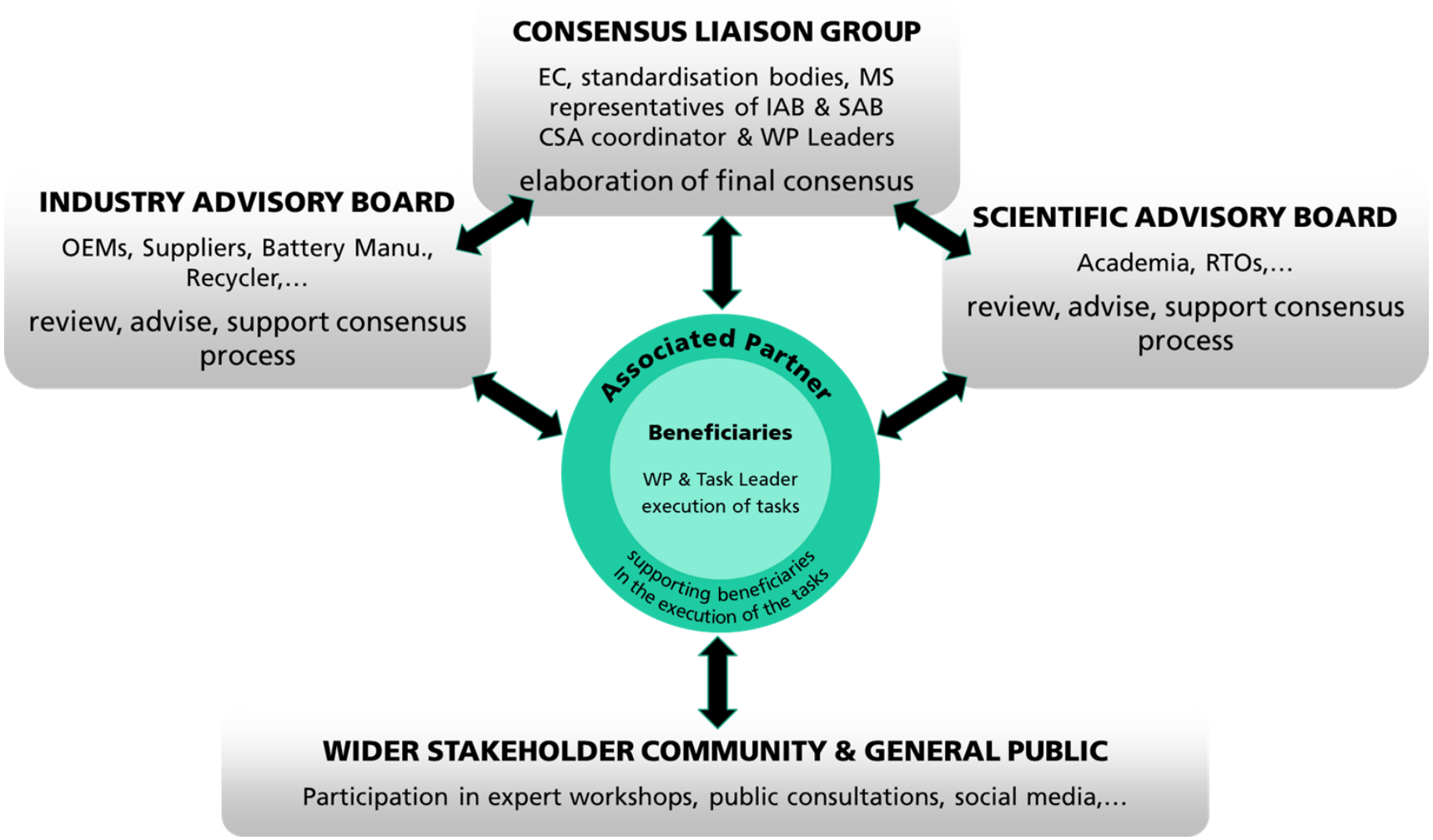
Broadening consensus building

TranSensus LCA Management Structure



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