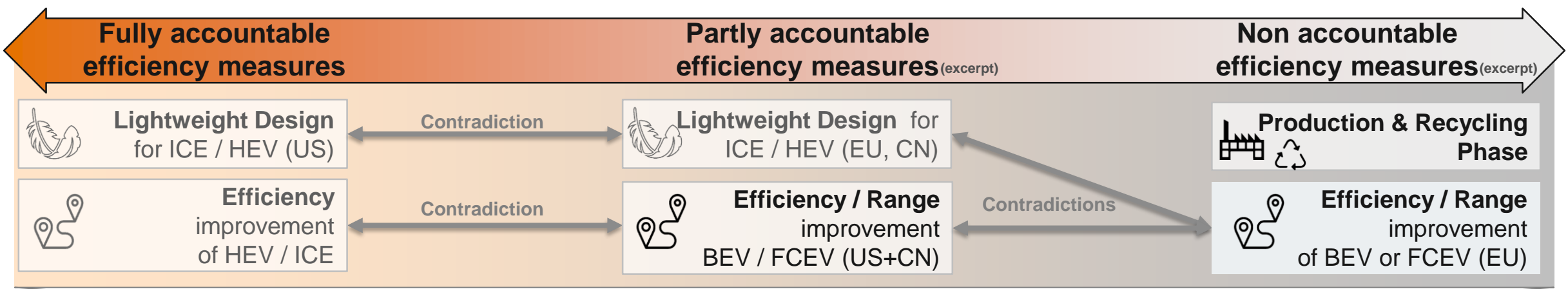


**Holistic evaluation of components and systems  
for electrified vehicles – Life cycle assessment  
as a decisive factor in the innovation and  
development process?**



- » **Sustainability in the Automotive Value Chain**
- » **Life Cycle Assessment of a Battery Case**
- » **E<sub>2</sub>P - fka's Approach to Assess Sustainability holistically**
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- » **Conclusion**

# Several efficiency measures are not or not fully accounted in current CO<sub>2</sub> legislation – e.g. EV efficiency improvements



- Currently: pure orientation on tailpipe emissions in international legislation
- **Perspective: Legislation addresses further measures as well as production and recycling phase**

## Life Cycle Assessment

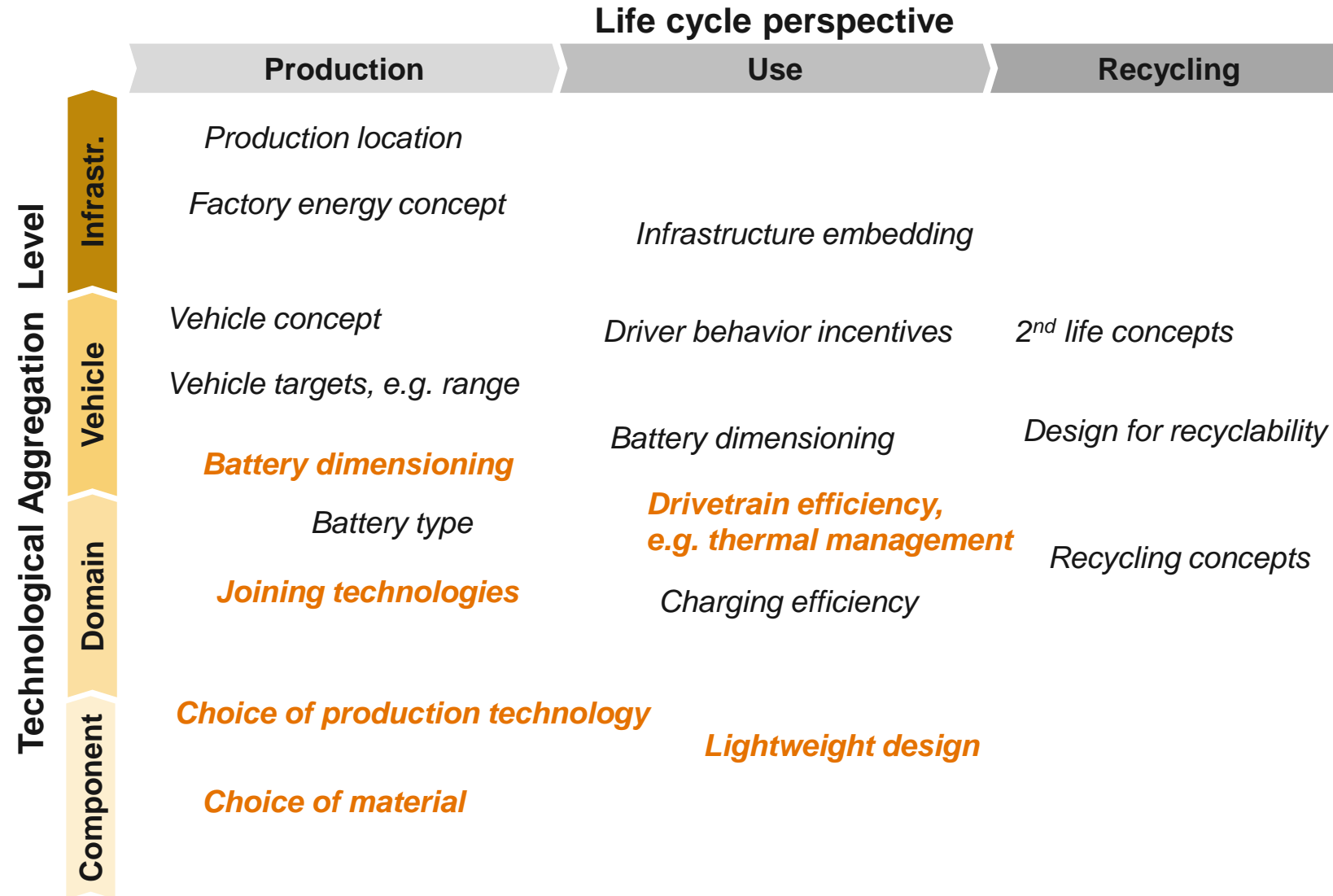


*European Commission is obligated to evaluate options for LCA until 2023*



- **Monitor the CO<sub>2</sub> emissions of the full vehicle lifecycle, including production and recycling**
- **Perspectively integrate LCA (or elements thereof) into legislation to ensure a comprehensive CO<sub>2</sub> reduction**

# In the medium-term, life cycle assessment could be a game changer for technological decisions



- » The number of options / decisions increases significantly, when **LCA is the baseline of legislation.**
- » However, a full LCA is a very **complex task**
- » Most probably, **legislation could start** with a reduced approach including **predefined values**, e.g. energy efficiency of material production
- » Further undefined factors include the methodology, e.g. credit approach



# OEM are outpacing the legislator in decarbonization, putting tremendous pressure on suppliers



## Measures in the supply chain (examples)



**Mercedes-Benz announced to strive a carbon-neutral car production in Europe 2022, all plants by 2039. Transparency on CO<sub>2</sub> footprint and CO<sub>2</sub> as an award criteria in the supply chain.**



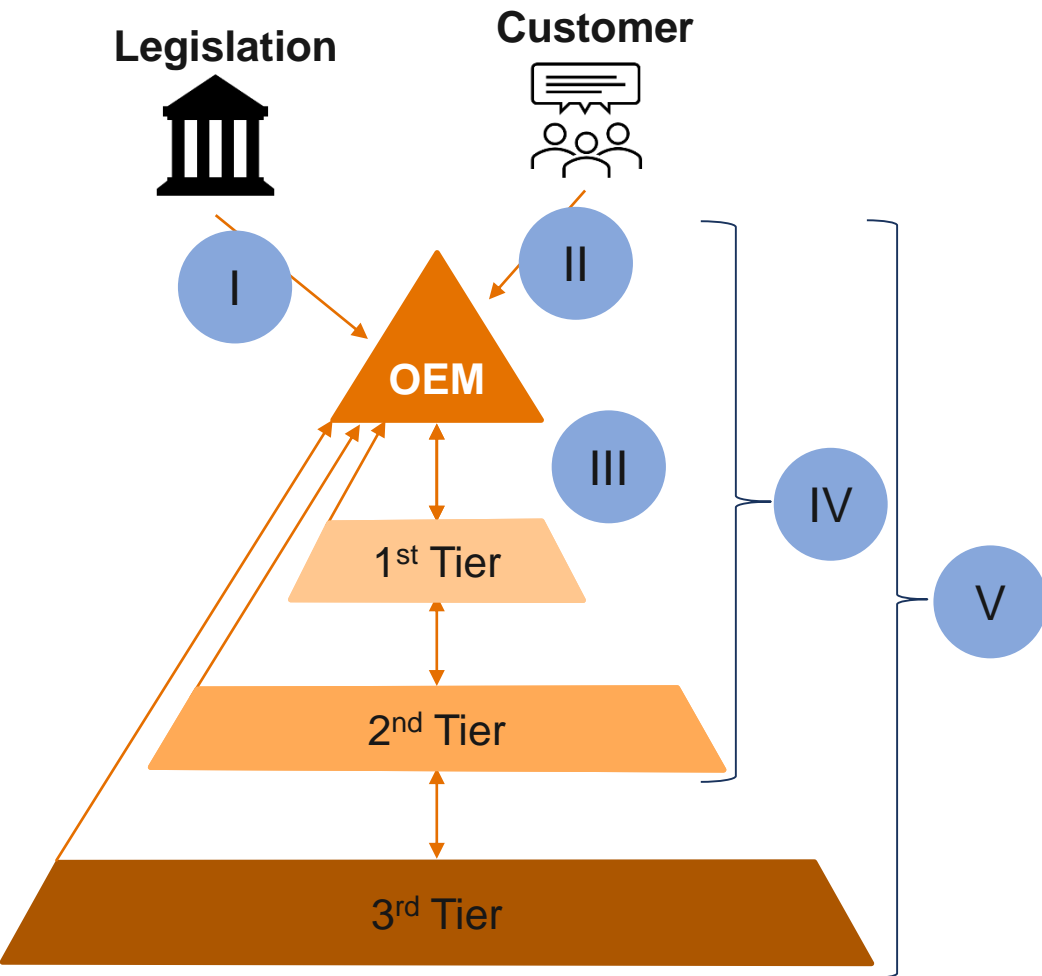
**Volkswagen announced to introduce a mandatory environmental ranking system for their suppliers, which requires full transparency about lifecycle emissions**



## Conclusion

**Sustainability, esp. CO<sub>2</sub> footprint becomes as a decisive factor in the automotive value chain**  
**Suppliers have to consider CO<sub>2</sub> in technology strategies**

# Deeper look on the LCA roles along the value chain



I Emission reduction targets, including life cycle approach in future potentially

II Demand for sustainability incl. (limited) willingness-to-pay

III 1<sup>st</sup> Tier is made responsible for the further LCA management of the value chain

IV Further integration task and monitoring of own LCA footprint

V LCA analysis of production layout and component designs

## Key Questions

- » How to adapt own processes to **lower CO<sub>2</sub> emission**?
- » How to actively **integrate LCA** into development and **innovation processes**?

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# Technology strategy with E<sub>2</sub>P: Step-by-step approach to determine life-cycle indicators, costs and performance



- » Analysis of the decision environment
- » Definition of the specific OEM or end customer requirements



- » Identification of performance indicators
- » Systematic determination of a weighting



- » Life cycle analysis (LCA), e.g. determination of GWP / CO<sub>2</sub> footprint
- » Cost analysis
- » Quantification of the technological performance



- » Calculation of indicator values
- » Transparent comparison of all weighted performance indicators in a two-dimensional portfolio representation (E<sub>2</sub>P)



- » Development of a technology strategy
- » Strategic recommendations for action

## Environmental Analysis

1



2



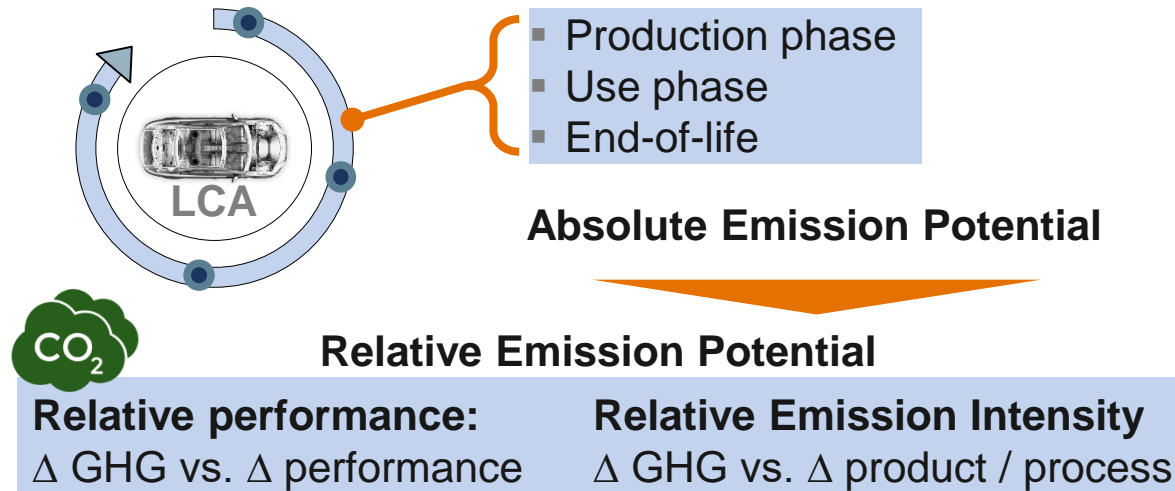
3



## Strategy

# Holistic E<sub>2</sub>P approach allows to efficiently analyze the Economical and Ecological effects of a particular Performance modification.

## LCA investigation



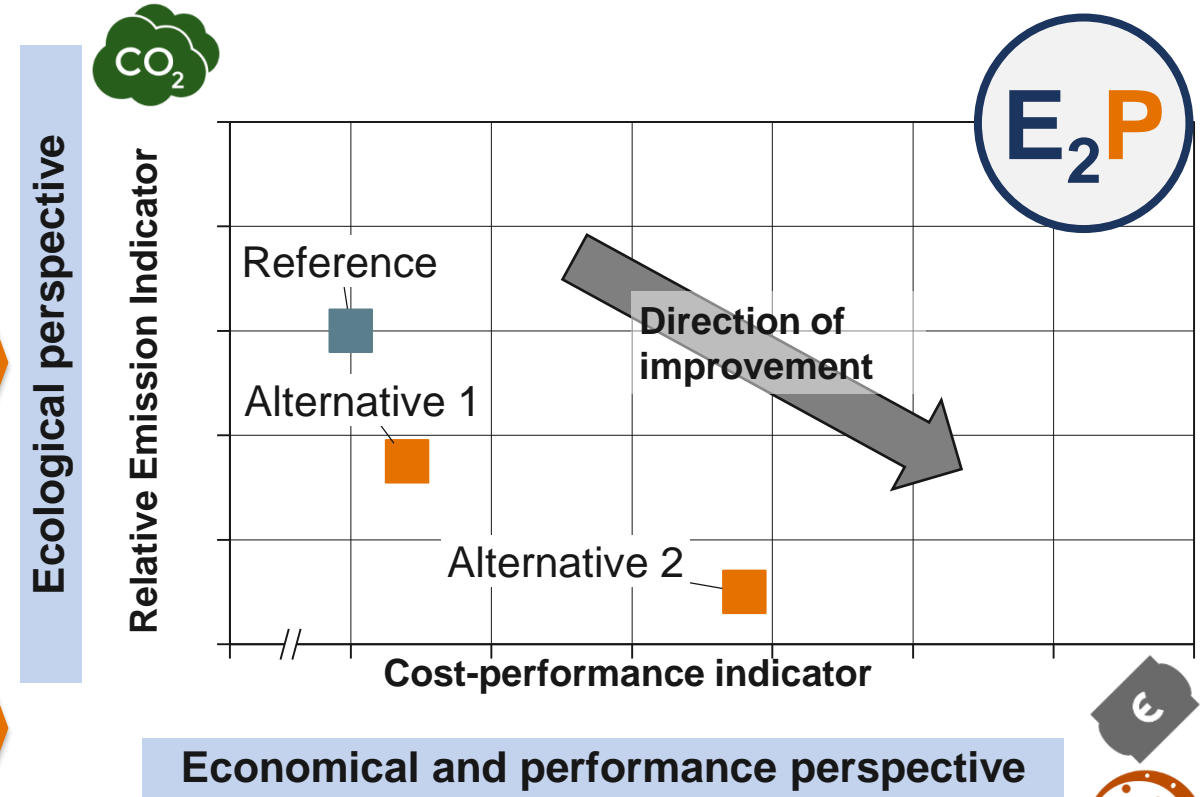
## Holistic performance indicator (component / vehicle)



### Outcome

Relative emission potential over the entire life cycle  
Holistic performance indicator (Cost and Technology)

## E<sub>2</sub>P portfolio assessment



### Outcome

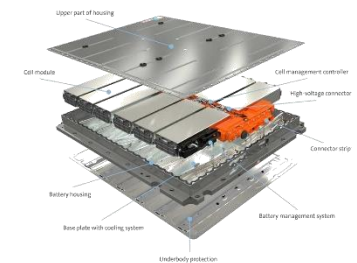
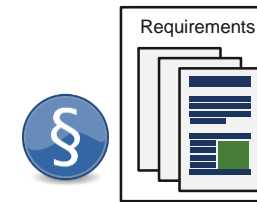
⇒ E<sub>2</sub>P-label: Economic, Ecological & Performance  
⇒ Neutral analysis for internal and external use

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- » The **target** of the study is to understand general requirements and boundary conditions for the development of battery housings in electric vehicles, and, on this basis, **outline the potential for the application of aluminium** by performing a technical, ecological and economical assessment.
- » A **comparative study between aluminium and steel** shall present the **advantages and possible challenges** of aluminium.
- » An existing CAD model, reengineered based on the design of the **structural parts of the Volkswagen ID.3** aluminum battery case will be **used as a reference**.

- WP1 – Identification and systematisation of requirements
- WP2 – Research on current steel concepts
- WP3 – Virtual assessment of case concepts
- WP4 – Holistic assessment of concepts
- WP5 – Comparative study and documentation



- » **Sustainability in the Automotive Value Chain**
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## Life cycle assessment as a decisive factor in the innovation and development process?

### Automotive Value Chain



- » Legislation is beginning to reflect LCA aspects
- » OEMs force sustainability, esp. CO<sub>2</sub> footprint becomes a decisive factor in the automotive value chain and suppliers have to consider CO<sub>2</sub> in technology strategies

### Technology Perspective



- » LCA thinking needs to be implemented into the product development process
- » Solely focus on view on the GWP over the entire life cycle neglects performance and economic boundary conditions
- » Consequently, a holistic approach is needed in the innovation and development process

### Holistic Toolkit



- » E<sub>2</sub>P helps to evaluate technology options already in the concept phase and therefore enables comprehensive technology strategies to comply with the changing decision factors in supplier awards

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