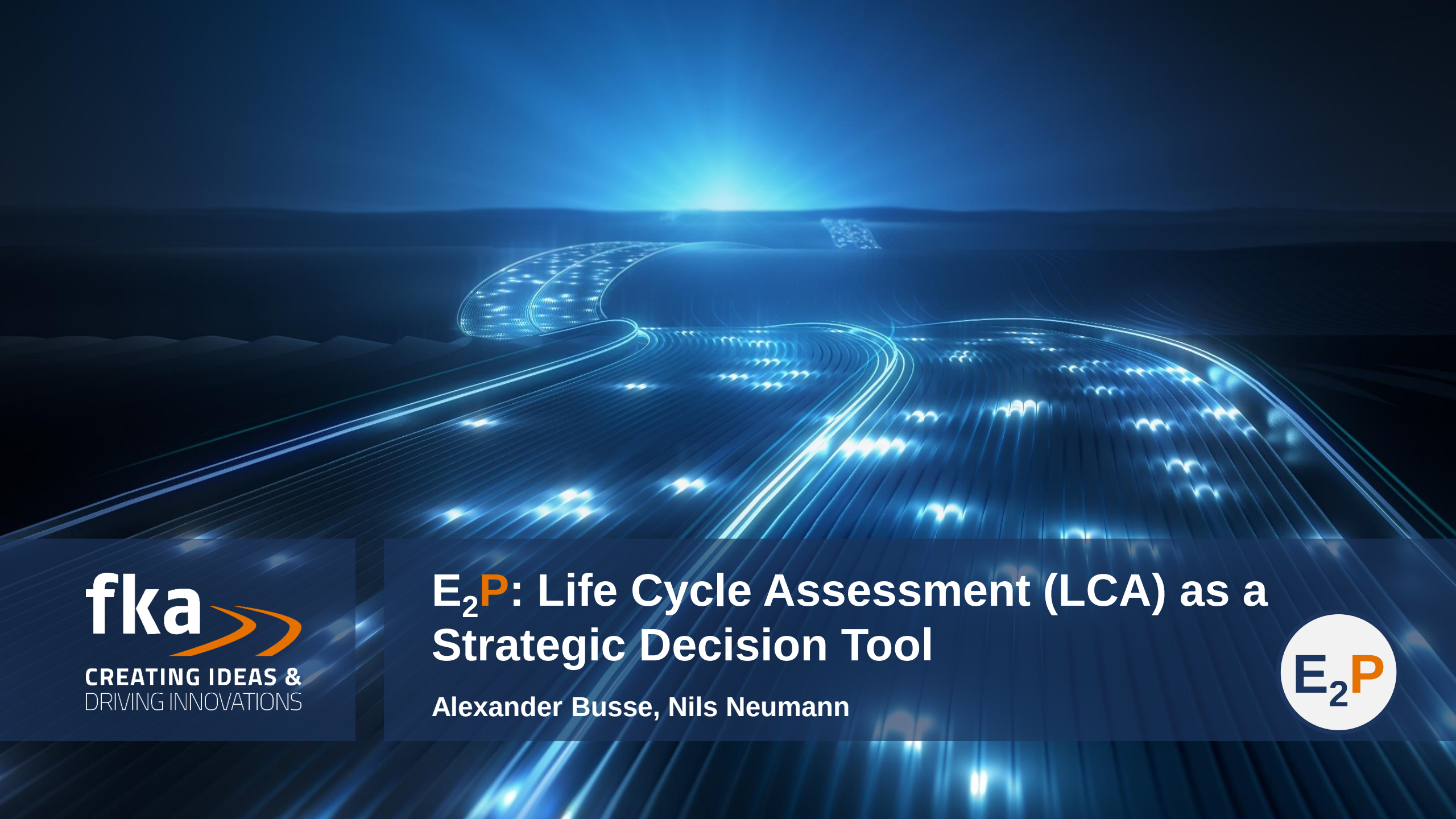


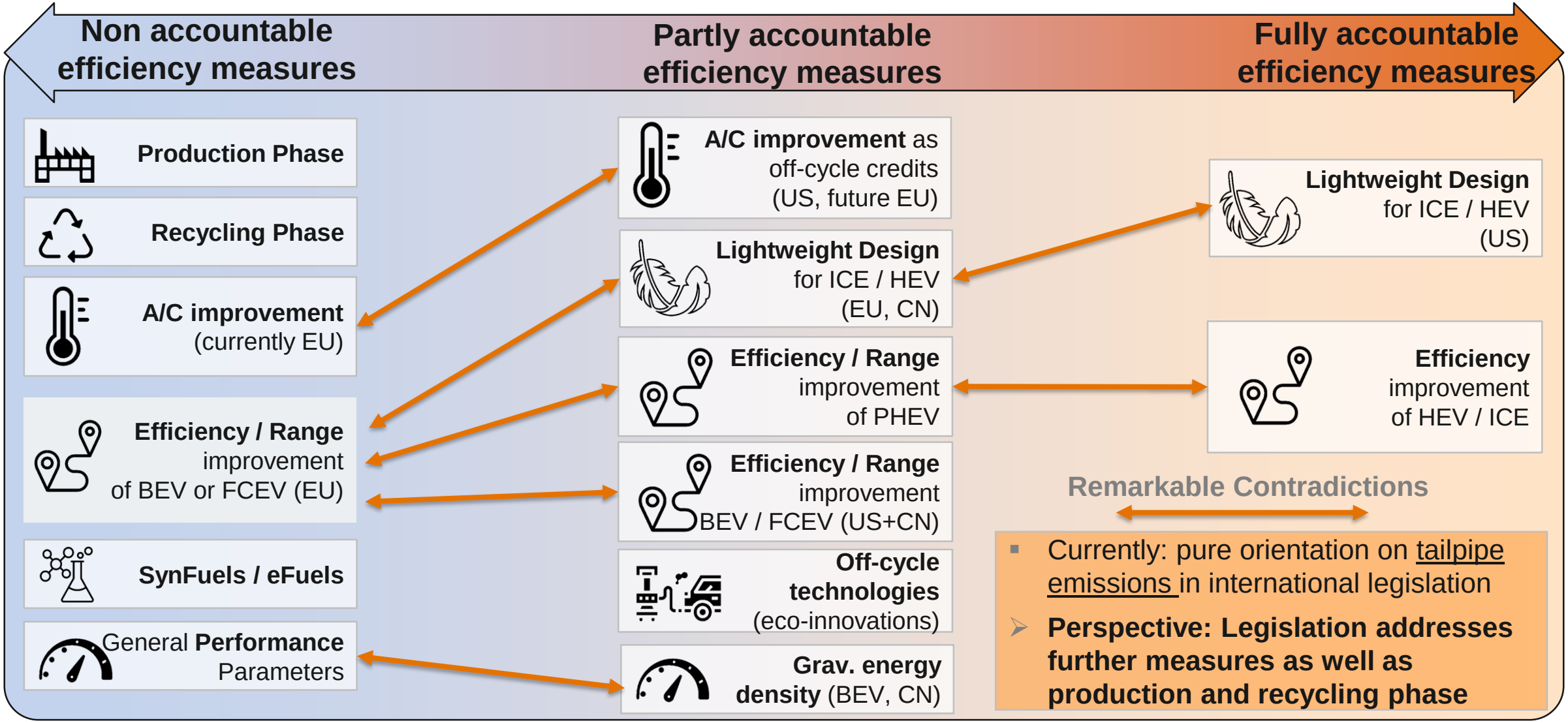
fka
CREATING IDEAS &
DRIVING INNOVATIONS

E_2P: Life Cycle Assessment (LCA) as a Strategic Decision Tool

Alexander Busse, Nils Neumann

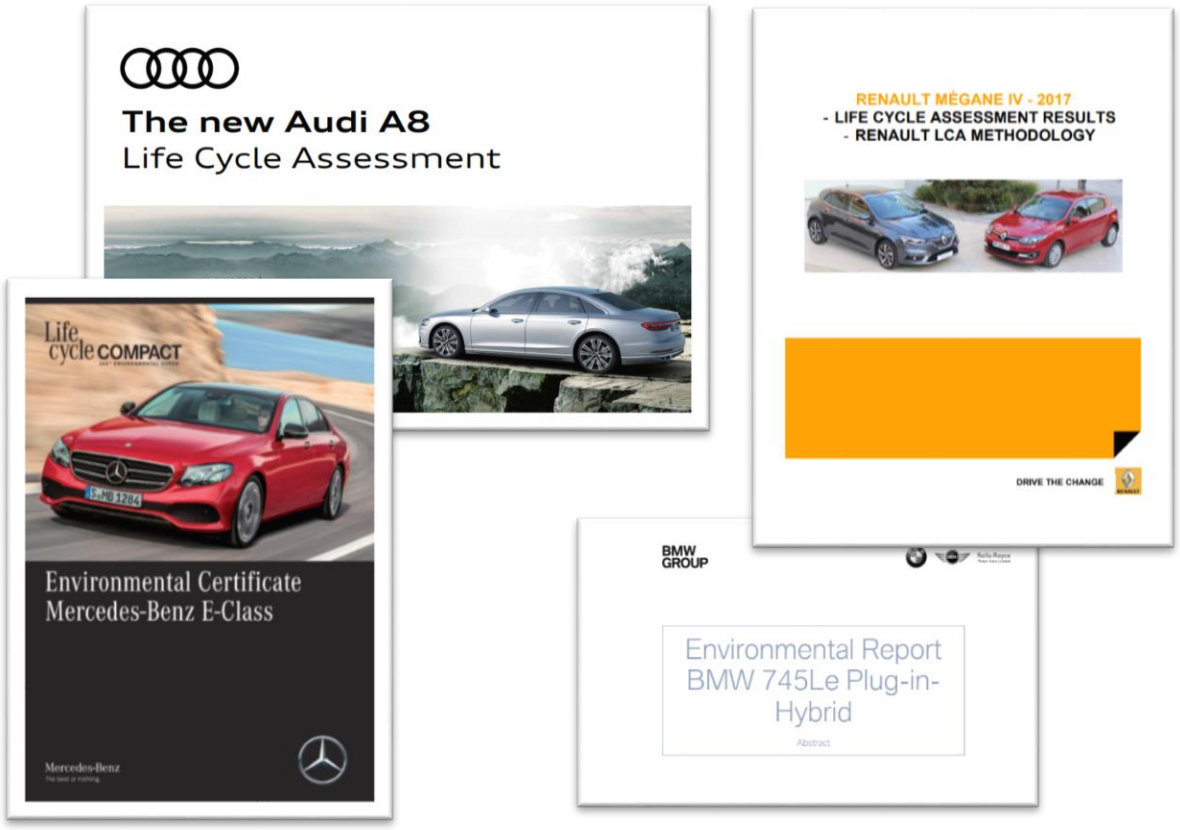
E_2P

Several efficiency measures are not or not fully accounted in current CO_2 legislation – e.g. production, but also EV efficiency improvements.



Life-cycle assessment (LCA) is increasingly important – currently for voluntary targets, that may become mandatory in the medium-term.

Current voluntary OEM reports on vehicle LCA



Possible future legislation, e.g. EU

- Current legislation (EU Regulation 2019/631) already includes first steps towards LCA
- Legislation focused on both vehicle LCA and alternative (bio) fuels

§ Life-cycle emission of passenger cars

- Article 7 (10)
- Possibilities for regulating life-cycle emissions will be evaluated by 2023

§ Additional possible amendments

- Article 15 Nr. 2
- By 2023, the impact of synthetic and advanced alternative fuels shall be analyzed
- Impact on existing fleet level shall be investigated

Life-cycle emissions are being recognized as important by OEMs in the context of sustainability strategies.

In the medium term, life-cycle emissions may become a mandatory part of greenhouse gas legislation.

Technology strategy with E_2P: 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

Environmental Analysis

- Identification of performance indicators
- Systematic determination of a weighting

KPI Analysis

- Life cycle analysis (LCA)
- Cost analysis
- Quantification of the technological performance

Holistic Technology Analysis

- Calculation of indicator values
- Transparent comparison of all weighted performance indicators in a two-dimensional portfolio representation (E_2P)

E_2P Analysis

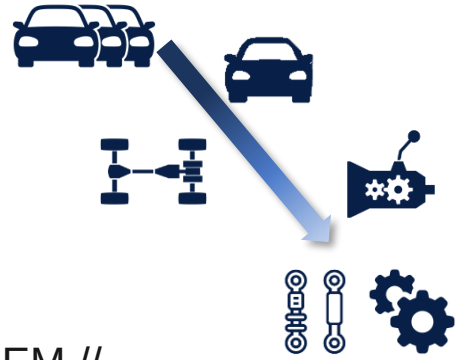
- Development of a technology strategy
- Strategic recommendations for action

Strategy

Environmental Analysis and Determination of KPI as basis for the E_2P Approach

Environmental Analysis
external view

- Analysis of the decision environment
- Drivers and influence factors on
  - Fleet
  - Vehicle
  - System
  - Subsystem
  - Component
- Definition of the specific OEM // end customer requirements
  - Standards
  - Expert knowledge and interviews
  - Benchmarking and meta studies



Outcome

Analysis dimension and influencing factors

KPI Analysis
internal view

Ecological	Economical	Performance
GWP[kg CO_2e]	Component cost[€]	Mass [kg]
Primary energy [kWh]	Manufacturability [-]	Crash performance
…	…	…

Weighting of the KPIs

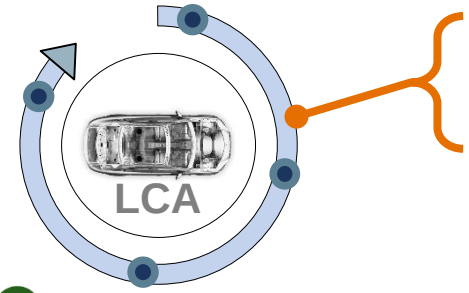
- Analysis of requirements ⟷ KPI correlation
- Methodology toolkit: QFD, utility analysis, Lead User, ….

Outcome

Weighted KPI as defined variables for E2P label

Holistic E_2P approach allows to efficiently analyze the Economical and Ecological effects of a particular Performance modification.

LCA investigation



- Production phase
- Utilization phase
- End-of-life

Absolute Emission Potential

Relative Emission Potential

Relative performance:
Δ GHG vs. Δ performance

Relative Emission Intensity
Δ GHG vs. Δ product / process

Holistic performance indicator (component / vehicle)

Cost

Δ EUR

Techn. performance

Δ performance (e.g. mass, vehicle dynamics, NVH…)

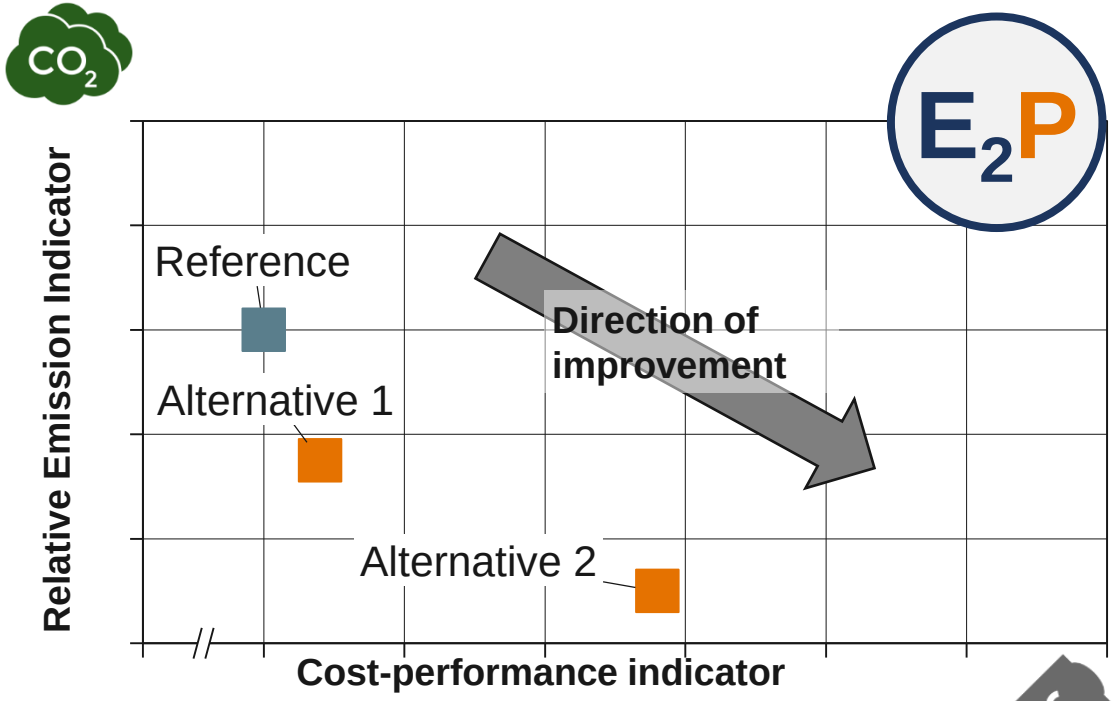
Outcome

Relative emission potential over the entire life cycle

Holistic performance indicator (Cost and Technology)

E_2P portfolio assessment

Ecological perspective



Economical and performance perspective

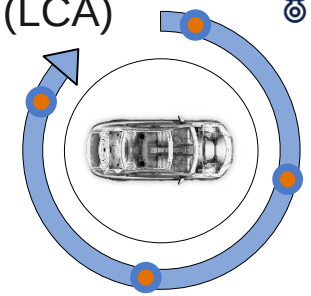
Outcome

⇨ E_2P-label: Economic, Ecological & Performance → Independent analysis for internal and external use

Life cycle assessment on component, vehicle as well as fleet perspective: GWP benefit can be evaluated to the complete vehicle fleet

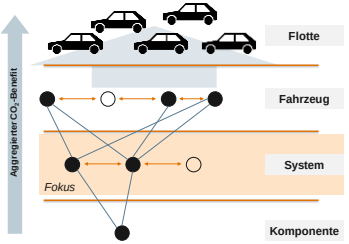
Component

Life Cycle Assessment (LCA)



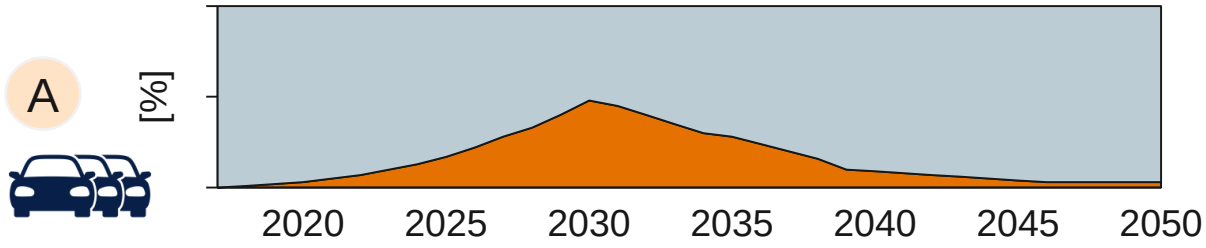
Vehicle

LCA –Effect at Vehicle Level



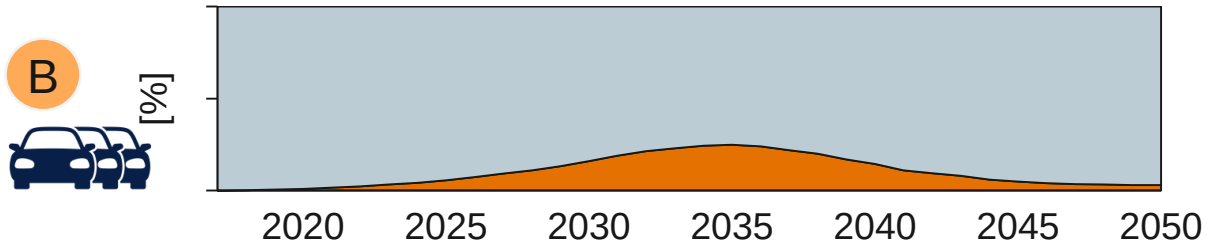
+ Scenarios + Market Models + TCO-Models

A



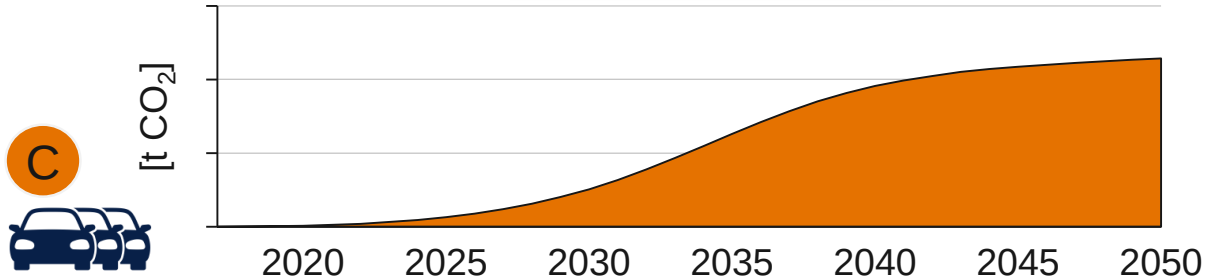
+ Service Life + Import/Export

B



+ Performance

C



- **Market share / "Take-Rate" in new car fleet**
- **CO_2-Benefit** of a technology for current CO_2 regulation
- **Technology diffusion in the stock**
- Consideration of service life, import/export, performance, specific to segments and technical characteristics

Outcome

- **Cumulative GWP benefit**
- **GWP and CO_2 impact can be validated at a technology level**

E_2P allows derivation of specific technology strategy as well as strategic recommendations

Organizational implications
- Investment strategies, e.g.
  - Technology decisions
  - Production planning
- Organizational adaptions, e.g.
  - Organization of R&D-Teams
  - Setup of Life Cycle Engineering Teams

R&D implications
- Direction of further R&D activities
- Setup of concrete R&D projects
  - Process adaptions

Further analysis

Monitoring
- Complementary technologies
- Competitor activities
- Disruption radar

Communication
- Exchange with customers
- External communication of technology position in E_2P evaluation

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