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Good practices for companies to significantly reduce their carbon footprint

LCS Life Cycle Simulation GmbH

2024-03-14 EU Top Gear Workshop

Good Practices for Carbon Footprint

Overview

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Methodical approach

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Good practice general

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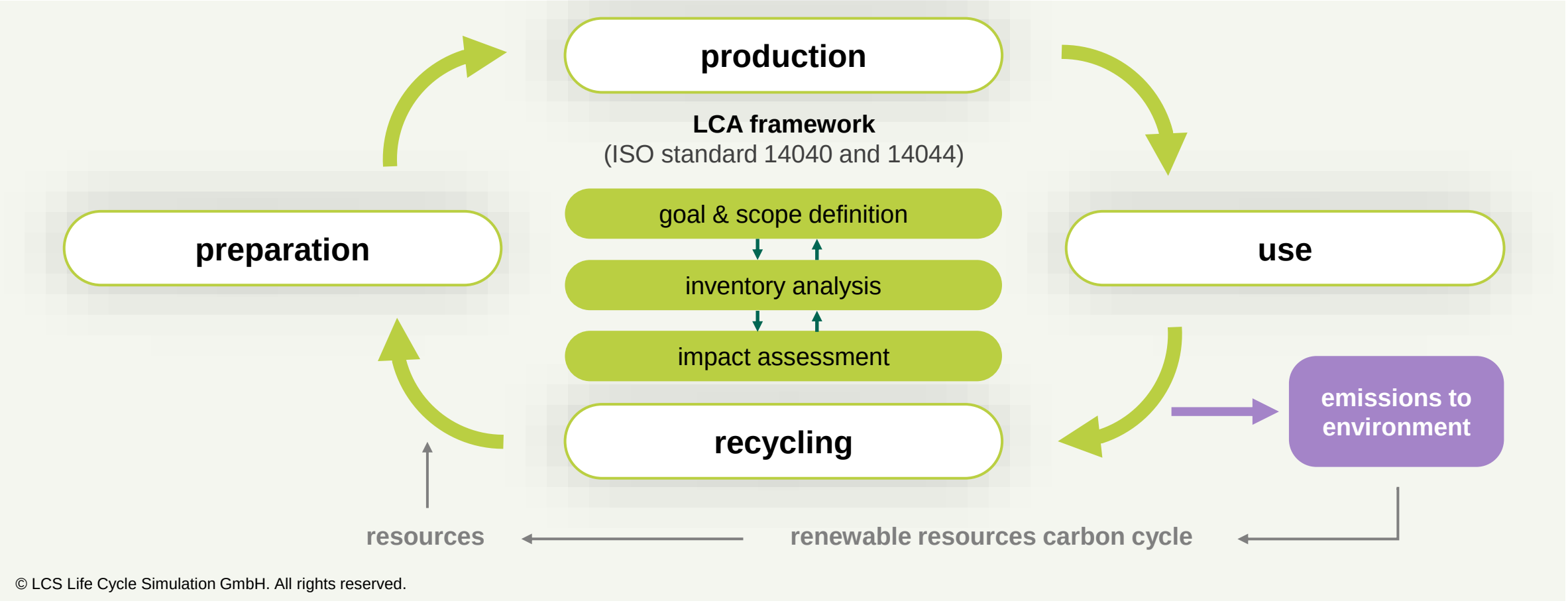
Good practice example

Methodical approach

Life cycle assessment as a standard for resource efficiency and sustainability



Methodical approach

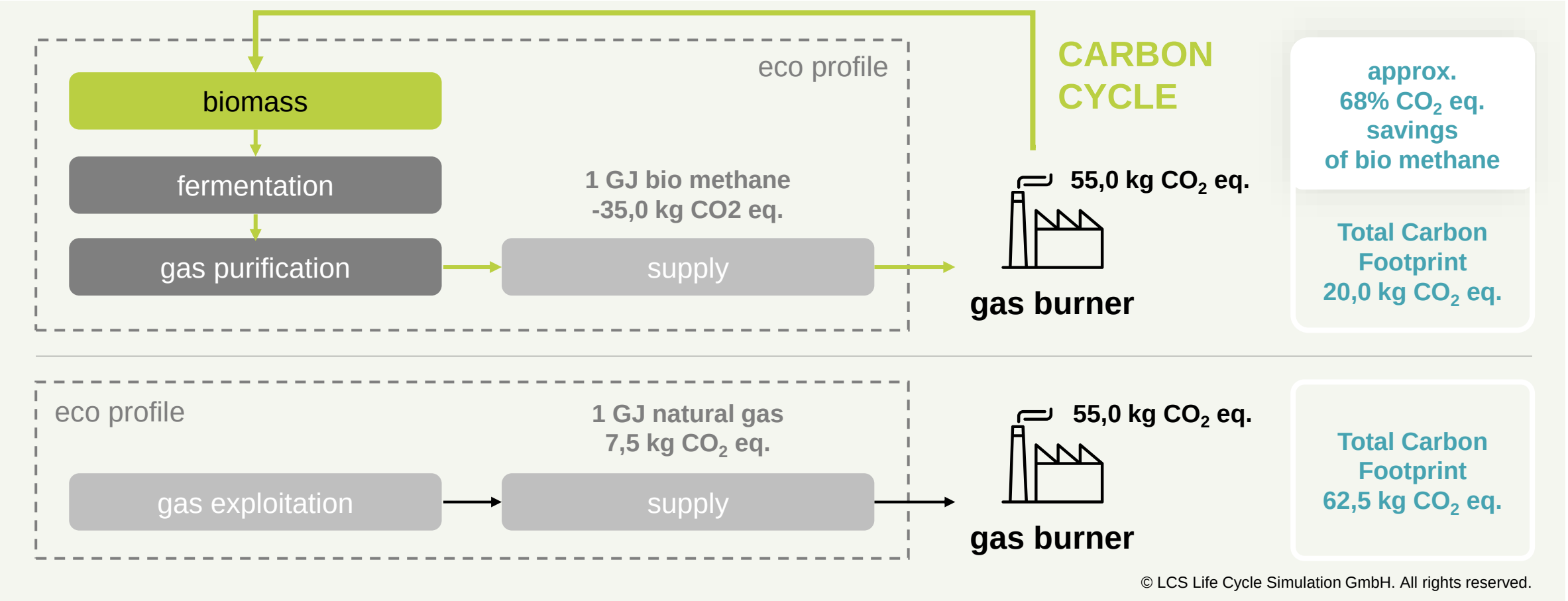
Definition of environmental impact categories in life cycle assessment
https://eplca.jrc.ec.europa.eu//EnvironmentalFootprint.html

	Parameter Life Cycle Inventory	Unit	Description	Examples
	Primary energy (PE, total)	kWh	Total of heating values of used non regenerative and regenerative energies	Crude oil, natural gas, hydro power, etc.
	Primary energy (PE, regenerative)	kWh	Total of regenerative energy values	Hydro power, wind, solar, etc.
Impact category	**Characterization factor**	**Unit**	**Description**	**Examples**
Resource depletion	**Abiotic resource depletion (ADP, fossil)**	kWh	Use of non regenerative fossil resources	crude oil, gas, coal, etc.
Resource depletion	**Abiotic resource depletion (ADP, elementary)**	kg Sb-equiv.	Use of elementary resources	In, Fe, Ti, U, etc.
Climate change	**Green house warming potential (GWP)**	kg CO_2-equiv.	Emissions to air which influence the heat balance of the atmosphere	CH_4, CO_2
Summer smog	**Photochemical oxidants creation potential (POCP)**	kg ethene-equiv.	Emissions to air which act as ozone creators at ground level	HCs
Acidification	**Acidification potential (AP)**	kg SO_2-equiv.	Emissions to air which create acidification of rain water	NO_x, SO_2
Eutrophication	**Eutrophication potential (EP)**	kg PO_4-equiv.	Overfertilisation of water and soil	P- and N-compounds

Impact categories are chosen under consideration of long-term stable characterization and taking into account the ILCD handbook on LCIA ; characterization factors for impact assessment by CML University of Leiden, https://www.universiteitleiden.nl/en/research/researchoutput/science/cml-ia-characterisation-factors

Methodical approach

Example: Conversion to bio-methane



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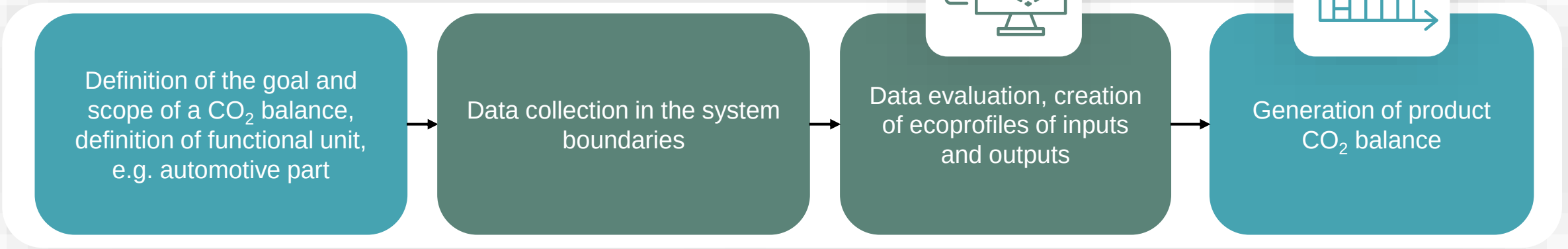
Approach

Carbon Footprint



Good practice general

Implementation in your own company, creating a WIN-WIN situation

Approach to CO_2 balances is essential, i.e. implementing a strategy to achieve corporate success

Company level (scope 1)

- Creating transparency in energy and material flows
- Recognition of hot spots
- Identification of optimization potential and evaluation

Suppliers (scope 2, 3)

- Regocnition of hot spots
- Evaluation of substitution options

Customer communication (scope 2, 3)

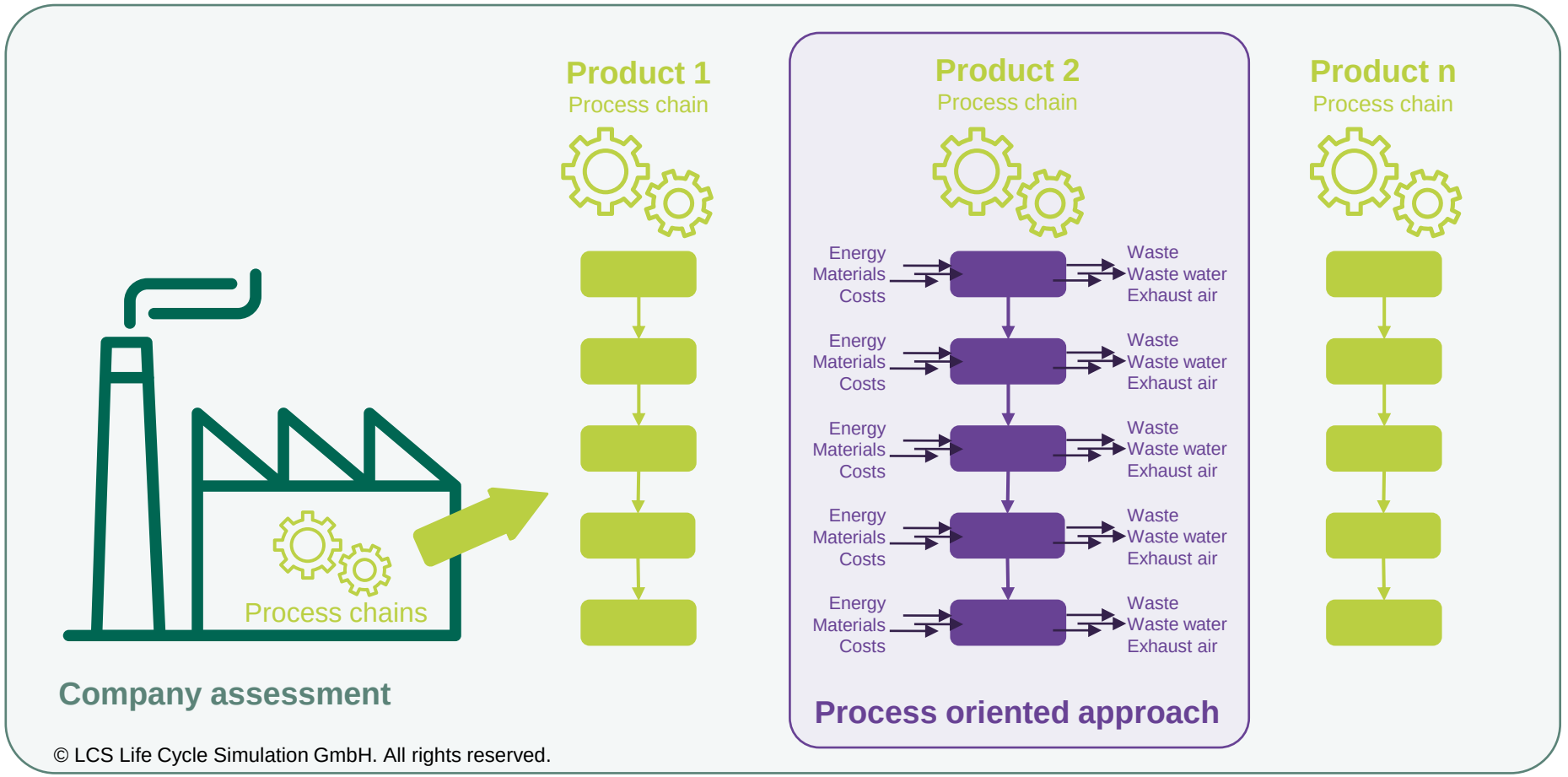
- Status of CO_2 balances (how implemented → scope 1 to 3, proportion fossil versus renewable)
- Potential of new products and technologies

„Thinking outside the box"

- New technologies
- Renewable energy
- Raw materials from organic agriculture

Good practice general

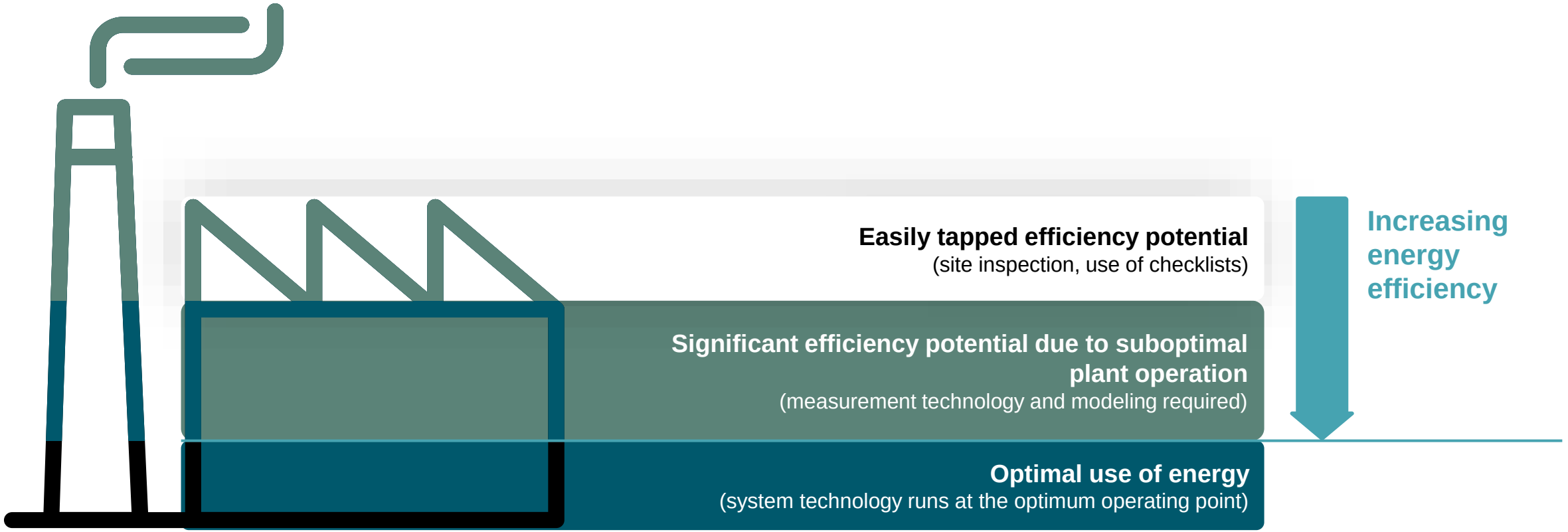
Corporate balance sheet (energy and material) versus processoriented approach



Transparency and collecting KPIs is a key success factor

Good practice general

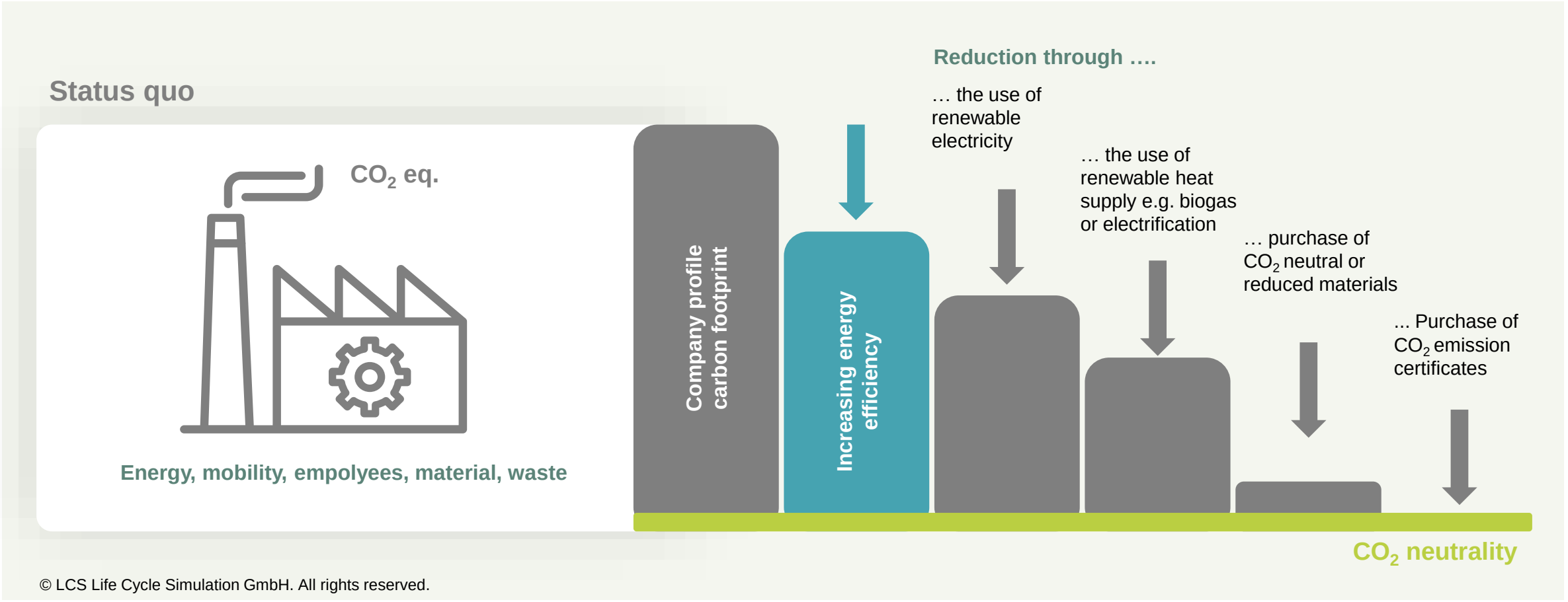
Identifying potential for energy optimization



Good practice general

Climate neutrality at company level - simplified illustration

CO_2 reduction strategies – usable for CO_2 potential



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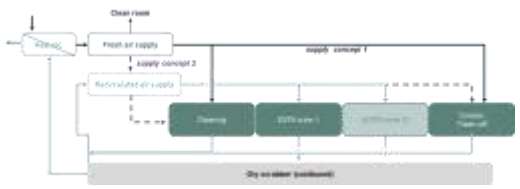
Good practice example

Building digital twins

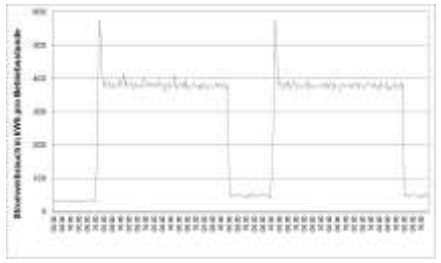
e.g. paint shop

digital twin

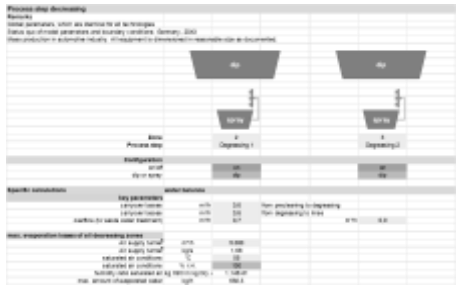
process documentation



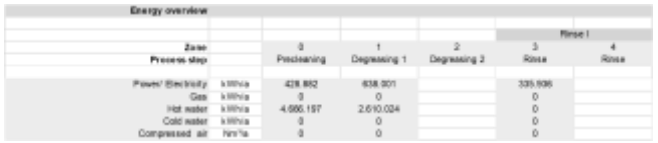
production measurements



detailed process modeling

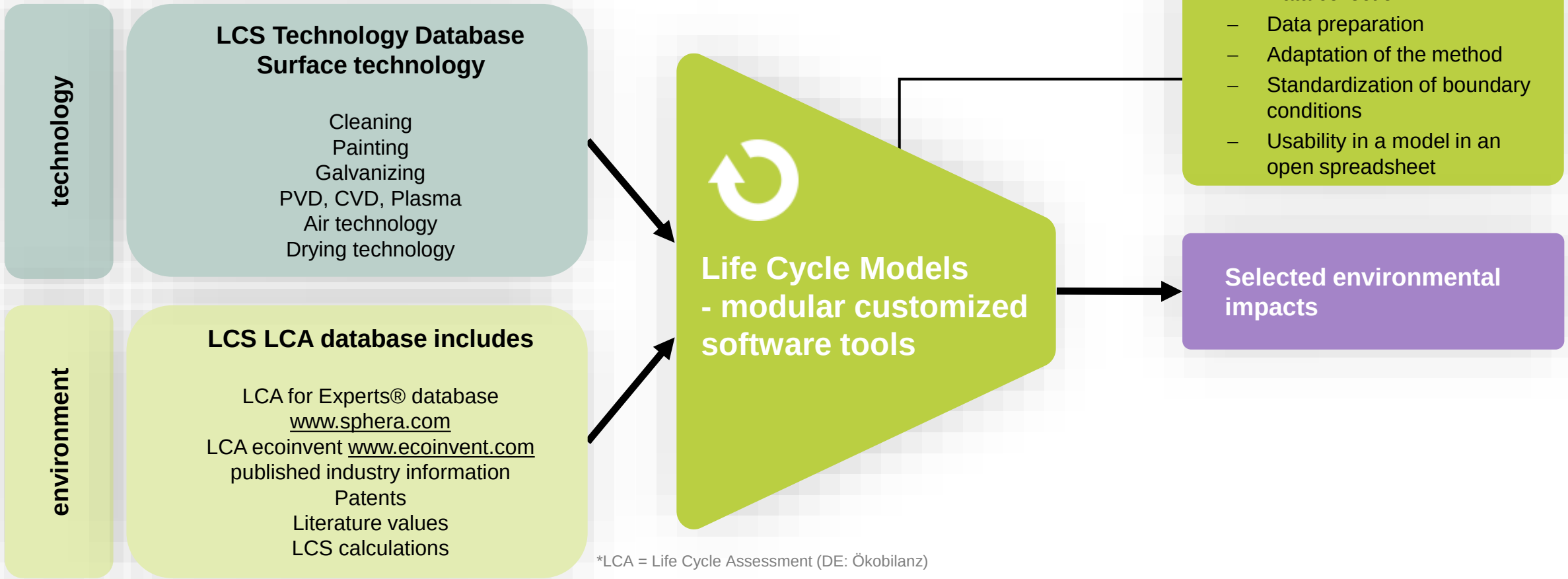


energy matrix



Good practice example

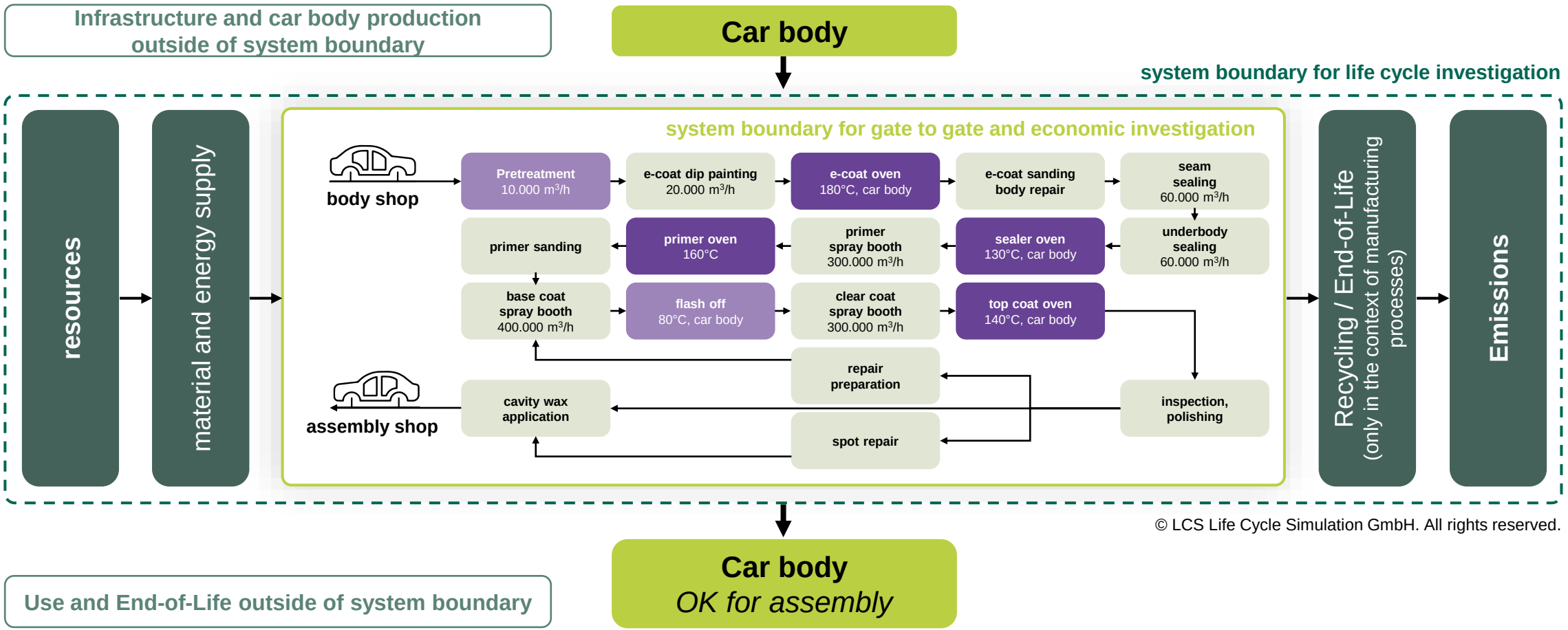
Consolidation of technology and environmental assessment



*LCA = Life Cycle Assessment (DE: Ökobilanz)

Good practice example

Definition of system boundaries (resources to factory gate)



Good practice example

Practical example automotive coating

- Status (EU average, BAT document Dec 2020)

- **Car body surface:**
  - Ecoat: 100 m²
  - Top coat: 5 m² interior, 15 m² exterior
- **Car body weight: 400 kg steel**
- **Paint system:**
  - Ecoat (hydro)
  - Primer (hydro)
  - Base coat (hydro)
  - Clear coat (solvent)
- **Overspray via Venturi** (potential dry separation and air recirculation)
- **Spray booth exhaust air** (potential heat recovery via heat wheels)
- **Exhaust air purification** only via dryers thermal post-combusting (potential for dry separation complete purification [spray booths and dryers])
- **Climatic conditions for all air conditioning:** Frankfurt/Main (30-year hourly averages)

Good practice example

Practical example automotive coating

- Status (EU average, BAT document Dec 2020)

- **Material-, energy- and recycling eco-profiles**:
  - EU27 boundary conditions, 2021

- **Calculation and database:**
  - LCA for Experts, www.sphera.com (so far GaBi)
  - Ecoinvent, www.ecoinvent.ch
  - LCS Expertise since 1999 (digital twin, thermodynamic calculations, etc.)

Good practice example

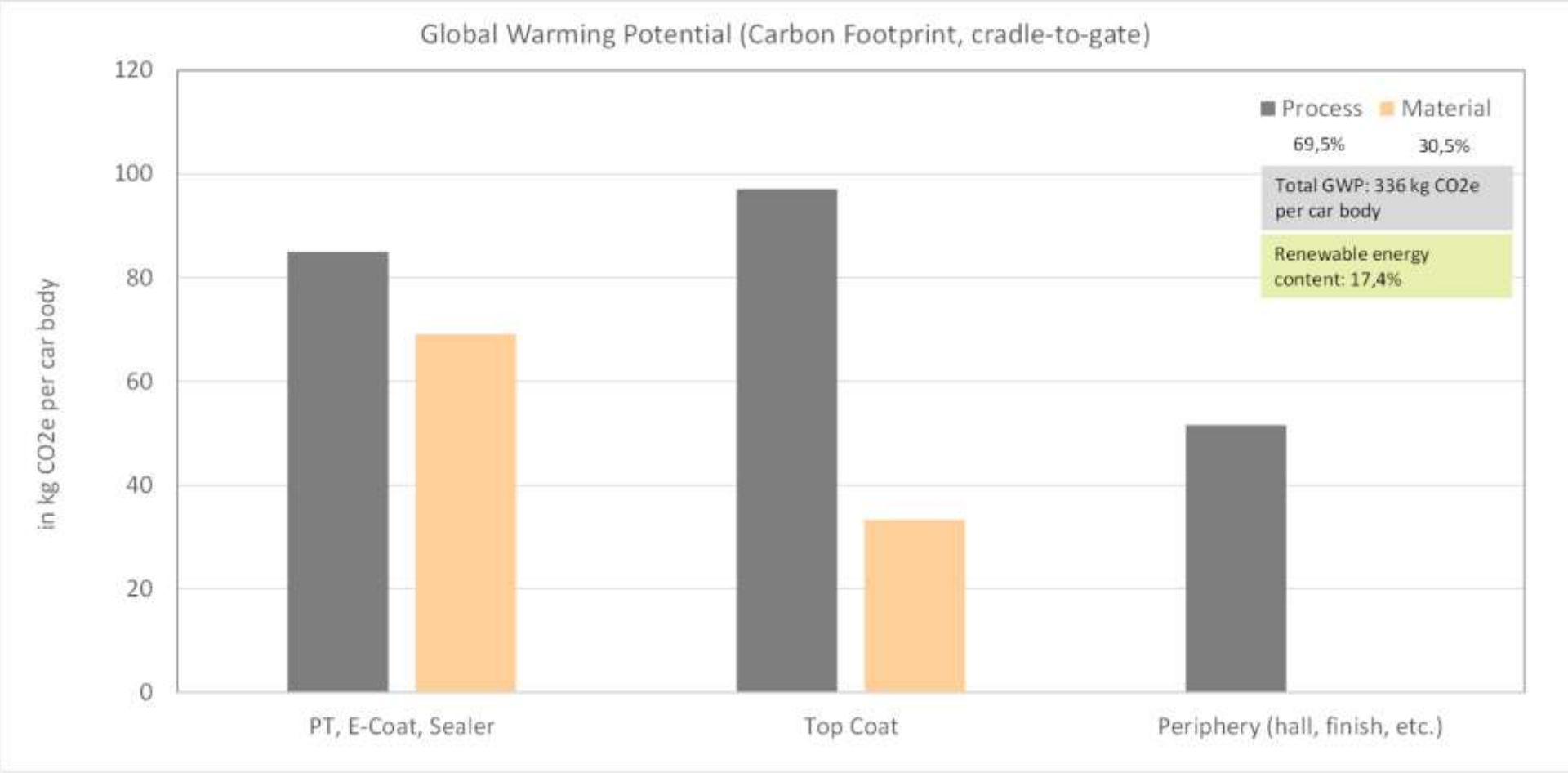
Status of the environmental footprints (EU BAT Reference Document, Dec 2020)

Energy consumption (electricity, heat, natural gas, cooling, compressed air)

- Plant level 2013 to 2015 (25 paint shops)
- **Basis:** Average value 0.85 MWh per painted car body (50% range 0.61 to 1.01 MWh/car)
- **Scenario (0,60 MWh/Kar)**
  - Dry scrubber, 80% air recirculation, heat recovery
  - CC exhaust air purification
  - Increase in material efficiency through 100% robot application
- **Outlook Scenario**
  - Dry scrubber, up to 95% air recirculation, heat recovery
  - Complete exhaust air purification
  - Low bake temperature processes

Good practice example

Practical example automotive coating- ecological footprint, **basis: EU average modeled**



Good practice example

Practical example automotive coating- scenario description – cradle to gate

Baseline

– Basis: average 0,85 MWh/car, VOC average 25,7 g/m²

Sc (0,6 MWh)

– Scenario 0,6 MWh/car, VOC 15 g/m²

Sc Outlook

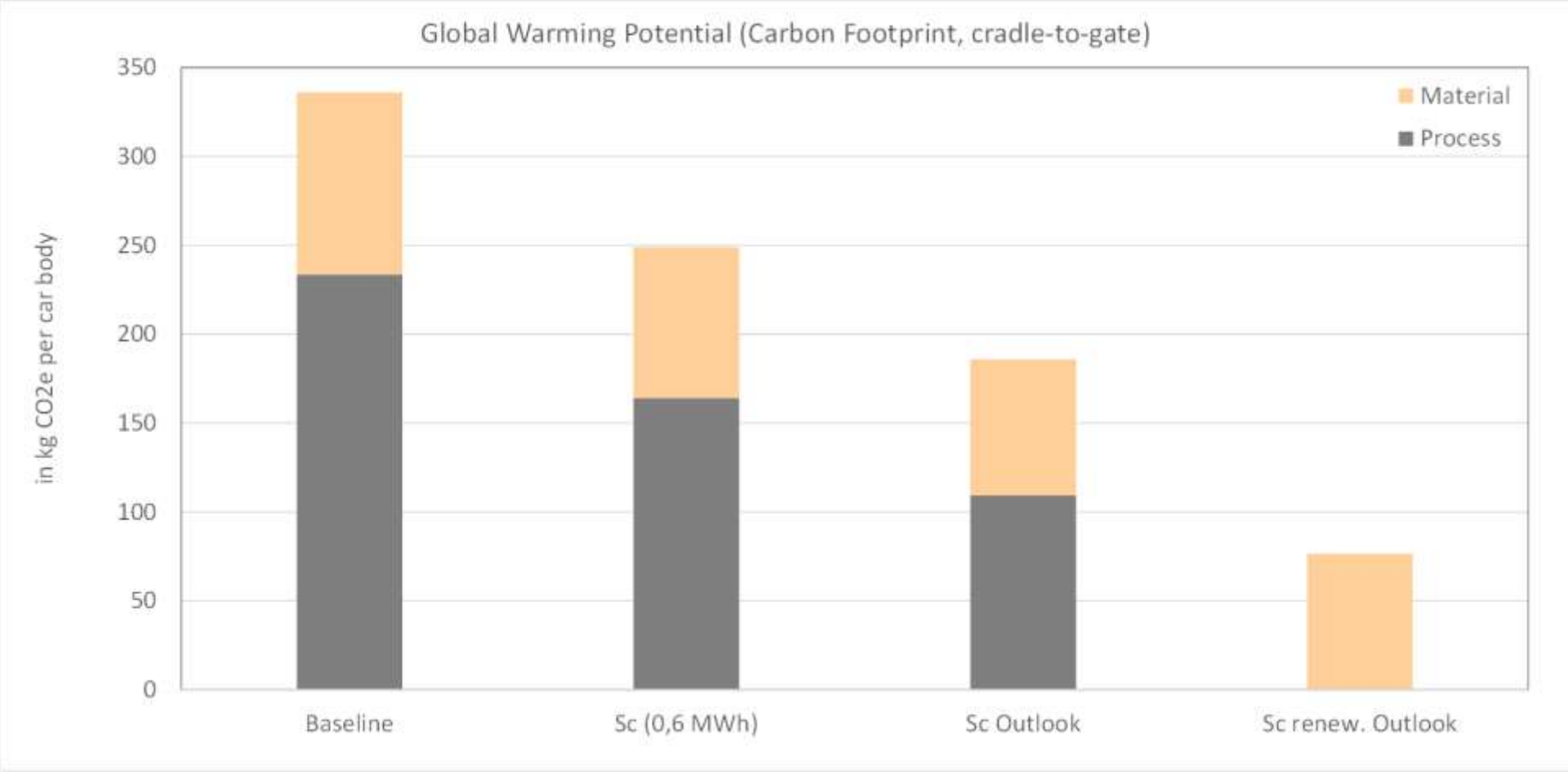
– Scenario outlook, VOC < 8 g/m²

Sc renew. Outlook

– All energy sources with renewable electricity: electricity, hot water, cooling, natural gas, compressed air

Good practice example

Practical example automotive coating- ecological footprint - scenario



Outlook

Create transparency

- Material and energy flows in production and over supply chain

Modeling of production and supply chain

- For identification of potentials
- For evaluation of potentials (improve efficiency, new materials or technologies)

Communication to clients

- Added values of materials or technologies

LCS Life Cycle Simulation GmbH

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