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Holistic investment decisions based on Life Cycle Models

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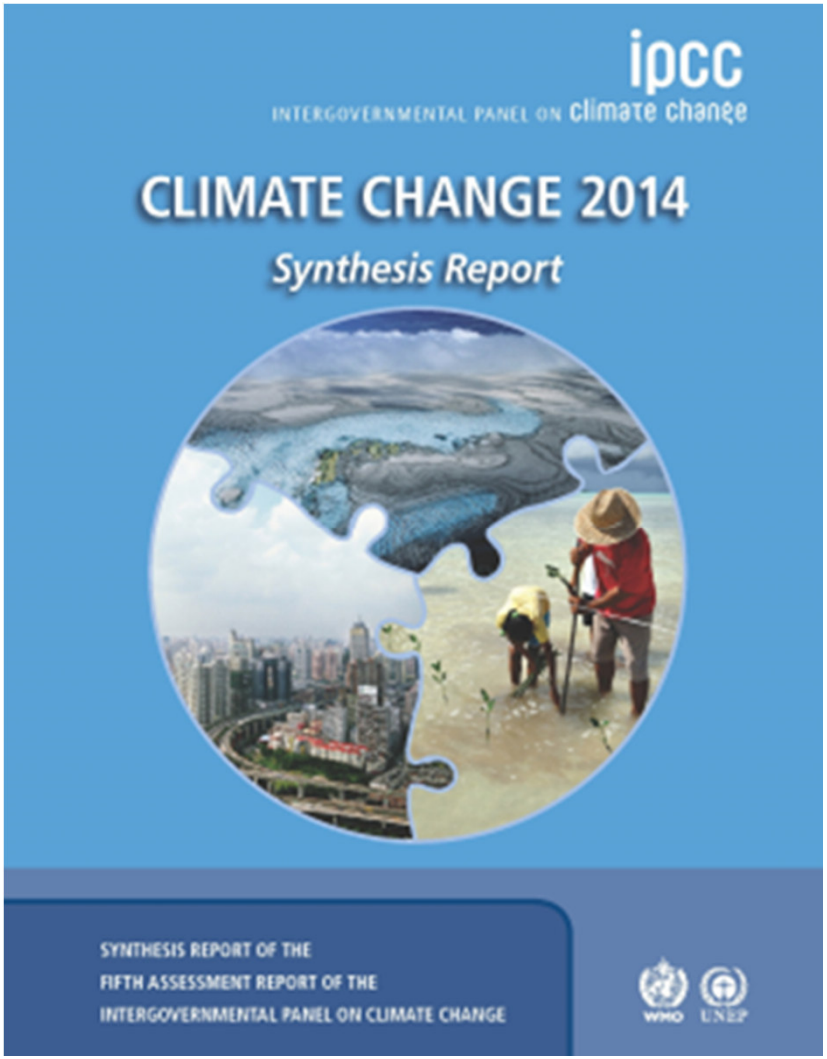
Holistic investment decisions based on Life Cycle Models

Overview

- Motivation – Introduction
- Challenges for investment decisions
- Holistic approach with Life Cycle Models
- Outlook - Application

Motivation

Synthesis Report by Intergovernmental Panel on Climate Change (IPCC)
Nov 2014



source: http://www.ipcc.ch

Core message

- *Global warming terminable to 2°C temperature rising with intermediate action*

Measurements

- *Reduction of green house gases about 40 to 70 percent until 2050 and to zero until 2100*

Implementation

- *Conversion from fossil to renewable energies (solar, wind, hydro)*
- ***Significant reduction of energy demand (increase energy efficiency)***

Motivation

Green Paper: Energy efficiency

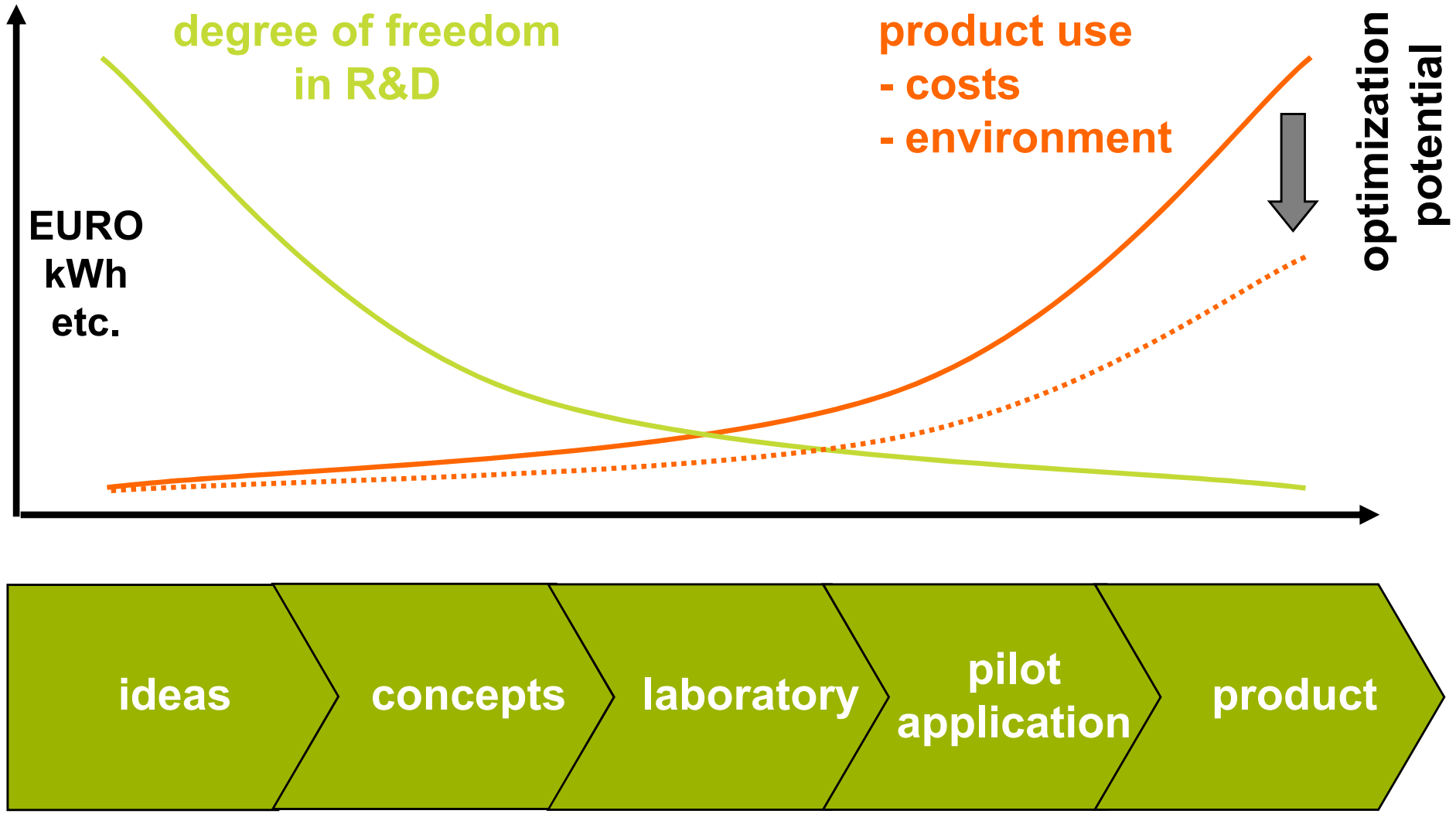
source: www.bmwi.de, August 2016

Main Challenges

- *Efficiency first*
- …

Motivation

Dependencies in the development process



R & D essentially influences life cycle performance

Challenges for investment decisions

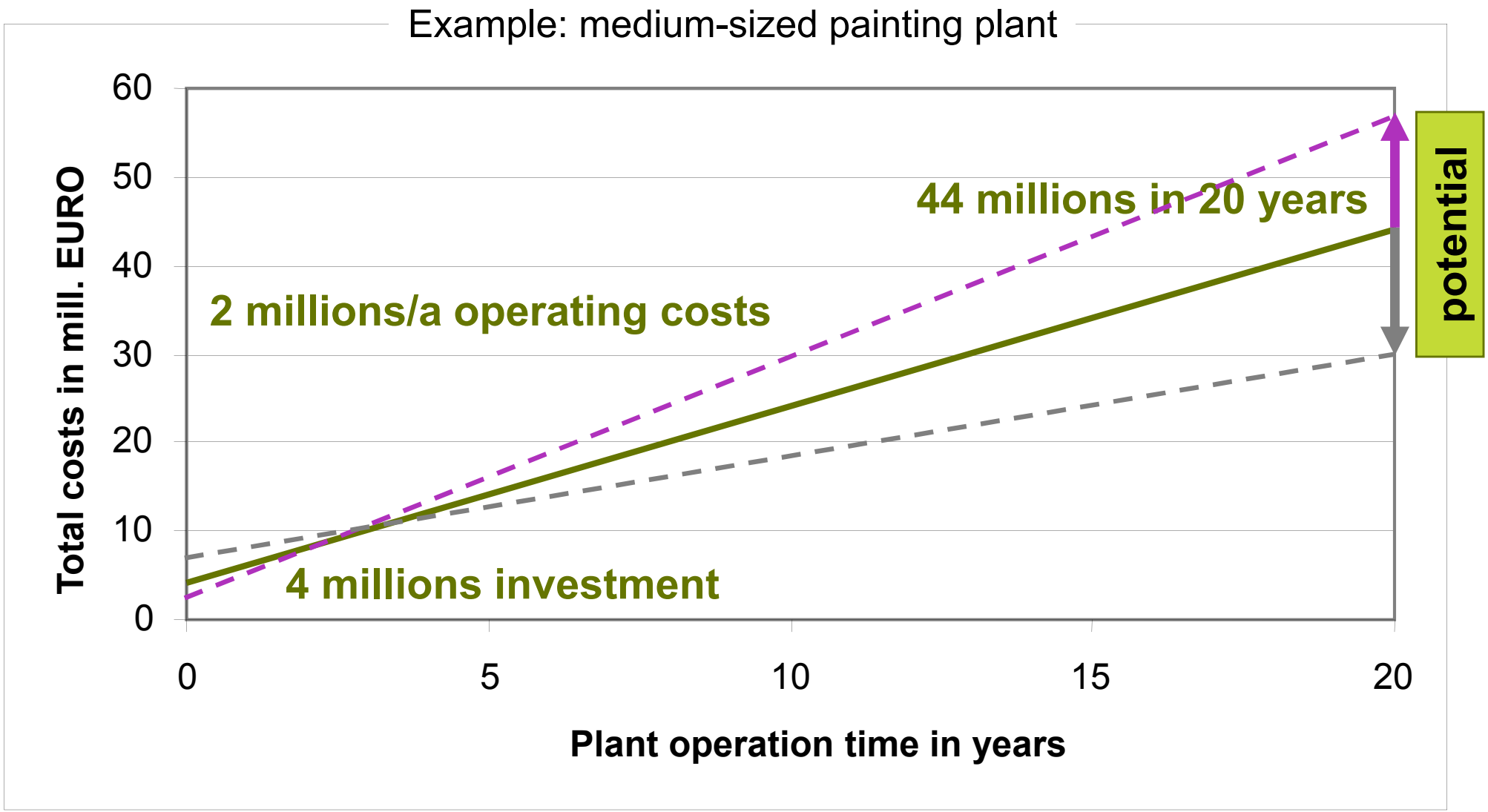
Aspects

- Knowledge management of increasing “dynaxity*”
- Think in life cycles
- Overview and details: both views are mandatory for holistic optimization
- Expand one dimensional cost calculations

*Dynaxity = Dynamics + Complexity

Challenges for investment decisions

Investment and Development of Operating Costs



Long plant operation time → consider the life cycle costs

Challenges for investment decisions

Expand cost calculations

Total Cost of Ownership (TCO)

Purchase **Use** **End-of-Life**

TCO is mostly limited to small system boundaries

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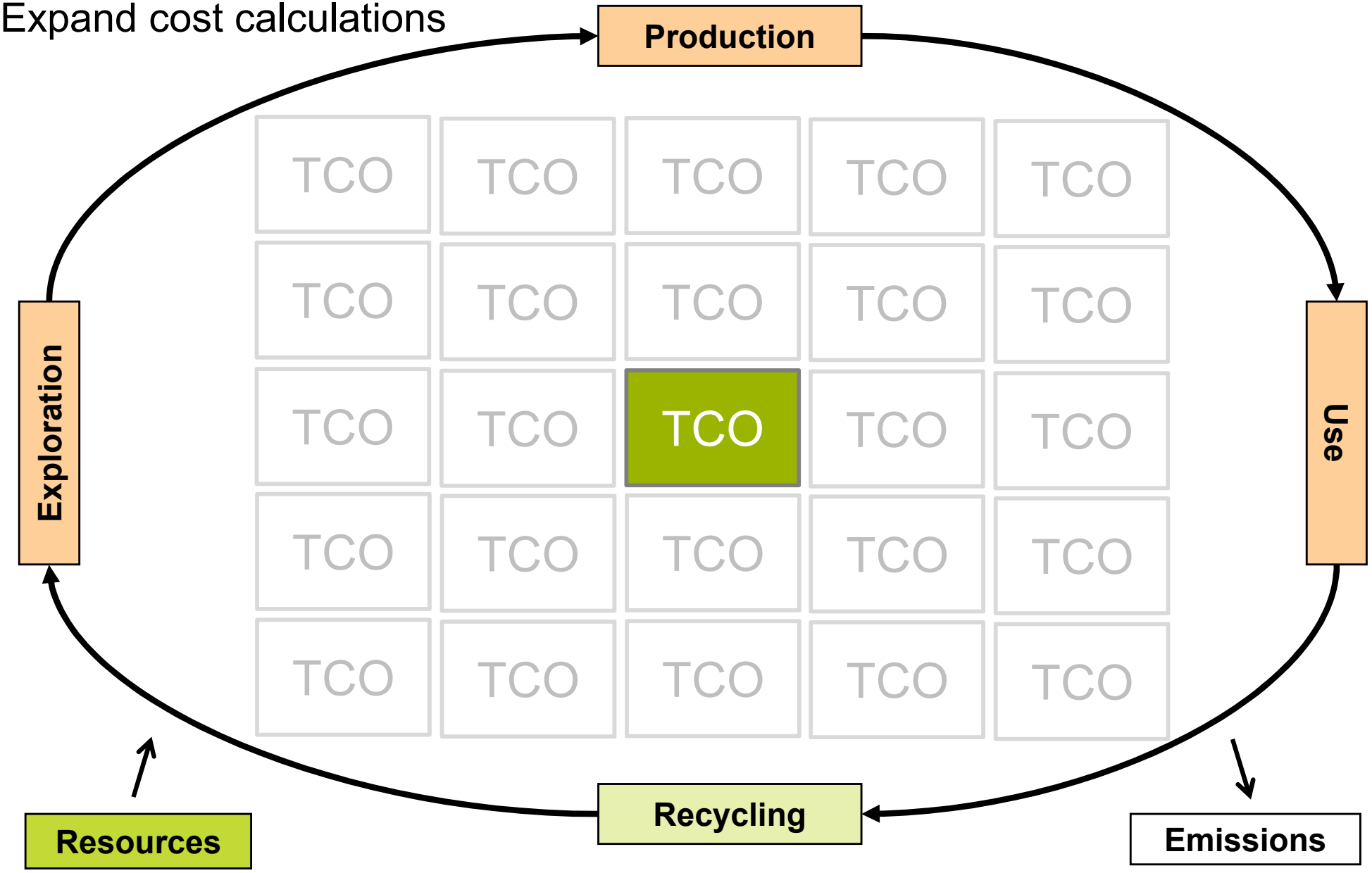
Challenges for investment decisions

Expand cost calculations



Life Cycle Assessment has a more comprehensive view than TCO

Challenges for investment decisions

Cause (technical characteristics) and effect (costs)

Level 7: Life Cycle Costing (cost efficiency)

Level 6: Life Cycle Assessment (resource efficiency)

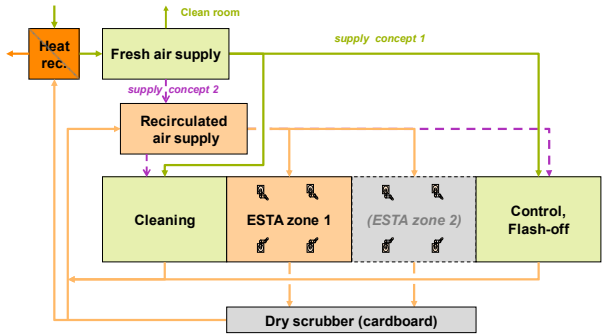
Level 5: personnel (education)

Level 4: material flows (material efficiency)

Level 3: energy flows (energy efficiency)

Level 2: technical evolution status

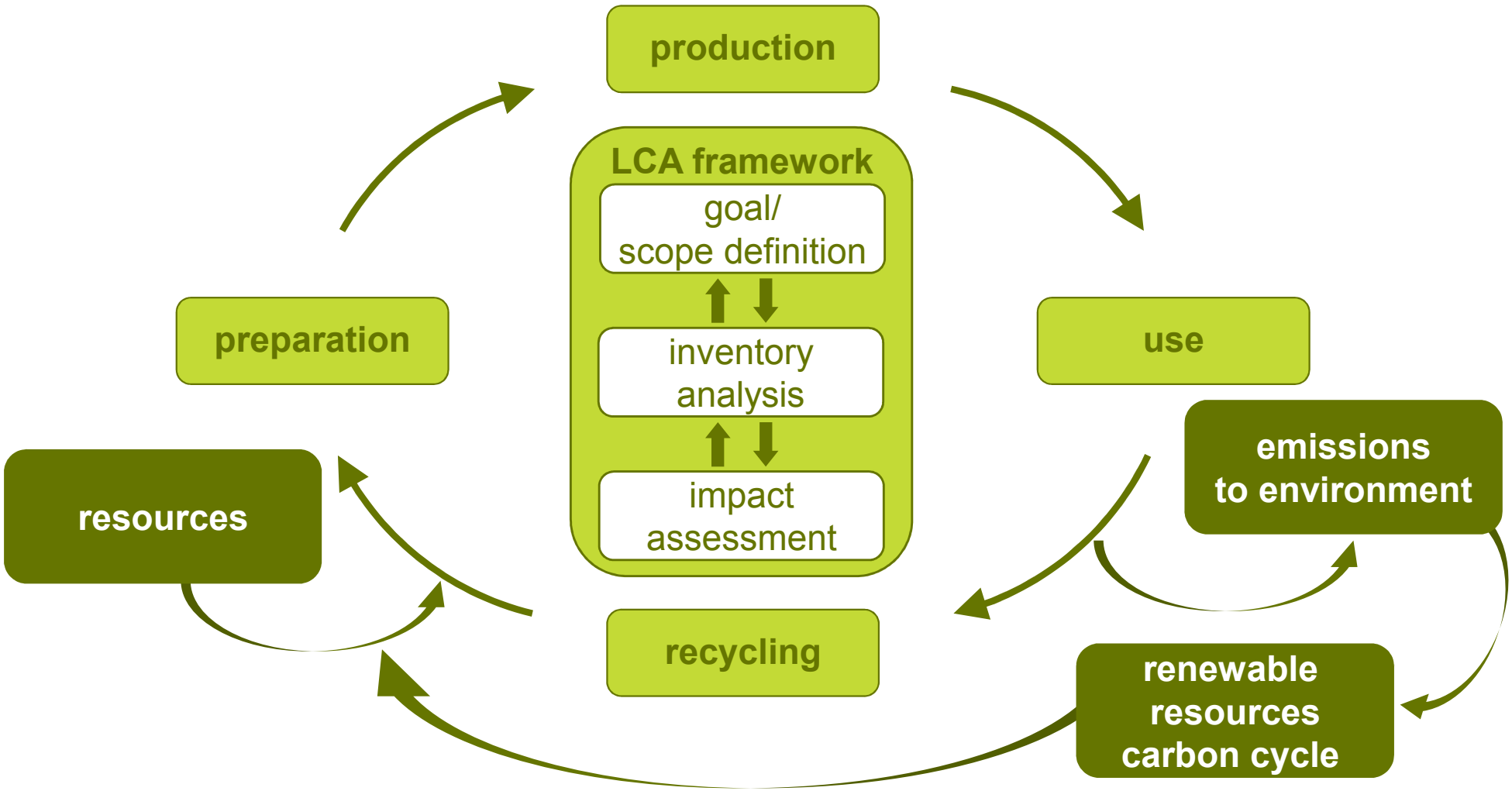
Level 1: technical characteristics



MULTIDIMENSIONAL analysis and evaluation is a MUST

Holistic approach with Life Cycle Models

Life Cycle Assessment (ISO Standards 14040 & 14044)



Measuring ecological sustainability

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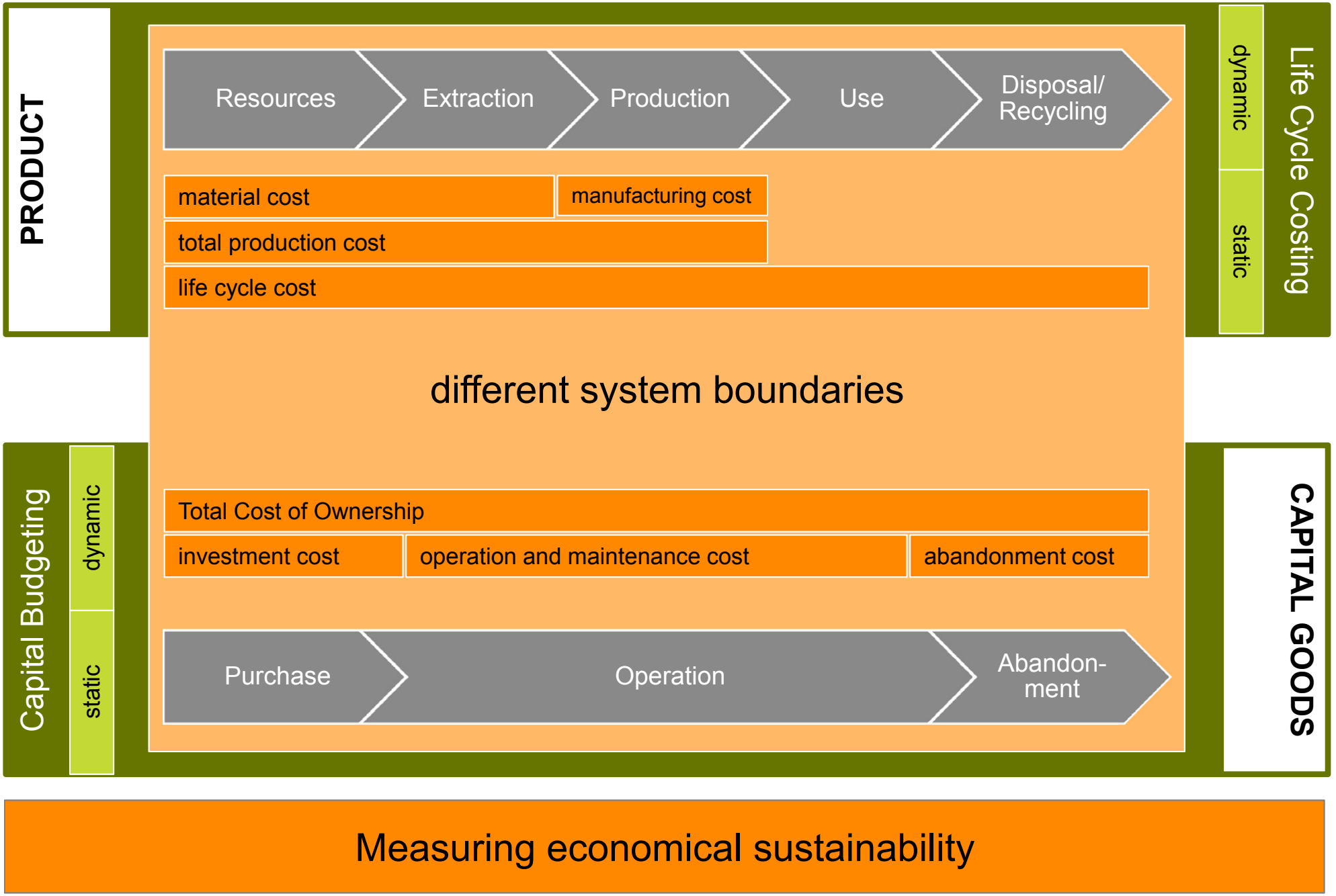
Holistic approach with Life Cycle Models

Life Cycle Costing



Measuring economical sustainability

Holistic approach with Life Cycle Models

Linkage of analysis and application

Analysis

Module 6: integration of socio-economic aspects

Module 5: process-, life-cycle cost (profitability)

Module 4: LCA (resource efficiency)

Module 3: material flows (material efficiency)

Module 2: energy flows (energy efficiency)

Module 1: technical characterization

Level 6: knowledge transfer
- trainings, workshops
- talks and presentations
- teaching in universities

Level 5: management systems (operations)
- ISO 14001
- ISO 50001

Level 4: simulation models (processes, life cycle)
- parametrisation
- modularisation
- scenario analysis

Level 3: holistic technology comparison
- ISO 14040 and 14044, VDI 4075
- Hot-Spots, strengths, weaknesses
- savings potential

Level 2: product-LCA and EPD
- ISO 14040 und 14044 (Life Cylce Assessment)
- ISO 14025 (Environmental Product Declaration)

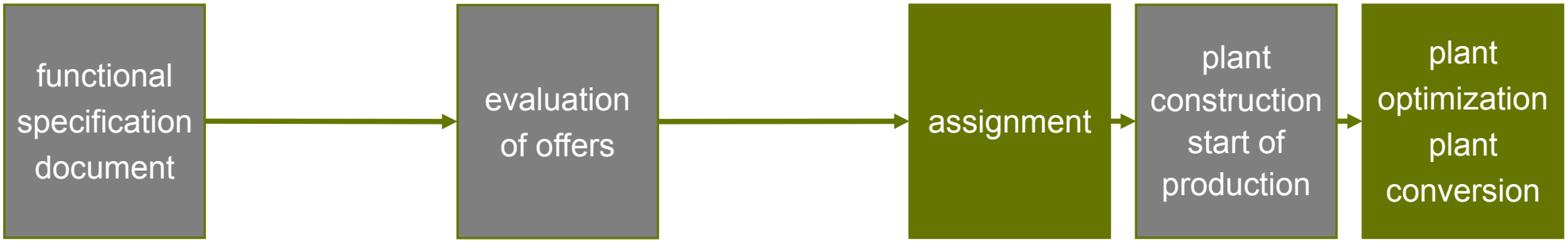
Level 1: ecoprofiles (material, energy)
- ISO 14040 und 14044

Application

Holistic approach with Life Cycle Models

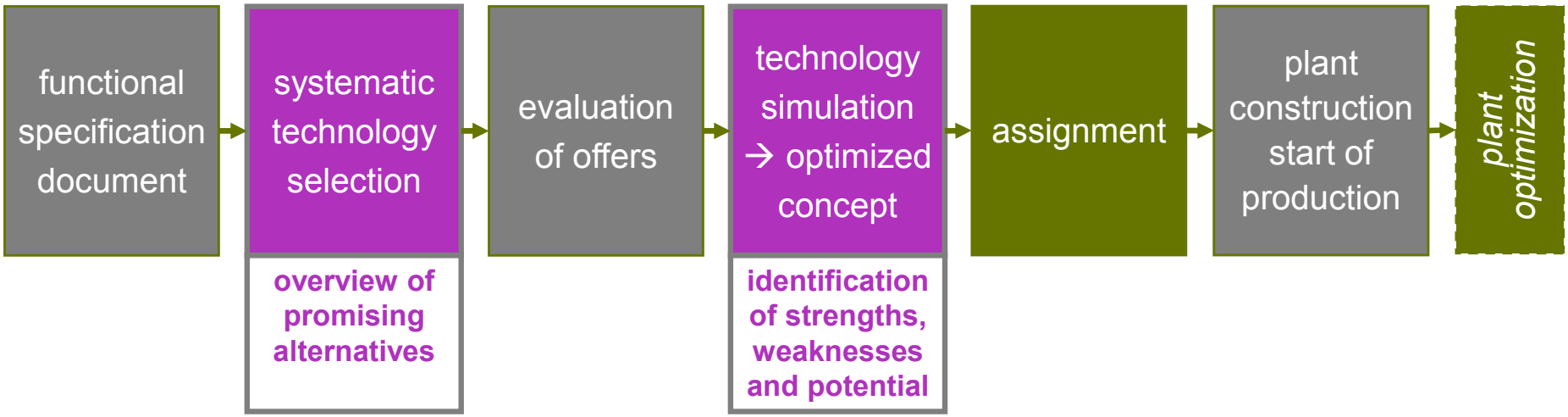
Procedure of Investment Decisions

classical procedure



total investment

optimized procedure

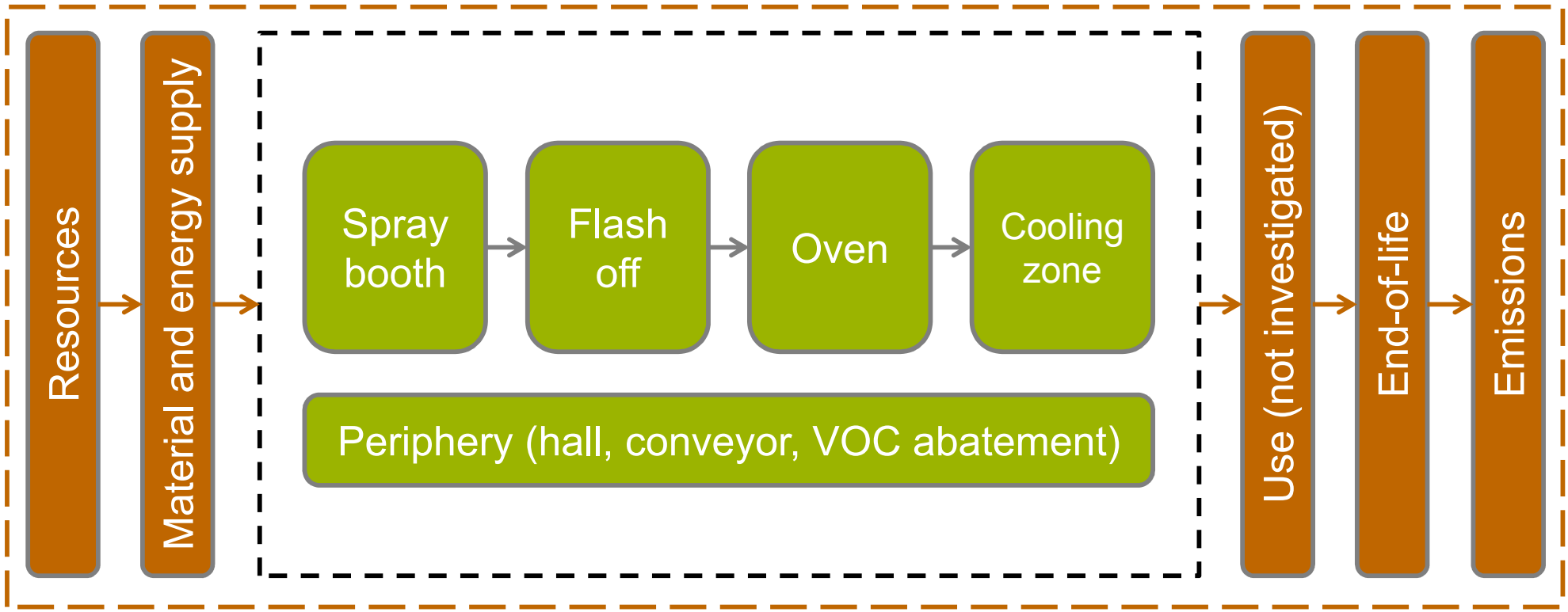


Comprehensive preparation for long term investments is profitable

Outlook - Application

Definition of Coating Process (Starting Point)

- Modeling of coating process over life cycle
- One layer coating process for plastic cabinets (pretreatment not shown)
- 2 shift production, 4.250 h/a, location Berlin (climate data)
- Solvent borne topcoat (50% solids), layer thickness 40 µm, transfer efficiency 20% (manual)



Outlook - Application

Procedure to build-up life cycle models

data collection
- technological characteristics (temperature,...)
- installed machinery (efficiency, yield,...)
- general setup (lot size, local climate, work shifts,...)

basic LCS life cycle simulation model

simulation of energy demand / cost

calibration with site specific energy and cost data

calibrated LCS life cycle simulation model

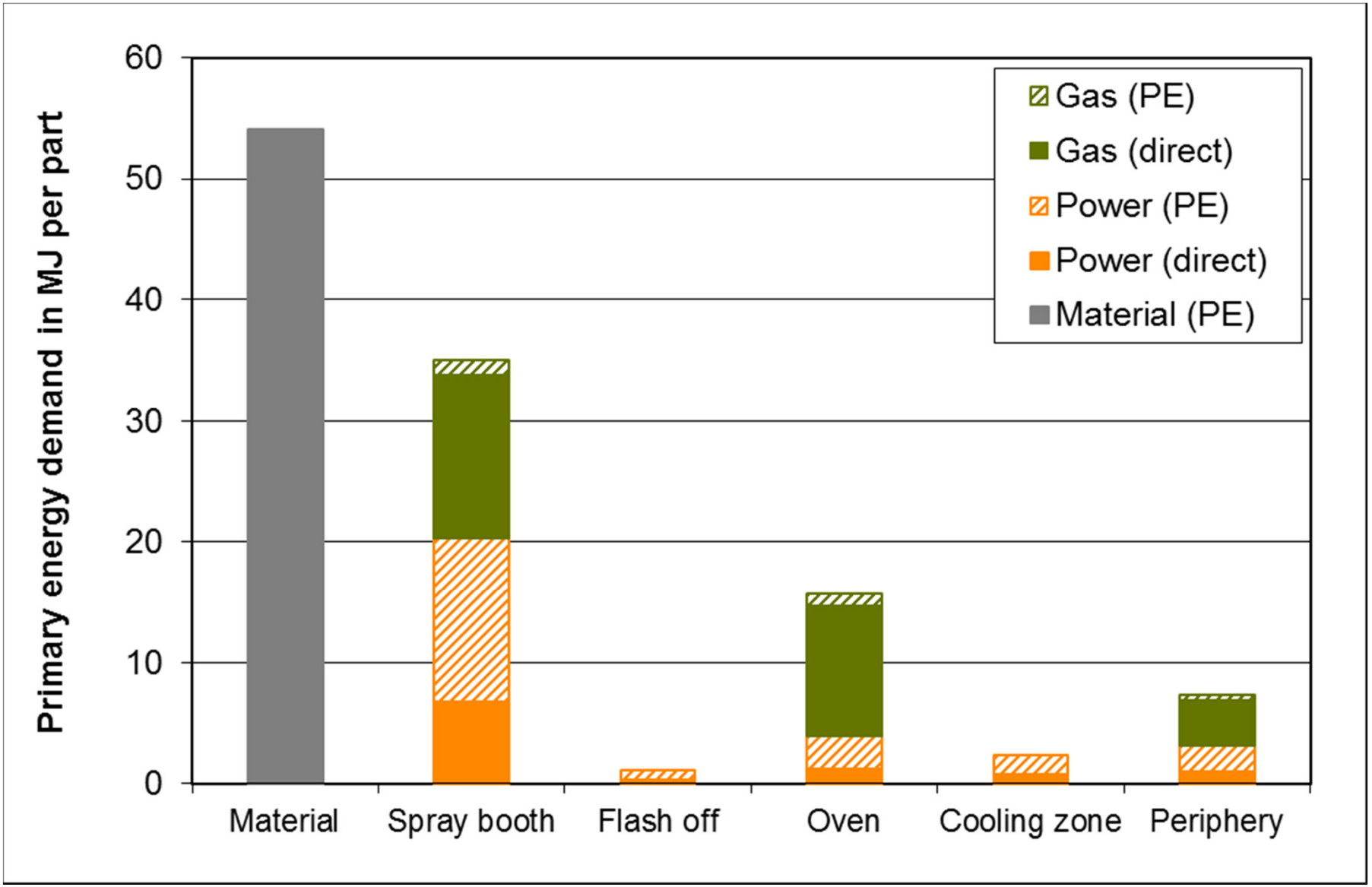
compilation of meaningful key parameters

identification
of optimization potential

comparison
with other technologies

Outlook - Application

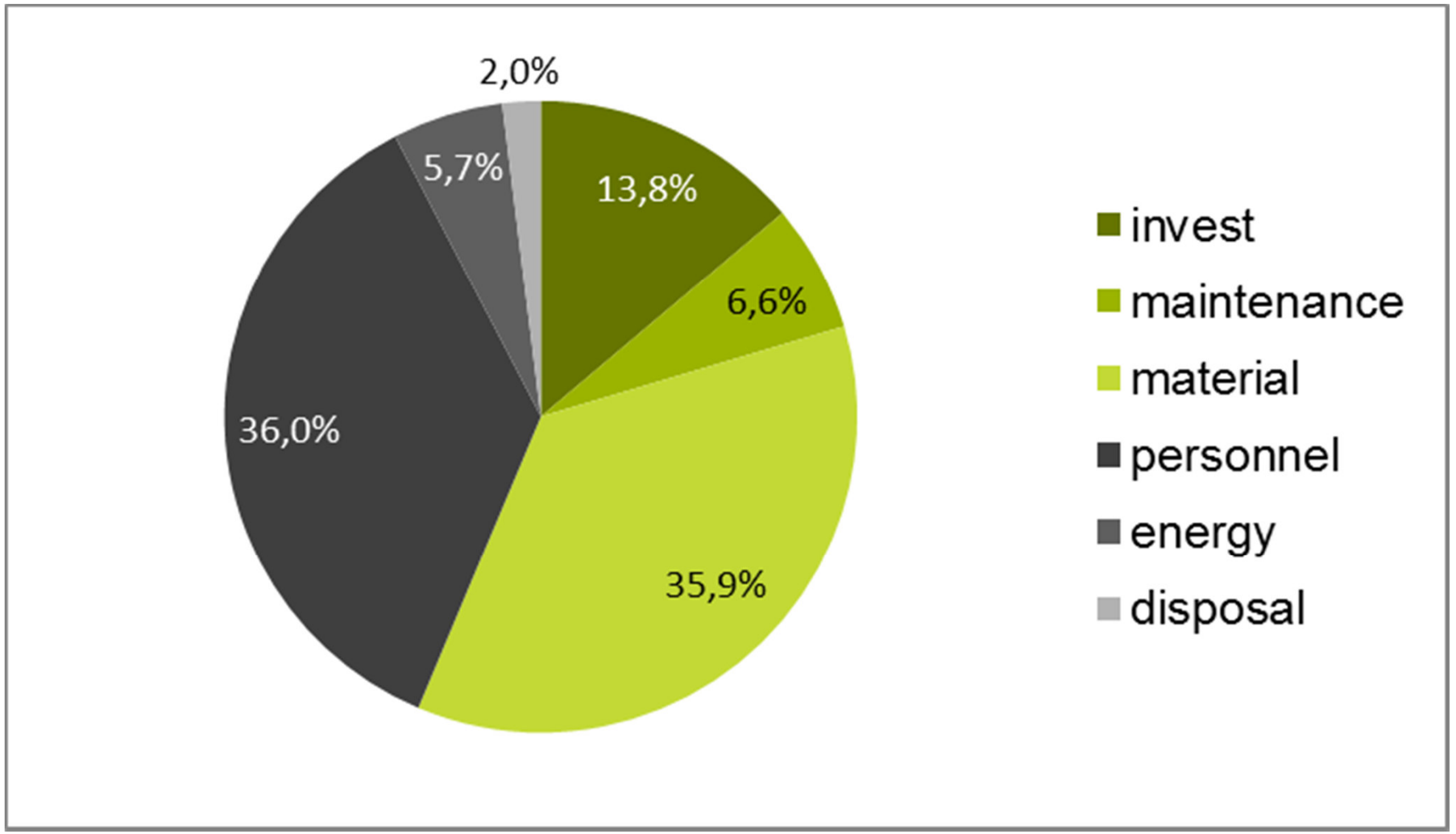
Coating Process (Starting Point) – LCA Coating Process



PE = Primary energy (cradle to gate), direct = direct energy input to specific process step

Outlook - Application

Coating Process (Starting Point) – LCC Coating Process



Outlook - Application

Definition of Coating Process (Starting Point)

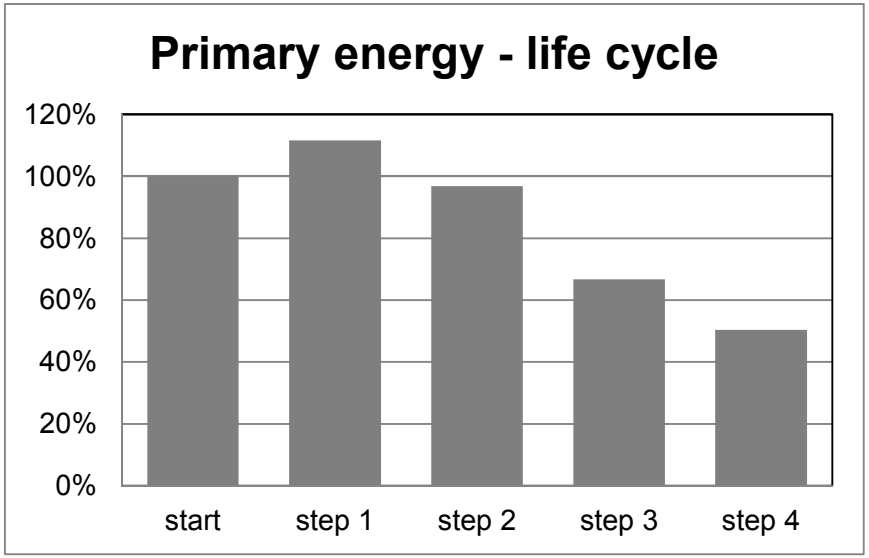
- **Starting point:** one layer coating process for plastic cabinets, solvent borne coat system
- **Step 1:** implementation of VOC abatement (fulfilment of VOC directive)
- **Step 2:** implementation of water borne coating (fulfilment of VOC directive)
- **Step 3:** improvement of material and energy efficiency (water borne coat system)
- **Step 4:** transfer of research results from BMBF-project ENSIKOM, high material efficiency by recycling of solids and solvents (solvent borne coat system), high energy efficiency (compact process + UV curing), no gas use

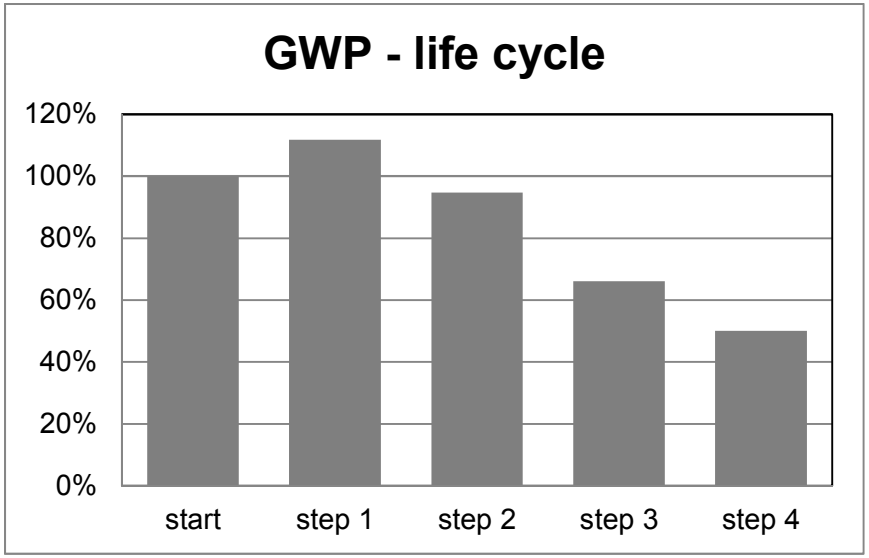
Federal Ministry of Education and Research

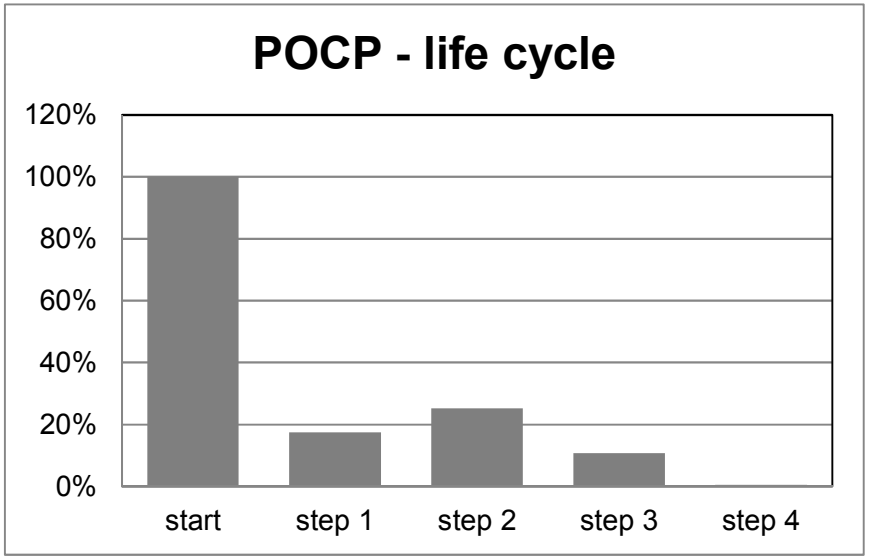
BMBF-project ENSIKOM - Development, simulation and process secure implementation of an environmental friendly and competitive coating process for complex plastic parts, www.r-zwei-innovation.de/de/673.php, founded by the German Federal Ministry of Education and Research, 2013

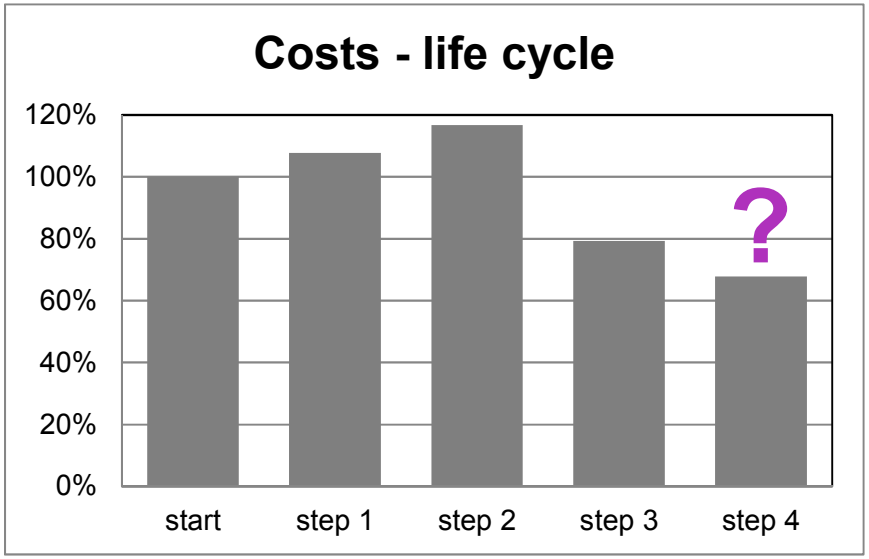
Outlook - Application

Coating Process – LCA and LCC









Outlook - Application

Life Cycle Optimization Potential - Estimation

boundary conditions: 2-shift production process

savings: difference starting point to step 4

271 tons crude oil equivalents per year

10.4 **oil trucks á 26t net load per year**

670 tons CO_2 equivalents per year

5.5 Mio. km at 120g CO_2 per km

In addition: reduction of 61.2 tons of VOC emissions per year

Contact

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