

Life Cycle Assessment of Buildings

Niklaus Kohler

Prof. i.R.
Karlsruhe Institute of Technology [KIT], Karlsruhe, Germany

Overview

- Looking back
- Buildings and Ball pens
- Problem fields
- Development Directions
- Buildings as a service ?
- Perspectives

Ball points and buildings

1 year

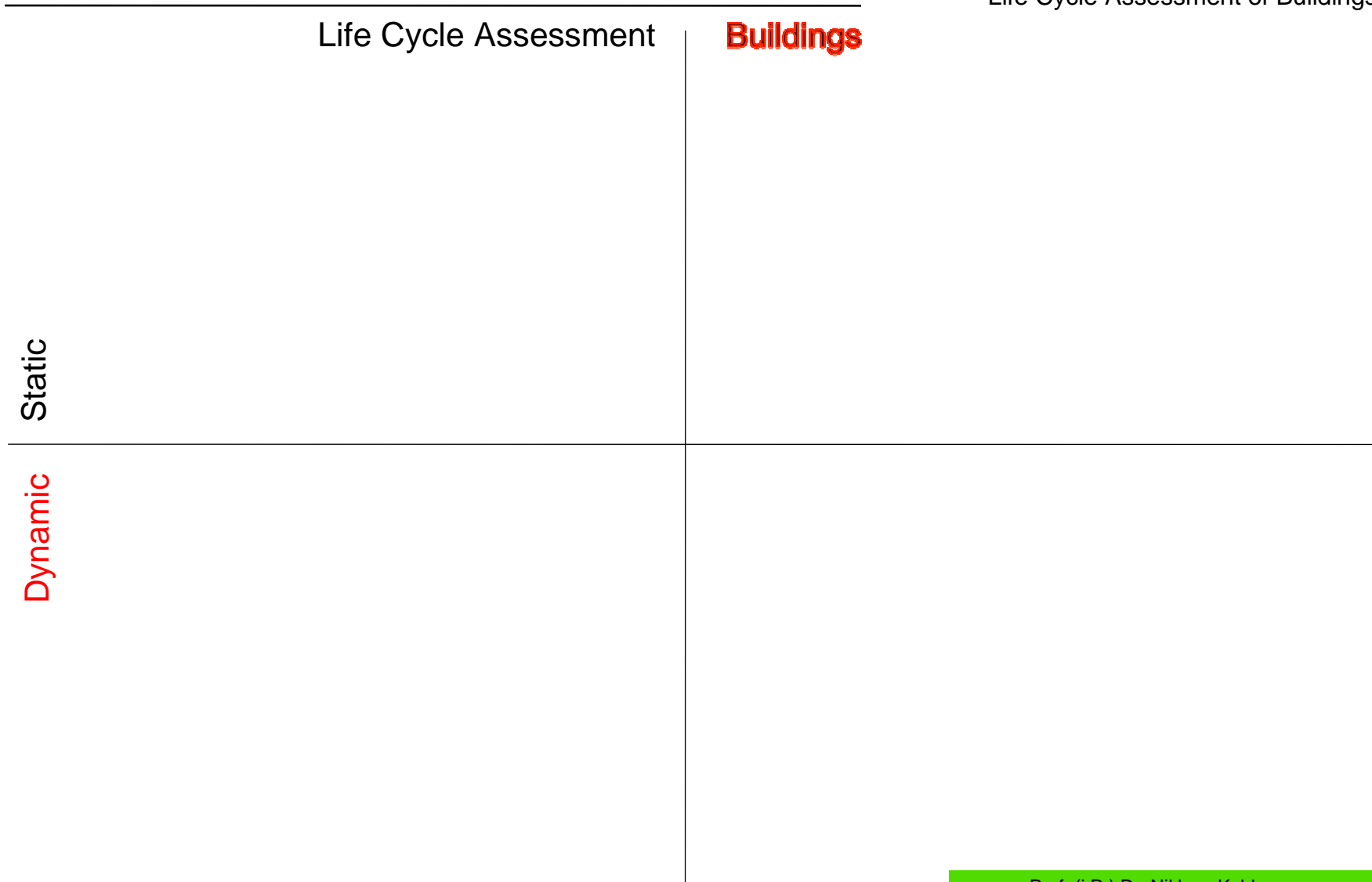


130 years










Problem fields

Life Cycle Assessment of Buildings



State of the art

	Life Cycle Assessment	Buildings
Static	<p>LC Inventories of materials :</p> <p>EPD of products </p> <p>Data bases  </p>	<p>Building description :</p> <p>Product models</p> <p>Interfaces</p> <p>Link sustainability rating </p>
Dynamic	<p>LCA Standards + Rules :</p> <p>Indicators</p> <p>Mid-point end-point </p> <p>Link to climate change </p>	<p>LC Scenarios :</p> <p>Aging functions</p> <p>Obsolescence</p> <p>Uncertainty </p>

4 directions

- Standardisation
- Simplification
- Differentiation
- Integration

- Allows to compare results
- Allows to accumulate benchmarks
- Basis for software development

- Exclusively new building oriented
- Unrealistic scenarios
- No more link to real world

- Simplification on the basis of a complete model
- Simplification due to limited resources
- Simplification is often “partial”

- Simplification of basic data
- Simplification of building description (cut-off)
- Simplification of results
- Simplification of life cycle scenarios

Introduction of stochastic methods

Introduction of emerging methods (agents)

Differentiation of scenarios (technology change)

Dynamic LCA

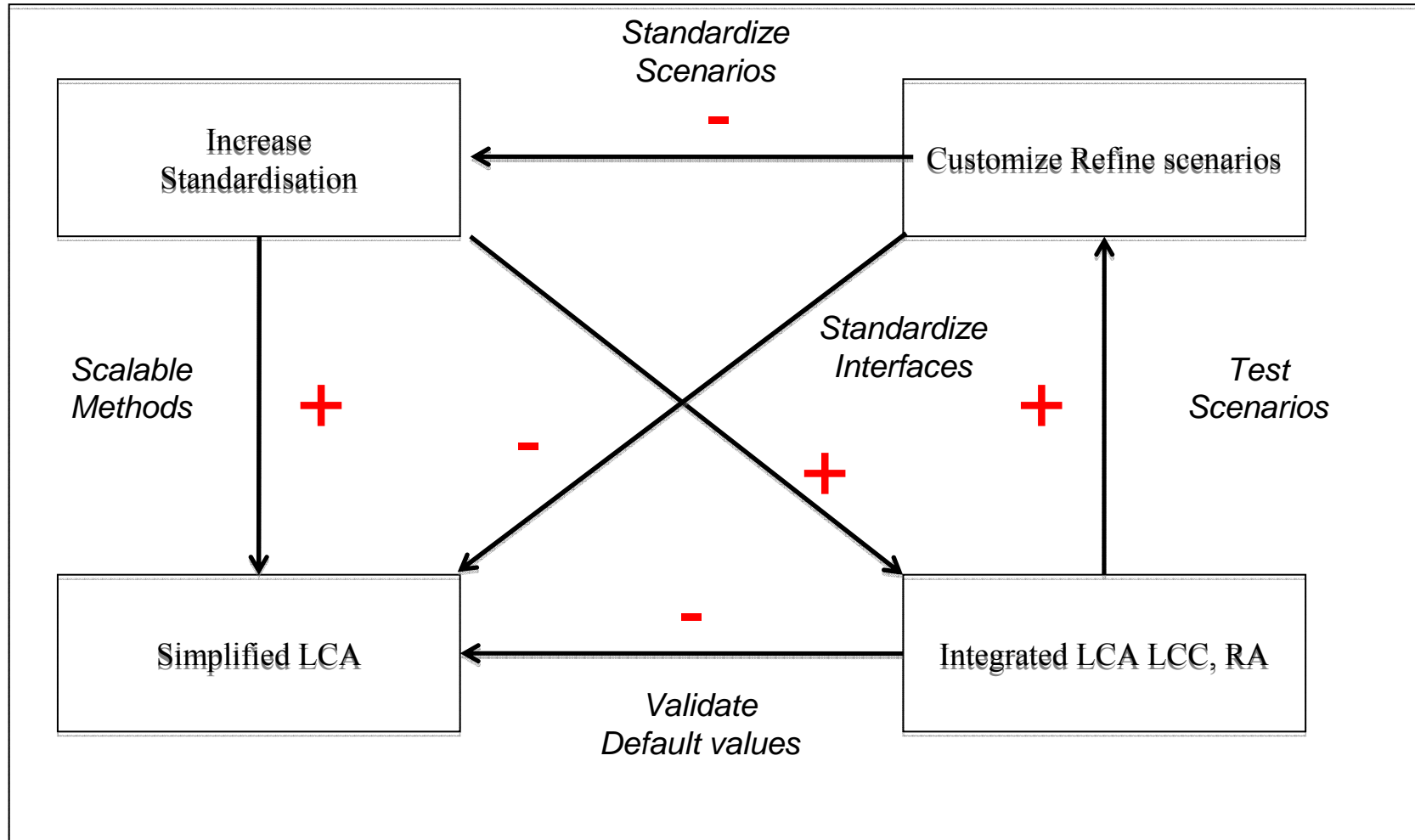
Optimisation methods (multi criteria)

Consecutive LCA

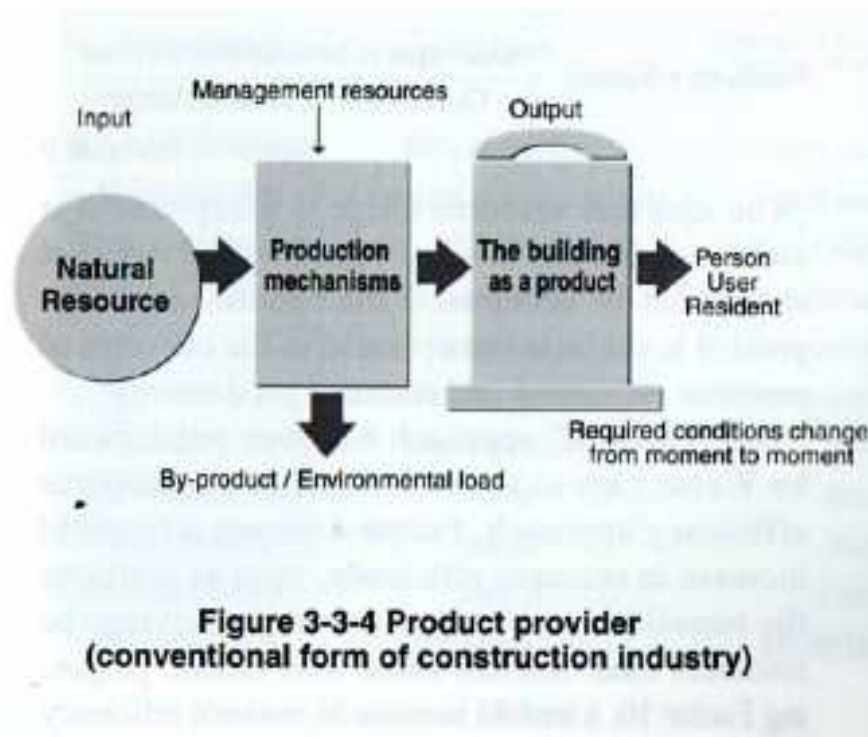
Actor centred LCA

- Common methodology LCA, LCC, RA (risk assessment)
- Automatic, comprehensive uncertainty assessment
- Link to sustainability assessment
- Common, scalable building description (product model)
- High degree of automatization
- Development of multidimensional visualisation of results

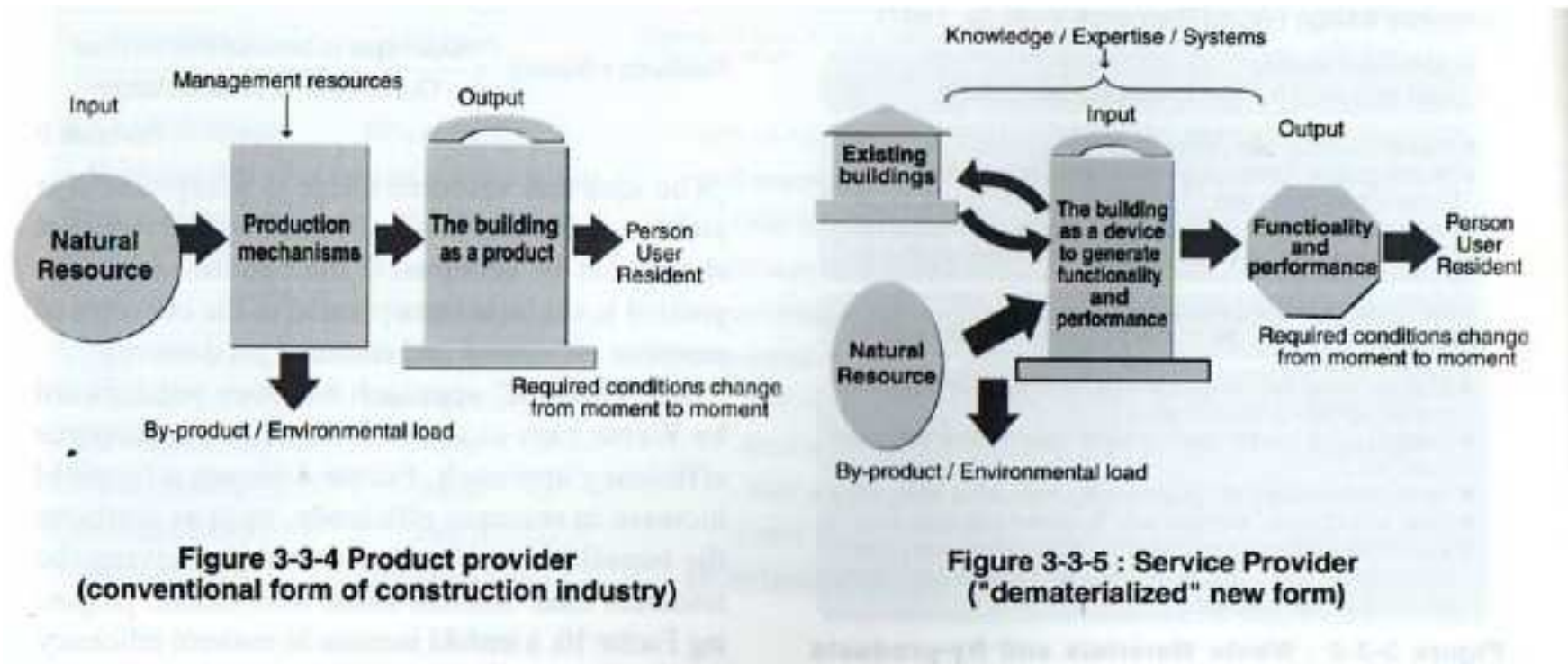
Development interrelations



Building as a product



Building as a service



Target budget approach (2000 W society)

Table 1 Primary energy and CO₂ targets for domestic buildings after SIA 2040 efficiency path (2000-Watt Society)

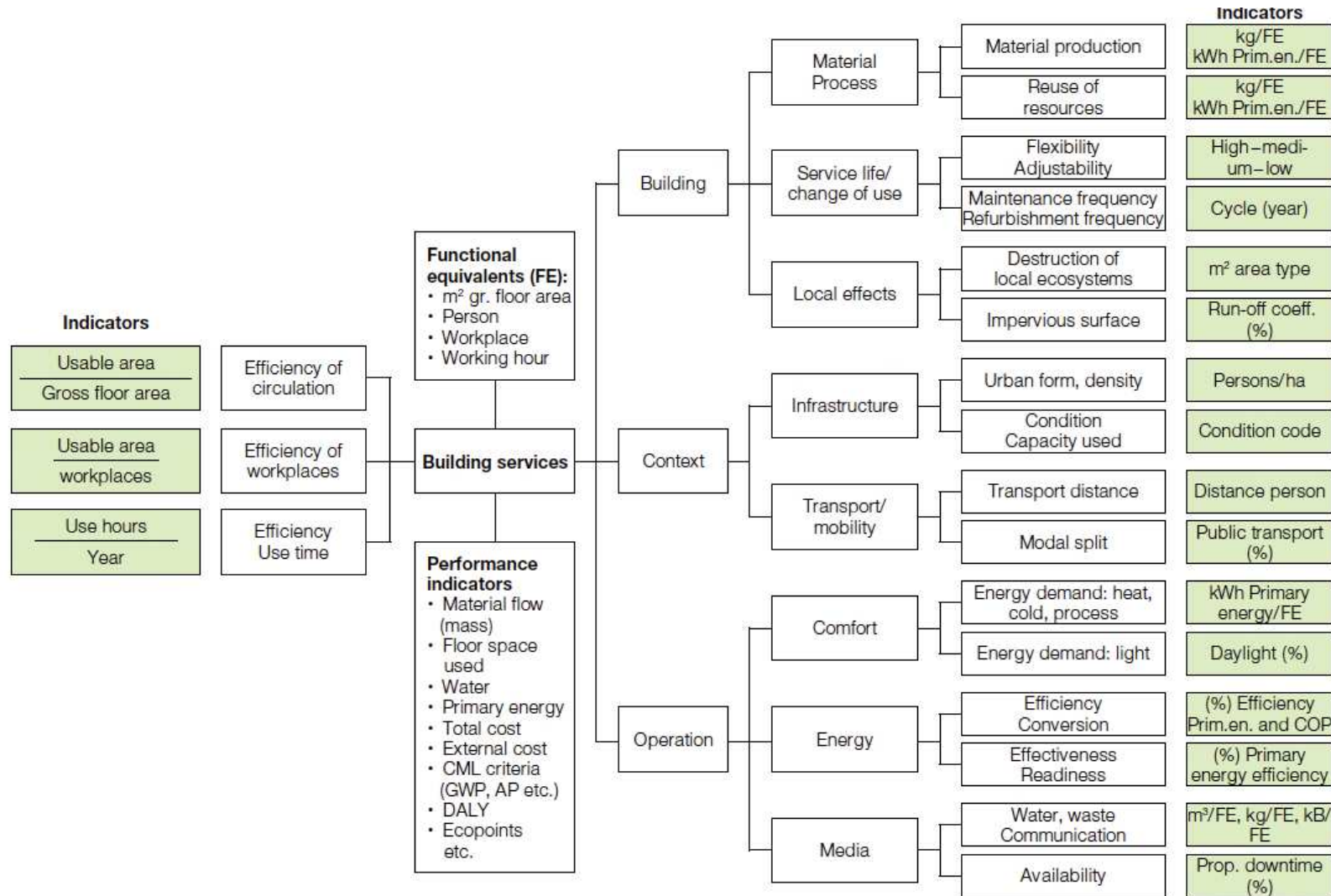
	Primary energy non-renewable (MJ/m ² /year)		CO ₂ equivalent (kg/m ² /year)	
	New housing	Existing housing	New housing	Existing housing
Target for building construction	110	60	8.5	5.0
Target for building operation	200	250	2.5	5.0
Target for building induced mobility	130	130	5.5	5.5
Overall target	440		16.5	15.5

Energy efficiency path (SIA)

The assumed domestic surface per person is 60 m² (440 MJ/ m² year / 365 days / 24 hours / 3 600 sec)
 * 60 m² person * 106 = 840 Watt/person
 source : (SIA 2040 – Energie Effizienzpfad - 2011)

Parameters overview

Life Cycle Assessment of Buildings



- Constitution of a pool of reference buildings as a basis for the development and validation of integrated LCA methods
- Development of LCx – BIM models (including infrastructure)
- Integration of LCA, LCC and RA into all sustainability rating
- Automatic estimates of uncertainty and reliability of results
- Development of LCA for refurbishment of existing buildings
- Definition of Zero Energy and Positive Energy concepts through LCA

LCA 2062 : 180 years and zero energy ?

