

IEA EBC Annex 72:
Assessing life cycle related environmental impacts caused by buildings

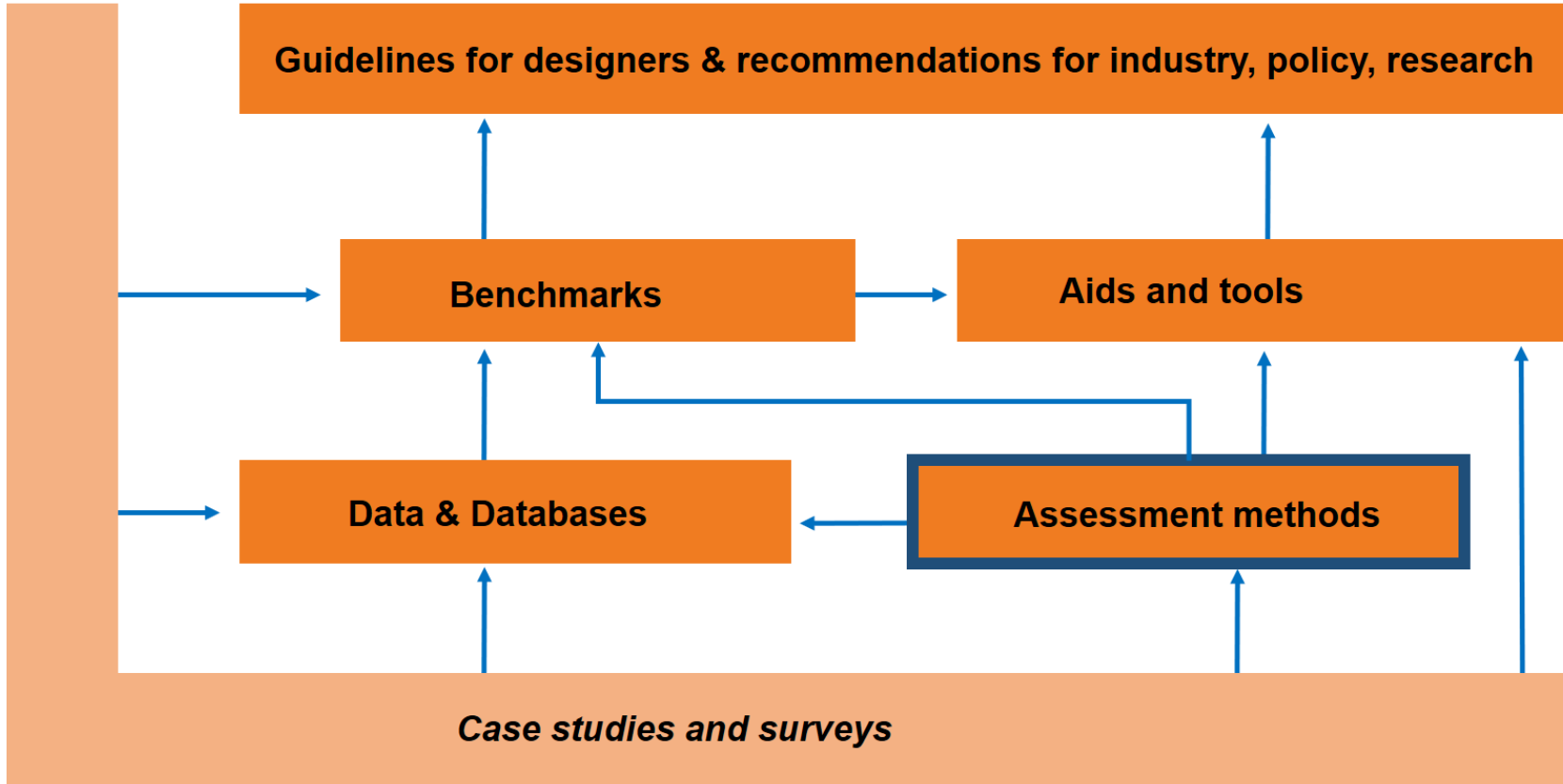
Life cycle assessment of buildings: requirements on methodology

Thomas Lützkendorf and Maria Balouktsi
Karlsruhe Institute of Technology, Germany
Leader of Subtask 1

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Context

The position of ST1 „Assessment Methods“ and the interrelations to other ST's and results



The assessment methods form an inseparable unit with the databases and the benchmarks.

Design and assessment tools can prepare the calculation and assessment rules for environmental impact results in a practical way and link them to both data and benchmarks.

Target

Why we need better and more transparent assessment methods?

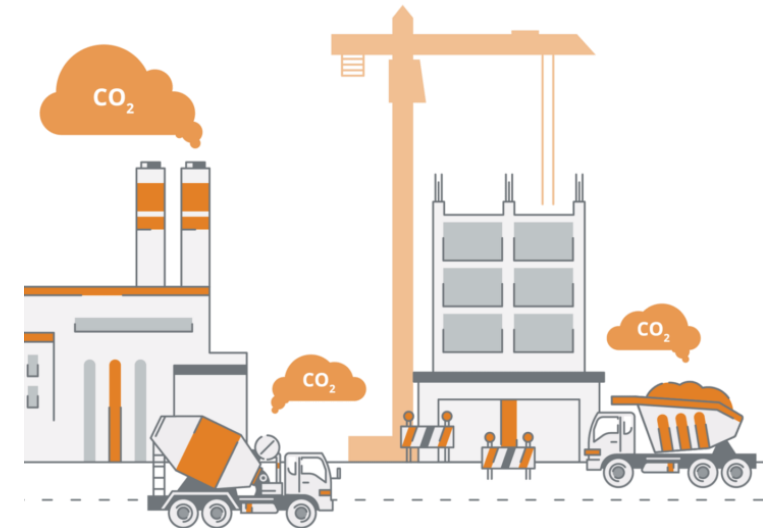
- ❖ The methods are progressing worldwide towards considering the whole life cycle of buildings.
- ❖ There is a political and social interest in the determination, assessment and influencing of resource consumption and environmental impacts associated with the construction, maintenance, use and end-of-life of buildings.
- ❖ Many institutions and governments are faced with the task of (further) developing and/or introducing mandatory assessment methods.
- **There is a need to give recommendations for new methodological questions and to generally improve the transparency of the methods.**



Checklist I (traditional aspects)

Aspects to clarify in the development and description of an assessment method

- Object of assessment (type of building / functional equivalent)
- Refurbishment projects as specific case of application
- Building model (included building components and tech. systems)
- Life cycle model (included life cycle stages)
- Reference study period (e.g. 50 years)
- Area of protection, impact categories, assessment criteria, indicators
- Scenarios for operation, replacement and EoL, among others
- Source of information for product- and service-related data



<https://www.carboncure.com/concrete-corner/what-is-embodied-carbon/>

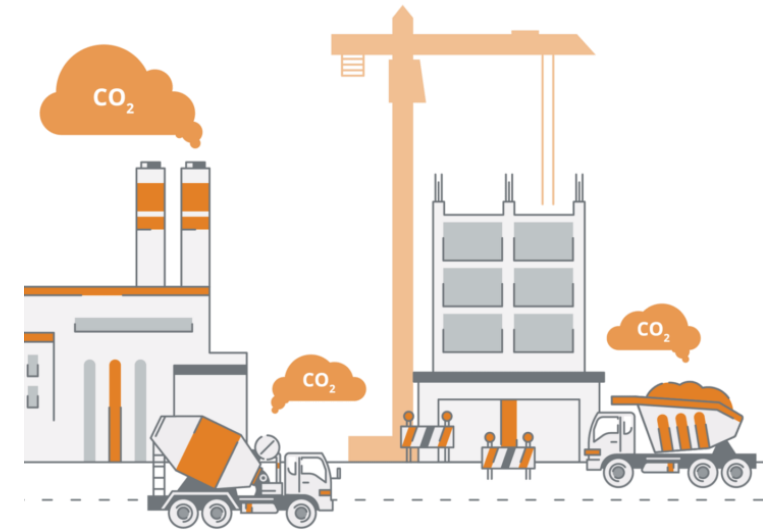
Checklist II (additional aspects)

Aspects to clarify in the development and description of an assessment method

- Type of dealing with aspects of time (e.g. consideration of future technological developments)
- Type of dealing with different types of uncertainties
- Type of dealing with discounting of future emissions
- Approach for assessment of bio-based products (0/0 versus -1/+1)*
- Approach for assessment of building-integrated photovoltaic systems and exported excess electricity
- Type of dealing with additional information (D1, D2**, carbon content)
- Accepted options and rules for offsetting greenhouse gas emissions
- Specific aspects of assessing upfront emissions (A1-A5)

* climate neutral from the very beginning or time-related considerations

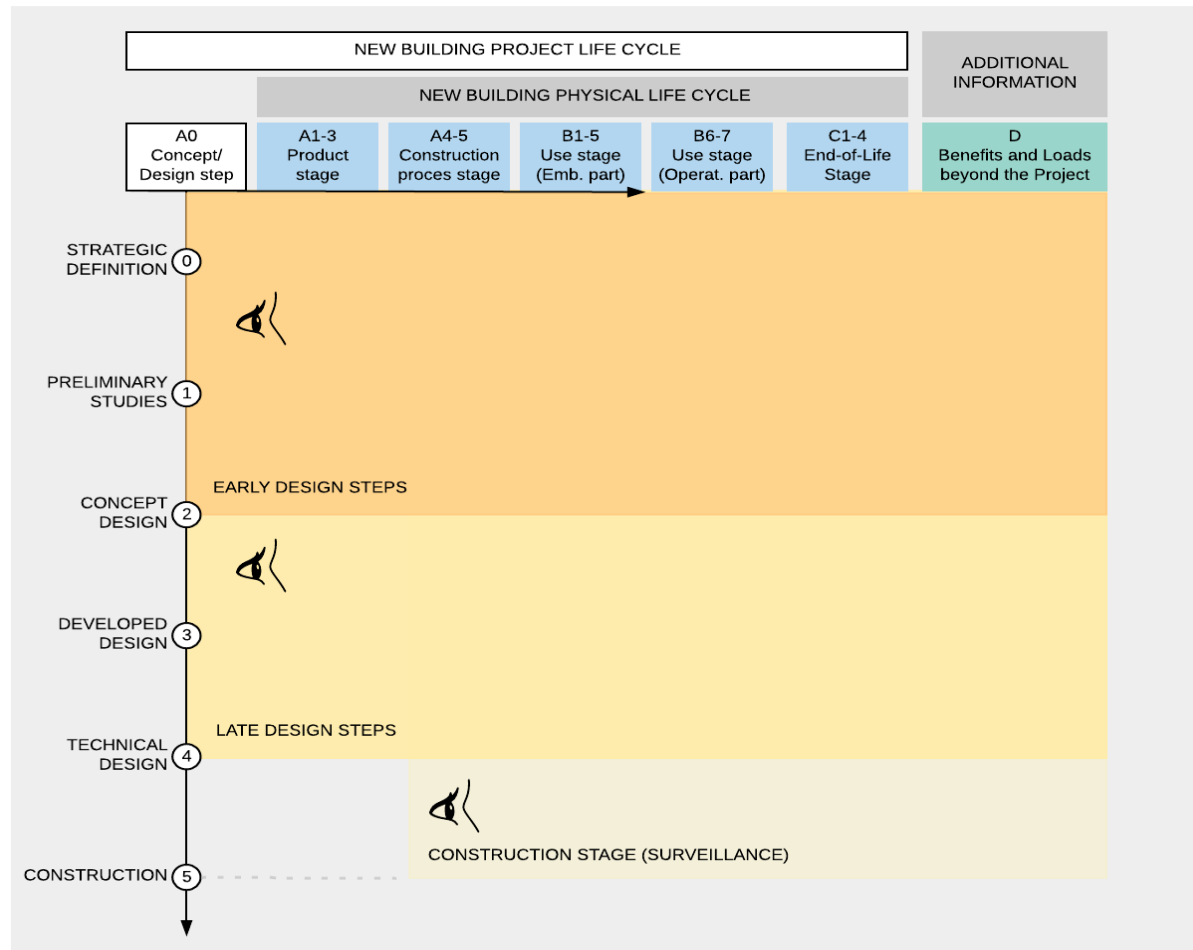
**D1 = recycling potential; D2 = potentially avoided emissions elsewhere from exported energy



<https://www.carboncure.com/concrete-corner/what-is-embodied-carbon/>

Integration into design process

An assessment method shall be applicable at different stages of design and decision making process

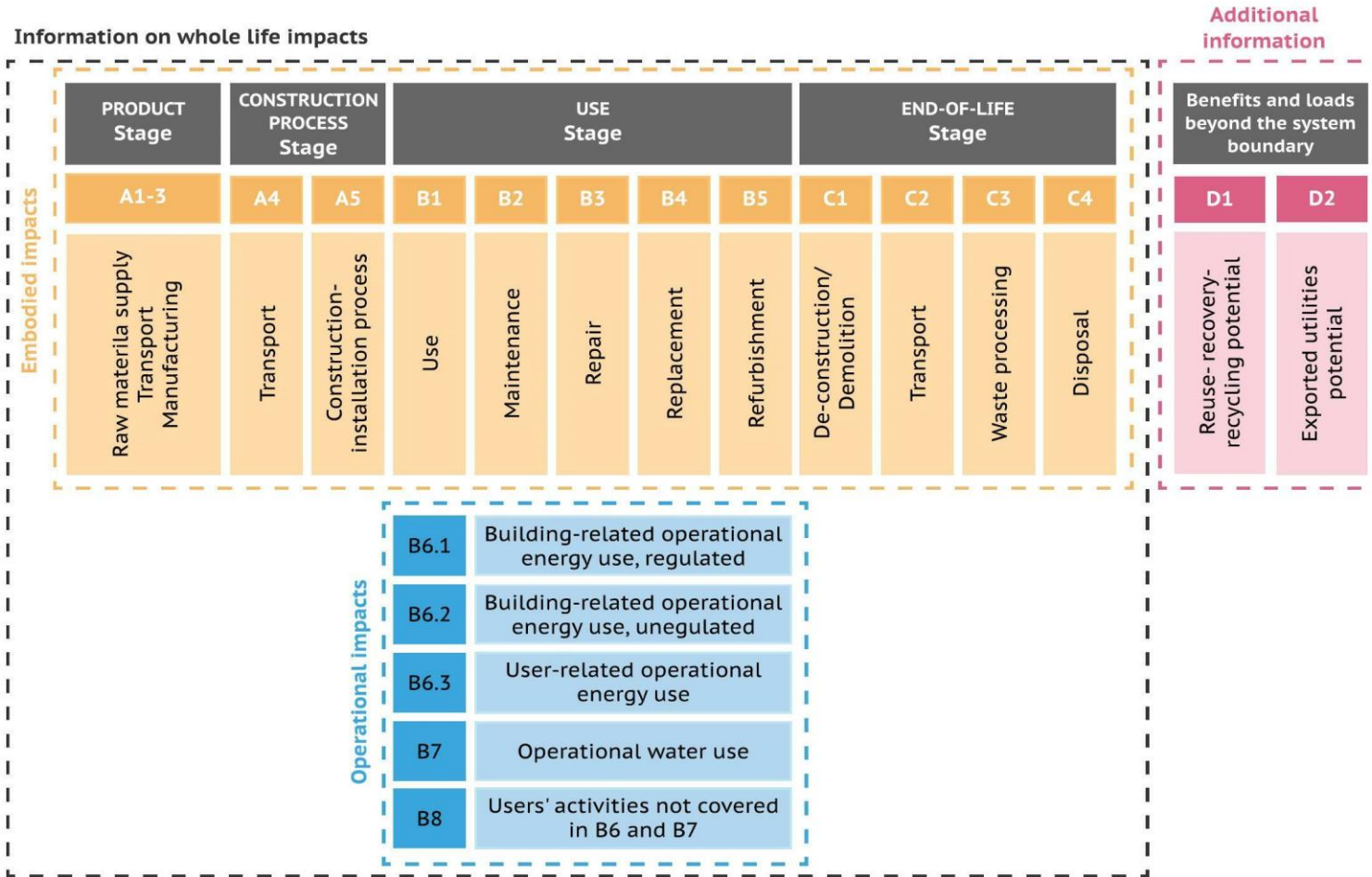


In principle, an assessment method must be applicable across every design phase, but it must be adaptable to the following situations in the design progress:

- Existing granularity of the building model
- Availability of appropriate data (generic/average versus specific)
- degree of uncertainty

Life cycle model for buildings

Adapted from EN 15643 and current draft of EN 15978-1



Embodied impacts

- Upfront
- Recurring
- EoL

Operational impacts

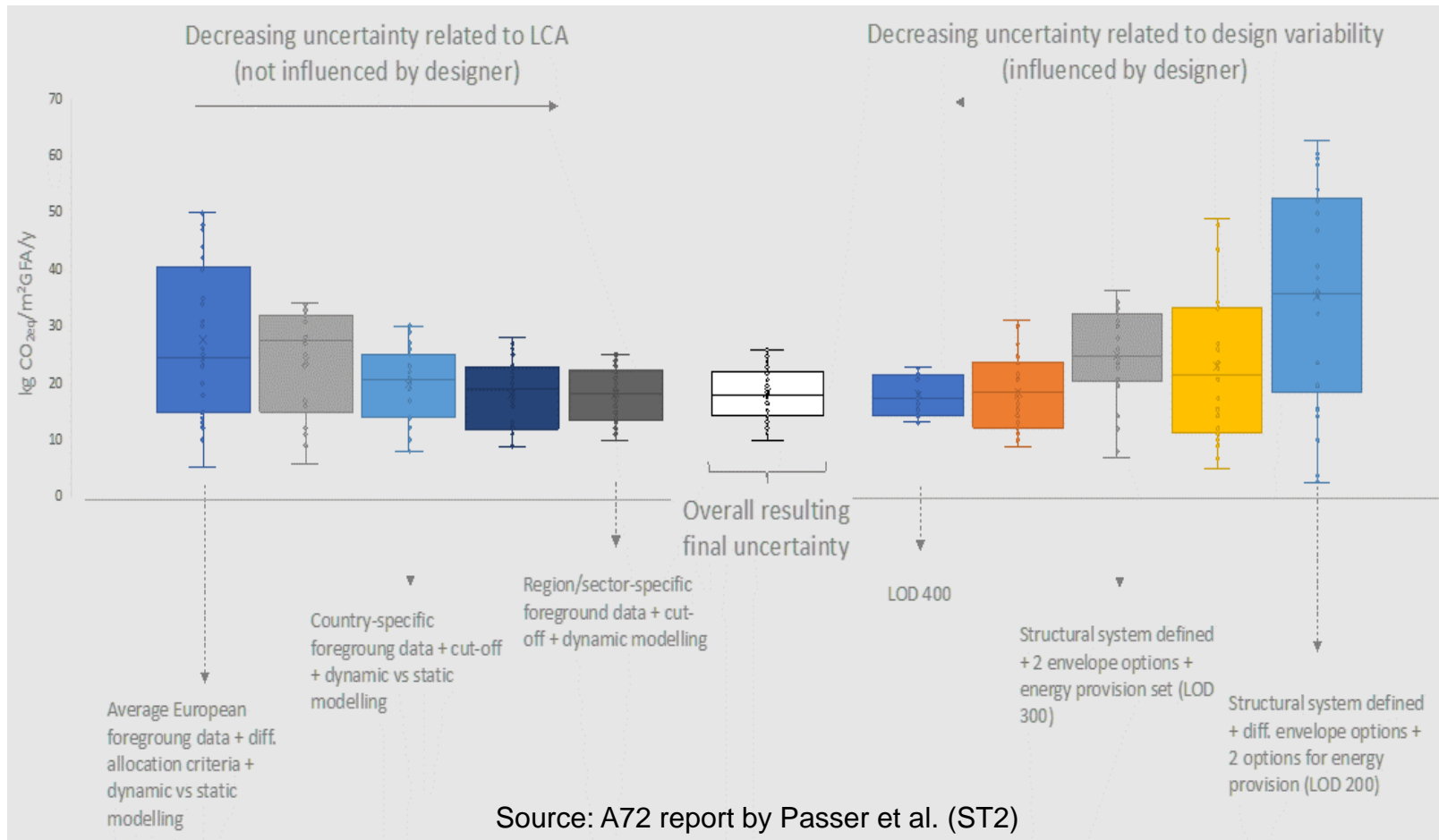
- Regulated
- Unregulated
- User related
- *Non-energy related*

Additional information

- Recycling potential
- Potentially avoided impacts from exported energy

Handling of uncertainties

Typology of sources



Uncertainties in relation to

- LCA-method in use
- Data quality
- Design variability

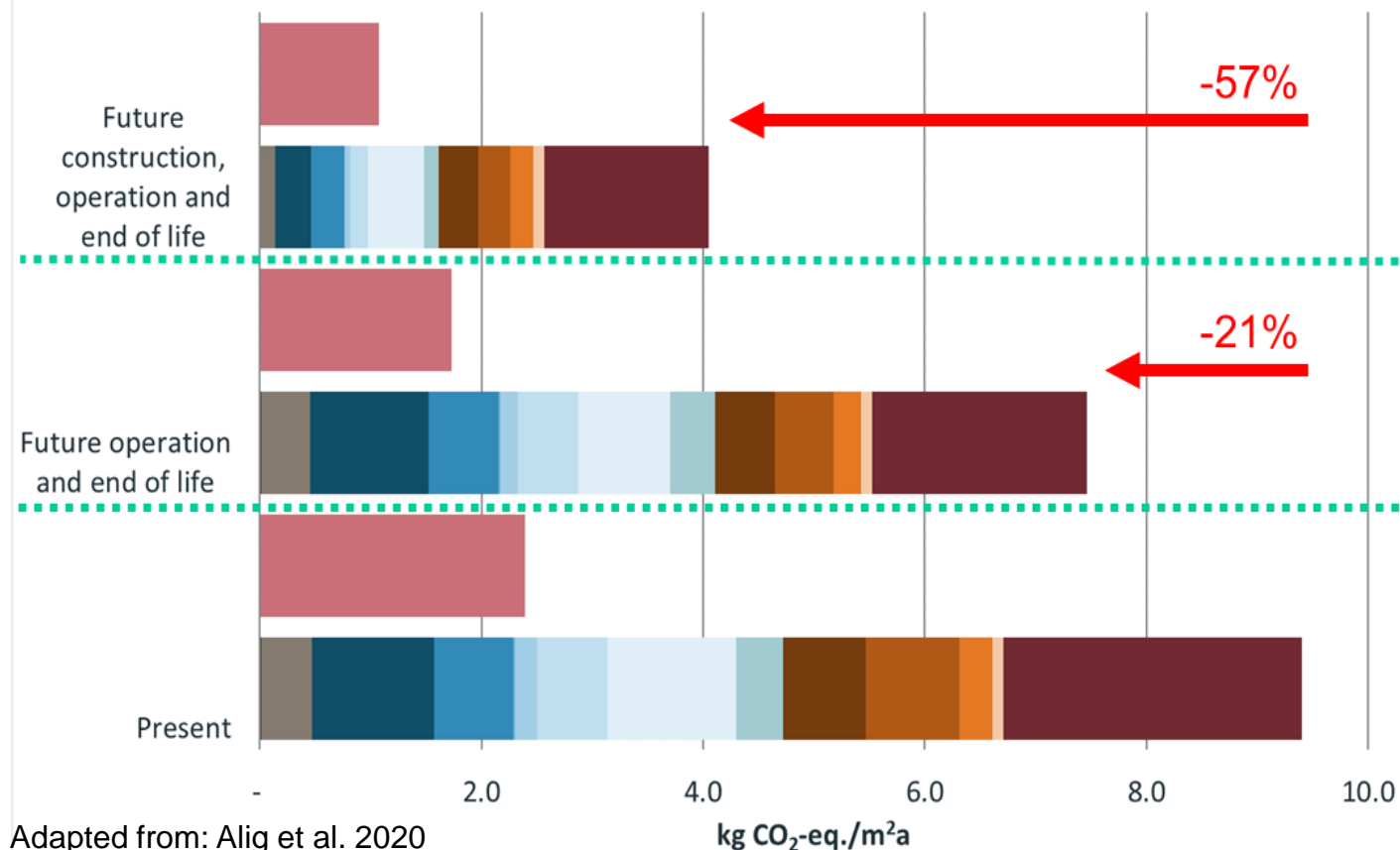
Further research is needed to capture, assess and communicate the degree of uncertainty of an assessment result.

From static to dynamic considerations

How far we can go with assumptions and can we trust published mitigation pathways?

Note: D0 to I is embodied, B is operation

■ D0 ■ D1 ■ D2 ■ E0 ■ E1 ■ E2 ■ E3 ■ E4 ■ E5 ■ E6 ■ M1 ■ M3 ■ M4 ■ M5 ■ I ■ B



Adapted from: Alig et al. 2020

Assumptions have already been made for future energy generation and the manufacture of building products.

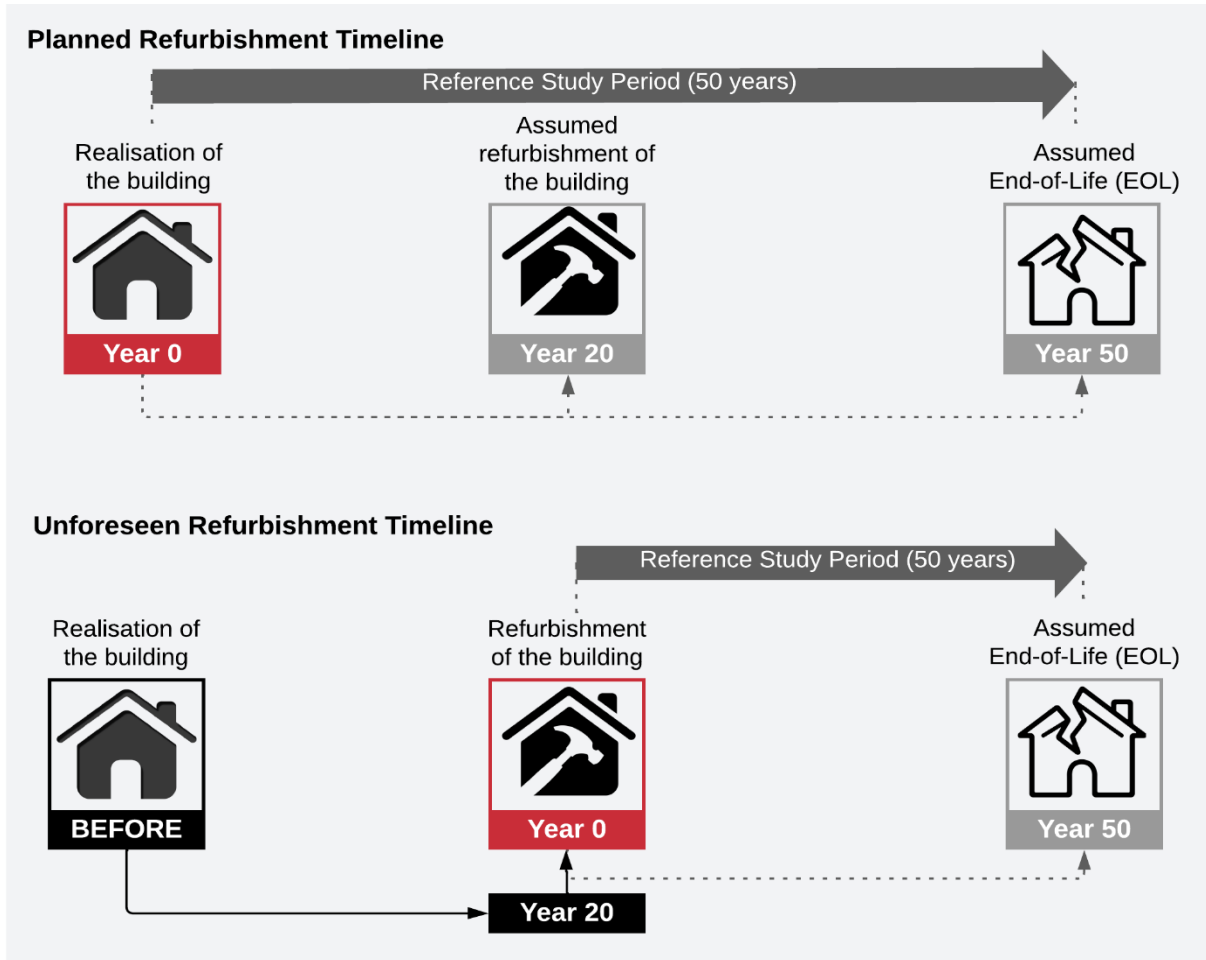
It is recommended to test dynamic considerations in the form of studies.

With a transition to dynamic considerations, the benchmarks must be adjusted.

Regulatory measures and private investments are required to increase the likeliness of the future scenario underlying the LCA.

Application case „refurbishment“

What is the difference between B5 refurbishment and refurbishment as start for a next use service life ?



A building refurbishment already planned at the time of design is part of the building's functional equivalent (described in the client's brief) and considered in the life cycle model as module B5.

A need for refurbishment that arises during the service life of an existing building is considered a refurbishment project. A new life cycle begins.

- ❖ No physical discounting (equal importance of current and future emissions)
- ❖ Use of -1/+1 approach in the assessment of bio-based products
- ❖ Sub-division of life cycle based impacts into embodied and operational part
- ❖ Carbon content, use of resources, impacts on local environment as additional indicators in the assessment of environmental performance
- ❖ Data on recycling potential and potentially avoided impacts elsewhere as additional information
- ❖ Static approach in the case of legal requirements

- ✓ When assessing **environmental performance** of buildings, the **complete building in its entire life cycle** must be considered, including all upstream and downstream processes.
- ✓ For the design and assessment, suitable building and life cycle models with a **high degree of transparency** are needed to make uncertainties clear and able to reduce.
- ✓ The main indicator for quantifying potential effects on the climate are the **GHG emissions, measured in kg CO₂ equivalents**. GHG emissions should be determined using life cycle assessment and preferably **divided into a fossil and a biogenic share**.
- ✓ The resulting carbon footprint of a building should be **supplemented by information on the biogenic carbon content as well as other indicators** to record the **environmental performance**.



Main results

available from spring 2023

Rules and recommendations for the development of assessment methods for environmental impacts

Target groups

- *Designer*
- *Researcher*
- *Policy maker*
- *Industry*

Application cases

- ❖ *Design and decision making*
- ❖ *Sustainability assessment*
- ❖ *Standardisation*
- ❖ *Legislation*
- ❖ *Research*

