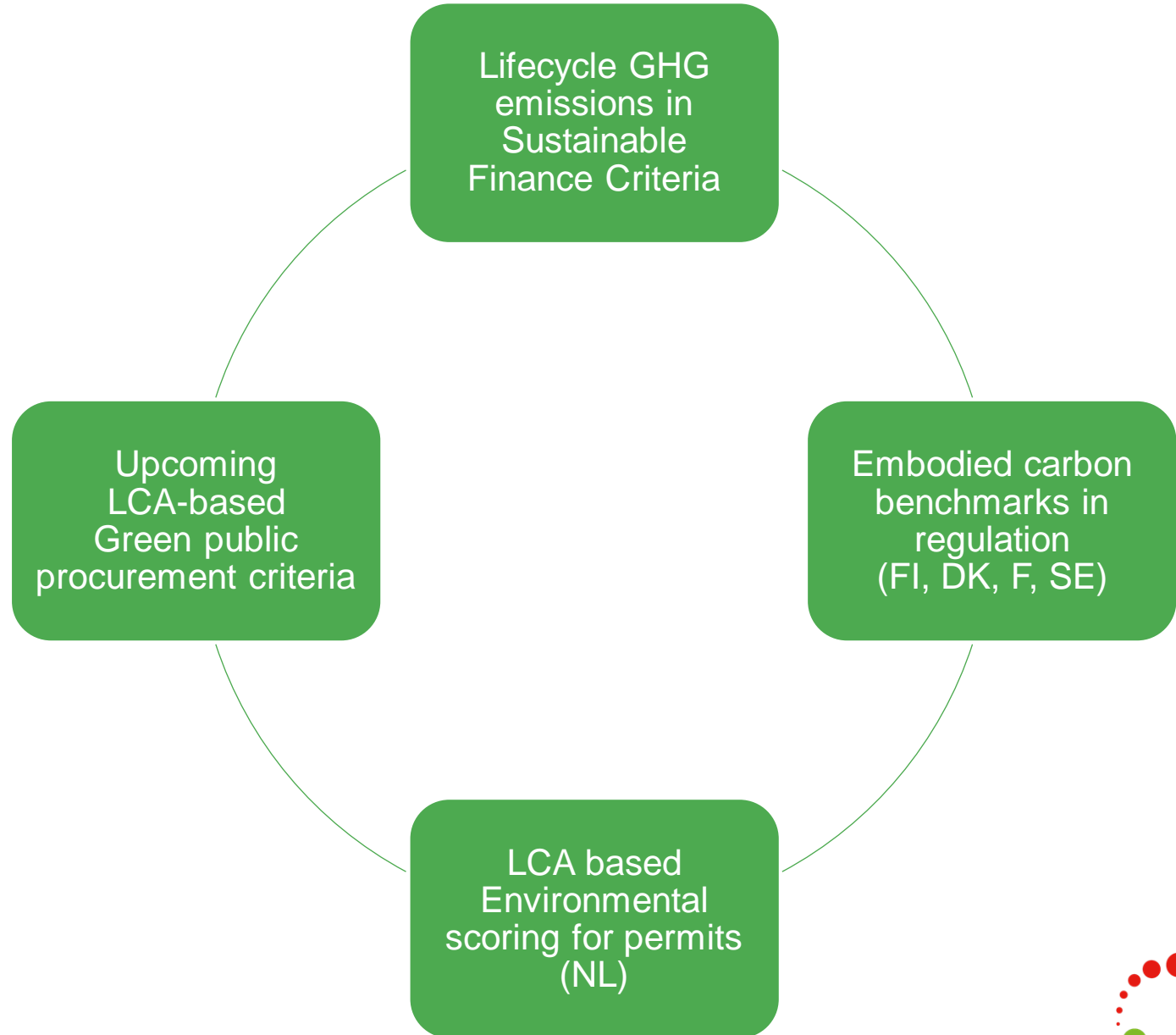




Pixabay ©DGNB

The need for more “dynamics” in Life Cycle Assessments  
for improved building-related decision making processes  
LCM 2021 – J. Kreißig, Dr. A. Braune, M. Fischer

# LCA of buildings gains importance in policy making



# Use LCA scenarios to evaluate future developments. Which future?

„There are known knowns; there are things we know we know.

We also know there are known unknowns; that is to say we know there are some things we do not know.

But there are also unknown unknowns – there are things we do not know we don't know.“

[Donald Rumsfeld]

# Weaknesses of standardized LCA rules

Can we evaluate potential long-term environmental effects by using

- **static emission factors** and **resources depletion factors** for e.g. 50 years of energy use in buildings?
- **datasets for future replacement, deconstruction and recycling** that are based on **current technologies**?
- **reference service life** and replacement **cycles** that are based on **statistics** of today?

Don't these weaknesses **minor the trust** of informed decision makers into the entire methodology?

# Since 2015: DGNB requires EN 15978 compliant LCAs

LIFE PHASES	A 1-3			A 4-5		B 1-7							C 1-4				D	
	MANUFACTURING PHASE			CONSTRUCTION PHASE		USE PHASE							END OF THE LIFE CYCLE				BENEFITS AND STRESSES OUTSIDE THE SYSTEM LIMIT	
	Procurement of raw materials	Transport	Production	Transport	Construction/installation	Use	Maintenance	Repair	Exchange	Modernisation	Energy consumption during operation	Water consumption during operation	Removal / demolition	Transport	Waste processing	Disposal	Potential for reuse, reclamation and recycling	
MODULES IN ACCORDANCE WITH EN 15978	A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D	
DECLARED MODULES	X	X	X					(x) <sup>2</sup>	(x) <sup>1</sup>		X	(x) <sup>3</sup>				X	X	X

Pragmatic decision:

Consider only the information that architects / design teams can deliver and that they can influence directly

# Uncertainty of scenarios

In LCA, many sources and types of uncertainty exist: Uncertainty of parameters, modelling decisions, data variability, preferences, errors, data gaps, etc.

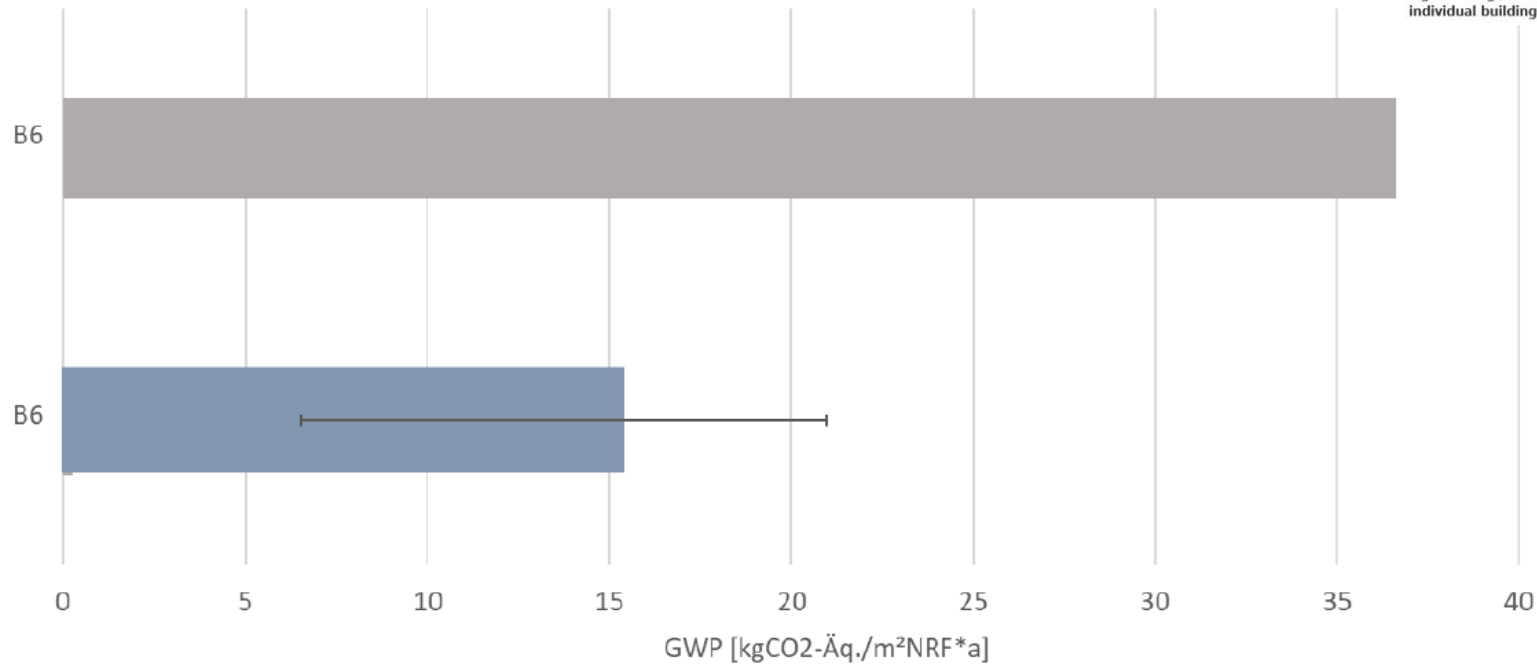
In building LCA, scenario uncertainties are important due to **the long life cycle**.


According to Gantner et al, **uncertainties in building LCAs** occur due to:



- **chosen materials and building elements**
- **future materials and building elements**
- **future incidents**
- **the modelling choices** (e.g. system boundaries)

# Scenarios for B6 Energy use: Static vs. dynamic modelling

B6 – statisch vs. dynamisch



 Deterministisches/ statisches Ergebnis für B6

 Median der dynamischen Ergebnisse für B6  
 Varianz der dynamischen Ergebnisse für B6

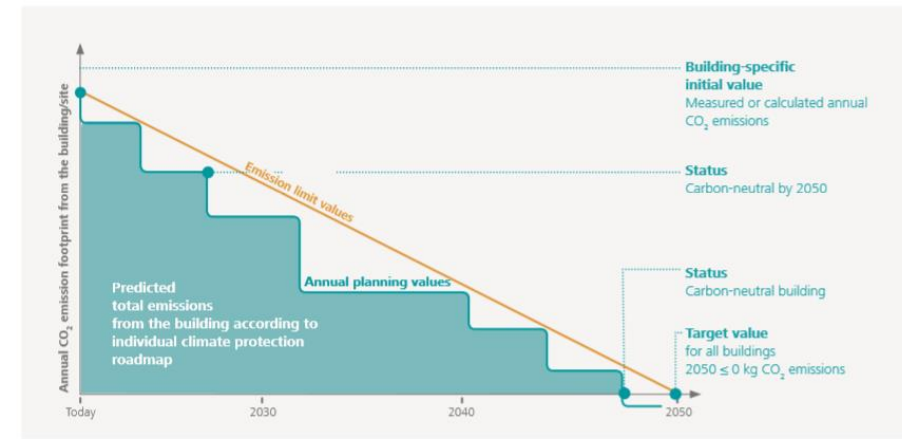
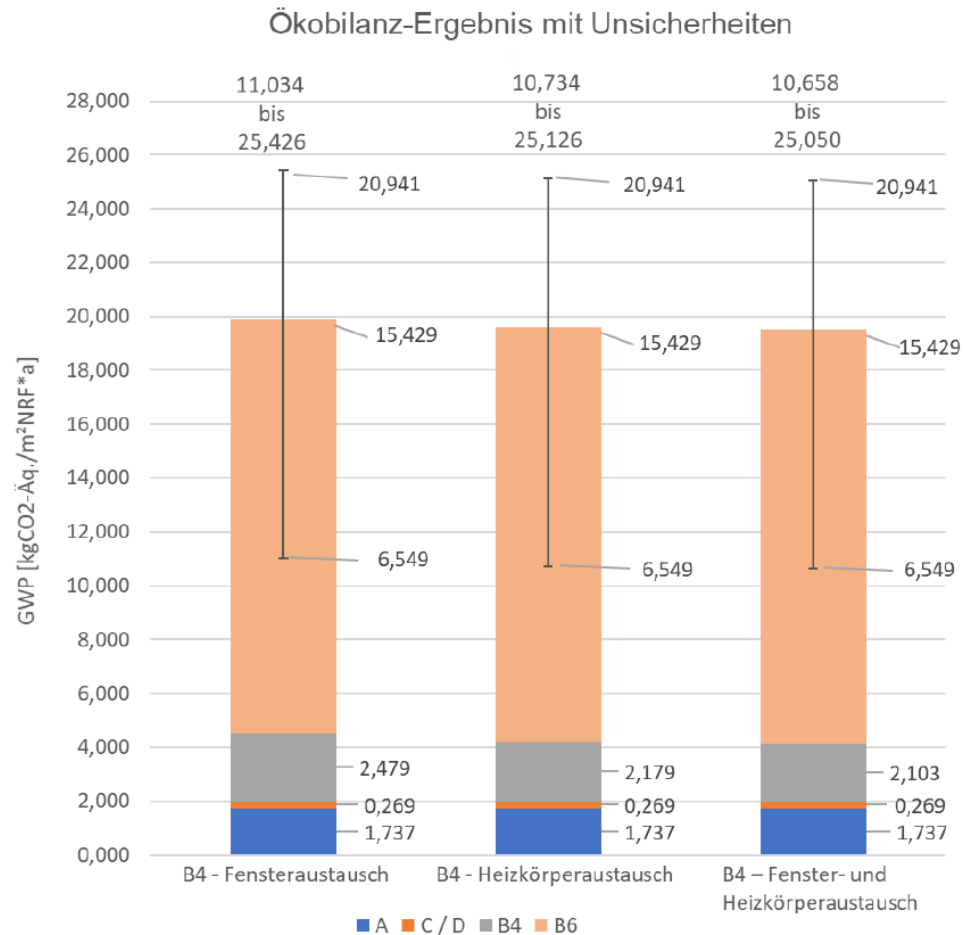


Fig. 6 – Diagram illustrating the principle of a climate protection roadmap with straight lines representing limits for individual buildings or sites

Source: Carolin Bayer, 2019 and DGNB, 2020



# Scenarios for B4 Replacements: Uncertainties are important



Source: Carolin Bayer, 2019



# Possibilities to deal with uncertainties

1. Use datasets with future scenarios?  
(DGNB Framework for carbon neutral buildings)
2. Calculate uncertainty and communicate ranges of uncertainties in results?
3. Pragmatically discount future emissions? (France)
4. Provide several scenarios? (new EN 15978 draft)
5. Focus on upfront emissions / resources?

LIFE PHASES	A 1-3			A 4-5		B 1-7					C 1-4				D		
	MANUFACTURING PHASE			CONSTRUCTION PHASE		USE PHASE					END OF THE LIFE CYCLE				BENEFITS AND STRESSES OUTSIDE THE SYSTEM LIMIT		
	Procurement of raw materials	Transport	Production	Transport	Construction/installation	Use	Maintenance	Repair	Exchange	Modernisation	Energy consumption during operation	Water consumption during operation	Removal / demolition	Transport	Waste processing	Disposal	Potential for reuse, reclamation and recycling
MODULES IN ACCORDANCE WITH EN 15978	A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D

# Discussion

1. Use **datasets with future scenarios**?  
(e.g. DGNB Framework for carbon neutral buildings)

- + Higher reliability, more realistic results
- High effort to develop databases with respective temporal representativity

2. **Calculate uncertainty** respectively and communicate ranges of uncertainties in results?

- + Acceptance of „unknowns“, display of ranges of results
- High effort, new features for software and data

3. Pragmatically **discount future emissions**? (e.g. France regulation)

- + Low effort, fast solution, guiding direction
- Valid definition of factors and methodology

4. Provide **several scenarios**?  
(new EN 15978 draft)

- + Higher acceptance, use of LCA as optimisation tool
- Effort to define / calculate / communicate

5. **Focus on upfront** and first years impacts („DNSH“ approach for scenario)?

- + Climate crisis needs immediate actions
- Possible shift of burdens to later modules

# Summary

Buildings with their long lifetimes require different perspectives and thus LCA rules than products with short(er) lifetimes

Uncertainties of defining future scenarios threaten the acceptance of the entire methodology which leads to lower political pressure to use LCA and reduce more than the direct impacts.

Different approaches to address these uncertainties exist – with pros and cons.

**Climate crisis need immediate answers from science and standardizing organizations.**

# Contact

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