

A case-based study on the use of life cycle assessment and life cycle costing in the building industry

Session: Education & Economy 2: LCC - Economic Challenges

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WHO AM I...

Christine Collin



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2019 Senior Sustainability consultant, Buildings, Rambøll

2018 DGNB consultant

2017 Sustainability consultant, Buildings, Rambøll

2016 Structural Engineer, JPM ApS

Education

2016 M.Sc. Architectural Engineering - DTU and TU Wien

2014 B.Sc. Civil Engineering - DTU and TU München

WHAT I DO...

- Sustainable Building Design, DGNB, LEED, BREEAM
- Life Cycle Assessments (LCA)
- Life Cycle Cost (LCC)
- Research & Development e.g. 'GreenBIM'

References

- [WGBCs](#) 'Bringing embodied carbon upfront' report, which will be published 23rd of September 2019
- EEA – Quantification Methodology for, and analysis of, the decarbonisation benefits of sectoral circular economy actions
- [LCE from the perspective of an engineering consultancy, 2018](#)
- *IASS Hamburg, Sustainability Gains from Combining LCA and Parametric Design in the Early Design Phases of Structural Design, 2017*

A STRONG HERITAGE

- Founded in 1945 in Copenhagen, Denmark
- Founders: Professors Johan G. Hannemann and Børge J. Rambøll
- Talented engineering combined with social visionary aspects
- Strong principles and philosophy



GEOGRAPHICAL FOOTPRINT



Today

15,000 experts

Close to 300 offices in 35 countries

INTEND - INDUSTRY PERSPECTIVE

Only 4 % of all building projects in 2018 in Denmark were considered sustainable¹ including:

- Certified buildings
- Low energy buildings
- Additional sustainability measures



In Ramboll Denmark approximately 6,5 % of the building projects are described as sustainable

Question: How are we going to change the current practice?

CASE STUDIES – ASSESSMENT OF DIFFERENT DESIGN TOOLS



1. Life Cycle Engineering Screening



2. Building element LCA and LCC



3. Whole building LCA and LCC








LIFE CYCLE ENGINEERING SCREENING

Tool to compare different products on their sustainability throughout the building life cycle, to enable informed design decision

Can be used with both generic and specific product data

Comparison of functional equivalent products		Sustainability parameters		
		Social 	Economic 	Environmental 
Life cycle stages	Production			
	Construction			
	Use			
	End of Life			



CASE - SCREENING



	Social	Economic	Environmental
Production			
Use			
End of Life			

Acoustic ceiling panels	Environmental Impact [kg CO2 eq/m2]	Lifetime [years]	Price [kr/m2]	Maintenance friendly	Recycled Material Content [%]	Toxicity and degassing [mg/m3]	Product Certification	Aesthetics
Ceiling Panel 1	0,43 kg CO2 eq /m2	50 years	130 kr/m2	Yes Possible de- and remounting for easy accessibility	0%	0,02mg/m3	FSC/ PEFC	The solution does not meet the requirement for a "uniform ceiling surface"
Ceiling Panel 2	1,87 kg CO2 eq /m2	30 years	296 kr/m2	Yes Possible de- and remounting for easy accessibility	71%	<0,5mg/m3	C2C	The solution meets the requirement for a "uniform ceiling surface"
Ceiling Panel 3	1,20 kg CO2 eq /m2	50 years	225 kr/m2	Yes Possible de- and remounting for easy accessibility	52%	0,01mg/m3	?	The solution meets the requirement for a "uniform ceiling surface"

POTENTIALS AND BARRIERS

- Can be tailored for the specific need
- Enable informed decision-making, not only focusing on functionality and aesthetics
- If demand arise the manufacturers will start competing on more parameters than just price
- Clients like the simplicity and the visual comparison



- Data gathering can be time consuming
- No regulation of manufacturers to disclose the needed information
- Risk of neglecting important parameters, if comparing too few indicators
- It may be necessary to introduce weighting of the parameters if some products receive equal 'score'

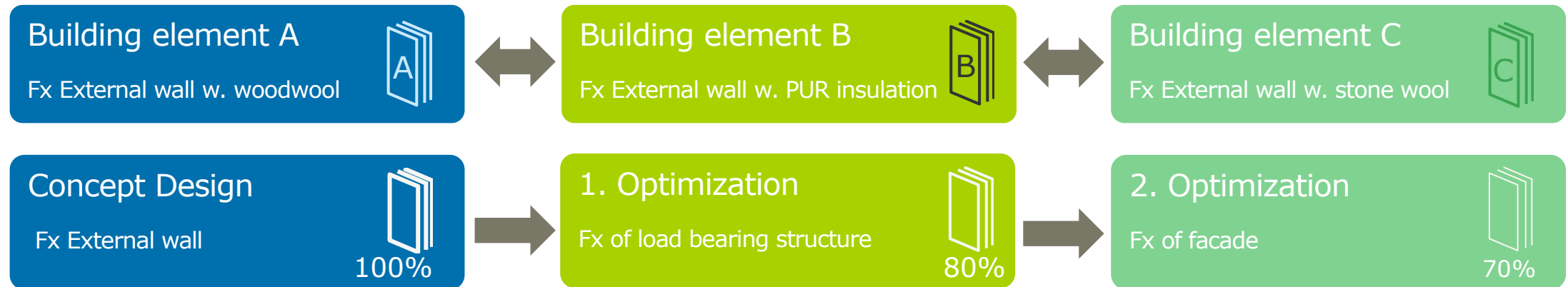




BUILDING ELEMENTS COMPARISONS



LCA/LCC can be used to compare comparable building elements or for optimization

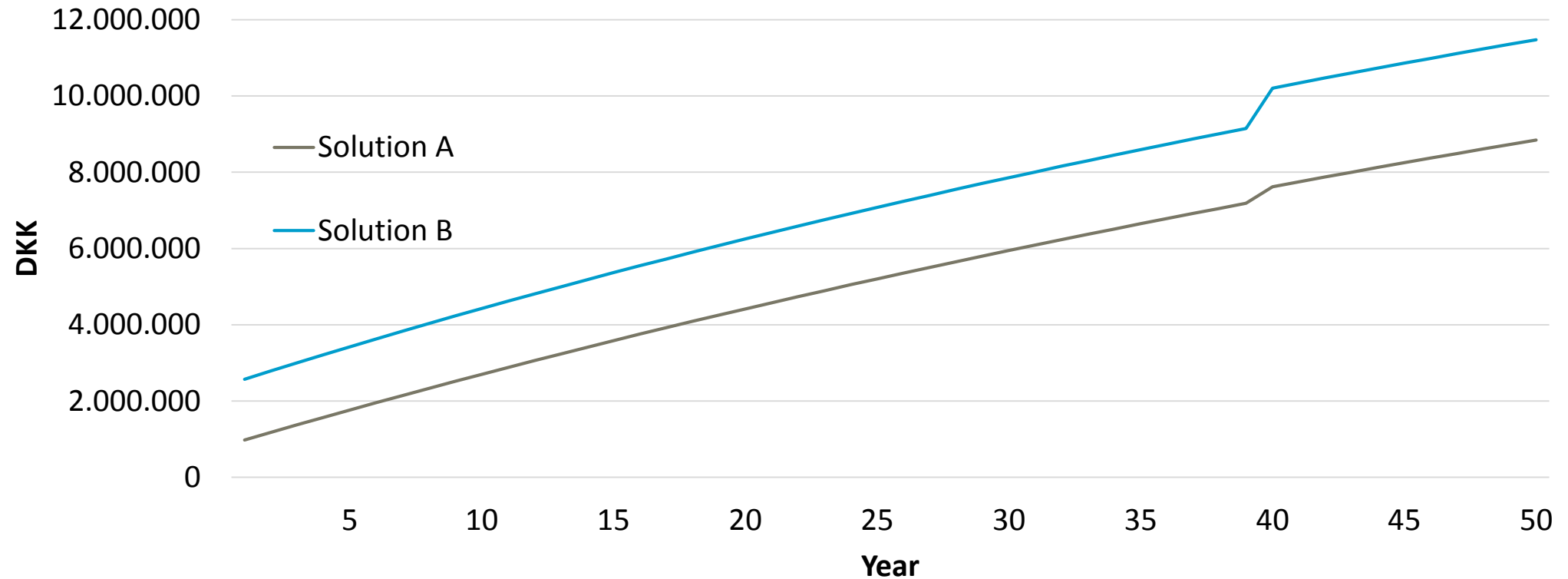




CASE – LCC CALCULATION DURING EARLY DESIGN



Solar shading systems in a life cycle perspective





POTENTIALS AND BARRIERS

- Enable informed decision-making, not only focusing on functionality and aesthetics
- Operator developers are more likely to see the benefit of these assessments
- Calls for an integrated design process and early stakeholder inclusion

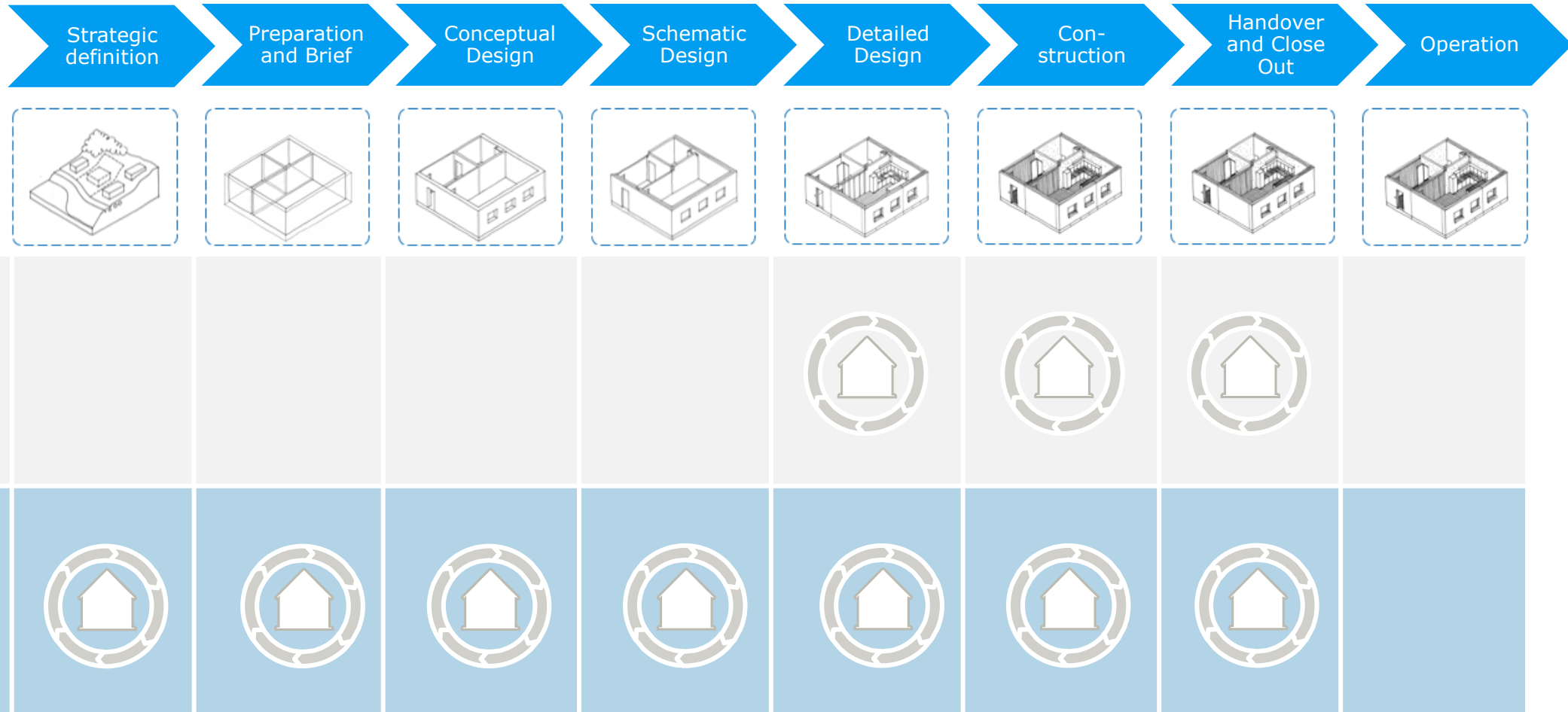


- Design phases are limited in time
- Conservative construction industry with a “business as usual” approach
- Often different companies need to be involved as well as facility managers and contractors, which often are not included in the early design stages

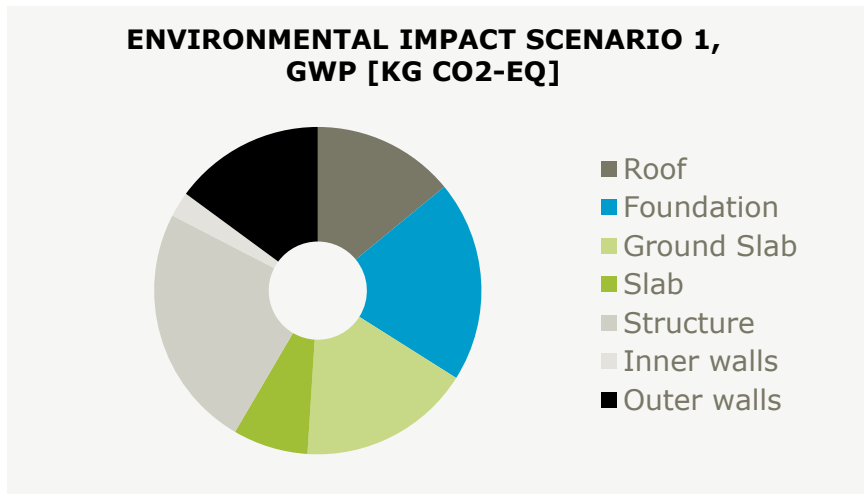
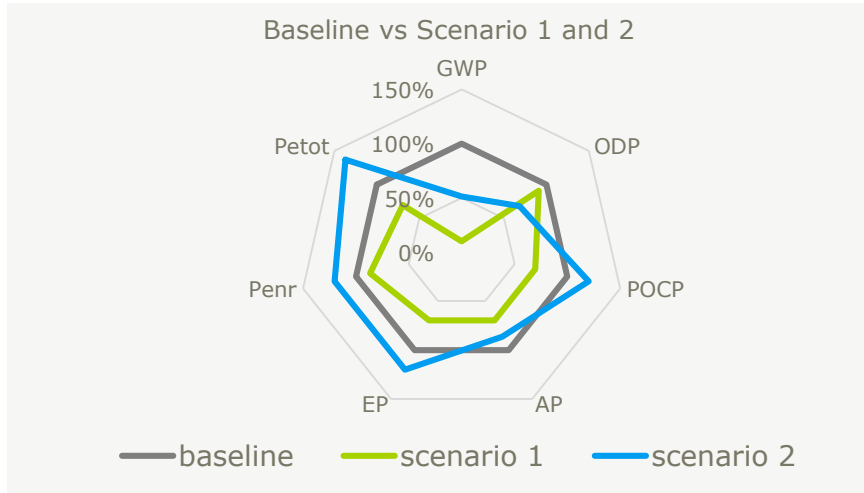




WHOLE BUILDING LCA AND LCC



CASE – BUILDING LCA DURING CONCEPTUAL DESIGN





POTENTIALS AND BARRIERS

- Shows the building elements with the largest emissions or related cost
- Enable informed decision-making
- Useful for certification purposes, both DGNB, LEED and BREEAM
- Is best perceived by client if results are converted into certification points (needs to be simple)

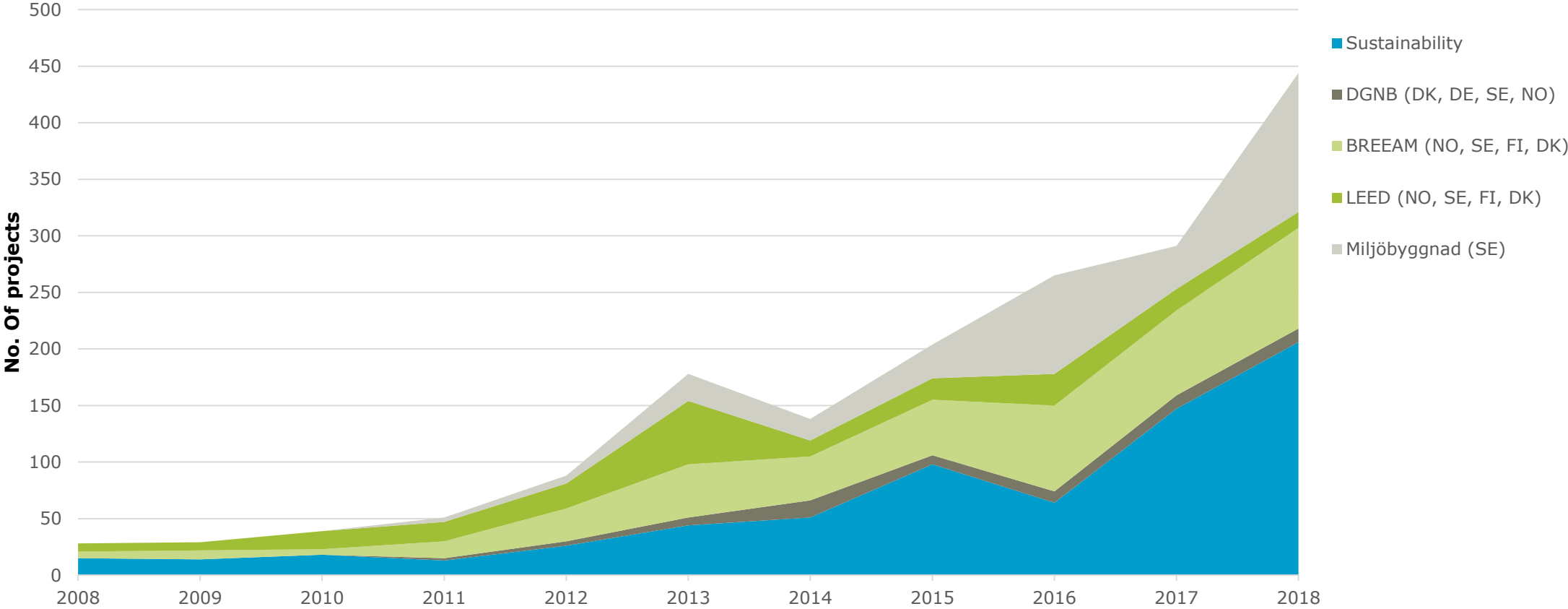


- Lack of integration between BIM and LCA/LCC tools
- Lack of standardized 3D models makes it time consuming to retrieve and check data
- Lack of detailed data in models e.g. rebar or timber studs



INDUSTRY PERSPECTIVE - THE NORDIC COUNTRIES

Increase in Sustainable Building Projects Globally in Ramboll from 2008-2018



THANK YOU



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