LCA IM PLANUNGSPROZESS VON GEBÄUDEN

DESIGN DECISION TABLE FOR DECISION MAKERS (IEA EBC ANNEX 72)

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KONTEXT

Zentrale Aufgabe bei der Planung von Gebäuden muss es sein, unerwünschte Folgen für den Klimawandel zu minimieren. Ziel ist hier ohne betriebsbedingte Treibhausgas-emissionen auszukommen oder zumindest mit einer ausgeglichenen Bilanz entsprechender Emissionen im Betrieb (netto-Null).

Aufgrund dieser deutlichen Verringerung bekommen die sogenannten „grauen" (engl. embodied) Treibhausgasemissionen von Bauprodukten immer mehr relative und absolute Bedeutung. Allerdings wird deren Berechnung und Reduktion im Entwurfsprozess von Gebäuden noch immer vernachlässigt.

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Die Methode der Ökobilanz (LCA) ist geeignet, um Umweltauswirkungen von Gebäuden zu quantifizieren. Ergänzend kann sie planungsbegleitend unterstützen, ent-sprechende Varianten und Maßnahmen zu evaluieren, um die Ressourceneffizienz und Klimaschutz von Gebäuden und Bauwerken zu erhöhen. Für die Berechnung der Umweltauswirkungen sind zahlreiche methodischen Festlegungen erforderlich. Mit deren Harmonisierung und der Ermittlung der inhärenten Unsicherheiten hat sich das Projekt IEA EBC Annex 72 befasst. Die Ergebnisse des Projekts sind methodische Leitfäden zur Bewertung der lebenszyklusbasierten Umweltauswirkungen von Gebäuden.

DESIGN DECISION TABLE

Um die Anwendung von LCA bei der Planung von Gebäuden zu erleichtern, wurde für Entscheidungsträger der am Bauplanungs-prozess beteiligten Akteure eine Design Decision Table entwickelt. Frühzeitige Entscheidungen haben einen großen Einfluss zur Reduktion der Umweltauswirkungen, weshalb es notwendig ist, diese zum richtigen Zeitpunkt im Entwurfsprozess zu treffen. Eine Übersicht möglicher Fragestellungen in den jeweiligen Planungsphasen, sowie zur Verfügung stehende Hilfsmittel sind nach den methodischen Elementen in der Tabelle strukturiert, um die Implementierung von LCA zu erleichtern.

DEFINITION DER ENTWURFSSCHRITTE, RELEVANTE PERSONEN, DEFINITION DER AUFGABEN IN JEDEM ENTWURFSSCHRITT UND ÜBERBLICK ÜBER DIE RELEVANTEN MEILENSTEINE FÜR DIE DURCHFÜHRUNG DER ÖKOBILANZ

ÜBERBLICK ÜBER DIE WERKZEUGE, DIE FÜR DIE ÖKOBILANZ VERWENDET WERDEN KÖNNEN UND AUSWAHLVERFAHREN FÜR DIE WAHL DES RICHTIGEN ÖKOBILANZWERKZEUGE MIT SCHWERPUNKT AUF DAS THEMA BUILDING INFORMATION MODELLING (BIM). BIM-TOOLS KÖNNEN DIE LCA-BEWERTUNG UNTERSTÜTZEN UND ERLEICHTERN. INFORMATIONEN WELCHE IN DAS BIM-MODELL IMPLEMENTIERT WERDEN SOLLTEN.

Early design (0–2) | Detailed design (3–6) | Management (7–8)

general information:

Design step definition	**Strategic definition** 0	**Preliminary studies** 1	**Concept Design** 2	**Developed Design** 3	**Technical Design** 4	**Manufacturing and Construction** 5	**Handover and commissioning** 6	**Operation and management** 7	**End of use, re-cycling** 8
Core Objectives	Requirements & target setting, review of project risks & alternatives, site appraisal, clients brief	Feasibility studies, call for design competition	Concept, sketches, competition design	Elaboration of design, building permit application	Detailed technical design, procurement of construction works	(Pre-) Fabrication of construction products, Construction and supervision	As-built documentation, hand over, commissioning and testing	Facilities Management and Asset Management, Evaluation and Improvement of building performance	Decommissioning of the building, deconstruction, reuse and recycling
Milestones									
LOD	0	0-100	100-200	200-300	300-350	350-400	400-500	400-500	400-500
Important to consider for reducing the environmental impacts	**Clarify the need for the building**	**Build less: Reduce area built where possible**	**Optimize the building shape design to reduce the energy demands as much as possible**	**Optimize the design of the building systems, especially structure and envelope**	**Optimize the design of the building services, finishings (and the rest of the building systems)**	**Coordinate actions of the stakeholders based on awareness about the environmental impacts**			
	Is a new building needed? Can an existing building be transformed/retrofitted instead?	Reduction or optimization of the built area to the minimum	Integration of passive and bioclimatic design strategies in the design of the building **volumes**	Integration of passive and bioclimatic design strategies in the design of the building **envelope**	Can I reduce or optimize the embodied and operational building impacts?				Can the materials to be demolished be reused/ recycled/upcycled/ downcycled?
				Can I reduce or optimize the material quantities in the building?	Which materials and construction systems enable to minimize transports, waste generation, construction and operational/use emissions?				
Who are the most important stakeholders? Key role at the stage	**Designers (architect and engineer)** **Client**	**Designers (architect and engineer)** **Client**	**Designers (architect and engineer)** **Client** **Sustainability assessment and certification expert**	**Designers (architect and engineer)** **Client** **Sustainability assessment and certification expert** **BIM manager**	**Designers (architect and engineer)** **Client** **Sustainability assessment and certification expert** **BIM manager** **Contractor**	**Designers (architect and engineer)** **Client** **Sustainability assessment and certification expert** **BIM manager** **Contractor**	**Designers (architect and engineer)** **Client** **Sustainability assessment and certification expert** **BIM manager** **Contractor** **Project commissioning**	**Designers (architect and engineer)** **Client** **BIM manager** **Commissioning management systems**	**Designers (architect and engineer)** **Client** **Contractror**
Information needed for conducting the LCA	Definition of the **building program with general areas**		Definition of the **main building elements** (material quantities and BIM model verified) what if scenario assessment comparison	Definition of the **building elements to be included in the building** (estimated material quantities and BIM model verified)					
Purpose of LCA	**Identify the baseline scenario** To optimize the volume/built surface ratio, (especially in residential buildings)		**Improve the design of the building volume** To compare building design alternatives and macro components		**Compare different products and manufactures** and reduce the building's environmental impacts				**Compare/determinate the potential of reuse and recycling of the building**

related to background:

Task of the design stage (Design steps and project phases)	Setting and identifying the target impacts based on the building program, typology, country, etc.	Verify the surfaces and building geometry with the target estimated impacts. Re-define or adjust the design.	Verify the systems and building elements material estimations with the target or benchmarks impacts. Re-define or adjust the design.		Verify the material estimations (including technical equipment, installations) with the traget or benchmarks impacts. Re-define or adjust the design.		Labeling or certification of the building impacts befor/after construction, considering the real materials and process of the building.	Tracking the certified impacts values along the building life cycles in the maintenance, repair, refurbishment and substitution stages.	Identify potential re-use or valorization of the building elements and materials. Consider the building as a material bank to the next generations.
Which level of decomposition to should be used? (Systematic building decomposition in LCA)	**Floor areas (with different functions)**		**Elements/Components**		**Materials** **Generic material data** ←—— - - - **Product specific material data** - - -→				
How to reduce the design related uncertainties? (Uncertainties)	**Strategy 1: Project development strategy** /	/	Definition of the element groups	Definition of the elements (main element material defined) + Definition of the sub-elements uncertainties reported according to the granularity of the data	Definition of the materials as planned-uncertainties reported according to the granularity of the data		Definition of materials as build-uncertainties reduced to the minimum	Definition of materials as build-uncertainties reported reduced to the minimum	Definition of the RSL of materialsuncertainties connected to the RSL scenario
	Strategy 2: Optimization /	Identification of the most important	Optimization Identifikation of the most important parameters	Optimization of the parameters/elements that were defined as the most relevant	Optimization of the parameters/elements that were defined as the most relevant		No uncertainties reported	No uncertainties reported	No uncertainties reported
Which tools can be used for the LCA? (LCA tools)	**Complex Tool** With Benchmarks for early evaluation of environmental profile over building lifecycle. Pure calculation not useable due to a lack of information. (e.g. GPR Building, CAALA, OneClick LCA, TOTEM)	**Complex Tool** With Benchmarks for early evaluation of environmental profile over building lifecycle. Pure calculation not useable due to a lack of information. (e.g. PLEIADES, FCBS Carbon, LCAbyg, Lesosai)	**Complex Tool** With Benchmarks for early evaluation of environmental profile over building lifecycle. Pure calculation useable with large inaccuracies. (e.g. PHribbon, the ZEB Tool, Athena Impact + Tally, Enerweb)	**Pure Calculation** with some constraints due to w some lacks of accurate information (e.g.SimaPro) **Complex Tool** Benchmarks can be exploited for estimating construction process, and evaluating building operation and EoL (e.g. Lesosai, BIMELCA,))	**Pure Calculation** **Complex tool** (possible for all currently available tools) Benchmarks can be exploited for evaluation of building operation and EoL		**Pure Calculation** (e.g. GENERIS, GPR Building, CAALA, Sphera GaBi) Complex tool not necessary with conclusion of the design process. Benchmarks can be exploited for evaluation building operation and EoL	**Pure Calculation** Complex tool for supporting renovation measures. Benchmarks can be exploited for evaluation building operation and EoL (e.g. Pleiades, Athena Impact + Tally, SBToolCZ, LCAbyg)	**Pure Calculation** Obtained values enrich information to be exploited as, e.g., environmental benchmarking (e.g. SimaPro, LCAUS, The ZEB Tool, Sphera GaBi)
How can BIM impove the LCA during the design process? (Workflow in LCA)	Possibility of systematic quantity take-off from BIM Automatic update in case of changes The use of BIM models for different purposes (LCA, operational energy, optimization)		Possibility of systematic quantity take-off from BIM Automatic update in case of changes The use of BIM models for different purposes (LCA, operational energy, optimization)		Possibility of systematic quantity take-off from BIM Automatic update in case of changes The use of BIM models for different purposes (LCA, operational energy, optimization, technical equipment)		Possibility of systematic quantity take-off from BIM Automatic update in case of changes The use of BIM models for different purposes (LCA, operational energy, optimization, technical equipment, digital twin)	Possibility of systematic quantity take-off from BIM Automatic update in case of changes The use of BIM models for different purposes (LCA, operational energy, optimization, technical equipment, digital twin, management)	Possibility of systematic quantity take-off from BIM Automatic update in case of changes The use of BIM models for different purposes (LCA, operational energy, optimization, technical equipment, digital twin, facility management, CE)
What is the purpose of the visualization and which types should be used? (Visualization in LCA)		Purpose: **Identification of hotspots** Comparison of design options		Purpose: **Comparison of design options** Correlation, uncertainties and sensitivity analysis				Purpose: **Temporal distribution** Spatial distribution	

SYSTEMATISCHER ÜBERBLICK ÜBER DIE METHODEN ZUR GLIEDERUNG VON GEBÄUDEN

STRATEGIEN ZUR REDUZIERUNG DER UNSICHERHEITEN BEI DER ÖKOBILANZIERUNG, DIE IN DER PLANUNG BEEINFLUSST WERDEN KÖNNEN

ÜBERBLICK ÜBER DIE VISUALISIERUNG DER LCA-ERGEBNISSE UND AUSWAHL, WELCHE IN UNTERSCHIEDLICHEN ENTWURFSSCHRITTEN PASSEND SIND.

ALLE RESULTATE BEFINDEN SICH AUF DER SEITE HTTPS://ANNEX72.IEA-EBC.ORG

QUELLE: DIE DESIGN DECISION TABLE IST IM RAHMEN DES IEA EBC ANNEX 72 ENTSTANDEN

9 INDUSTRIE, INNOVATION UND INFRASTRUKTUR
11 NACHHALTIGE STÄDTE UND GEMEINDEN
13 KLIMASCHUTZ UND ANPASSUNG
12 NACHHALTIGER KONSUM UND PRODUKTION