Zukunft Bau

Abstract of BBSR-research project

Title

Title long version: Investigation of Life Cycle Analysis‘ calculation methods in the certification system *Nachhaltiges Bauen für Bundesgebäude (BNB)* - Comparison of complete and simplified calculation method

Motivation

The Life Cycle Analysis (LCA) is an accepted methodology for quantifying and evaluating environmental impacts. Especially in the construction industry the LCA represents an established standard and is used for sustainability certification projects, for example in the certification system *Nachhaltiges Bauen für Bundesgebäude (BNB)*. The according BNB-assessment criteria allow choosing either a complete or a simplified calculation method. Until now, the simplified calculation method is the practically preferred option, although it is unknown to which extent the environmental impacts are under-/overestimated through this method. Thus, the research project aimed at identifying the result impacts of both calculation methods and at generating a resilient method comparison based upon exemplary LCA of real reference buildings.

Scope of research

In order to realise the outlined definition of goals, the research project was separated into seven sequential work packages as shown in figure 1.

The researcher has a large number of simplified calculation method’s LCA at one’s disposal. Out of this population of available LCA for various buildings, preferably representative reference buildings had to be identified and chosen. After having ascertained and clustered the population with regard to possibly relevant buildings characteristics, the appropriate distinction attributes of typology, size, data base and synergies were applied on it which led to a selection of the most adequate reference buildings (*work package 1*).

The results of these reference buildings’ already existing LCA following the simplified calculation method are one necessary part the required basis for the comparison of the two differing calculation methods. However, these available LCA-results had to be harmonised and, if necessary, adjusted according to the standards of the relevant BNB-criteria in order to ensure conformity (*work package 2*). This work package was also helpful to refresh the data base and knowledge of the identified reference buildings based on the documentation of the original LCA- and certification performance.

Based upon the conformity checked simplified calculated LCA it was possible to complete their building components’ catalogue towards the complete LCA-calculation method. Therefore, the researcher had to model the chosen reference buildings constructively in all relevant components of the normative cost categories 300 and 400 in accordance with DIN 276 (*work package 3*). Simultaneously it had to be checked, which building components could be mapped with fitting data sets of the official German data base Ökobau.dat respectively for which building components one had to face specific gaps of data base.

Using the completed building components' catalogue all building components and their layer structures and correlating materials and products had to be linked with the fitting data sets of *Ökobau.dat* (*work package 4*). Finishing this work package the researcher could preliminary conclude that the complete LCA-calculation method shows at least general application suitability because the identified gaps of the official data base could be bridged in most cases, for example by using data sets of *Environmental Product Declarations (EPD)*.

Based upon the results of the former steps a comparison analysis of the LCA-results of both calculation methods was realised in *work package 5*. The analysis included the level of overall results as well as the level of partial results (life cycle periods, building components). Furthermore the leading components of the LCA-results could be identified through a sensitivity analysis.

Work packages 6 and *7* completed the research scope by interpreting the comparison results (see key finding scenarios in figure 1) and designing the "most sustainable" calculation method of buildings' LCA.

Results and key findings

The LCA-results of the chosen reference buildings were able to prove that both calculation methods are characterised by certain deviations, but that these deviations are not significant enough to lead to differing LCA-assessments of the reference buildings. However, this conclusion is only valid with regard to the actual level of energetic building quality and technical efficiency because the environmental impacts of the reference buildings are mainly determined through the energy demand during the building operation phase. Thus, an ongoing usage of the simplified calculation method can lead to more significant deviations between both calculation methods in the future.

Considering the additional expenditure of time being noticed when realising the complete LCA-calculation method, this is in fact no appropriate option. Hence, the researcher considers an advanced LCA-calculation method to be the "most sustainable" (environmentally adjusted, functionally practicable, economically rationalised) option. This advanced method should expand the simplified method by the leading components of building services and could fulfil the scientific accuracy requirements as well as the practical requirements of economic efficiency. As the only valid option it could furthermore remove the present duality of two different calculation methods.

Basic information

Short title: Investigation of Life Cycle Analysis‘ calculation methods in BNB-system

Researcher / Manager: Darmstadt University of Technology, Department of Concrete and Masonry Structures, Prof. Dr.-Ing. C.-A. Graubner (Project management), Dipl.-Wirtsch.-Ing. Sebastian Pohl (Project realisation)

Overall costs: € 98,042.00

Federal Government subsidy: € 68,042.00

Project duration: 18 months

Figures:

Figure 1: flowchart.jpg
Caption: Flowchart of the research project and scope