

Wienerberger Sustainable Building Academy

Executive Summary

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Environmental Indicators

The Environmental Footprint of a nearly zero energy building – in comparison to other indicator sets

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Goal

The construction and use of buildings in the European Union account for about half of all the extracted materials and energy consumption as well as about a third of the water consumption.¹ The sector also generates about one third of all waste and is associated with environmental pressures that arise at different stages of a building's life-cycle including the manufacturing of construction products, building construction, use, renovation and the management of building waste.

Nowadays resources such as water, energy, land use and biodiversity are becoming increasingly scarce. To counteract this growing shortage, we have to find a way to use environmental resources more efficient. Since the building sector is responsible for several impacts on the environment, this sector especially needs to be tackled to find solutions for a more sustainable future.

The goal of this project is to analyze the relevance of a wide set of environmental indicators for the Life Cycle Assessment (LCA) of a building, concerning the Product Environmental Footprint (PEF) method.

Methodology / Approach

The building for the investigation is an elderly care residence. It is a multi-residence housing facility intended for senior citizens. The residence is situated in Nieuwpoort in Belgium and around 100 seniors on an area from 6847m² can live there. The residence building is calculated for two variants. The first variant is a passive house construction with clay bricks and the second variant is a passive house with lime stone (eco-materials).

In addition, the analysis has been analysing (a) the contribution of the different elements and (groundfloor, foundation, external walls, internal walls, staircases, roofs, water supply, elevator etc.) and (b) the contribution of the different life cycle phases (manufacturing transportation, use, maintenance, end of life, etc).

The relevance of impact category for the care residence is analysed by performing a Life Cycle Impact Assessment with the Program SimaPro. The software models and analyses the

¹ Source: European Commission (01.07.2014). Communication from the commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions – On Resource Efficiency Opportunities in the Building Sector.

life cycle of the building with different impact assessment methods. For this case study the methods, CEN, PEF, ReCiPe, Eco-indicator 99 and OVAM:MMG is used.

The analysis did not focus on the impact of the building as such, but on the different impact assessment methods in order to identify if any environmental impact category which is not (yet) included in the current EN15804 standard does seem relevant for construction products and/or buildings.

The first step is to find out which impact categorie(s) and related environmental indicator(s) are most relevant in each method at element level and life cycle phase level. To investigate this, a weighted single score have been calculated and the contribution of each impact category to this single score was determined, because not every method has the same unit. This is the reason for the normalization. Furthermore, in order to weight the different impact categories an assignment and calculation of the categories and resources reflecting the relative importance is carried out.

Then the contribution of each impact category according to the different impact assessment methods applied are summarised and visualised the extremes (minimum and maximum) and average contribution. This analysis has been done for the two building alternatives (i.e. clay bricks and lime stone).

Furthermore a literature study was assessed regarding the impact categories in question, such as particulate matter, human- and eco-toxicity, ionizing radiation and land use. The collection and evaluation of the existing models discribing the above mentioned impact categories was collected and other researches' conclusions and recommendations in this field were likewise considered to get a more accurate idea of the relevance of the categories.

Results

The analysis based on the contribution of each impact category to the single score shows that two environmental indicators (particulate matter, human toxicity) have a high relevance in the case of the care residence. It was also decided to deeper investigate two other impact categories (ionizing radiation and land use) due to higher importance compare to other indicators and due to related research in the field which has shown their importance for construction sector, although in this case study it cannot be seen clearly.

Conclusion

The interpretation of the results in SimaPro as well as the literature study and the interview of the experts in the field of Life Cycle Assessment exposed the environmental indicators particulate matter, human and eco toxicity, ionizing radiation and land use as important in the Life Cycle Impact Assessment. However, all of these indicators are not being considered in the European standard yet and are therefore left out when it comes to the interpretation of what a more sustainable future in the building sector should be like.

Recommendations

This project showed that there are in fact different environmental indicators that are not included in the European standards even though they have a high impact if the analysis is carried out with the method PEF.

Since this study only investigates one case study it is only able to produce results of limited reliability. To enable professionals, decision makers and investors throughout the EU to use life-cycle aspects, they need empirical based, reliable, transparent and comparable data. More case studies with varying sets of material buildings should be evaluated in order to make a

clear statement concerning a possible expansion of the indicator set in EN 15804. Afterwards a discussion on the validity of EN 15804 and its application is required and where appropriate the indicator set should be extended regarding the objectives of different public and private stipulations.
