Environmental Assessment of Buildings and the influence on architectural design

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Abstract

This licentiate thesis examines environmental assessment tools for buildings. This is done by investigating, analysing, comparing and testing how different environmental assessment tools measure the environmental performance of buildings and examining the consequences this may have on architectural design.

The study begins by analysing three environmental assessment tools: Leadership in Energy and Environmental Design (LEED), Code for Sustainable Homes (CSH) and EcoEffect. These tools are then tested on a case study building (an eight-storey residential building) to analyse differences regarding assessment results, improvement proposals and potential impacts on architectural design.

One of the environmental impacts assessed in the three tools, namely Climate Change caused by gases having Global Warming Potential (GWP), is then analysed in greater detail from a life cycle perspective by measuring CO₂-equivalents (CO₂-eq). A basic calculation tool (referred to as the ENSLIC tool), based on life cycle assessment methodology, is used to assess a case study building (a four-storey office building in Gävle). The CO₂-eq emissions from a building’s material production and energy use are calculated and the impacts of a number of suggested building improvements and changes of energy sources are analysed.

The studies show the complexity of assessment tools and different ways to make comparisons. Both similarities and differences between the tools are apparent, regarding hierarchical structure and also on each hierarchical level, from categories to issues and parameters. It is also shown that the choice of environmental assessment tool may have an influence on the architectural design of buildings.

The difficulty with assessing complex buildings is apparent even when only one environmental issue is assessed with the LCA-based ENSLIC tool. Many aspects influence the assessment result. These include energy use, choice of materials and choice of energy sources.

The complexity and difficulty in linking buildings to environmental impact create a need for interactive tools measuring environmental performance, which can be useful as decision support in the early design phase.

Keywords: green building, sustainable building, environmental assessment, assessment tool, architectural design, CO₂ (Carbon dioxide)