ON THE APPLICATION OF SIMULATION TOOLS IN BUILDING DESIGN WITH EMPHASIS ON SUSTAINABILITY

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ABSTRACT

A planned building design is assessed based on a simulation approach where in particular the peak load heating and peak load cooling analysis is carried out on the building. In particular within the scope of this research, sustainability has been assessed based on modified geometries and different geographical locations of a generic building structure. The employed methodology in this study establishes a foundation for comparison between the original building design and a modified one, with particular emphasis on sustainability and the overall building performance.

INTRODUCTION

Recent advances within the built environment, in essence emphasize the role of sustainability as it can affect both existing and future buildings. A large portion of efforts in this respect, are related to isolated building performance evaluations and the usage of high-efficient insulation materials. In this study however, the focus has been shifted towards a simulation approach where particular elements in the building design are isolated and examined both separately and as a collective.

The objective of this research has been the development of a methodology that can be utilized on a generic building structure and will be independent of the specific building. The usage of the methodology in conjunction with the simulation tools hence provides an early stage sustainability assessment of a designed building and raises the awareness about the influence of distinct design features on the overall building performance.

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METHODOLOGY

The developed methodology establishes a framework for analysis of the building by usage of Autodesk® Revit® Architecture and Autodesk® Revit® MEP. A 3-D representation of the building is designed and shown in Figure 1.

Figure 1: Three-dimensional representation of the designed building.

The building is modeled in Autodesk® Revit® Architecture, dependent on the desired building structures. This design is considered as the basic design. The modeled building is thereafter imported into Revit® MEP where spaces are defined for initial analysis, as shown in Figure 2. This procedure enables the base line parameters to be established.

Figure 2: Possible space considered for in-depth analyses inside the building.
A redesign of the building further provides the original design to be compared to the base line and hence allows for establishment of a sustainable design based on the entire building design, as shown in Figure 3.

![Figure 3: The used methodology for sustainability analyses.](image)

**FEATURES**

Among other parameters, the analyses can target the values of heating and cooling loads based on the desired loadings within each space, predefined loading scenarios and geographical locations while considering weather related information.

**CONCLUSIONS**

The methodology presented in this study enables an alternative approach to building refurbishment and sustainability, based on a design approach. By considering the entire building as a foundation for energy analysis, the methodology provides a robust yet accurate tool for establishment of building design and sustainability.

**FURTHER READING**