Designing a guideline of thermal comfort control strategies and building parameters for designing office buildings with high energy flexibility

Background

When stepping forward as a society, any move towards a greener future should include buildings as a main focus. The vast majority of the energy used in buildings is consumed in order to make the occupants feel comfortable, and this is ensured by following specific guidelines for thermal comfort when a building is designed. Current thermal comfort research including research conducted within the iCARE program [1] shows that these comfort limits can be exceeded or bypassed in certain ways without compromising the thermal comfort of occupants. With more relaxation in thermal requirements the building could use less energy or could be used as a dedicated thermal storage means. The use of this storage potential can alleviate the fluctuating supply of renewable energy sources (RES).

Aim of the project

The aim of this project is to design a guideline that supports designers to design buildings with high energy flexibility. The guideline will be developed based on the iCARE thermal comfort operational strategies [1]. The guideline investigates specific thermal comfort control strategies and building parameters such as the thermal mass, the heat/cool delivery system and the façade and how these strategies and parameters affect the flexibility of a specific building based on specific indicators that will be chosen. The designer can use the guideline in the design phase to decide on specific parameters of the building in order to achieve energy flexibility.

Main Objective

- Create the design guideline

Context/Scope

- Focus on new office buildings and renovation of offices
- Input will focus on iCARE’s project research outcomes
- Investigate the impact of operational control strategies on energy comfort and flexibility performance
- Investigate key building parameters and their effect on energy flexibility

Methodology

The technique that will be used in this study, is a simulation based study and the methodology is presented in figure 1. The simulation study starts by studying the building performance when using Common Practice comfort control strategies in order to create a reference. Progressing with the simulation phase, other comfort control strategies (e.g. iCARE project’s thermal comfort research outcomes) will be implemented and a sensitivity analysis will be conducted in order to understand the magnitude of the effect of the design parameters to the outcome of the simulations. Based on the outcome of the sensitivity analysis, different renovation techniques will be proposed and categorized. Each parameter will be classified based on how easy it is to apply in a typical Dutch office building.

Acknowledgements

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References

- Validation, verification, and testing techniques throughout the lifetime of a simulator study. Berezai, Slau. Annual of Operations Research 03/10/2013 1-10