



A Holistic Methodology for Sustainable Renovation towards Residential Net-Zero Energy Buildings

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Background

Nowadays, buildings are required to have higher levels of environmental, social and economic performances. While more and more new buildings are constructed in a sustainable manner, most of the challenges are still to come in the renovation sector. Indeed, in order to meet the national goals for energy use and greenhouse gas emission reduction in the building sector, the low rate of replacement of inefficient buildings in developed countries means it is not enough to simply create new, low or Net Zero Energy buildings and rely on the existing rate of energy renovations of buildings. In Europe, only around 1% of the building stock is renewed and only 1-2% is renovated every year. This renovation rate needs to be increased considerably to meet the energy use reduction goals within the national time frame sets. It is therefore crucial to convince building owners to invest in sustainable renovation.

Purpose

The main purpose of the project is to develop a holistic methodology so as to inspire and guide homeowners and their retrofit project teams to reach higher levels of environmental, social and economic performances.

The methodology to be developed will be divided into three stages. Each stage includes methods to be integrated or developed. Stage 2 needs to integrate stage 1. Stage 3 needs to integrate stages 1 and 2. The process is iterative, which means that homeowners have the possibility to add or change wishes or priorities and obtain updated results.

Stage 1 will focus on actively integrating the homeowners in the renovation process, educating them, analysing their needs, priorities, wishes and behaviours as well as in the meanwhile gathering the building intrinsic properties. After the determination of the most relevant values concerning the building and homeowners, this first stage shall lead to a classification of quantitative and qualitative data as well as selection of relevant criteria to be used in the optimisation.

Based on stage 1 and in order to determine the set of measures which are the most appropriate for the homeowners, and for a sustainable renovation approach, a multi-criteria optimisation process will be integrated into the methodology. Stage 2 will therefore reduce the domain of possible retrofit scenario solutions to a few.

Finally, stage 3 aims to support the homeowners in the decision making process and present the benefits of the selected solution, the fulfilment of the wishes and needs as well as to verify that the performance criteria are verified. This third stage will therefore conclude the decision making process by evaluating with the homeowners the suggested alternative scenarios. In order to do that, the building before and after renovation will be compared, and the alternative scenarios will be classified based on both the quantitative and

qualitative priorities emitted by the homeowners in the first stage of the process. This last stage gives freedom to the homeowners to actually add new inputs and reiterate the process. The methodology will be developed in such a direction that it could be used later on to develop a tool/interface for homeowners looking for a sustainable building renovation.

Supervisors

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Contacts with companies and external centres

- ♣ There is a direct collaboration with Saint-Gobain Isover during the whole period of the Ph.D.
- ♣ In the context of the IEA ECBCS Annex 56, the Ph.D. fellow collaborates with the Danish Building Research Institute (SBI), Teknologisk Institut, Cenergia Consultants and Boligselskab Sjælland.
- ♣ In the context of the IEA ECBCS Annex 56, the Ph.D. fellow collaborates with foreign institutions sharing the same annex sub-tasks.
- ♣ In the context of an exchange program in Switzerland, the Ph.D. fellow will collaborate with a Swiss laboratory (CCL – EPFL) and a Swiss company (ESTIA S.A.).

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