



# Reflection

## *Graduation process*

The topic 'renovation strategies for low-temperature heating' is positioned in the Building Technology studio between the disciplines of facade design and climate design, with the main focus being on climate design. With its aim to contribute to the sustainable energy transition of the Dutch housing stock it fits in well with the core values of the master track.

The used methods in the research, literature review, case study analysis and analytical simulation, generally worked well for this specific study. The strength of the method of analytical simulation lies in the quick assessment of different strategies through the easy adjustment of parameters. This was especially valuable in this research case, as multiple housing typologies were tested. Possible threats of this method are the over-simplification of the object in question and the high risk of errors due to wrong input data. Next to this, limitations are imposed by the used program, restricting the possible research outcomes. The case study analysis was acquired from an external source, which had the disadvantage that not all the required information on the case study was available.

The focus of the research program LTReady, to which this research is related, is on developing budget-friendly and realistic renovation strategies. This particular research has a different aim, i.e. the improvement of thermal comfort through the implementation of low-temperature ready renovation strategies. The methodology of testing measures is similar to the research program regarding the assessment of low-temperature readiness. However, due to the differences in research focus and constraints, the outcomes regarding the best suitable strategies vary a lot. In this thesis, there is a direct link with the design, as theoretical and practical research is used to support the decision-making process for the selection of the best suitable renovation design proposal for a dwelling.

A moral issue encountered during the research process was the partial disregarding of the costs within the research, and focusing mainly on thermal comfort. This decision might give the impression that finances play no part in the energy transition, while the number of people living in energy poverty has been growing over the past months and thus indicates otherwise. The optimizing of thermal comfort in this regard is only relevant for a select group of people, who have enough financial possibilities, but still require extra motivation besides the beneficial impact on the climate and possible financial gain. However, for the people that would benefit the most from an energy renovation, this research does not provide a solution, as the strategies proposed here, with their heightened focus on thermal comfort and little regard for budget, might be out of touch for these people.

## *Societal impact*

The presented results in this thesis cannot be directly applied in reality, but are a valuable contribution to a better understanding of the differences between housing typologies and thermal comfort in low-temperature dwellings. As the research indicates, the differences between housing typologies greatly affect the extent of renovation that is required and thus every case should be individually assessed.

The innovative character of this research lies in the new approach to thermal comfort, where it is seen as one of the main goals of energy renovation and not a side effect. Innovation has been achieved here as the outcomes presented vary from other studies where different constraints have been applied. The study outlines the possibilities of thermal comfort improvement within the existing renovation measures on the market.



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It is hoped that this project can be used as an example and as an accelerator of the energy transition in the Dutch building stock and can in this way be of impact on the built environment. The results of the study have an impact on sustainability on all three different levels: people, planet and profit. In the first case, it directly affects the people as the improved thermal comfort has multiple benefits for a person's physiological and psychological wellbeing. The research has proven to be of importance on the planet scale, as it focuses on the phasing out of unsustainable heat sources and implementation of renewable and more sustainable sources for the provision of heat. Profit can be achieved for the building renovation sector and building owners, as the highlighted diverse potential of renovation could result in higher renovation rates, and the improved comfort of the dwelling can be reflected by an increase in property value.

This project hopes to increase the support for energy renovation and the energy transition in general, by presenting the individual gain that can be derived from it. It is, however, important as well to mention that for a successful transition a feeling of solidarity within society is essential. In the proposals for sustainable developments, this aspect should not be overlooked, as a sole focus on personal gain could be hazardous for the overall support of the energy transition.