

# Designing for inclusivity in the context of zero energy housing renovations

In what way could zero energy housing renovations be optimized in terms of matching residents' needs with heating and ventilation systems' functioning with a focus on visually impaired users?



**Naam:** Alina Boyuklieva  
**Afstudeerrichting:** Integrated Product Design  
**Titel:** Designing for inclusivity in the context of zero energy housing renovations  
**Plaats van onderzoek:** Delft  
**E-mail:** alinaboyuklieva@gmail.com  
**Werkstatus:** open for job opportunities

## Method

The project follows the Double Diamond approach (Figure 1). As a starting point serves the problem that the systems' usage that designers envisioned did not match residents' actual usage. That decreases systems' efficiency and causes potential health hazards for the residents. The main goal of the project is to decrease this gap. Three sub-questions are explored during the 'Discover' phase (Figure 1). As a part of a project of Stella Boess, the main challenges of newly installed zero energy systems are examined from a human-centered design perspective. For this aim, a series of eleven stays at a demo apartment in Reigersbos was led. Next to that, I analyze the needs of visually impaired users through literature research and six user interviews. That knowledge contributes to the accessibility evaluation of the newly installed systems in Reigersbos.

In the 'Define' phase or as I call it – 'Synthesis', I translate the discovered insights into actionable Design guidelines and requirements – Design Challenges and Design Fundamentals (Figure 2). They serve as main principles in the 'Develop and Deliver' phase.

During the 'Develop' phase, various ideas are generated through brainstorming with fellow students and target users. Two design questions form the scope of the design space (Figure 1). Different Inclusive Design tools and approaches for co-designing with visually impaired users are examined. The project results in two deliverables – short-term oriented design, targeting decision makers, and one long-term oriented – targeting end users. The first is a Booklet with guidelines and recommendations (Figure 3, top) while the second is a set of two future concepts (Figure 3, middle, bottom). During the 'Deliver' phase, the focus lies on their development.

## Results

The aforementioned Booklet is targeting the stakeholders, responsible for choosing the systems in a renovation – project managers, engineering advisors, et cetera. It provides specific guidelines and recommendations presented as step-by-step actions. Complying to them will lead to more inclusive solutions that meet residents' needs better. This will not only increase their comfort rates, but could also decrease the expenses for support and maintenance after a renovation and improve the efficiency of the systems. The two future concepts, 'Breathing Walls' (Figure 3, middle) and 'Tactimap' (Figure 3, bottom) aim to illustrate how the discovered needs could be embodied in products in the long-term. Their target group is end users, namely

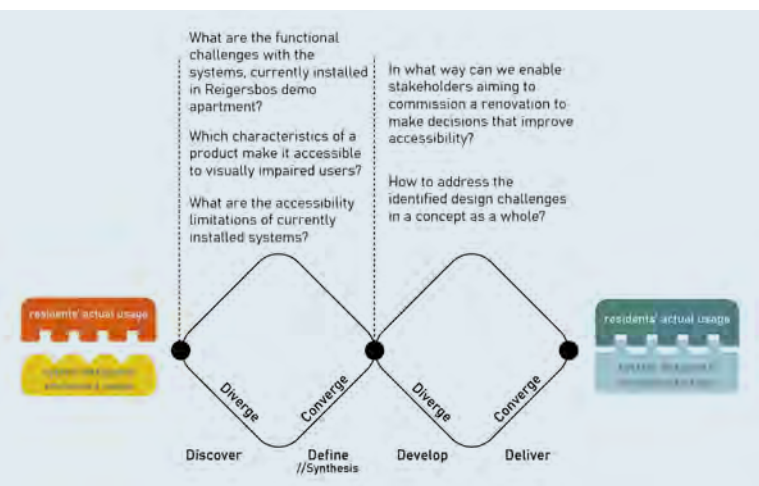


Figure 1. the Double Diamond Approach.

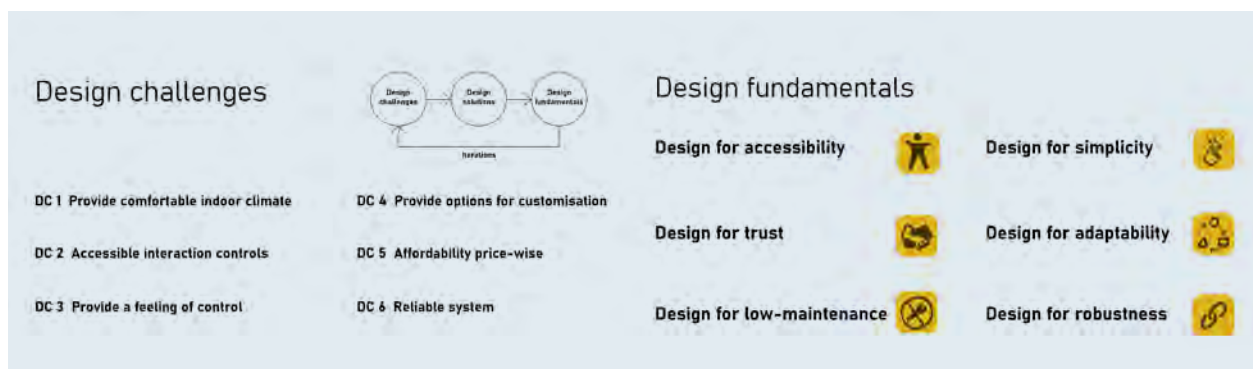


Figure 2. Design Challenges and Design Fundamentals.

visually impaired and the wider public. 'Tactimap' is a physical 3D overview of the heating and ventilation systems in a space. It incorporates tactile and thermal feedback. 'Breathing Walls' is an interactive convector cover that provides accessible heat feedback and light indication. It enables the resident to be well aware of the actions of the systems and control it accordingly.

## Conclusion

This work expands on the existing knowledge of zero energy housing renovations and Inclusive Design. It intertwines them in 3 products – a Booklet and two future concepts – 'Tactimap' and 'Breathing Walls'. On the basis of literature research and interviews with expert users, it can be suggested that the Booklet would be a successful Inclusive Design tool in improving the outcomes of zero-energy housing renovations. Based on the user evaluation and technical research, 'Tactimap' was an interesting product exploration. However, its inability to comply to some of the main requirements makes it not worth to explore further in the same form. 'Breathing Walls' on the other hand, showed promising potential for future development. It was desirable for the users and a brief exploration can suggest that it is also a technically feasible solution. Overall, the project provides a new perspective on renovation projects and suggests a practical way to deal with the identified challenges. It expands on the field of Inclusive Design tools while also incorporating an innovative take on future products tailored to users' needs.

## Personal impression

This project was a huge learning experience for me where I developed my analytical and complex problem-solving skills. Supported by great experts, I had the opportunity to expand my knowledge about zero energy renovations, accessibility and Inclusive Design which I would also like to tackle in my future job. My main motivation during the project was the fact that I worked on a real case which could improve people's lives and that I could contribute to the inclusiveness of our society. Now, I am more eager than ever to start my career as an Industrial Designer with a human-centered focus.

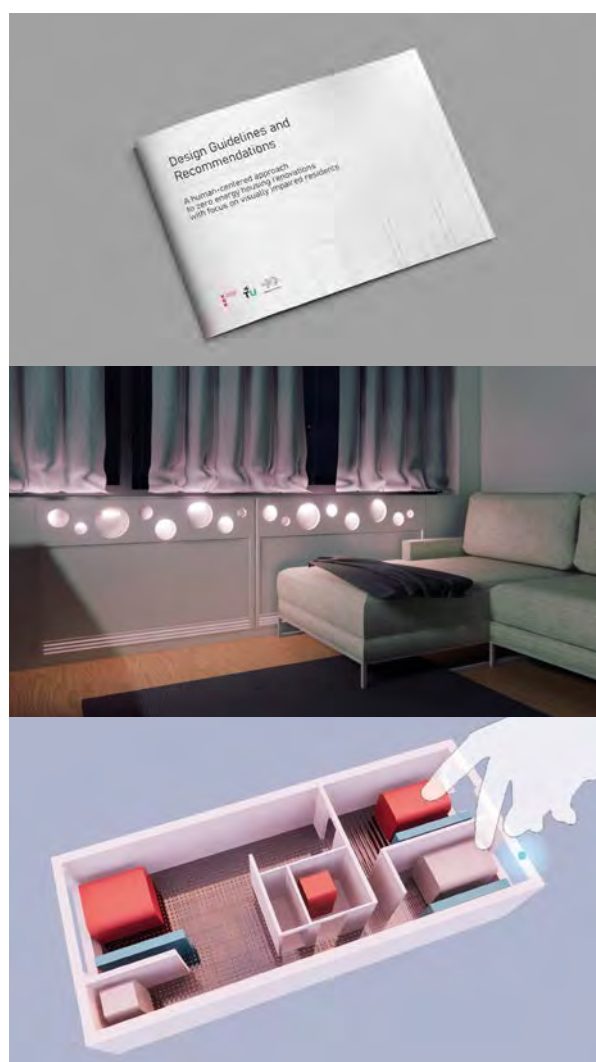


Figure 3. the three products: a Booklet (top) and two future concepts 'Breathing Walls' (middle) and 'Tactimap' (bottom).

### *Uit het juryrapport*

Sterk was ook dat de visueel gehandicapten hun creativiteit in het ontwerp kwijt konden.