REFLECTION

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Position topic in the graduation studio

The master Building Technology is a combination of engineering and architectural design. The focus is on innovative and sustainable design in the built environment. This thesis is a part of the series of graduation projects within the 2ndSKIN project. The 2ndSKIN project aims to develop a prefabricated system for building renovation of walk-up apartments. The system is translated into a zero-on-the-meter concept, where building services are integrated into the façade of the building (Silvester et al., 2016). But which measures are needed when there is a heating grid in the neighbourhood, or when another type of heat pump will be used? What will the energy performance do and how will the design look like? This thesis is therefore aiming at designing a prefabricated renovation approach which is applicable to accommodate different energy saving measures, depending on different energy systems. Thereby this thesis is focusing on the climate and façade department.

SWOT analysis of the approach

A SWOT analysis is a technique for understanding the strengths and weaknesses, and for identifying the opportunities and the threats of the research. In Table 1 different aspects regarding the research are mentioned. One of the strengths of the research could be that approach can be upscaled to different energy systems and in a later state also to different building types. One of the weaknesses of the research could be the renewal of the applied BENG regulations (Bijna Energie Neutrale Gebouwen [Almost Energy Neutral Buildings]) in 2020. There is no adequate software available (yet) that includes these new regulations (RVO, 2018). It is therefore not possible to perform calculations, based on the new BENG regulations. Another threat could be the willingness of the occupants to contribute to the refurbishment of their apartment. It is necessary to have more than 70% of the occupants committed to the refurbishment of their apartment. Otherwise, the housing corporation needs to ask the court to judge the renovation proposal (Rijksoverheid, 2018).

	Helpful	**Harmful**
Internal origin	*Strengths* - Renovation approach can be upscaled to buildings with different energy systems - The existing building will reach the current BENG regulations	*Weaknesses* - The relatively short time span of the research - The applied BENG regulations will be renewed in 2020
External origin	*Opportunities* - The approach can be upscaled to different building types - Part of building stock that needs refurbishment will increase	*Threats* - Refurbishment of apartments can have high costs - Occupants who are not willing to contribute to the refurbishment of their rental apartment - Differences between design tolerances and existing building

Table 1: SWOT analysis

Relation between the research approach and aimed results
At the P2 presentation, on January 11, 2019, the research approach was presented in a different order then the research approach in the end. The first research approach was to first make the design, secondly apply it in the neighbourhood and afterwards simulate the energy demand. Due to the feedback after the P2 presentation, the research approach has changed since it is not necessary to have the design before the simulation phase. The research starts with the simulation phase and then the design phase so that the simulations are a direct input for the design. Aspects of the design can be applied in different neighbourhoods with different energy systems, therefore the effect of the neighbourhood of the building has become less important.

Relation between research and design
The first phase of the thesis was the literature research of different renovation approaches and different energy systems. Analysis of all available literature has been used to set the 'categorized energy systems'. Those criteria were input for the simulation phase. Literature research has been done to get more insight in the layout, construction type and energy demand of walk-up apartments. These insights have been used directly when analysing the existing building. After the simulation phase, 'design criteria' have been set up, this was input for the design phase. In the design phase, all research of the thesis came together and have been used to start the design phase. While designing, different analysis has been derived to make design choices.

Issues or dilemmas during the process
During my research, I ran into a few issues and dilemmas. I will elaborate more on three issues:

- Before my P2 presentation, I had the idea to simulate more concepts and variants then I did in the end. I wanted to simulate at least eight concepts plus two variants for every concept. This would have resulted in 16 different simulations. The simulations did not take that long to run, but if I needed to design 16 different designs this would have taken too much time. So, I concluded to simulate four main energy concepts and two variants for each concept.

- The transition between the simulation phase and the design phase was complicated. I did not know where to start with the design. The transition from simulation to start thinking creative was difficult. With the support of my mentors, I managed to change my mindset.
  I started sketching and ran into design challenges that were needed to solve.

- Personally, I have a tendency to analyse a lot. Make a lot of possibilities and cross out the ones that not fit the criteria points. Because of this, I also wait to draw conclusions of the analysis. This was an issue during my research since it took me sometimes too long to take the next step and start with a new challenge that I needed to solve.

Application of results in practice
Different energy systems can be applied in a neighbourhood. Which energy system should be applied depends on different factors. For example, if district heating is present in the neighbourhood, then it could be more energy efficient to connect to this grid. There are renovation approaches with a zero-on-the-meter concept on the market, but no solutions for other energy systems. The aim of this research is to design a prefabricated system for building renovation of post-war walk-up apartments, where different energy concepts can be applied. By doing this the renovation approach will be more specific to the context. Not every building needs to be energy neutral, to become energy neutral on a neighbourhood level.

Achievement of projected innovation
After the design phase, it is possible to renovate post-war walk-up apartments with a standardized renovation technique where different energy systems can be applied.

Contribution to a sustainable development
By creating a prefabricated façade module that is suitable for different energy systems, it is possible to apply to different energy sources. This can reduce the energy demand for the entire neighbourhood. The approach will contribute to a self-sustaining energy system for the Netherlands, which could mean independency from the fossil energy supplies of other countries. This ensures no energy shortage or high energy prices.

Impact on sustainability (PPP)

People:
More residents in the Netherlands cannot pay the energy bill anymore and are suffering from energy poverty. The refurbishment of buildings will lead to a decrease in the energy demand and therefore a lower energy bill. Refurbishment of buildings will increase indoor comfort. This thesis focused on walk-up apartments that are used for social housing.

Planet:
Global temperature is increasing and an energy transition is required to limit climate change. The current energy source is based on fossil fuels and this should change to a system based on renewables. This thesis focused on different energy systems that are based on residual waste or renewables.

Profit:
The transition from a fossil fuel-based energy system to a renewable system is a complex and expensive process. Since there is a need for refurbishment this will lead to new jobs in the architecture, construction and building services sectors. The new renovation approach will be applicable to different energy systems and therefore can be applied in a different context with other energy sources.

The socio-cultural and ethical impact
A new energy system for the building requires a different lifestyle from the residents. Residents need to learn how they can cook electric instead of gas. Besides that, the heat pump has a different control system than the conventional HR-boiler. The heat pump operates the most energy efficient when there are not too many temperature changes (no setback temperature during night hours).

Relation between the project and the wider social context
Many people can benefit from reducing building energy demands. Residents of post-war walk-up apartments will benefit from the energy retrofit of the building, which will result in a better quality of living. It will result in energy savings – and therefore reduction of the energy bill - as well. Engineers and architects also benefit, since there are a lot of residential buildings that need refurbishment. Generally, this project contributes to the reduction of CO_2-emissions and therefore helps to achieve the climate targets of 2020.

Effect of the project to architecture/ the built environment
It is important to consider the energy potentials of the neighbourhood in order to choose the energy system of the building. The aim of this thesis was to design a renovation approach that is applicable to different energy systems. In this way, more buildings can be renovated depending on the urban context. It gives a more situation dependent solution. Therefore, the renovation approach can be upscaled to different energy systems which increases the scope of the renovation approach.

References

Rijksoverheid. (2018, December 4). Huurwoning. Retrieved May 7, 2019, from https://www.rijksoverheid.nl/onderwerpen/huurwoning/vraag-en-antwoord/mag-mijn-verhuurder-zonder-mijn-toestemming-het-complex-waarin-ik-woon-renoveren

RVO. (2018, September 19). Energieprestatie – BENG. Retrieved March 12, 2019, from https://www.rvo.nl/onderwerpen/duurzaam-ondernemen/gebouwen/wetten-en-regels-gebouwen/nieuwbouw/energieprestatie-beng

Silvester, S., Klein, T., Boess, S., Guerra-Santin, O., Konstantinou, T., &Steensma, S. (2016). *2nd Skin: Zero energy apartment renovation via an integrated façade approach* (NO: TKI/ENERGO TEGB 113029). Retrieved from https://projecten.topsectorenergie.nl/storage/app/uploads/public/5a0/c14/5dc/5a0c145dc79f1846323269.pdf