

Graduation Plan

Master of Science Architecture, Urbanism & Building Sciences



Graduation Plan: All tracks

Submit your Graduation Plan to the Board of Examiners (Examencommissie-BK@tudelft.nl), Mentors and Delegate of the Board of Examiners one week before P2 at the latest.

The graduation plan consists of at least the following data/segments:

Personal information	
Name	Nienke Smit
Student number	4666437

Studio		
Name / Theme	Facades & Products/Energy & Climate	
Main mentor	Thaleia Konstantinou	Façade and Product Design
Second mentor	Eric van der Ham	Climate Design
Argumentation of choice of the studio	My preference went out to a topic where both façade design and climate design were (equally) represented. This, together with a special interest in the energy transition and renovation, led to the choice for this topic.	

Graduation project	
Title of the graduation project	LT-ready Buildings: Renovation Solutions for Low Temperature heating networks
Goal	
Location:	N.A.
The posed problem,	The renovation rates of preparing housing for the integration of low-temperature heating are too low, which restricts the progress of the energy transition.
research questions and	Which minimal renovation strategies are needed for different typologies of residential buildings to prepare the housing for the integration of low-temperature heating and optimize the thermal comfort of the residence?
design assignment in which these result.	The design assignment within the thesis consists of two parts: <ul style="list-style-type: none"> - Creating a framework, where based on sensitive parameters for renovation, measures are proposed for different typologies of housing to enable the integration of low-temperature

	<p>heating and optimize thermal comfort.</p> <ul style="list-style-type: none"> - A detailed elaboration of the proposed renovation measures on a case study that is representative of one of the housing typologies.
<p>Process</p>	
<p>Method description</p>	
<p>Looking at the process set up of the thesis, 4 key methods of research can be identified:</p> <ul style="list-style-type: none"> - Literature review <p>At the start of the thesis, a literature review is performed to gain knowledge of the topic, identify what has been researched already, and find where the research gaps lie within this topic. The following sub-topics will be explored: Collective heating and low-temperature heating, low-temperature ready requirements, applicable renovation measures, residential building stock typologies, and thermal comfort. Based on the literature review, preliminary renovation concepts are proposed for the different residential building stock typologies.</p> <ul style="list-style-type: none"> - Case study investigation <p>The second method consulted is the case study investigation. A representative case study for one of the typologies will be selected, which will be thoroughly investigated and documented.</p> <ul style="list-style-type: none"> - Simulations <p>Multiple renovation concepts will be tested on the case study through the use of simulation software. The criteria that will be tested are thermal comfort and the readiness for integration of low-temperature heating.</p> <ul style="list-style-type: none"> - Research by design <p>The renovation concept that performed the best on the criteria during the simulations, will be worked out in further detail on the case study. During this elaboration of the design, detailed drawings will be produced. Eventual complications that come up in this stage will be reflected on.</p>	

Literature and general practical preference

[The literature (theories or research data) and general practical experience/precedent you intend to consult.]

Reflection

1. What is the relation between your graduation (project) topic, the studio topic (if applicable), your master track (A,U,BT,LA,MBE), and your master programme (MSc AUBS)?

In the master track of Building Technology, the focus is on combining architectural design and engineering aspects, to create innovative sustainable solutions for the built environment. This is reflected by this research topic, because an attempt is made to find a solution for the stagnating renovation rates and within this attempt, both architectural and engineering aspects are addressed. The optimization of thermal comfort is considered to be a more engineering-related subject, while the outcome of the optimization results in a design where the architectural aspects are considered as well.

This topic is related to the whole MSc AUBS, as it touches on the multiple disciplines represented in this Master's program. In the search for a solution for the problem that is addressed in this thesis, the barriers and motivation of homeowners to perform renovation measures are investigated, which itself is a topic that lies more in the research field of MBE. The solution provided in this thesis, on the other hand, focuses on enhancing the living experience, which is an architectural theme. The solution itself has a more engineering focus, which relates the topic to the discipline of Building Technology.

2. What is the relevance of your graduation work in the larger social, professional and scientific framework.

Social Relevance

The energy transition needed to achieve the climate ambitions has consequences for every sector in the Netherlands, including the building sector. To be ready for this transition and the switch to low-temperature heating, the current housing stock has to be updated and thermally improved. However, this is currently happening at a rate that is too slow to achieve those goals. As homeowners themselves are responsible for carrying out renovation measures, solutions for this problem have to be sought in removing barriers to renovation and increasing the motivation of homeowners. This research aims to find a solution for increasing the motivation amongst homeowners. This is of social relevance as the solution provided could help oppose a wider societal problem. Additionally, the solution presented could lead to more comfortable homes, which homeowners could benefit from.

Scientific Relevance

There has been a great deal of research on the topic of thermal comfort in relation to energy renovation. However, what is lacking within this research is the focus on optimising thermal comfort. In research, thermal comfort is approached as a constraint (Mejjaouli & Alzahrani, 2020, Wang et al., 2015) or an additional measuring value (Kauko et al., 2014). Studies by Bjørneboe et al. (2018) have demonstrated that a focus on enhancing the thermal comfort could potentially be an interesting selling point to increase renovation rates. Next to this, the case study presented in the study Wang et al. (2015) lies within a different climatic region than the Netherlands, which could lead to different outcomes as thermal comfort heavily depends on outside weather conditions. A separate evaluation of the thermal comfort aspects in the Netherlands is therefore necessary.