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	Stamatia Kounaki
Student number	4748751
Telephone number	
Private e-mail address	

Studio	
Name / Theme	Energy Transition: Facade renovation
Teachers / tutors	Thaleia Konstantinou Eric van de Ham
Argumentation of choice of the studio	The reason I chose to work on this graduation studio is the fact that it aims to give an answer to a very realistic problem that is very urgent to be solved in order for the Netherlands to reach the energy targets for 2050. It affects more than 6 million existing homes in the Netherlands still need to save a lot of energy. But a zero on the meter refurbishment of these homes is often too expensive and there are not enough funds. Since, something has to be done in the coming years, the research of new technologies for fast and cheap renovation is very important. So this graduation topic gives me the opportunity to learn more and occupy myself with sustainability, building physics, climate and façade design which are my main interests but also gives me the opportunity to learn more about the current techniques of building and renovating in the Netherlands.

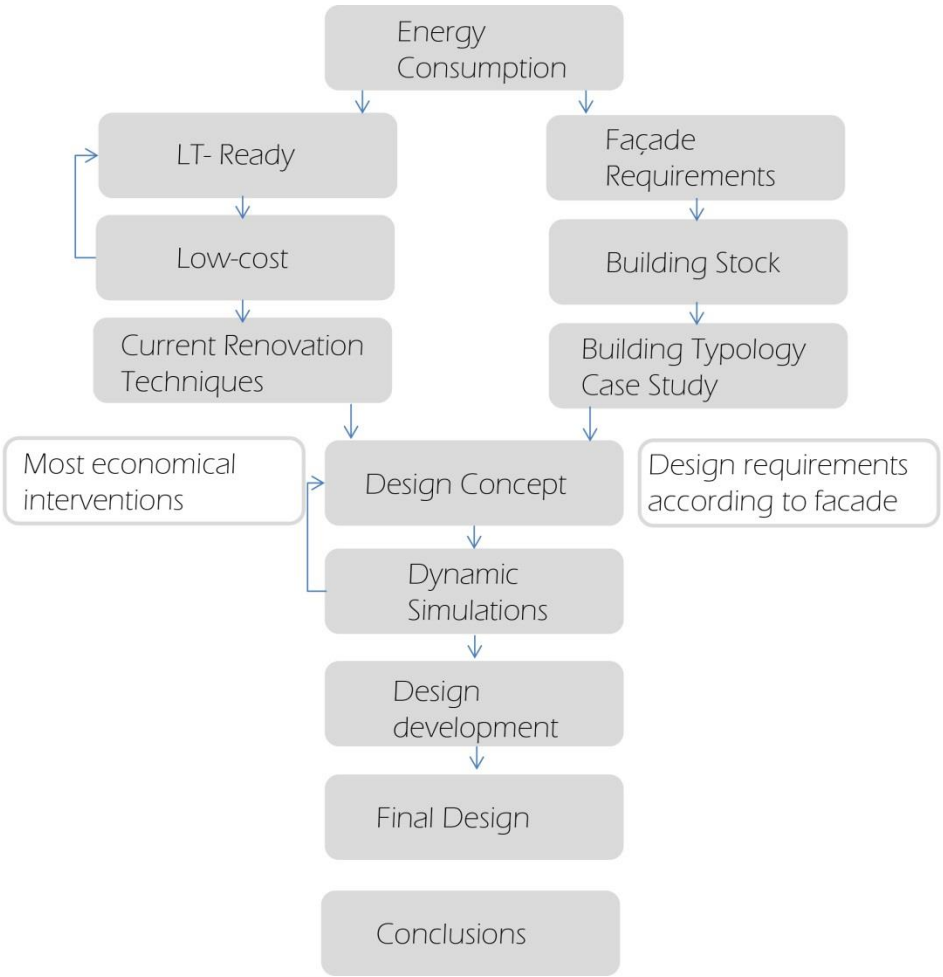
Graduation project	
Title of the graduation project	An LT- ready and economically feasible renovation façade design.
Goal	
Location:	Vlaardingen, Rotterdam
The posed problem,	The building sector, is accounting for approximately 40% of the energy consumed in EU and it is the biggest energy user, bigger than industry and road transport. So, refurbishment is a necessary step to reach the ambitious energy and decarbonization targets for 2020 and 2050 that require an eventual reduction up to 90% in CO2

	emissions. More than 6 million existing homes in the Netherlands still need to save a lot of energy. But a sustainable solution for the refurbishment of many homes is often too expensive, technically impossible or aesthetically undesirable so new technologies have to be developed. Through some reasonable and proved steps the focus of the research is determined. So, the focus is residential building stock and in particular post war apartments that are 50 years old and suffer from a variety of physical problems, but also were built under far lower energy and sustainability standards, so there is a lot of potential for improvement. Secondly, the focus will be on refurbishment of the building envelope, as it is very influential with regard to energy reduction and in particular the façade, since energy consumption for heating and cooling of buildings is directly related to heat losses through building envelope components, ventilation and heat gains in the building through solar radiation. The indicator for energy efficiency is heating demand, as it accounts for the largest percentage of energy consumption in residential buildings. Namely, more than half of the final energy consumption of residential buildings in the EU is used for space heating, reaching up to 70%. According to the "project-plan MVI energie" it is necessary to insulate the houses in such a way that heating with low temperature heating (<55 ° C) can be achieved. There are few affordable alternatives to insulate a home, and there is not enough knowledge about what is needed for LT-ready, so the façade component will contribute to this.
research questions and	Main Research Question: Which design principles are needed in order to achieve a faster, economically feasible and LT-ready renovation for post-war portiek apartments? In order to answer the main question, initially some sub-questions are researched and answered: • How much does a renovation cost today, what makes a renovation expensive and how could it be lowered to a more feasible amount? • How does the low temperature heating aspect affect the renovation concept? • What are the condition and construction of existing residential building stock? • What strategies and retrofitting measures are currently applied in refurbishment practice? • What are the new innovative materials that can be used in a new standardized renovation component?

design assignment in which these result.	Design of the façade for the renovation of the portiek post war apartment that is the case study in Rotterdam. This will be the end result of the research. The aim is to find an innovative approach combined with the traditional ways in order to achieve the LT ready and economically feasible aspects.

Process

Method description



Literature and general practical preference

Agentschap NL - Ministerie van Economische Zaken. (2011). *Voorbeeldwoningen 2011: Bestaande bouw*. *Chapter* (Vol. 6). Sittard, The Netherlands.

BAM Woningbouw NV, ENECO installatiebedrijven Zuidwest BV, Hogeschool Rotterdam,

T. U. D. (2016). *2nd SKIN zero energy apartment renovation via an integrated façade approach*. TU Delft, Delft, The Nehterlands.

Bouwhulpgroep. (2013). *Documentatie Systeemwoningen '50-'75*. Eindhoven, The Netherlands.

Buildings performance institute Europe. (2017). *Prefabricated systems for deep energy retrofits of residential buildings*. Brussels, Belgium.

Dijkstra, L. P. J. (2013). *An environmental and economic impact comparison of renovation concepts for Dutch residential buildings*. TNO, Utrecht, The Netherlands.

Gosztonyi, S., Stefanowicz, M., Bernardo, R., & Blomsterberg, Å. (2017). *Multi-active façade for Swedish multi-family homes renovation - Evaluating the potentials of passive design measures*. LTH, Lund University, Lund, Sweden.

Hermelink, A., & Müller, A. (2010). *Economics of deep renovation*. Eurima - European Insulation Manufacturers Association, Berlin, Germany.

Jelle, B. P. (2011). Traditional, state-of-the-art and future thermal building insulation materials and solutions - Properties, requirements and possibilities. *Energy and Buildings*, *43*(10), 2549–2563. https://doi.org/10.1016/j.enbuild.2011.05.015

Konstantinou, T. (2014). *Facade Refurbishment Toolbox: Supporting the Design of Residential Energy Upgrades*. TU Delft, Delft, The Netherlands.

Miloni, R., Grischott, N., Zimmermann, M., Geier, S., Hofler, K., Venus, D., & Boonstra, C. (2011). *Annex 50: Building Renovation Case Studies*. Empa, Building Science and Technology Lab, Duebendorf, Switzerland.

MVI Energie 2018. (2018). *LT- Ready: Realistisch en betaalbaar isoleren voor lage temperatuur verwarming*. Delft, The Netherlands.

Papadopoulos, A. M. (2005). *State of the art in thermal insulation materials and aims for future developments*. *Energy and Buildings* (Vol. 37). Aristotle University Thessaloniki, Thessaloniki, Greece.

Stutvoet, E. (2018). *Energietransitie: omarm de complexiteit*. Technische Universiteit Delft, Faculteit Bouwkunde, Afdeling Management in the Built Environment, Delft, the Netherlands.

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)?
2. What is the relevance of your graduation work in the larger social, professional

and scientific framework.

1. The graduation topic is very relevant to the master track Building technology since it is a combination of sustainability and technical details of the façade design. Knowledge both in energy transition, building physics, climate and façade, all previous taught in the track are needed. As of the master program, the project is of great importance for the building environment and architecture as the energy renovation aims to a cheap, energy efficient but at the same time aesthetically pleasing result suitable in the Dutch building context.

2. The financial motives of the project are very important. An energy efficiency renovation has a direct benefit on reduced energy bills and easily accountable payback time. As this project aims in a cheap renovation solution the payback time will be even shorter. The renovation is going to also repair the technical damage of the old housing stock and upgrade its performance and appearance, increasing the property's value. The aging houses appear to have few social attractions and limited economic value but when upgraded their value can increase. The improvements can then be part of an overall scheme to increase the value and the rent prices, or even the gentrification or upgrade of whole, now not so attractive areas. Thus the renovation project can also be relevant in the social framework. If successful it could be used in a large number of apartment blocks to regenerate socially problematic areas, along with restructuring the socio-economic group of renters. The housing for the residents are is better but also the image of a renewed green building or neighborhood adds value.
The social benefits include also the employment opportunities in the residential sector through the refurbishment market development. Last but not least the Co2 reduction and energy savings that will occur form the renovation is one more benefit for the society.

Time planning (in the next page)

	calendar week	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
P1																																														
	thematic research																																													
	conceptual research																																													
	first literature study:building stock, renovation techniques																																												
	draft graduation plan																																												
	presentation																																												
P2																																													
	literature study: building stock																																												
	cases study: current renovatio techniques																																												
	literature study: renovation costs																																												
	defining of research question																																												
	litrature study: prefabricated																																												
	litrature study: insulation materials																																												
	literature study: MVI energie																																												
	outline of the design task																																												
	Graduation plan																																												
	Report																																												
	Presenation																																												
P3																																													
	Design by research results: list of possible solutions																																												
	1. Building physics calculations and design																																												
	2. dynamic simulations																																												
	3. validate																																												
	4. design development																																												
	5. final façade design																																												
	draft reflection																																												
	conceptual thesis report																																												
	plan for the remaining time																																												
	presentation																																												
P4																																													
	intake of P3 presenation feedback for design																																												
	renovation façade design: variants																																												
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P5																																													
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