

A Catalyst for Circularity

Exploring the Facilitating Role of
Housing Design in Fostering Resilient
Communities



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Advanced Housing Design
Ecologies of Inclusion

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Advanced Housing Design: Ecologies of Inclusion

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Cover image:

Reimagining a Street. Made by Author

Delft, June 13th 2025

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Foreword

'It was either the four of you or five Bulgarians,' the landlord said, as he handed us the keys, like we were the lesser of two evils. We were four students in the midst of the pandemic in 2020, living in an 89 sqm four-bedroom apartment with lead pipes, mould, draft and single glazing and using our laptops and blankets for warmth. Meanwhile, next door immigrant workers lived in a similar apartment with ten to twenty residents -we could never tell-, and logically but tragically, some preferred sleeping in our shared staircase. My experience in that neighbourhood refuelled my interest in housing on the outskirts of cities, where many reside, yet stories remain untold and the people invisible.

It might seem like a horrible place to live, but I truly loved my time there. The crises that the neighbourhood faced, instigated the resilience of its inhabitants. An amazingly strong community of volunteers organised everything from yoga classes and gardening to financial advice and shared dinners. And everything was free. I became a volunteer too, giving advice on sustainable living and renovation: energy coaching. As an energy coach, I had the unique position of visiting different people at home. Unfortunately, many of my neighbours were suffering from energy poverty. Just like me, they were renters who did not have any agency over their homes, and we were subjugated to the poor maintenance of landlords. The autocracy of landlords like these eventually led to the eviction of my roommates in June of last year.

I want to emphasise that we are in a time of crisis, not just of housing but also of the climate. Both subjects are close to my heart, and I am not alone in this; I have met many people who want to work towards a sustainable future. Yet for people who are not homeowners and have a low income, like everyone in my immediate environment, it is incredibly difficult to gain agency over our built environment.

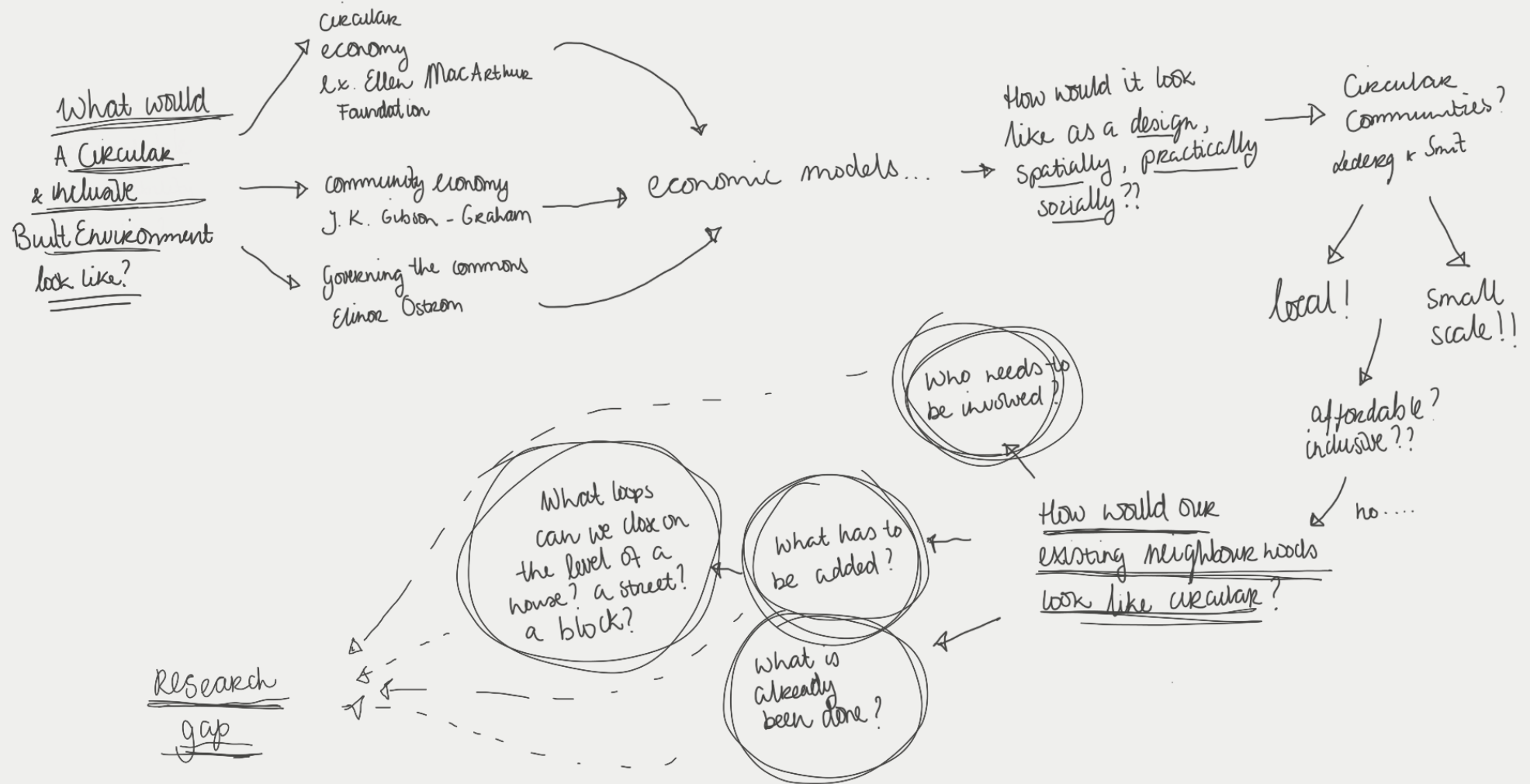
I am fully aware that architecture will not be the answer to the issues illustrated in this anecdote. However, I am confident that if we can foster resilient communities through different lenses (e.g., ecology, economics, sociology, anthropology, urban planning, and architecture) and different scales (e.g., regions, cities, neighbourhoods, streets, and buildings), we are one step closer to fixing the tidal wave of crises we now find ourselves in



Figure 1 image from IIED Conference, source unknown, redrawn by author (2024)

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Introduction

Rethinking Architecture

Introduction

Rethinking Architecture for a Circular, Resilient and Just Future

There is an urgent need to rethink the way we design and build our living environment due to the climate crisis. For over half a century, humanity has demanded more ecological resources and services than the Earth can produce. The building sector holds a great responsibility in this depletion (WWF, 2022; UN, 2023). Transitioning to a circular economy could be a means to restore our built environment. The European Union, including the Netherlands, also aims to become a circular economy, which they describe as “a model of production and consumption, which involves sharing, leasing, reusing, repairing, refurbishing and recycling existing materials and products as long as possible.” (European Parliament, 2023).

Problem Statement

The situation in Midden-Delfland, a polder area in the Netherlands, is an illustrative example of the effects of human depletion and manipulation on the landscape. This has led to risks of subsidence, salinisation and flooding. That is why Redesigning Deltas, a research group spearheaded by the TU Delft, is developing a more natural and climate-mitigating plan as a positive and restorative force for Midden-Delfland and the surrounding urban area, the metropolitan region of Rotterdam-The Hague. Redesigning Deltas proposes transforming Midden-Delfland into a National Productive Park, serving as a green lung and sponge for the metropolitan area, as well as a production site for biobased building materials, such as wood and bulrush (Redesigning Deltas, 2022).

Although this project builds upon the research and aims of Redesigning Deltas, I argue that the transition towards a sustainable future is not merely a technological issue with a technological solution; it is also a socio-spatial concern. In particular, concerning the outskirt urban neighbourhoods that lie at the border of Midden-Delfland, which are relatively densely populated and have a diverse variety of socio-economic households, such as Tanthof in Delft (Gemeente Delft, n.d.). Besides including diverse households, I believe their housing should also be taken into account. Approximately 85 to 90 per cent of the existing housing stock in the EU is expected to still be standing in 2050, making these buildings part of the circular transition as well (Pomponi & Moncaster, 2017; European Commission, 2021). More importantly, I argue that the use of existing materials should



Figure 2 How to live in the Dutch Delta? Tanthof, Delft (Picture by Author, 2024-25)

always be a starting point in circular architecture. It is important to include peripheral neighbourhoods, including their buildings and residents, towards a sustainable transition and strengthen and adapt their existing socio-spatial infrastructure, with consideration of the most vulnerable residents, human and non-human alike. In other words, resilient communities are essential for tackling the climate crisis (IIED, 2023).

Socio-spatial justice and the climate and housing crises are not solvable solely through architecture. Nevertheless, the architectural field must contribute to an inclusive and sustainable future. This project considers the necessity of a multi-disciplinary approach for a circular housing sector, building upon research from Economics, Sociology, Anthropology, Architecture and the Built Environment. In addition, I argue that contributions from the Architectural field are more than opting for bio-based or reused building materials; it also requires a socio-spatial approach. Therefore, I aim to explore how architects can design to facilitate and strengthen existing communities in the face of climate urgency through this research. I studied the local impacts of a circular economy, focusing on the street level. More specifically, the collection of houses and households that form a street. What if we imagine that our streets are completely circular? How does that tie into our existing plans for mitigating the climate crisis, such as the plan of Redesigning Deltas for Midden-Delfland? What does this mean for the existing community, and how can we ensure a resilient community for the future?

These questions have led to the following research question:

‘What role can architects and designers play in fostering an inclusive, energy-neutral and circular living environment?’

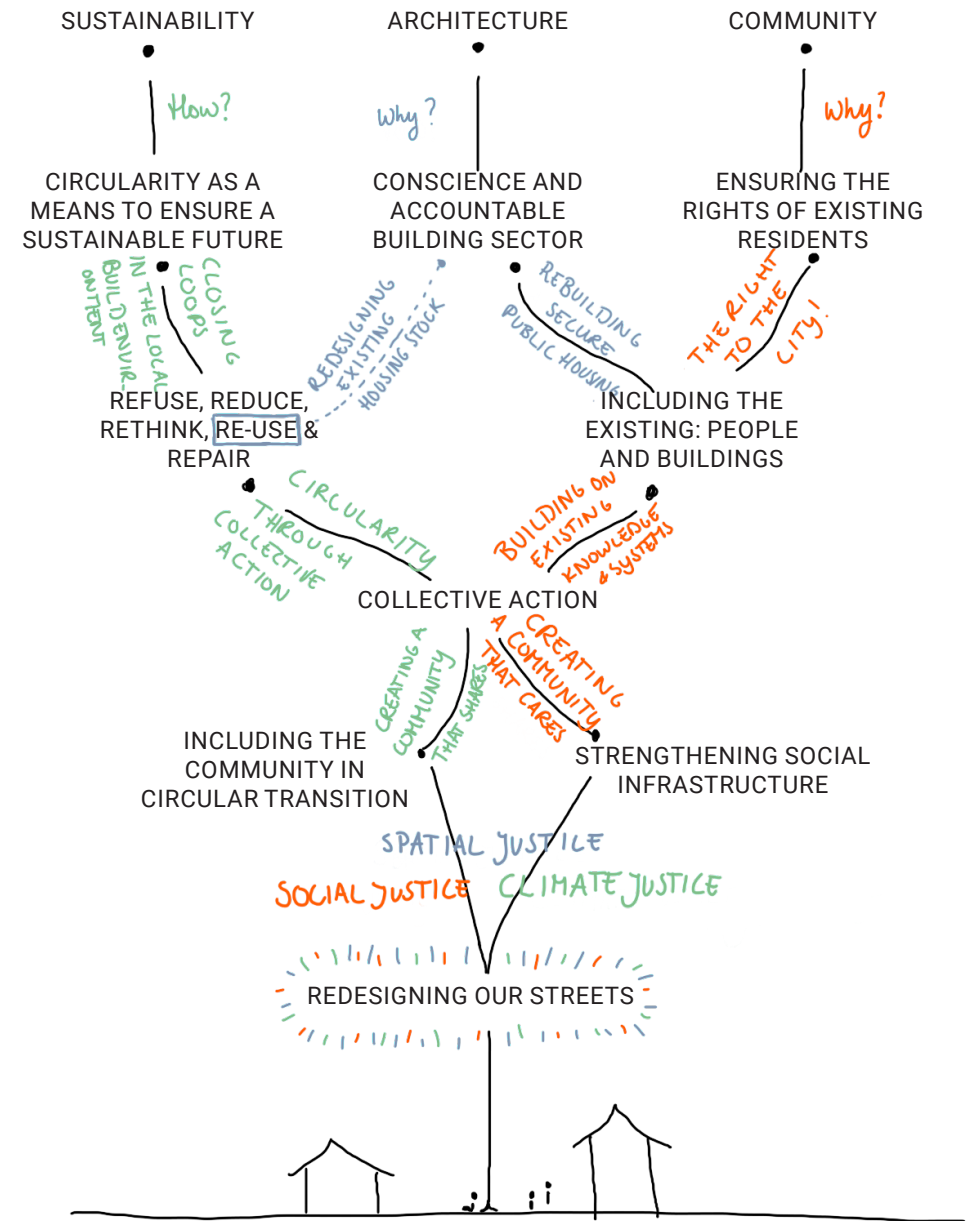


Figure 3 Research Themes (Work by Author, 2024-25)

Research Aim

This project argues for the necessity of a multi-disciplinary approach for a circular housing sector, building upon research from Economics, Sociology and Anthropology, besides Architecture and the Built Environment. I explore the Circular Economy and its local and spatial implementation (see Chapter 1.1). From an architectural perspective, circular housing can be viewed as both a new technology and a novel form of living. Thus, I will employ sociological knowledge on adopting new technology (see Chapter 1.2), as well as anthropological methods on exploring lived spaces (see Chapter 1.2 and 1.3) should be employed. In doing so, this research aims to demonstrate that the theoretical circular model can be translated into spatial living environments. Living environments that are appropriate in their context and empowered by their residents. In short, with this research, I intend to learn how architects can design to facilitate and strengthen existing communities in the face of climate urgency.

Research Questions

The initial research question ‘What role can architects and designers play in fostering an inclusive, energy-neutral and circular living environment?’ is divided into three sub-questions:

1. How do different existing communities adopt circular housing?
2. Which spatial or architectural interventions promote adopting to circular living for residents?
3. What is the existing community of Tanshof like regarding sustainability and socio-economic inclusion and justice?

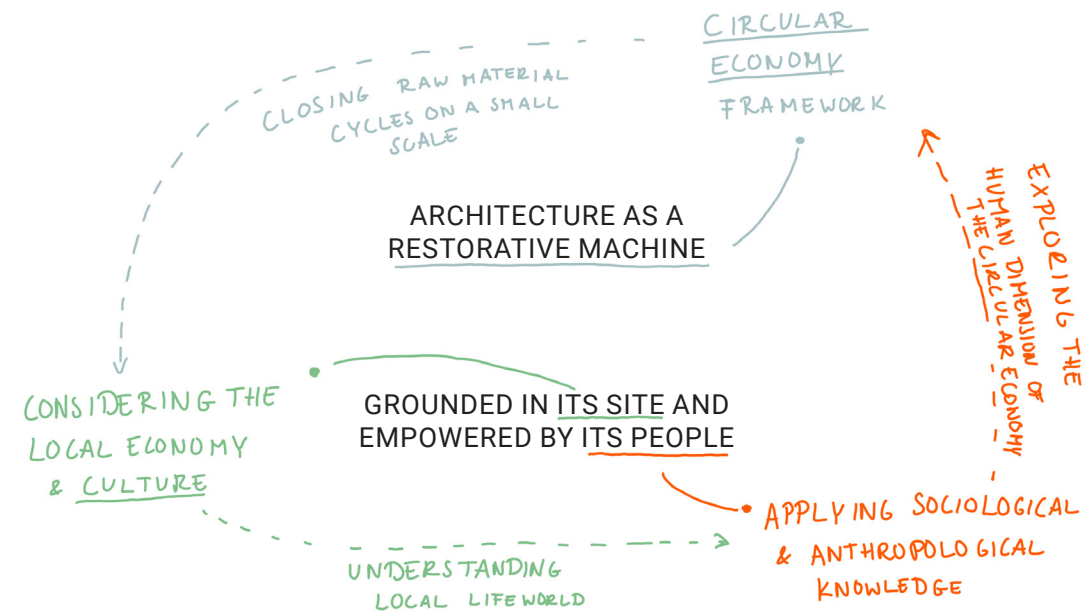


Figure 4 Research Aim, annotated (Work by Author, 2025)

Fostering circular communities is primarily a social question, understanding the intrinsic motivation of their residents to care for the environment. This is a people-based challenge and therefore differs depending on the specific community and individual. It requires sociological knowledge on technology adoption (see Chapter 1.2), as well as methods that build upon anthropological knowledge on studying communities. So, different communities should be analysed based on their experiences with circular living. Focusing on their values, daily lives and local knowledge. The people-based aspect of circular communities has led to the first sub-question: **How do different existing communities adopt circular housing?**

Yet, even though architecture has social implications, it is primarily a spatial field. I argue that architecture can facilitate the transition to circular housing. Therefore, it is essential to examine the factors that stimulate or hinder residents from a perspective, leading to the question: **Which architectural or spatial interventions promote the adoption of circular living for residents?**

Both community and architecture hold an element of specificity, as community is always based on its people, and architecture is grounded within its site. The role of architecture in community living changes depending on the existing situation. In my research, I have selected Tanthof as a case study. I believe that the developed methodology can be extended into a community design practice. So as part of this practice, the existing community of Tanthof should be studied to build upon their existing sustainability network and other habits and customs. Therefore, the third sub-question of this research is: **What is the existing community of Tanthof like in terms of sustainability, socio-economic inclusion, and justice?**

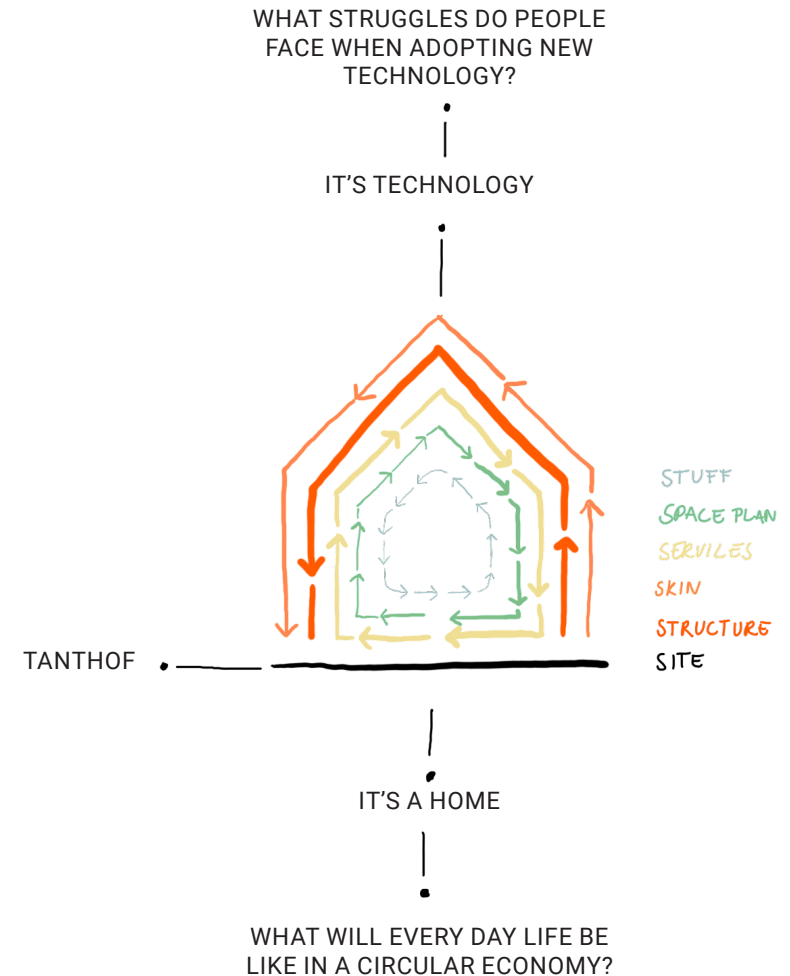


Figure 5 Operationalising Circular Housing (Work by Author, 2025)

Context - Midden-Delfland



Figure 6 (Google Earth, edit by author, 2025)

Midden-Delfland

A Green Lung in between Cities (Google Earth, 2025)

Context - Tanthof



Figure 7 (Google Earth, edit by author, 2025)

Tanthof

Border between City and Landscape (Google Earth, 2025)

Context - Project Location

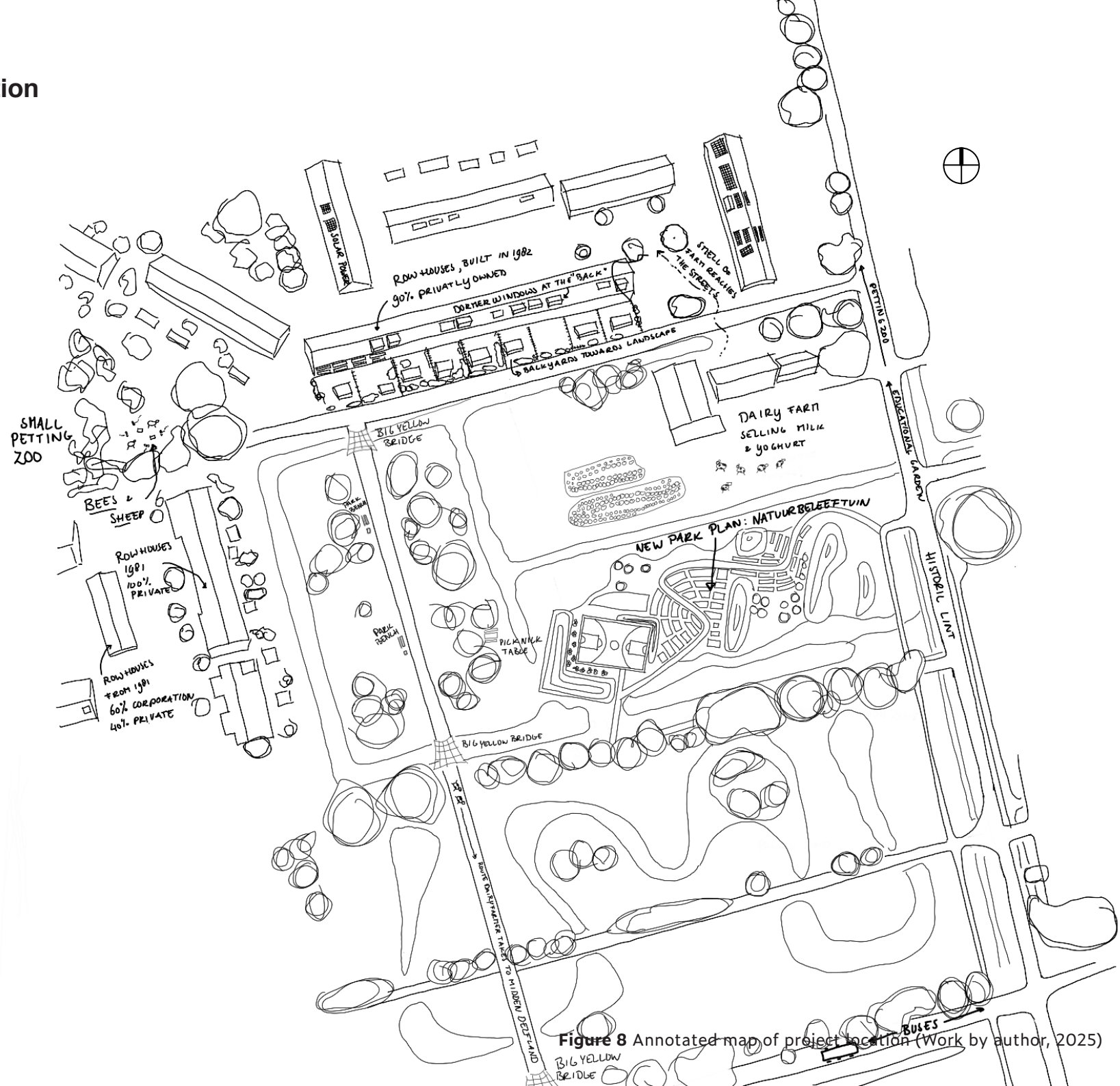


Figure 8 Annotated map of project location (Work by author, 2025)

Tanthof, Delft

A Short History

This project focuses on Tanthof in Delft, one of the urban neighbourhoods that borders Midden Delfland. Covering 6830 homes, Tanthof has approximately 12.5% of Delft's total housing stock. The neighbourhood was developed from the 1970s to the 1990s as an extension of the city. What is remarkable for its time is that the neighbourhood was not built by covering the polder with a layer of sand, but instead, the polder landscape was preserved, retaining its watery nature. Additionally, it was decided after some debate to preserve the historic lint of farms that runs through the area, called Abtswoude, which now serves as a central element dividing Tanthof East and West. Its buildings are small-scale, focused on the human dimension, and designed for young families (see Figure x). This is now very evident in the dominant row house typology, the abundance of play areas, several petting zoos, and even the layout of its streets.

Now vs. Then

Some of the plan's intentions have become lost. Firstly, family-centred design is a mismatch with the current demographic: numbers from Het Kadaster show that single-person households are now more dominant, as 39% of Tanthof West and 45% of Tanthof Oost consist of single-person households. In Tanthof Oost, families with children are ranked third in terms of household types (Kadaster, 2024). Secondly, although the polder landscape was a key feature of the design, the relationship between the residential area and the landscape has faded over time.



Figure 9 Abtswoudsepark

Tanthof and Redesigning Deltas

Redesigning Deltas proposes densifying the urban edges surrounding Midden-Delfland to strengthen its borders and mitigate the housing shortage within the existing urban tissue. This project builds upon the Redesigning Deltas proposal and aligns with the position of designing spatial interventions that are a restorative force for their environment. However, this project prioritises the existing housing and community. Additionally, this project explicitly links the restorative design to the circular transition. Thereby, this proposal argues that restoring the local environment should be the primary focus of circular architecture.

Tanthof and The Circular Housing Transition

Regarding the circular and energy-neutral transition, Tanthof still has steps to take, as indicated by the fact that 39% of the homes have an energy label of B or higher, and no dwellings are energy-neutral (Gemeente Delft, 2024). Since 51.4 per cent of the dwellings in Tanthof are privately owned (Gemeente Delft, 2024), the circular housing transition is particularly challenging, as the responsibility is essentially that of the homeowners.

Tanthof is an interesting and relevant case study for the circular housing transition, as most of its dwellings are row houses, which is very typical for Dutch residential neighbourhoods. The proximity to TU Delft presents an opportunity to conduct more research on-site and focus on the local community (see Chapter 3.3). This research will be the basis for a design proposal (see Part 4).



Figure 10 Project location

The project location

The project location is at the northwestern edge of Abtswoudse Park, which is filled with Japanese cherry trees that bloom in April. In the image above, captured in March, the trees remain bare, revealing the row houses behind the park. The image depicts the backs of the houses, showcasing their backyards, brick sheds, and fences. It is thus a blind street, offering no view from the ground floor into the park.

What may be most striking about the location is the bridges. There are hardly any sightlines from the park towards the neighbourhood to the north or from the park towards the polder landscape of Midden-Delfland to the south. Yet these four yellow and blue bridges form an exception, connecting the city with the landscape. The last two bridges lie approximately 90 metres apart, crossing a ring-ditch and effectively making the project location somewhat of a separate island at the edge of the park.

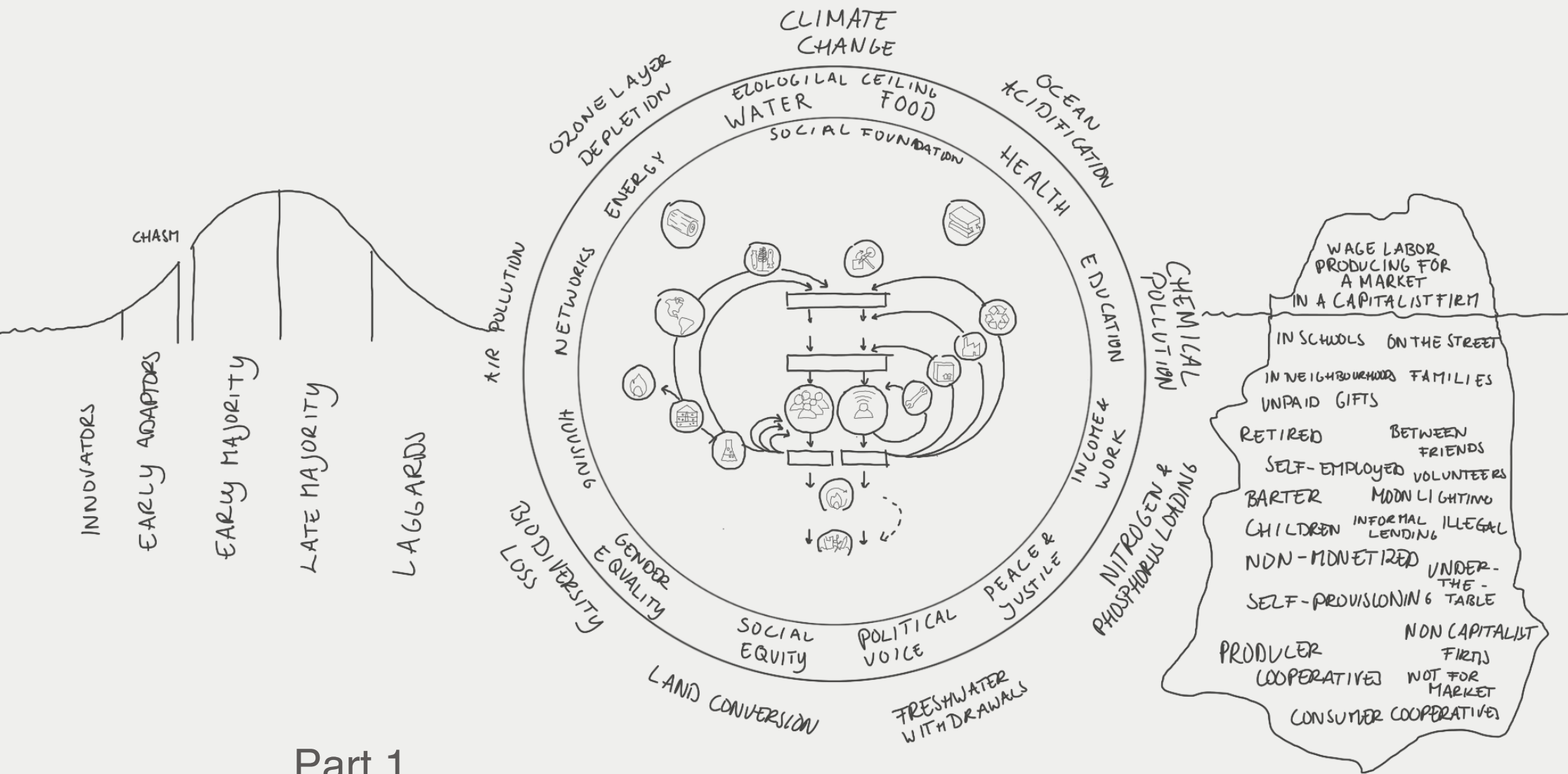
Reading Guide

This report consists of four parts. **Part 1 is the theoretical basis of the research.** The first chapter, 1.1, discusses the Circular Economy paradigm and its implementation in the Built Environment and the local scale. Since this paradigm is a relatively uncontested discourse within policy and academia, it forms the foundation of this research. However, this literature review also questions and adapts the framework in consideration of local conditions. Chapter 1.2 dives into the social side of the Circular Economy, considering the human conditions for circular housing adoption. The term adoption will be further explained in this chapter as well. Part 1 ends with a proposed method for researching and designing circular housing (chapter 1.3).

Part 2 looks into the early adopters of circular housing. This section comprises three case studies, which were researched through ethnographic fieldwork and document analysis. These case studies are Aardehuis Olst, Boschgaard in 's Hertogenbosch and Geworteld Wonen in Rijswijk.

Part 3 looks at the current state of the circular housing transition, with a focus on the residents' perspective. This part includes a chapter featuring expert interviews on researching how to assist residents in the energy transition (Chapter 3.2). Additionally, local conditions are studied through fieldwork and interviews. Delft, the project location, has a local energy collective called O15Duurzaam. They offer advice on sustainable housing renovations and energy conservation, providing insight into the urban majority's perspective on sustainable living.

Parts 1, 2, and 3 are data-based research studies. Therefore, these three parts will be discussed in the **discussion**, and afterwards, **conclusions** will be drawn (pp. 105 -115). **These conclusions will be applied to a design proposal for a circular housing project in Tanthof, Delft. This design proposal will be presented in part 4.**



1.1 Architecture and the Circular Economy

A Theoretical Framework for A Circular and Inclusive Built Environment

Rethinking how we dwell means rethinking our economy — the way people make choices and distribute resources and prosperity. Architecture will always be entangled with the economic system in which it operates. The current linear and capitalist economy has shaped our past and present architecture. Thus, to create architecture that prioritises ecological responsibility, the economy must also change. The Circular Economy (CE) is often cited as the solution for a sustainable future in policy and academia. This chapter discusses key theoretical frameworks of CE. Yet, this review will also discuss other economic systems that could provide a sustainable and inclusive future, besides the CE. Even though CE has been celebrated from within the academic field and policymakers alike as the solution for the climate crisis, this study seeks to challenge the assumption that the CE is universally beneficial, arguing instead for a more nuanced analysis of its limitations, potential unintended consequences, and areas where it may fall short in addressing complex socio-environmental issues. Scholars from various fields have examined the possibilities of other economic systems that could provide an ecologically conscious and inclusive future. Due to the current CE discourse, other economies have been underexposed. However, researchers from within the field of architecture and economics plead for the co-existence of economic systems to ensure resilience (Fitz & Krasny, 2019; J.K. Gibson-Graham et al., 2013). Therefore, other economic theories will also be included and compared to the circular model.

The Circular Economy

The EU aims to achieve a CE by 2050, since they argue that “[s]caling up the circular economy ... will make a decisive contribution to achieving climate neutrality by 2050 and decoupling economic growth from resource use, while ensuring the long-term competitiveness of the EU and leaving no one behind.” (European Commission, 2020). The CE is gaining momentum, yet this idea has been around and has evolved since 1970, and many definitions and frameworks have been formed. An early example that is still relevant today is the Cradle to Cradle principle by architect Bill McDonough and chemist Michael Braungart (2002). They argued for an economic paradigm shift, because up until then, the economy had been formed since the Industrial Revolution was incredibly wasteful,

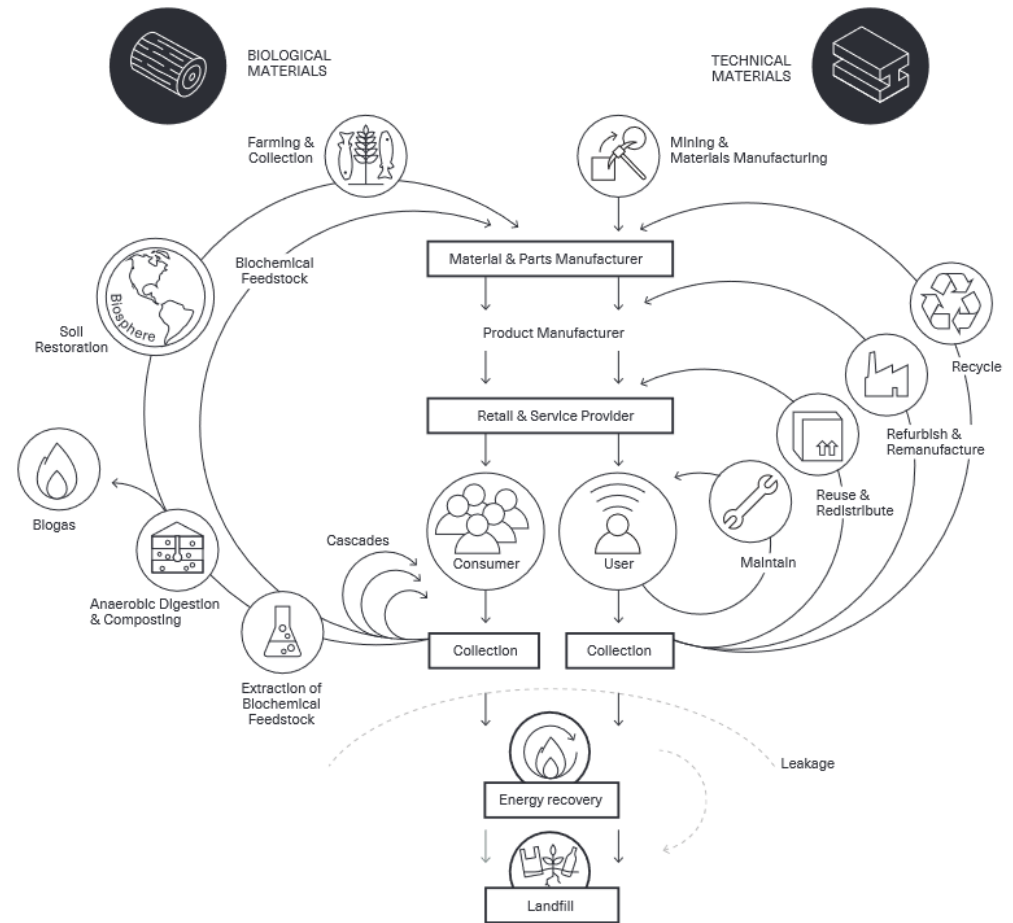


Figure 1.1 Circular Economy Framework Ellen MacArthur Foundation. (Ellen MacArthur Foundation, 2013; edit by Leclercq and Smit, 2022)

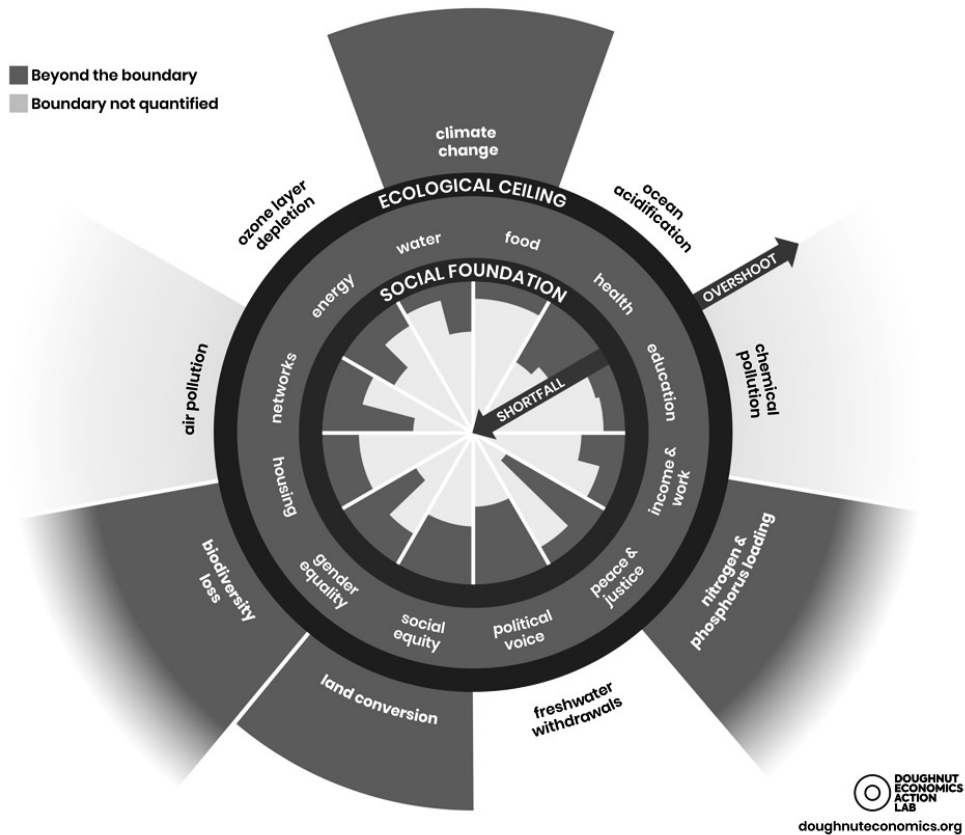


Figure 1.2 Doughnut Economy. (Raworth, 2013)



Figure 1.3 The Iceberg metaphor as an acknowledgement of economic diversity. (Gibson-Graham et al., 2013)

dangerous and harmful for human and ecological health. McDonough and Braungart explain the vastness of this problem:

“High-tech products are usually composed of low-quality material, globally sourced from the lowest-cost provider, which may be halfway around the world ... the problem intensifies when parts from numerous countries are assembled into one product, which is often the case with high-tech items, such as electronic equipment and appliances. Manufacturers do not keep track of – nor are they required to know – what exactly is in all of these parts” (p. 38-39).

McDonough and Braungart continued to illustrate the consequences of such an industry, which creates problems such as ‘sick building syndrome’; the unknown amount of crude products in the home, from insulation materials to electronic appliances, that pollute the indoor air quality, leading to unidentifiable illnesses, allergies and asthma. Thus, they developed a framework to design products that safeguarded human and environmental health while also leaving a positive footprint on the planet.

The core of their framework was to ensure infinite closed-loop material cycles. To think in loops, everything must be seen as food rather than waste. So McDonough and Braungart identified two types of nutrients: biological nutrients and technical nutrients, stating that the former can biodegrade to build healthy soil, as it is derived from the biosphere, and the latter should continuously be recycled into new products of equal value without contaminating the biosphere. They call their approach Cradle to Cradle, since materials do not have to ‘die’, but instead can be ‘reborn’ (Braungart & McDonough, 2002).

The Ellen MacArthur Foundation developed a newer model for the CE that is partly based on the Cradle to Cradle principle of McDonough and Braungart (2013). The Ellen MacArthur Framework describes CE as “an industrial economy that is restorative by intention and design.” (Ellen MacArthur Foundation, 2013, p. 14). They summarised their approach in a diagram (See Figure 1.1). The influence of McDonough and Braungart’s waste is food principle is a guideline within this model, yet this model shows a clear priority within the raw material cycles. Starting with small and local initiatives, and moving to large-scale recycling factories. Thus, the longer the loop, the more external energy is required. This model is less focused on the health benefits of the Circular Economy than the Ellen MacArthur Framework, which tries to appeal to industrial businesses to transition towards a CE. Therefore, their main incentives are the monetary benefits that a CE could offer. The European Union makes a similar argument, by stating that “moving towards a more circular economy could increase competitiveness, stimulate innovation, boost economic growth and create jobs” (European Parliament, 2023)

It can be questioned whether it is possible to remain with the same core values as a linear economy, i.e., money and growth, to accomplish an economic paradigm shift.

In addition, this model is not fully applicable to the built environment, as researchers Pomponi and Moncaster (2016) also note. Buildings are uniquely designed for a specific context, and our built environment is mostly already constructed, designed in and for a linear economy. They note that “If we are to bring about circularity in buildings,

focusing on the new ones will not suffice.” (p.711). They stress that the greatest challenge in transitioning to a circular built environment is not technological advancement, but changing people, as individuals and as a society.

Other Economics

Recent scholars also warn that the idea of the CE has often been accepted as the only solution without critical interrogation and problematisation. Yet Zavos et al. have identified two valid critiques; Firstly, the CE is intrinsically technocentric, and secondly, case studies of a normalised or generalised CE do not address matters such as equality, representation or inclusivity at all (Zavos et al., 2024).

In addition, it can be questioned whether the CE discourse should focus so heavily on (regenerative) growth. By imagining that human activity must always lead to further progression, a framework has formed in which humans and non-human species are stuck in a discourse that everything and everyone is a resource. This is a point that is often cited against the current capitalist model (Lowenhaupt-Tsing, 2015; Fitz & Krasny, 2019). Our current economic system has created social and spatial inequalities, pushing other values such as community and care into the background. Therefore, it can be argued that a resilient economy should guarantee new values; a system that ensures climate justice as much as social justice.

Various economists have argued for a paradigm shift other than the CE model. Economist Kate Raworth’s model of the Doughnut Economy posits a hard inner and outer boundary within which an economic system should operate. The inner boundary is the social minimum, which consists of human rights such as education, health, gender equality, resilience, food, and energy supplies. The outer boundary is the ecological ceiling, with values such as biodiversity, freshwater consumption, climate change and the ozone layer (See Figure 1.2). Economic Geographers Gibson-Graham et al. refer to the Community Economy (2013): practices within our economy have no monetary motive, yet they improve the distribution of resources within society and contribute to our overall wellbeing. Gibson-Graham et al. use an iceberg as a metaphor to illustrate the economic diversity that is already present, yet vastly invisible in the mainstream economic system (See Figure 1.3). Acknowledging and reevaluating the worth and implications of these practices, such as gifting, sharing and volunteering, is the first step in creating a more just, ethical and inclusive economy. A study by Graziano and Trogal (2019) argues for the revaluation of volunteer work as well. They illustrate the positive societal impact of community libraries and repair cafés in London, which are under pressure due to a lack of funding and excessive reliance on personal sacrifices.

The most noteworthy advocate for The Community Economy and Collective Action is laid Anthropologist Elinor Ostrom, whose research has shown that our economy should have more actors than the market and the government; communities can and should be able to manage common goods and resources between themselves too as they are intrinsically affected by the consequences (Ostrom, 1990; Lengkeek & Kuenzli, 2022). So it is important

to bring communal efforts more to the foreground.

Resilience in Diversity

From within different frameworks, the Doughnut, Community and Circular Economy all aim towards a society that is more conscious of its natural environment and works towards restoration. However, these models cover other spatial domains, different degrees of practical applicability and of ecological and social sensitivity. Pomponi and Moncaster remarked that the CE works for a macro and micro scale, yet on a mesoscale, such as a building, it falls short of nuance (2016). The community economy, as its name states, works best on a smaller scale, giving space for citizens' initiatives, yet it must function alongside government and market (Lengkeek & Kuenzli, 2022). In addition, Lengkeek and Kuenzli argue that a network of commons creates possibilities for the efficient distribution of commons that fit within the local context.

The Doughnut Economy has identified critical values, yet it lacks a practical implementation; the CE and Community Economy are much further developed in practical execution, as examples of both already exist. Ensuring the ecological and social boundaries of the Doughnut Economy within a CE or Community Economy could strengthen all. These frameworks differ, yet these models should not be discarded because of their shortcomings. Instead, the coexistence of different economies could complement each other and strengthen society. The CE ideology provides a more conscious approach to our resources, and the Community and Doughnut Economy provide a better approach to equality at different scale levels.

Yet, all these frameworks require human responsibility. Philosopher Donna Haraway argues for "respons-ability: ... collective knowing and doing, an ecology of practices" (p. 34). She stresses that we are at a time of urgency for all species, in which we are faced with mass death and extinction, yet we refuse to be response-able, and we refuse to be present. Instead, Haraway pleads that we face the trouble and collectively think about rehabilitation and sustainability on our planet (2016). The human perspective is of utmost importance for ecologically responsible living. Therefore, the next chapter deals with the human side of architecture and the challenges people face regarding more sustainable dwelling.

1.2 Adopting Circular Living

A Theoretical Framework for Community-led Adoption of Circular Housing Strategies

"If our species does not survive the ecological crisis, it will probably be due to our failure ...to work out new ways to live with the earth, to rework ourselves ...We will go onwards in a different mode of humanity, or not at all" (Plumwood, 2007; p.1)

It is a human responsibility to ensure that our living environment does not deteriorate further but recovers and to provide resilience in times of climate disasters. As mentioned in the previous chapter, the technological part of circular architecture is well-established, yet the social implementation is lacking. Locally-led adaptation is indispensable because local actors have more knowledge and awareness of their own context and the consequences of new plans (IIED, 2023). So, how can (urban) communities be empowered to take action in times of climate crisis? This would require an inclusive, intersectional and community-specific approach (Ceinos et al., 2024), and so this chapter does not and cannot offer an all-encompassing solution for climate-adaptive living and life. Rather, this chapter covers theory on technology adoption and common barriers and behaviours of people when adopting sustainable living (e.g., home renovations and new builds) and tactics to alleviate reservations from recent studies. In addition, this chapter discusses the potential of Architectural Anthropology in technology adoption and as a method to design people-centred sustainable dwellings. Anthropological knowledge could provide insight into how architecture could contribute to a new mode of humanity, as mentioned in the previous chapter and stressed by Val Plumwood's quote above, the ecological crisis requires people to change.

Adopting Circular Living

Sociologist Everett Rogers' Diffusion of Innovations Theory (1962) provides a foundational framework for technology adaptation: the understanding of how new ideas, practices, or technologies spread through social systems. Rogers identified five adopter categories: generalised personas based on abstractions from empirical research. These five categories are innovators, early adopters, the early majority, the late majority and laggards:

Innovators - a small group of venturesome people with high interest in new ideas. Usually they have a social network that reaches beyond their local origins, spanning out to others around the world, who have a similar interest in technology. This group has high financial liquidity and risk tolerance.

Early Adopters - A group with high influence within society, more socially engaged than the *innovators*, and a more rational approach toward new technology. This group is identified by high upward social mobility, social status, education and wealth.

The Early Majority - A group that provides the connection of new technology in their social network. This group is significantly larger than the *early adopters* and is somewhat more risk-averse; this group will deliberate some time before adopting an innovation.

The Late Majority - The group that adopts just after the average, mostly due to economic necessity or peer pressure. This group can be defined as sceptical, most barriers must be removed before this group considers innovating.

Laggards - A group of traditionally-minded people, very tied to their local environment. Their decisions are often made in accordance with what has previously been done. This group is very suspicious of innovation and agents of change.

Rogers arranges the five categories in a bell curve, indicating the relationship between the smaller groups, *innovators*, *early adopters* and *laggards*, and the larger majority (see Figure 1.4). Over the years, this theory has been modified after the discovery that there is a significant struggle to bridge the gap between the early adopters and the early majority (Moore, 1991). Moore notes that this 'chasm' is not a marketing issue of new technology but spans across domains. For circular architecture in particular, this chasm is evident; Circular (housing) projects do exist, but up until now, they have mostly been initiated by so-called pioneers, while the majority of the building sector still operates linearly. There is also little motivation among the majority of residents for energy-neutral and circular living, despite the EU's goals. Recent literature has highlighted the importance of residents' contributions to a climate-neutral housing sector. The home has an intimate and private character, and therefore it should offer a degree of appropriation and control to its residents. Thus, it is important that residents understand and contribute to a circular living environment (Krutisch et al., 2023).

Barriers and Behaviours in the Energy Transition

While Rogers' model explains how innovations spread, more recent research highlights

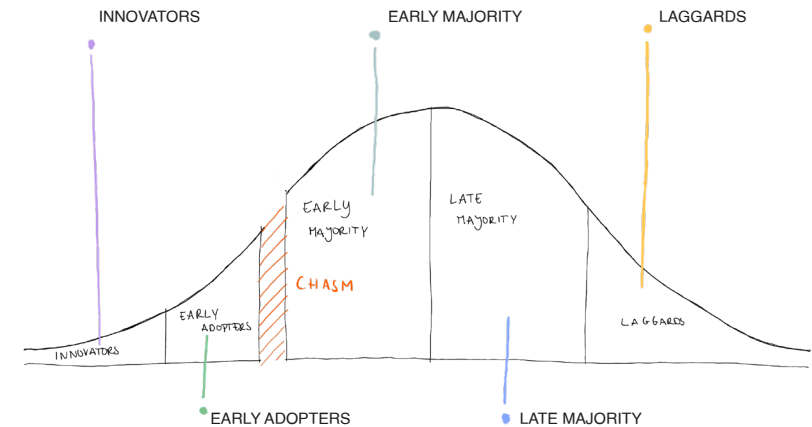


Figure 1.4 Chasm Theory. (Diffusion Research Institute, 2025; edit by author)

specific psychological and social barriers to adopting sustainable practices. Krutisch et al. (2023) advocate for exploring spill-over effects as an approach to stimulate sustainable housing renovations among residents. Spilling effects can be defined as one behaviour leading to another behaviour, either within the same person or group or spilling to other people or groups. An example is a recent Norwegian study (Egner & Klöckner, 2021) that showed that someone is more likely to conduct a new energy-efficient retrofit when they have conducted an earlier energy-efficient retrofit in the past three years. Yet the opposite spilling effects occur too; someone could also be less likely to do something if they, or their acquaintances, have negative experiences with a similar activity.

Due to the urgency and the EU policy for an energy-neutral and circular housing sector, a lot of research is currently being done on barriers that people encounter in the process of making their homes more sustainable. These barriers can be divided into four categories: 1) financial, 2) social, 3) institutional and finally 4) business barriers. See Table 1.1. In chapter 3.3, this is further explored by interviews with researchers who are currently involved with residents in the energy transition.

Shifting focus to local communities

Both Rogers' (1962) theory and recent research on the energy transition highlight the importance of involving people and their communities in the circular transition, from both sociological and economic perspectives.

From an anthropological perspective, the added value of the local is emphasised even more. Woods and Berker (2022) conducted a case study of energy-neutral buildings, affirming the need for greater user involvement. According to them, the added value is not only their contribution to the execution, but also their insights. Woods and Berker found that future-proof buildings are now mainly designed with universally applicable solutions,

Financial barriers	Legal barriers	Social barriers	Technical barriers
High upfront costs	Complex ownership structure	Collective decision-making is complex and lasts long	Lack of technical know-how
Difficult collection of funds	Limited access to financing	Lack of awareness and interest	Lack of consistent and standardized solutions
Lack of sufficient funding	Limited enforcement of regulations	Homeowners's behaviour towards renovation (different interests)	Safety and seismic risks
Split incentives	Complex and multilevel regulations	Lack of transparency and pure communication	Differences between predicted and actual savings
Financial burden for homeowners	Animal policies		
CMs business case*	Unregistered HOAs		
Investors hesitancy	Limited municipal resources		

Table 1.1 Summary of common barriers (Elgendy et al., 2024; edit by author)

but that this does not do justice to local knowledge and lacks the implementation of local qualities such as community, history, geography and climate. Technical top-down knowledge is indeed required, but so is the local understanding of a place. Residents understand the social infrastructure through daily practices. Designers and engineers can navigate by means of maps, but locals understand their environment in a narrative way. Architectural anthropology suggests that involving residents in the design process can align technical innovations with local narratives and practices, fostering better community acceptance.

Architect Gil-Fournier promotes anthropological integration in architecture, too, building upon anthropologist Bruno Latour's notion of 'learning to be affected' in a spatial domain. According to Latour, the more we learn, the more differences we can notice, and through these differences we can be affected or influenced and respond more consciously. 'Learning to be affected' is about learning to understand others through confrontation, allowing room for discussion and debate (2004). In architecture, this discussion between end-user and designer is often an afterthought. Yet a circular transition relies heavily on the end-users, and so designers should learn more about their perspective. Gil-Fournier (2019) adds that "the affective should be at the centre of decision-making practices. ... Taking care of others means moving closer to them, getting to know them and also learning to better understand them and their respective lives." (p. 91). To sum up, methods to explore a new and more ecologically responsible way of living should include a level of rapprochement. That way, designers can better understand how people face the circular housing transition and respond more consciously to people's needs.

1.3 Interdisciplinary Methods for Analysis and Design

An Approach for Studying Circular Living in The Netherlands

“The word ‘understand’ comes from Old English – *understandan*. Literally, it means to stand in the midst of. It does not mean we have reached some ultimate truth. It means ... that we have experienced enough of something new, something formerly unseen, to be provoked, humbled, awakened, or even changed by it.” (Andrea Elliott, 2022, p. 520).

It is important to distinguish different categories of people, yet there will always be differentiations of these groups in different contexts. As Chapter 1.1 presents the value of combining various models for a resilient and ecologically responsible economy, Chapter 1.2 presents the differences between people. There is no one-size-fits-all solution for a circular future, nor should that be the aim. The beauty of Architecture and the Built Environment is that people can generate new ways to make use of a space and make it their own. The introduction raised the question of what if our streets were completely circular? If so, the role of the architect should be fostering, not dominant. Because technology adoption, especially in the context of someone’s living environment, ultimately comes down to appropriation of the technology. Various scholars (Ingold et al., 2020; Pink, 2022) refer to Architectural Anthropology as a method to navigate through various crises that society is currently facing, including housing and climate. Anthropology emphasises the Human Dimension; the many different ways a person can relate to a space, and the many varieties in people that exist, in gender, class, ability, age and migration background (Ingold et al., 2020; Pink, 2022). On the other hand, Architecture is a speculative discipline that enables the possibility of many future scenarios through design (Ingold et al., 2020; Woods & Berker, 2022). So there is an open-endedness in this interdisciplinary approach; the understanding that biases and prejudices can and should be contested in dialogue with others, so new ideas can be formed (Latour, 2004).

Participant Observation and Talks with Residents

This research attempts to understand the community’s perspective on circular housing projects to enable the circular transition. Yet, as mentioned in the quote by Andrea Elliott at the beginning of this chapter, understanding is never some ultimate truth; it is the possibility to stand amidst something and be moved by it, i.e., to “learn to be affected” in the words of Latour (2004). Thus, “standing amidst of” is a vital part of this research; getting

to know different groups in and their approaches to sustainable dwelling. So, this project requires a visit to people at home and making observations of their habits, a common method for ethnographers and anthropologists called *participant observation*:

“... participant observation is a method in which an observer takes part in the daily activities, rituals, interactions and events of the people being studied as one means of learning explicit and tacit knowledge of their culture. ... Participant observation is a way to collect data in a relatively unstructured manner in naturalistic setting by ethnographers who observe and/or take part in the common and uncommon activities of the people being studied.” (DeWalt et al., 2000, p.260)

DeWalt et al. (2000) note that participant observation requires the observer to be open-minded and non-judgmental. It also requires patience, as the observer must allow people to tell the stories they want to tell. Therefore, results might be unexpected or even surprising, which means that the observer has indeed gained new insights. This research, too, will include fieldwork at people’s homes, participating in community events and semi-structured interviews, focusing on the stories that people share and the things they want to show.

Sketching and Painting

Just as there is no one ultimate truth that can be derived from a deeper understanding of others, there also is no unambiguous truth that can be derived from a representation (Said, 1967; Latour, 2020). Yet drawing as a tool is much more than a representation; it is an attentive, even meditative, form of analysis, allowing the researcher and the viewer to look more closely and document a moment in precise detail. (Lucas, 2020, p. 20).

This research uses drawing and painting as a tool to document and analyse circular living spaces. It allows a researcher to stay with something a bit longer than photography would, seeing the result as a carefully documented collection of traces of a life put together in an image. Drawing is a way to document as well as a way to analyse. In addition, Lucas argues, a drawing or painting always leaves room for new interpretations by the viewer. This technique, therefore, ties in with the open-endedness of this research approach (Lucas, 2020).

The fieldwork of this research is twofold: 1) looking into the *innovators* and *early adopters* of circular living in The Netherlands, the so-called ecovillages, as well as 2) the local *early adopters*, *early* and *late majority* in Delft, the city in which the design project is located (see Figure 1.5). In addition to the fieldwork, expert interviews have been conducted with researchers studying residents' behaviour in the energy transition. Which results can be compared to the fieldwork studies?

Studying Early Adopters of Circular Housing in the Netherlands

The circular housing transition can be seen as a process of technology diffusion, as defined by Rogers (1962) and Moore (1991). The chasm, as identified by Moore, will be the focus of this research. As circular housing projects in the Netherlands are currently primarily executed by so-called pioneers, i.e. early adopters. This group can be identified as communities that have made efforts to live in housing made from reused and/or biobased materials and continue to share resources and engage in sustainable practices as a community. This group will be studied through participant observation, painting, and sketches.

Studying Early Adopters and The Majority in the Energy Transition in Delft

In addition, the local early adopters and the majority are also analysed. This part of the research is conducted through volunteer work with 015Duurzaam, a local energy collective. 015Duurzaam helps people who want to renovate their homes or save on their energy usage; these people can be seen as the (early) majority. The volunteers of 015Duurzaam are trained energy coaches, usually having some personal experience in sustainable home renovations. These volunteers can be seen as local early adopters, people who have installed solar panels or a heat pump or insulated their home, for example.

Volunteering as a research method is an experimental way of participant observation. Yet the added value is the long-term knowledge exchange with the 015Duurzaam and the residents, who have such a unique understanding of their lived space, which is often underexposed in academia and practice.

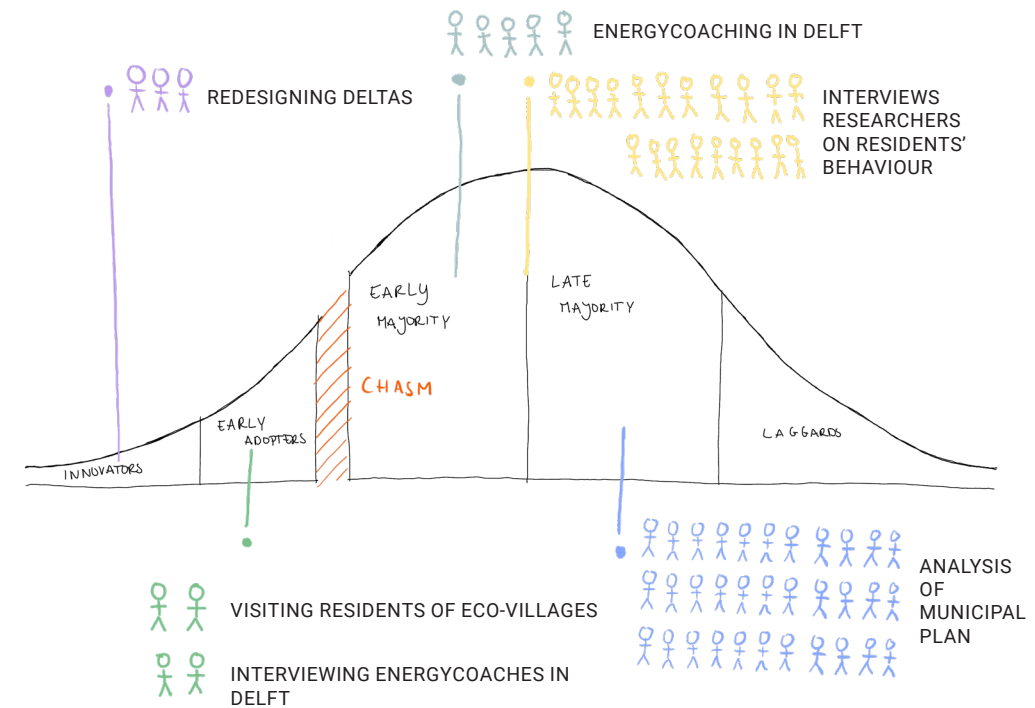
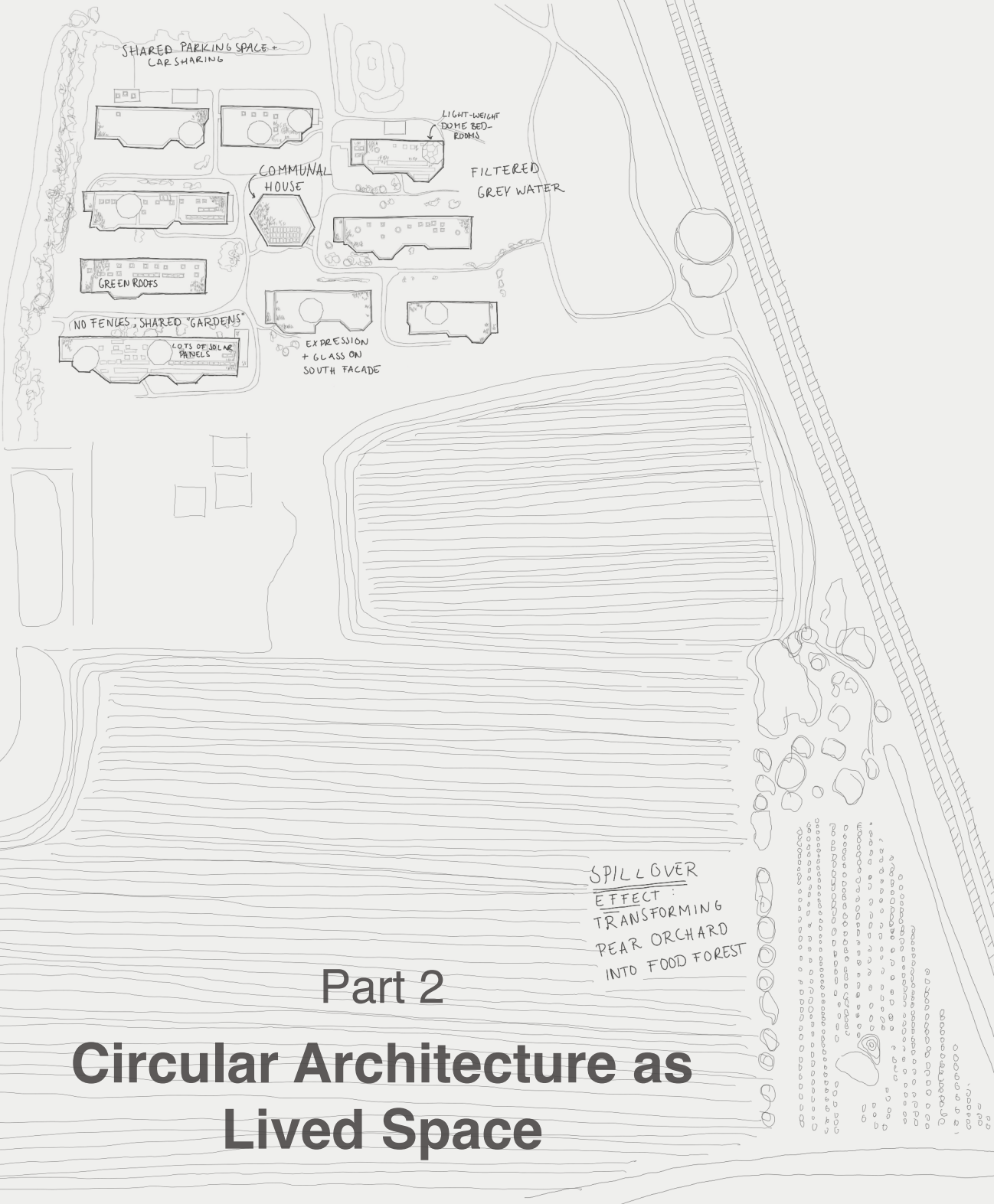


Figure 1.5 Methods put within the Diffusion of Innovations framework (Work by Author, 2025)



Part 2

Circular Architecture as Lived Space



Circular Architecture as Lived Space

An Ethnographic Study on Eco-Communities



Aardehuis, Olst



Boschgaard, 's Hertogenbosch



Geworteld Wonen, Rijswijk

2.1 Introduction

This chapter covers three case studies of circular residential communities. Through stories of residents and paintings, this chapter aims to paint a picture of circular living. All three residential groups have their approach to circular building and living. Aardehuis Olst has focused on self-build and environmentally friendly construction. Their compound consists of 23 homes and a shared building at its centre. At Boschgaard, self-build was also a key focus, alongside reuse. Their project, consisting of 19 homes, is partly adaptive reuse and for the rest, built mainly from reused materials. Finally, Geworteld Wonen, this project revolves around living together and gardening. With 47 homes, this case is by far the largest.

From each project in itself, much can be learned about organisation and barriers, as well as about sustainable living together and how these types of projects evolve over the years and with the residents. This part of the research is based on my findings and observations; however, I would like to emphasise that these may differ from those of the residents and readers of this report. It is an invitation to new interpretations and ideas.

2.2 Aardehuis, Olst

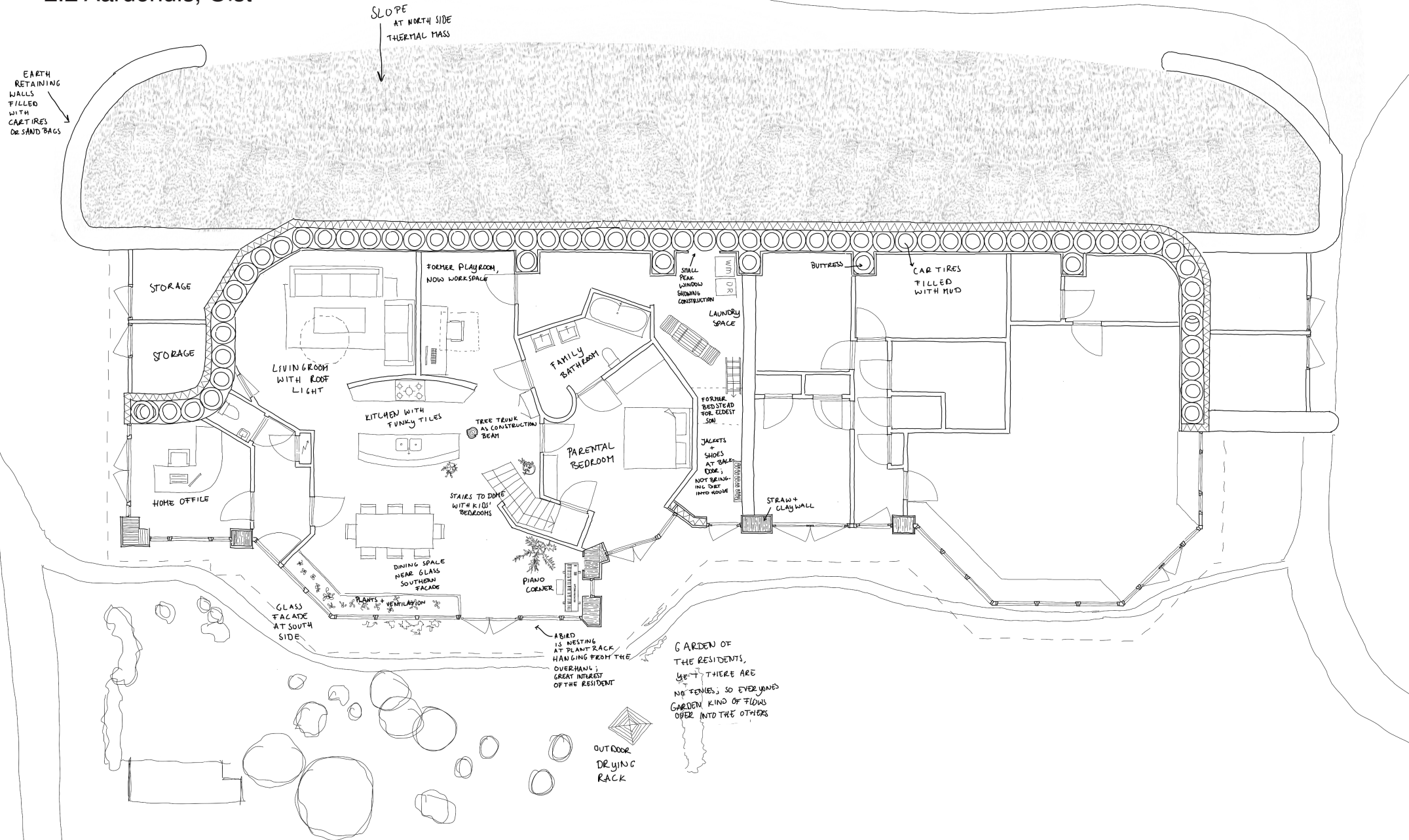


Figure 2.1 Annotated floorplan of semi-detached Aardehuizen. (Work by author, 2025)

Aardehuizen, Olst

Collective Private Commissioning (CPC) projects are becoming more common in the Netherlands (Den Heijer et al. 2020). These projects, mostly situated on designated CPC locations planned by the municipality, are developed by the residents, who commission an architect and contractor themselves. The Aardehuizen in Olst are a CPC project, yet their approach was less conventional. As one of the first eco-villages in the Netherlands, they had to work hard to adapt legislation and regulations to their needs. The Aardehuizen, as they call themselves, have had to set up a network, not only internally, but also with external partners, in order to set up a residential community within the Dutch framework that consists almost entirely of waste and bio-based materials that focuses on community instead of the individual.

Research Strategy

This chapter draws on a day of participant experience and observation at the Aardehuizen [Earth/Dirt Houses], a CPC neighbourhood in Olst, and background information from documents and articles on this project. The fieldwork visit was conducted in collaboration with Anna Lugard and Joaquim Boendermaker, two fellow master students, and together we interviewed four residents while working in the nearby pear orchard and during lunch in one of the homes. This approach gave us some insights into how the residents' lives have been adjusted to living in a so-called ecovillage. In addition, this chapter analyses the design and the building process based on drawings, photographs and online information provided by the residents.

A collective of Earthships between Village, Railway and Orchard

The Aardehuizen in Olst are inspired by the Earthship, a dwelling concept developed by American architect Michael Reynolds. Earthships are free-standing houses comprised of natural and waste materials and buried into the earth on three sides; the fourth side is a long south-facing glass façade. The other three façades, or rather sides, are walls made of dirt, held together by used car or truck tires (see Figure 2.1). The orientation and the composition of the façades provide passive heating and cooling, making use of the heat from the sun and the thermal mass of the earth-filled car tires. Using car tires ensures the

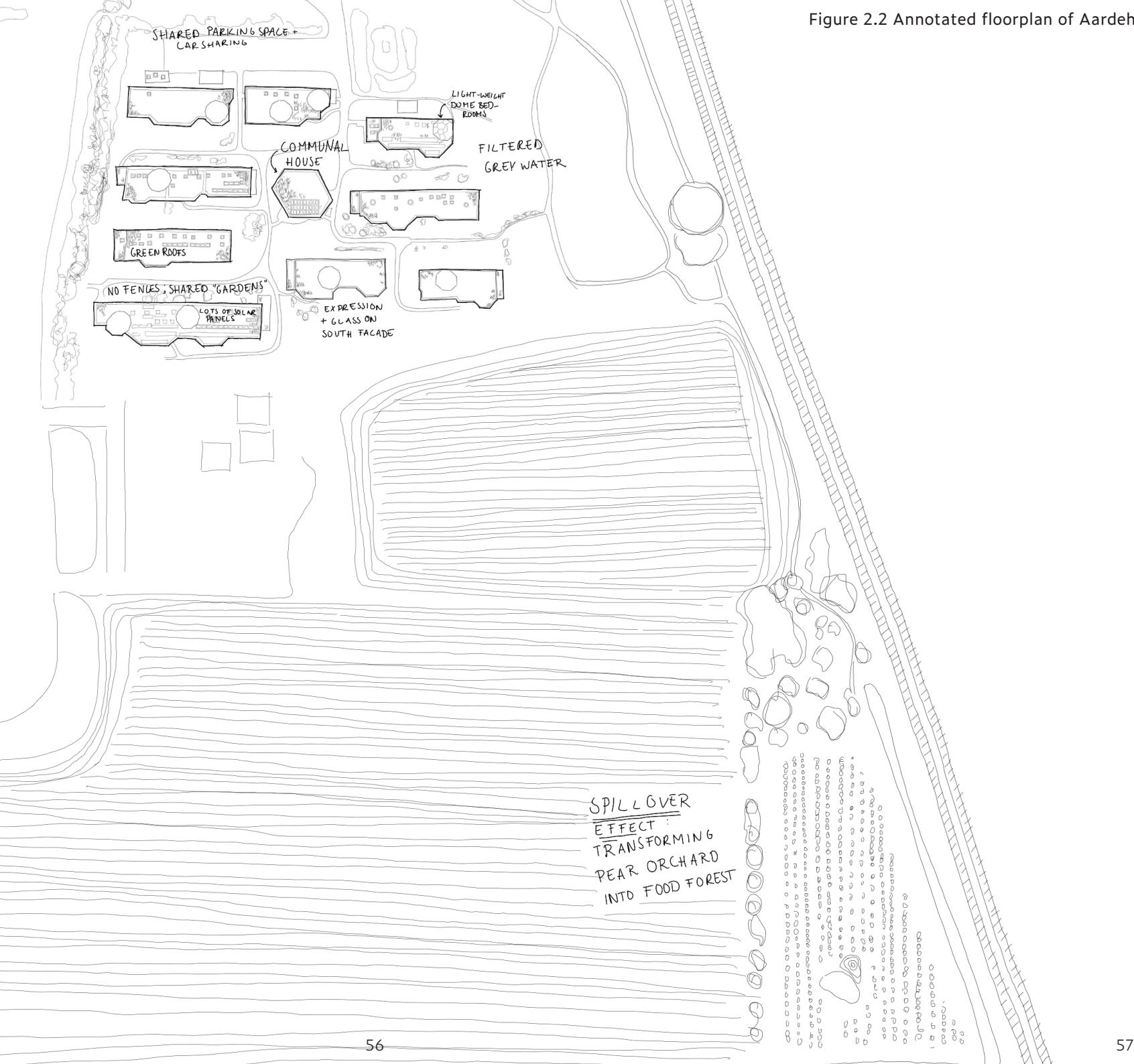
building stability – examples from over the years have proven to be able to withstand fires, hurricanes and earthquakes. In addition, the Earthships recycle grey water and filter black water locally, and they use PV panels for electricity. Another characteristic feature of the Earthship concept is the usage of waste materials in ornamentation, for example, the usage of bottle bottoms as decorative windows. (Earthship Biotecture, 2023; Ehrhardt, 2015).

In 2006, Paul, a current resident of the Aardehuizen, joined a project of Michael Reynolds in Sweden. When he came back to Deventer, the city where he resided, he gave a presentation of his experiences of the building process. This was received with great enthusiasm by Estella and Mirjam, who, together with Paul, founded an association for Aardehuizen in the Netherlands. Initially, the plan was to settle in Deventer, but it was not possible to set up a feasible plan with the municipality. So the plan moved to Olst, where the residents happened to know an alderman. In 2011, the Aardehuizen started building a construction shed, and in 2012, the first piles were driven into the ground (Vereniging Aardehuis, n.d.).

Afterwards, the Aardehuizen, together with volunteers, started building under the guidance of three professional construction coordinators from a construction firm. All Aardehuizen worked on various tasks, yet after the first year, they had decided upon a more efficient workflow and organisation. From 2012 to 2014, every Aardehuis member was part of a specialised team (e.g., roof team, facade team, clapboard team, masonry team, logistics team or the management and technical team). In effect, they had created their own contractor business, spearheaded by a mandate group that took executive decisions. Due to the time pressure, they also had to adjust the design. As the houses that had first been realised resembled the Earthship concept very strongly, with earthen slopes, outer walls made from reused car tires filled with dirt and inner walls made from rammed earth, the last houses the Aardehuizen built were timber frames structures filled with straw and the inner walls were made of sand-lime brick. In addition, they hired more professional help for specialised tasks such as the foundation. They also did not have the time to complete the interior as a collective as they had previously done. Instead, it was up to the residents individually to finish their houses after the collective shell construction (Vereniging Aardehuis, n.d.).

Even though the project had changed over time due to time constraints, the core values remained; The Aardehuizen are a passive housing project in a green environment, with collectively built houses, (mostly) comprised of natural and waste materials (see Figure x). Even now, the community remains a core value, as the Aardehuizen still have teams, for example, the collective house team, the mobility hub and a workgroup for the nearby orchard that they are transforming into a food forest

Figure 2.2 Annotated floorplan of Aardehuis Compound and Pear Orchard. (Work by author, 2025)



Residents' perspective

We were invited to visit the Aardehuizen by Gerard, who has been living in the Aardehuizen since 2012. He and his wife became involved in the project through an advertisement in the newspaper. They decided to join the project because they wanted a greener living environment for their children, and they wanted to live among people who had the same sustainable values as they did. They have been living in the Aardehuizen for over twelve years, and in recent years, their children have moved out to study.

On the day we went to Olst, we helped out at the outdoor maintenance day. The Aardehuizen also have green workdays on their own land, but the Saturday we visited, they were going to work on the land of a nearby pear orchard. This orchard had been polluted after years of chemical treatment, and some of the Aardehuizeners, together with other residents from Olst, made a plan to transform the plot into a food forest. Frans-Jan, one of the residents, has a background in food forestry and permaculture and explained to his fellow residents (Gerard and Ted) and us students how to remove sprue. The rest of the afternoon, we were removing and ensiling sprue.

Around 13:00, we had a lunch break and talked to the residents, Frans-Jan, Gerard and Ted, about their experience living at the Aardehuizen. Gerard mentioned that what he appreciates the most about living at the Aardehuizen is the community aspect:

"I'm a bit of an einzelgänger and here I've learned to appreciate that you have a green workday like this once a month, with a group of ten people. It's not that much fun to dig up your garden on your own, but if you're busy with a whole group and you first go for a coffee and then you're outside with everyone you know, it has some added value."

Frans-Jan adds to this by saying that they motivate each other, explaining how much they are able to accomplish by being able to brainstorm together or work together. Wessel, Gerard's oldest son, remarks a similar thing; he tells us that his parents often have neighbours walking in just to ask for advice on small things like odd jobs around the house. There is an open atmosphere, also encouraged by the layout of the site. Because there are no fences or cars on the site, spontaneous moments of gathering arise. "You make contacts much faster. If the weather is nice, then I suddenly see ten people having a drink there or something." (Gerard)

The Aardehuizeners also mention the added value of having a shared house. In the middle of the site, they have a shared building, called Het Middenhuis [the middle house]. Here, they organise a monthly potluck and sometimes other events such as dancing or playing games. The teenagers also use the space to sneak off to for sleep-overs or to have parties.

These so-called spilling effects extend beyond the Aardehuizen compound, as Frans-Jan remarks. He explains that the monthly guided tour and the efforts from volunteers who helped them build have led to other initiatives. This is something that the Aardehuizeners are proud of, but also something they value deeply. As their motto is not only to live more sustainably as a community but also to radiate this outwards. The community cares a

lot about sustainable living and the current climate crisis, yet they try to have a positive outlook, rather than despair. Ted mentions that he finds it important to talk to others about sustainable behaviour in a respectful manner. Even though he also notes that sometimes this is quite challenging. The Aardehuizeners also remark on the negative stigma associated with being an eco-community:

Gerard: "Whenever there's something going on here, you're quickly looked at as a group.

You're not the individual anymore, but you're one of the Aardehuizeners.

Ted: "Yes, if someone walks around naked here, so to speak, then the whole neighborhood has a name."

This is an unwanted by-product of living in a community like this, according to the Aardehuizeners. In general, they are very open-minded and tolerant towards each other, yet if one of them crosses a line, it will reflect badly on all of them. They dislike the connotation, yet they regard this as a minor inconvenience compared to the freedom they have gained from living in the Aardehuizen. Ted reflects on his previous living situation in a conventional Dutch residential neighbourhood. There, it would be an issue 'if someone had one bush too many', yet here people talk to each other and look after one another.

Wessel also talked about this level of freedom, which, according to him, derives from a sense of ownership and the self-building process. He indicated that with self-building, you place yourself at the centre of your environment. As he explained, there is more room for self-expression through self-building. Since it is "your own", it is possible to change the home for oneself, not for a possible future buyer and the future sales value. That is why the residents of the Aardehuizeners can make more conscious choices about how they want to live. They have a greater level of ownership than conventional housing, which also makes the Aardehuizeners want to take care of their place. Wessel mentioned that in a conventional neighbourhood, a resident might worry, 'When will the municipality fix this?', yet the Aardehuizeners will repair and clean up themselves as they regard the space as theirs. Gerard also explained how the self-building experience had given him the confidence to pick up other building projects in and around the house. For example, he showed us an alcove he made with Wessel and how he replaced the foundation of the house after the wood had started to rot.

The experiences of the Aardehuizeners show that agency can add value to circular communities. The self-build process not only gave the residents a strong sense of freedom and ownership but also empowered them to tackle other jobs later.

Sharing within the community can ensure more social and spontaneous contact. In addition, the Aardehuizeners have more than the square meters of their own house, but also a lot of shared greenery, shared transport and the middle house. The conventional framework of ownership has faded, and the Aardehuizeners get a lot of extra space and freedom in return. Nevertheless, this lifestyle only works for those who really want it and put in the effort, as the Aardehuizeners often emphasise.



Figure 2.3 (Work by author 2024-2025)

An earth house

This image shows one of the Aardehuizen. This house is one of the later houses without an earthen mound, but it was finished with clay plaster and wood. The structure of these houses is probably timber frame with straw. The structure is also finished with wood. A small canopy is attached to the house for brushwood that the residents also use for a mini library. This canopy, as well as the pedestrian sign, is overgrown with climbing plants. Only unpaved paths lead to the house, and the rest of the ground consists of grass and mud. A wheelbarrow and three waste bins for waste separation lean against the house. A small wheelbarrow is used as a decorative planter.



Self-build family home

This image shows part of Gerard's living room. On the right is the staircase to the children's bedrooms. On the left is a small part of the kitchen visible. On the right back is the door to the bathroom visible. Next to the bathroom door, glass bottle bottoms are visible, used as small windows in the wall. On the inside of the house are also many natural materials visible; for example, the wooden floor and a tree trunk that has been used as a column. The floor is marmoleum and the walls are clay plaster. Some plants hang from the construction. A steel beam has been used above the kitchen, probably to support the roof. The stairs were made by the residents themselves. A small adjustment block is visible between the railing and the column.

Figure 2.4 (Work by author 2024-2025)

2.3 Boschgaard, 's Hertogenbosch

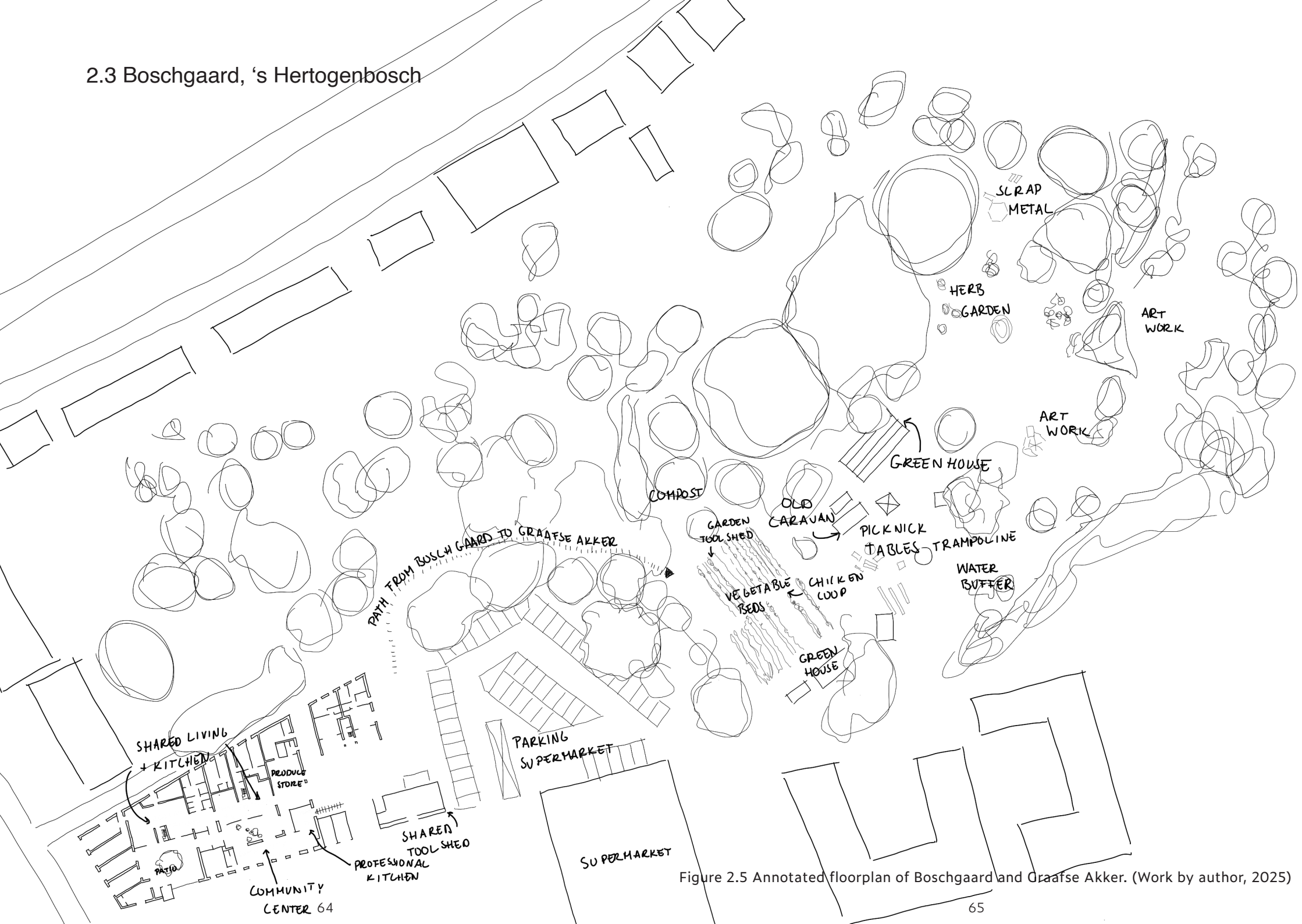


Figure 2.5 Annotated floorplan of Boschgaard and Graafse Akker. (Work by author, 2025)

Boschgaard, 's Hertogenbosch

Most circular housing projects in the Netherlands do not include existing buildings, nor do they offer housing for low-income households. The argument given against including social housing or other forms of affordable housing is the feasibility regarding construction and development costs. However, a new model of housing has recently emerged that demonstrates it is possible to realise a circular housing complex available to low-income households, known as a management co-operative. In this model, a housing association owns the building, while residents are appointed to specific tasks and rights. Boschgaard is an example of a management co-operative that was achieved through the efforts of the residents and their environment. This project is a combination of adaptive reuse of the existing community centre building and new construction, entirely built from reused materials. Boschgaard consists of nineteen apartments, housing 25 to 30 residents. This project illustrates the principles of a circular economy, as well as the theory of Elinor Ostrom on collective action, and aligns with the framework of Raworth's Doughnut Economy. Therefore, this chapter examines the relationship between spatial factors and the experience of Boschgaard's residents in order to gain better insights for designing circular places.

Research Strategy

This chapter draws on a day of participant observation and interviews at Boschgaard, as well as background information from documents provided by Superuse Architects and newspaper articles (Roover, 2018; De Graaf, 2023) on this project. The fieldwork visit was conducted in collaboration with Anna Lugard, a fellow master's student, and together we interviewed six residents while helping out on Boschgaard's monthly community work weekend, dedicated to odd jobs and maintenance. Through engaging with the residents, their perspective on communal living and sustainable living became much more apparent. Additionally, Document analysis was conducted to understand the architect's role and what design goals and methods they had applied.

A Self-Build and Re-use Housing Complex Grounded in Community

The Boschgaard housing project started with the squatting of an empty former community centre, the Patio. These squatters were in need of a place to live, but they became very involved with their direct environment. Four years after their settlement in the Patio, they appropriated a piece of land next to the building to use as a communal garden. The initiators cleared the land from brambles and called the plot the Graafse Akker. The squatters and other people from the neighbourhood use this land to grow vegetables and fruit, and educate children in the neighbourhood. Later on, more initiatives followed, such as art installations on the Graafse Akker and neighbourhood dinners in the Patio.

Nevertheless, despite their successes, the squatters faced considerable uncertainty. Looking for a stable home, the squatters entered a tender for an adaptive reuse project of a nearby school building. Their plan was appreciated by the jury, yet they lacked financial backing. In 2017, the squatters got an eviction notice from Zayas, the housing corporation that owned the Patio and the plot. However, instead of leaving, the squatters decided to take action. They were convinced that their initiatives, such as the weekly dinners and the vegetable garden, were of great social and ecological value to the neighbourhood (De Graaf, 2023). So, they started a petition for Boschgaard, a redevelopment plan that would transform the Patio into a community centre and residential complex. Their plan included a big professional kitchen, a shared tool shed for the neighbourhood, a meeting room with a bar and a distribution space for local produce. In addition, they had a desire to self-build and primarily use reused building materials, driven by both sustainability and affordability.

The squatters presented the director of Zayaz with 1,300 signatures and a building proposal. To their surprise, the director was positive and willing. The municipality also agreed to a possible amendment to the zoning plan. As a result, the Boschgaarden - the squatters and other like-minded people - were allowed to develop and build a residential building themselves in 2017 (Roovers, 2018).

The Boschgaarden hired Superuse Studios as architects. This Rotterdam-based firm specialises in reuse and ecological construction. Their first proposal was to add a floor to the existing building. The building would feature a shared meeting room and a shared greenhouse, along with nine individual apartments and ten co-living apartments. The existing foundation, however, could not carry an extra building layer. The foundation situation, together with the discovery of trusses at a demolition in St. Michielgestel, led to a new form for Boschgaard. Instead of doubling the current form, four new volumes were built on and near the old Patio. The three house-shaped volumes each cover four to six apartments, ranging in size from 39 to 83 m². Additionally, a small extension was built on the west façade with small apartments measuring 35 to 43 m². On the ground floor, there are three shared kitchens for residents, as well as a large kitchen for the communal centre, used for the weekly neighbourhood dinners. Other shared spaces include the patio, garden, toolshed, community centre and the Buurderij (a distribution centre for local produce). Yet, all apartments can be used autonomously, so sharing is voluntary and not mandatory.

The residents began building in 2021, working alongside a contractor with experience in building with residents. The residents were primarily involved with the finishing, such as constructing inner walls. The project was completed in March 2024, and the first residents were able to move in thereafter.

Resident's perspective

On Sunday, December 15th 2024, Anna and I went to Boschgaard to talk to residents and participate in the communal maintenance day. Together with Eugenie and Onne, two residents, I worked on a bicycle shed.

Eugenie, a primary school teacher, has been involved with the project for six years and moved in after the project delivery in March 2024. Within Boschgaard, she is part of the Sustainability workgroup and is responsible for acquiring funds and members (Boschgaard, 2024).

Before Boschgaard, she lived in another co-housing community. However, because she missed the urge for sustainability and a sense of community at that complex, she decided to look for another community. As an example, she recalled trying to have PV panels installed on the roof, yet it was too difficult to gain consensus among her fellow residents and the housing corporation. As Eugenie wanted to live more sustainably, she sought a new community with like-minded individuals. Eugenie was attracted to Boschgaard's plan due to the four principles behind it: sustainable, neighbourhood-beneficial, reuse of materials, and (partly) self-building.

As I arrived on site, Onne and Eugenie got an explanation from Meindert, one of the former squatters, about the workflow on the bicycle shed from the day before and what still had to be done. The residents had purchased and dismantled the second-hand shed a couple of months earlier and were now reassembling it. That Sunday, Onne and Eugenie were going to work on the roof. So Eugenie and I went up to the roof to remove the tarpaulin and drill planks. Onne stayed on the ground looking for the right parts. The complex had a large and well-organised workshop, with all the necessary tools, many of which looked well-used. Even though Eugenie had no background in handywork, she seemed competent and knowledgeable about the work.

Self-building had been an important pillar for the residents since the beginning. Sophie, one of the former squatters, explained that even though self-building and re-use was their demand, it was a steep learning curve, she reflected: "You say something, but you don't know what you are saying." They had enlisted the help of professional carpenters to teach them the right skills. This learning process gave the residents the confidence to complete the finishing work themselves, as they desired. Because the people from Boschgaard had the opportunity to choose an architect and a contractor for the shell construction and were able to construct the interior, they could safeguard their initial value of reuse. They attempted to uphold their initial values for the building process after moving in, which I observed during the maintenance day and the construction of the bicycle shed.

Several setbacks marred the maintenance day. Eugenie mentioned that it was harder

to find the energy for the new odd jobs they still had to do, which was also evident by the sheer number of residents who volunteered that day; only five residents showed up. It was also harder to maintain an efficient workflow, since there was not enough covered storage available at the moment, and some of the second-hand timber got misplaced or damaged, which led to disappointment. The residents whom we spoke to on the maintenance day also remarked that the co-living concept led to recurring discussions and disagreements. Eugenie and Peter, who had both lived in co-housing before, remarked that even though it is frustrating, friction is a natural part of living in such a community. Onne added that living in Boschgaard is something 'you need to want.' As confirmed by the residents of Aardenhuizen, a co-living community requires effort and dedication, and it is not for everyone.

For Eugenie, living sustainably was already a core value before moving to Boschgaard. Therefore, she was also more inclined to put in the effort for this lifestyle. However, living with others had also increased her sustainable efforts. Eugenie mentioned that she became a vegetarian in her previous housing community because she ate with her vegetarian neighbours, which showed her the benefits of that diet. Because of her move to Boschgaard, she learned more about self-building and reuse, which made it more logical to her. Eugenie explained that she started an education in furniture-making because the furniture maker who built her closet was not willing to dismantle it. So she did it herself and became motivated to learn more about reuse in furniture making. Her behaviour around reuse is also visible in small things at home. Peter showed us a broken mug that Eugenie had glued to a truss as a pen holder, for example.

The Boschgaarders also have a spillover effect on other people in the neighbourhood. The projects happening at the Graafse Akker show that the explorative actions of the Boschgaard residents create possibilities for others in the neighbourhood too to engage in art, food cultivation and exploring nature (see Figure 2.5).

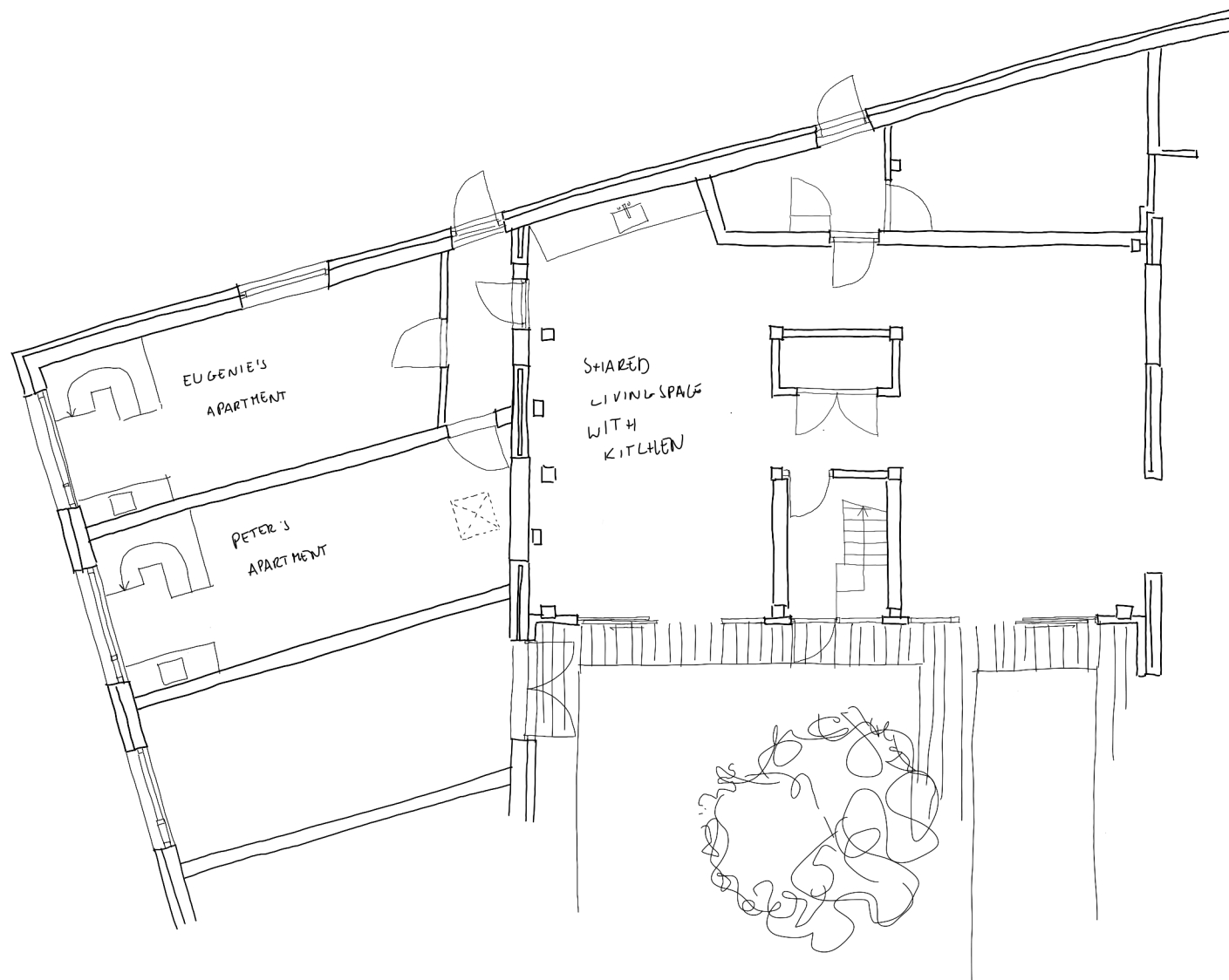


Figure 2.6 Annotated Floorplan of Boschgaard



Shared Living Room

The image shows one of the shared kitchens. It is used for laundry and storage, for example. Judging by the streamers, it also looks like it has been used for a party. However, judging by all the lamps lying around, it does not seem to be finished yet. The walls are ochre yellow and clay plastered, and the kitchen island is wood that has been sanded but not finished.

Figure 2.7 (Work by author 2024-2025)



Figure 2.8 (Work by author 2024-2025)

Residents working on bicycle shed

Onne and Eugenie are trying to slide two cladding parts together that have become somewhat weak and warped due to water damage. They have different tools for this. On the left in the drawing, the door to the tool rental is open, where Onne has just grabbed some things to help Eugenie. The residential buildings are visible in the background; on the right, new construction and behind it, the former community centre with an extension. Everything is made of reused materials, which can also be seen by the different door heights in the facade in the background. The brown rusted railing of the roof terrace is also reused; these are leftover plates from a milling factory. The garden is now mainly loose sand and partly tiled. There are a few tables and a parasol, but it is still very messy because the residents are still busy with their last jobs. The trailer in the background, for example, is full of paint cans.

2.4 Geworteld Wonen, Rijswijk

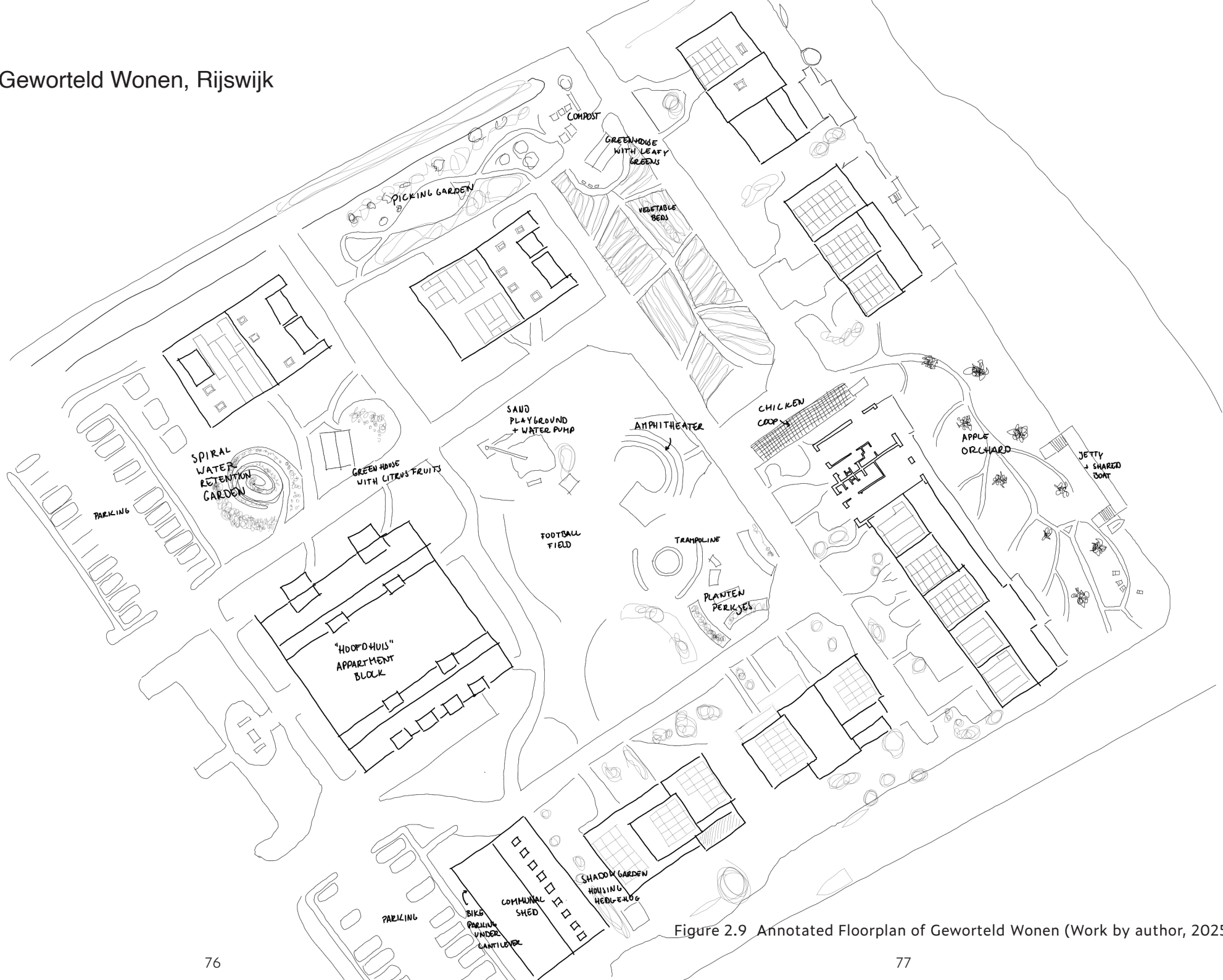


Figure 2.9 Annotated Floorplan of Geworteld Wonen (Work by author, 2025)

Geworteld Wonen, Rijswijk

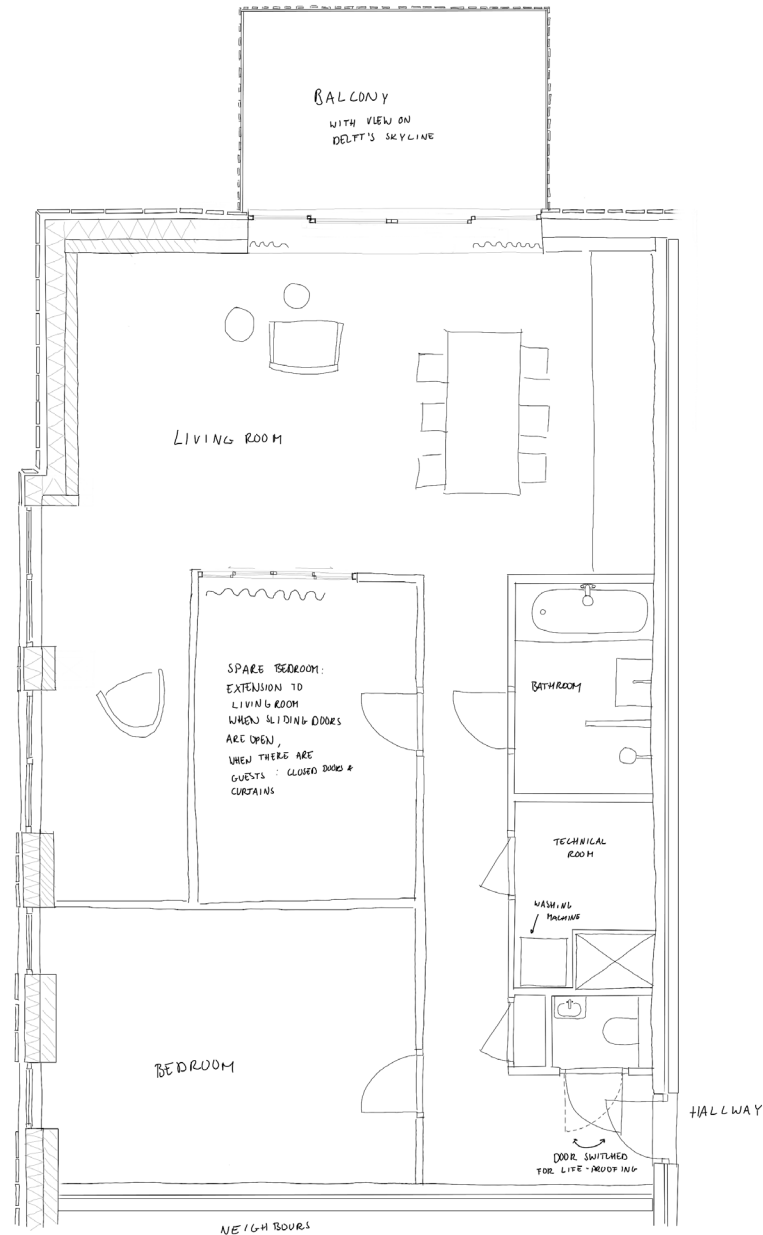


Figure 2.10 Annotated Floorplan of Apartment Hoofdhuis

While most circular housing projects are bottom-up, spearheaded by their residents from the outset, Geworteld Wonen is an exception, as the architecture firm INBO, in collaboration with project developer Beyond Now, has initiated this project. These initiators sought residents with a concept in development and a commitment from the relevant municipality, Rijswijk. Geworteld Wonen will have been inhabited for ten years as of 2025, following the delivery of the first phase in 2015. Since then, the residents, who now possess full agency over their neighbourhood, have been highly active and collaborative with one another and with other local actors in their vicinity. This housing project exemplifies Gil-Fournier's Affective Economy, which is based on Latour's thinking regarding "learning to be affective" through engaging closely and confronting one's prejudices and biases (see Chapter 1.1). Additionally, it illustrates a Community Economy on a small scale, as the residents demonstrate various forms of informal economic activity that are not rooted in monetary gain or growth, but in caring for one another and enjoying life. This chapter provides an overview of ethnographic findings on Geworteld Wonen, aiming to support architectural practices that encourage affective and communal living environments.

Research Strategy

This chapter draws on a day of participant experience and observation at Geworteld Wonen, a CPC project in Rijswijk, and background information from documents and articles on this project. The fieldwork visit was conducted in collaboration with Anna Lugard, and together we spoke to ten to twenty residents as they gave us a tour of the site, while working in their shared garden and during a neighbourhood lunch. Through this approach, we learned more about how the residents experienced living in circular housing through their stories, remarks, and our observations. In addition, this chapter analyses the design and the building process based on drawings, photographs and online information provided by the architect, INBO.

Urban Farming in the Metropole Region Rotterdam-The Hague

In 2009, the municipality of Rijswijk drafted a master plan for the Southern part of the city, rebranding the area into Rijswijk Buiten [Rijswijk Outdoors]. An ambitious

plan was developed in collaboration with TU Delft, the region of Haaglanden, and the waterboard Delfland to create an innovative and nature-rich neighbourhood. It was the first neighbourhood in the Netherlands without a gas supply. As the municipality wrote in the introduction of the master plan:

“Rijswijk sees realizing its high ambitions as a huge challenge. It wants to tackle this in collaboration with the province and the region, in interaction with the organizations within the municipality and in collaboration with future residents and builders. We are entering into an exciting process. We invite everyone with inspiration to participate. Working on a magnificent and daring Rijswijk-Zuid, building a real neighborhood of the 21st century!”
(Gemeente Rijswijk, 2009, p.4)

Despite the municipality's intention and motivation, Rijswijk Buiten came to a complete standstill in 2012 due to the financial crisis, as developers abandoned their experimental plans. Rijswijk resident Jeroen Simons, an architect at INBO, saw this as an opportunity to set up a project without a developer and entered into discussions with the municipality about the concept of Geworteld Wonen: a housing project that focuses on shared living and gardening. The municipality was interested in INBO's plan, provided they could prove its feasibility and find potential buyers.

INBO started an extensive inventory of the housing needs of their target group through discussions with potential residents. The architects visited information markets and gardening events to find these potential residents and strike up a conversation with them about their wishes. For those who were interested, INBO organised monthly inspiration sessions for co-creation.

As the plan developed further, some people dropped out, while others joined through word of mouth or informational networks. The final ownership structure of the CPO was determined, and the project was divided into three phases to ensure financial feasibility. The residents of Phase 1 had a say in, among other things, the main urban development plan, the layout of the basic homes, facade materials and the colour palette of the window frames. This part of the plan was delivered in 2016. The residents of Phase 2 were less involved, but they also had the opportunity to design their home floor plan in collaboration with INBO. Phase 2 was delivered in 2017 and, like phase 1, consisted of ground-level homes. Partly semi-detached and partly terraced houses that were somewhat more spacious than the standard Dutch terraced houses. The third Phase, also known as the main house, was an apartment complex that was sold by an external broker when the residents of the ground-level homes had already moved in. These residents also had a say in the layout of their home, but had less influence on the rest of the process. Also, some residents were not informed about the gardening concept by the real estate agent.

For the architect, living joy was one of the spearheads of the concept and, therefore, also the housing needs of the individual. That is why the input of residents and other interested parties was of great importance to INBO. They write the following about their role:

It is relativizing to note that in Geworteld Wonen 'Architecture' has become a means; the goal is much higher: that is living and living together. We have been building the 'community' from the start. ... In meetings in which the group formed - with new interested parties but also participants who eventually dropped out - we built the project. Together we developed basic floor plans and made choices regarding, for example, the use of materials in the facades. But also topics such as garden use, parking and the communal shed (designed to prevent separate storage areas at the homes) were taken into account in this process. (INBO, 2020, p.28 translated)

INBO sees their role as architects to foster a community, creating spaces together with the community, but also leaving space for the community to make the plan theirs. Since the delivery, the residents have been in full control. They came up with the program, the layout and the implementation plan of the garden. Occasionally, they employ professional help, but they carried out most of the work themselves on the biweekly green work day and via working groups. The garden currently has, among other things, a self-made amphitheatre, a football field, a playground for the children, a chicken coop, several greenhouses, a compost system, an orchard, a picking garden and a large piece of vegetable beds. In addition, they also have a communal shed with storage space for garden and DIY tools.

Residents' perspective

We visited Geworteld Wonen, or the Warmoestuín [Vegetable Garden], on Sunday, March 23rd at ten o'clock in the morning. We were expected by residents Ruud and Cock who had invited us to help out on the joint green work day. The main activity of the day was distributing humus, a mixture of cow dung and agricultural waste that they had bought from a nearby organic livestock farm and which the residents wanted to use to fertilise their vegetable beds. This was a big task that would take up the whole day, but there were also other tasks on the list for the day. For example, dead plants had to be dug up, fences had to be replaced, and a pole had to be repaired.

Ruud said that it could sometimes be difficult to gather people, but today he and three other residents, who together formed the garden work group, had also organised a sports activity for the children and a subsequent lunch. This way, they hoped that more people, for example, young parents, would help out that morning. It seemed to work; while Anna and I were getting our tea, more and more people started to arrive. Eventually, an estimated twenty people gathered at the communal shed. Everyone greeted us kindly and introduced themselves. One of the residents had baked cookies and offered them to us, and we were also invited to stay for lunch. We were told that two residents had made delicious soups for this lunch. The atmosphere was friendly, and there were many jokes among them. After a brief explanation by Ruud, everyone got to work. In the meantime, I was given a tour by Cock, occasionally supplemented with anecdotes from residents.

For example, Cindy told me about the chicken coop, which is close to her house. As

Cindy tells, most residents wanted to have chickens on the property, yet many people did not want to live next to the chicken coop. In the end, Suus and her family were fine with living next to the chickens, as she stated “put the chicken coop next to our house, then I would know that the location will not become the point of discussion that will lead to not having them at all”. Now, Suus’s household also has more say over the chicken coop. This is often the case; the people who live nearby a certain project or place have a little more say. That is why the chicken coop is also shaped in such a way that it does not obstruct the view from Suus’s living room window. Suus is also one of the residents who takes responsibility for the chickens. However, not only was Suus’s family taken into account, but also residents who were initially sceptical or strongly against these chickens. After some conversation, the problem for one resident seemed to be that he was afraid that the coop would attract rodents and diseases. Therefore, the group started thinking about how they could prevent these problems. First of all, the chickens are only allowed to eat in the raised, closed cage, not in the run. Additionally, the chickens are only allowed to be fed uncooked foods, which cannot stay in the cage overnight. It is important for the residents to listen to each other and understand where certain objections come from, says Cindy. This anecdote shows how residents have to make choices in consultation, this requires occasional compromises and attention to objections. Such objections and prejudices, in this case, have led to a better thought-out plan, than just the wish for chickens.

After the chickens, we walked through the orchard. The orchard consists of about ten trees by the water. Here they grow apples, pears and plums. There is also a jetty here and a few wooden loungers around a table. Some houses have backyards adjacent to this orchard and the water, and there are several SUP boards leaning against the houses. There is also a small boat at the jetty that the residents share. Cock says that a group of residents have taken a pruning course to be able to maintain the orchard. Then he points to the lounge chairs, which are used to “meditate with alcohol”, he jokes. It is a place where the residents sit together by the water to have a drink. From the jetty, you can sail towards the Westland and the children use it to swim. Sometimes they put a slide into the water for the children.

Cock lived with his wife Maria in an apartment in the main house. Previously, they had lived in Tanthof, but Maria thought it was boring and quiet. Cock also longed for more community spirit. They saw an advertisement for this housing project in the newspaper, and it appealed to them very much. It is clear that they are attached to their place of residence. Maria mentioned how much she likes being around young children and how she is collaborating with other residents on care tasks and making the homes suitable for lifelong living.

The community spirit that Maria and Cock longed for is evident. When I walk with Nathalie at the end of the afternoon, she has a bottle of olive oil in her hand to give back to one neighbour, and another neighbour pushes a magazine into her hands with an article that she thinks fits in very well with a project at Nathalie’s work. At various times during the day, it becomes clear how much the residents know about each other and how easily they share things with their neighbours. An example that the residents

themselves provide is how their app group blows up at the beginning of the evening with messages about borrowing ingredients for dinner. ‘Saves time cycling to the supermarket’, says one resident. It also shows that the threshold for sharing is low and that residents do not always have to buy everything themselves as a household. The communal shed, where we gathered in the morning, is also an example of this.

The residents of Geworteld Wonen consider themselves lucky. When Anna and I ask what the persuasive power of this housing project is, the five residents at the table agree that the amount of greenery is what they appreciate the most. However, one resident notes that others also want to start similar projects, but that this is difficult for others to get a similar project off the ground due to legislation and regulations. The real problem lies with the municipalities, she says.

that others also want to start similar projects, but that this is difficult to get off the ground due to legislation and regulations. The real problem lies with the municipalities, she says.



Figure 2.11 (Work by author 2025)

Community Lunch

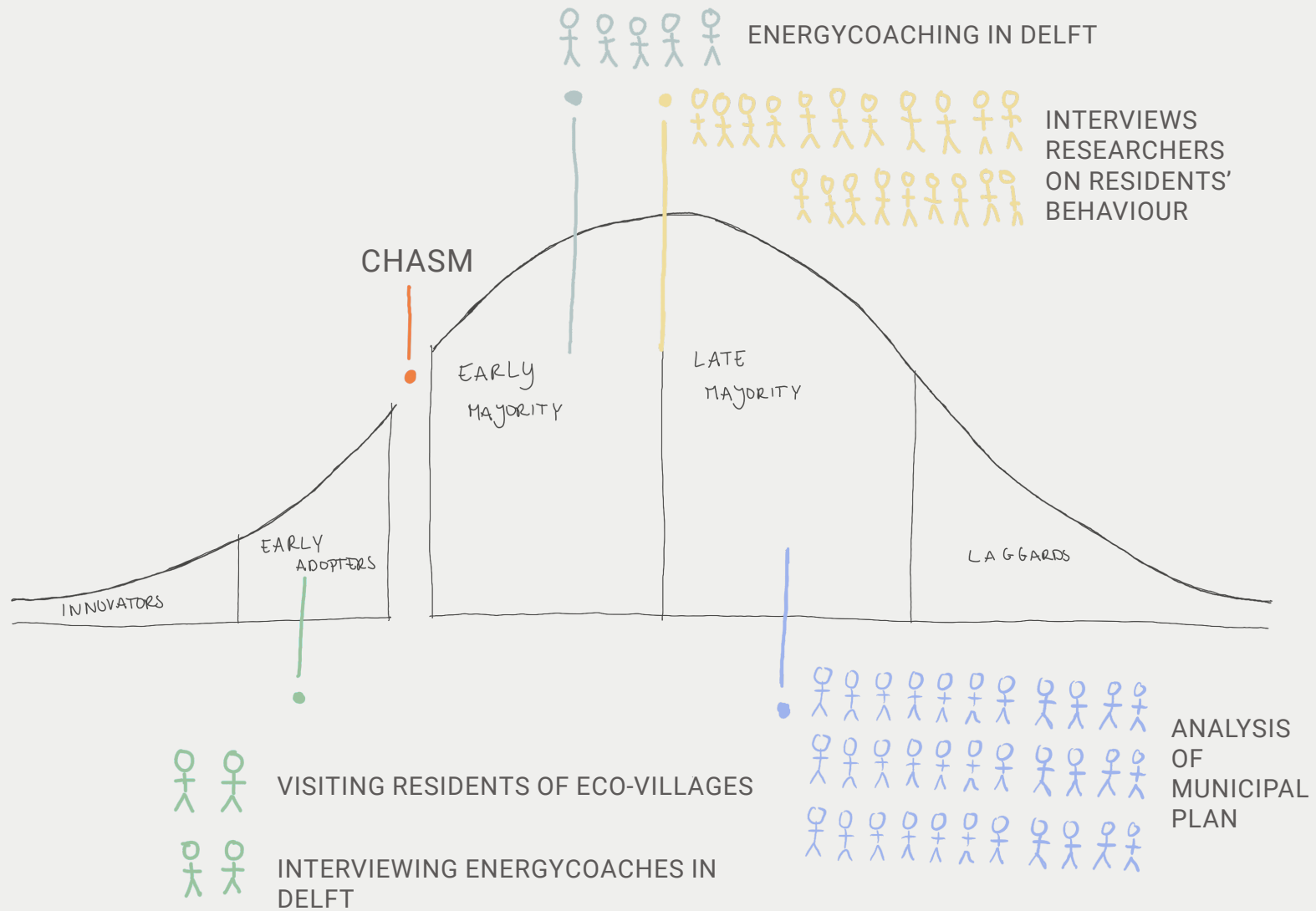
This image shows the end of the communal lunch. It is a colourful scene. The chairs and benches are all from the same series, but in a different bright colour. The tables are different, one is covered with a tablecloth and is a bit narrower, and the other is made of lacquered metal, just like the seating. Nathalie is driving a cart with dishes to her house, and in the background, someone is stacking chairs. Despite the early spring, a child is walking around barefoot with her bike. There are also some go-karts visible in the background that have been left unattended. There is a large sign with the text 'private terrain'. What is also striking is the different textures of the terrain; grass fenced off with tree trunks, clinkers with a half-brick pattern on the right side of the drawing, gravel on the left in the foreground and oddly shaped tiles behind that. The front gardens are also interesting; they are not fenced off, so the front facades are visible. The facades are only blocked by vegetation, which varies from house to house.

Urban Argiculture

This image shows part of the communal garden. In the foreground, freshly fertilised fields are visible with a scarecrow. In the middle of the image, the residents are busy shovelling manure that they received from a neighbouring cattle farmer. To the left of the manure heap are some toys, and children are playing on the swing. In the background, the farm houses can be seen. These buildings each cover four houses, and the house boundary is visible through the different colours of the window frames and the partitions between the gardens. One house has a SUP board and a shed in the front garden. The other house has solar panels. The residents are apparently free to choose the sustainable measures for their houses.

Figure 2.12 (Work by author 2025)





Part 3

An Inclusive Transition

3.1 Introduction

A circular and energy-neutral housing sector affects the entire society, and hopefully in a positive way. Our society is diverse, and not everyone has the same opportunities, knowledge and skills to live well and sustainably. It is important to be aware of these differences between people, especially when the aim is to go through a transition as a society. That is why this chapter focuses on various individuals and organisations, each with distinct perspectives and approaches.

The previous chapter focused on the pioneers of circular living; this chapter, however, looks more broadly at society as a whole. In particular, society in Delft. This chapter discusses both bottom-up and top-down efforts for the energy transition and sustainable renovations, examining the work of 015Duurzaam and the municipality of Delft. Additionally, experts were interviewed to gather insights into the perspectives of residents during sustainable renovations. Much of their work has not yet been published; therefore, Chapter 3.3 discusses their insights from the interviews. This is particularly relevant to this research, as the social aspect of circular living remains underexposed. The chapter, therefore, discusses the perspectives of government, residents, and academics. Understanding how ordinary people perceive more sustainable living, housing, and building provides insight into how designers can address their concerns and needs. That is an essential element for an inclusive transition.

3.2 Fieldwork at 015Duurzaam

An energy collective in the city

Energy coaches are becoming increasingly present in local political debates as a vital link between city residents and sustainable housing renovations. As a volunteer, an energy coach visits people at home for a conversation to discuss possible sustainable measures people can take at home. These measures range from small changes in behaviour and energy-efficient measures (e.g., radiator foil, draft strips, LED lighting) to advice on insulation and installations (e.g., ventilation units, PV panels, heat pumps). In Delft, 015Duurzaam, an energy cooperative, offers free energy coaching for residents in Delft and the surrounding area. 015Duurzaam's work is partly subsidised by the municipality, yet 015Duurzaam also builds upon the passion of its volunteers. Some of 015Duurzaam's energy coaches refer to themselves as a 'well-informed neighbour', as they are not experts, but citizens with training and an interest in sustainability who want to help their neighbours. Starting in October 2024, I have joined 015Duurzaam as an energy coach. This chapter presents insights from my own experiences as well as interviews with three of my colleagues at 015Duurzaam.

An Energy Collective in the City

015Duurzaam was founded by the initiators of Deelstroom Delft, a group of residents from Delft who have realised collective solar roofs, allowing residents of Delft to access renewable and local electricity. The initiators wanted to expand their network with energy coaching, as many of their members were eager to take on more. Through regional and national subsidies, they successfully launched energy coaching. In the first year, when 015Duurzaam still received substantial subsidies and resources, the organisation was able to contact 2,700 residents with small energy-saving projects and online campaigns. But municipal funds fluctuate, so over the years, the possibilities that 015Duurzaam has also changed.

However, the influx of energy coaches is substantial; the group mainly consists of retired homeowners who want to contribute to a better climate, such as my colleagues Peter and Joop, who, after retirement, wanted to get involved in Delft and were connected to 015Duurzaam through a volunteer bank. In addition to their regular tasks as energy coaches, both are now also rotating coordinators. Peter is someone who has made numerous

improvements to his own home over the years and enjoys sharing that knowledge with others. This is his hobby, and he also sees sustainability as a kind of game. This is also evident from the experiments at his own home, where, for example, he has reused the shaft of the old gas heater for balanced ventilation and is considering installing a home battery to optimise the use of his solar energy. Sustainability is also a hobby for Joop; for example, he uses his knowledge from his background as a terrain specialist for the redevelopment of a park next to his house.

The energy coaches are passionate individuals who enjoy sharing their knowledge and making it accessible to others. Joop sees the work of 015Duurzaam as a catalyst to empower people and also to stimulate the municipality. Peter describes the work of an energy coach as 'a well-informed neighbour', because we are not experts, but we do have basic knowledge or personal experience that we can share with others in the city. Many people know little about their house or their behaviour, or they have too much information from TV, commercial parties, friends, and neighbours. Energy coaches aim to disseminate accurate information on sustainable home renovations without financial gain or affiliation.

Additionally, 015Duurzaam brings people together. As Peter says:

"These types of organisations are good for the climate and the environment on the one hand, but they are also important on the social aspect, because we bring people into contact with each other. I think that is very important; it gives a perspective of being together and a vital community. You want people to stick together and see each other. I think that an organisation like 015duurzaam also helps with that, because we come behind the front door, which many organisations that also try to help in the social domain do not succeed in doing." (Peter)

He goes on to say that energy coaches always work from the given situation, listening to the residents without prejudice. But also working with the existing home to explore the possibilities for that specific home and the specific household. Joop also emphasises that the work is always tailor-made:

"I am idealistic about the goal we strive for, but I do try to help people as much as possible in a very pragmatic way. From what is really feasible for you? What really makes sense and what are fun things to do? The basic elements are the same for everyone, but how you mix them and how you apply them is different in every situation." (Joop)

It should be noted that the role of an energy coach requires patience and strong social skills. Despite the fact that my colleagues and I do this work because we want to commit ourselves to a sustainable future, there is an understanding of other perspectives of the residents. In my work at 015Duurzaam up until now, the cases varied widely; one resident was ill and was worried about their high energy bills. My colleague and I went looking for energy-guzzling household appliances together with this resident and an electricity meter, and installed measures against the draught in the house. Another household that was in

the middle of renovations told us enthusiastically about the plans for their new home. Peter and I provided some basic information about insulation and ventilation, as well as more specific details about the various window replacement options they were considering. In addition, I visited a household with a house from the 1920s, where there were significant moisture and draught problems. I helped them develop a plan of action and conducted a heat scan to identify the heat leaks. It also helped that I could ask my colleagues for more information about the moisture problems, because they had had similar issues themselves or had encountered them with other residents.

015Duurzaam is an informal and accessible network. There is an online dossier with several smart tools, and 015Duurzaam also has a few locations where coaches and residents can borrow measuring equipment. The coaches are trained via HOOM, a national cooperative of energy coaches. But apart from that, each coach has their own approach and niche. They are volunteers who work from their passion for sustainability and who have time to listen to individual situations. Peter, who used to be a civil servant, notes that the voluntary position offers significantly more freedom in working methods than a municipal position; there is more room to think creatively and listen to residents. What I have noticed is that this independence also creates trust. Energy coaches do not work for a commercial party (e.g., an energy company, installer) or a government agency (e.g., a municipality, housing association) that some residents may be suspicious of. It helps to be able to assure that our work is without obligation and independent. However, there is also a downside to the voluntary basis of 015Duurzaam.

Claudia, one of the initiators of 015Duurzaam, regrets that the energy coaches do not reflect society, as volunteer work mainly attracts pensioners who have the financial space and time to do something extra. A younger initiative of 015Duurzaam is the Energy Helpers, employees who install small energy-saving measures, often in low-income households or specific flats. Through a collaboration with the municipality, it was possible to pay the energy helpers. That team is therefore also somewhat more diverse. Claudia indicates that it is important to be able to pay people for their services, but above all, that it is essential that the initiative comes from or in consultation with residents themselves:

“You have to see where in the neighbourhood there is interest. If you have someone in the neighbourhood with interest in sustainable initiatives, then you can build on that. You have to have someone who is going to lead an initiative and that cannot be a municipal official. It is very complicated - I sometimes find it complicated too when I am in another neighbourhood and think ‘you could do it best this way’. But it is better if someone from the neighbourhood says, ‘these are the options, do you want to talk to me about them?’ It is the residents who live there and have to live with the consequences. I think it makes a huge difference if you feel involved. ... You also simply notice that people feel more satisfied if they were involved in the plans in advance.” (Claudia)

Unlike the municipality, Duurzaam015 stands next to the people. It is a different

scale, Peter notes. Claudia also notices that they have a better idea of the neighbourhood and street level than the municipality. Claudia, Joop, and Peter are also well-informed about their own street. Peter compares the energy efficiency of his home with that of his neighbours. Joop has inspired others in his street to install solar panels. Claudia also knows who on her block wants to get off gas, who does not and what their considerations and objections are. It is therefore frustrating that the municipality writes plans without having been on location, which are too general and thus not feasible, Claudia believes. The result is that the early adopters make their own plans, and the rest of the city lags or becomes suspicious of what the municipality has planned for them.

Conversations with residents show a level of distrust towards the government and housing associations. Several residents opposed the purchase of a heat pump because there were still many bugs, and they had heard stories about malfunctions and poor installation. As an energy coach, I have spoken to several people who expressed their concerns about the political discourse that creates uncertainty about financial funding for residents. For example, due to new laws on solar energy, residents have become somewhat skeptical about purchasing solar panels. A resident and her neighbour informed me and a colleague about the wrongdoings of their housing association, and both had stopped using their heating due to excessive costs. They mainly blamed the housing association for this. Another resident in Delft wrote an open letter to the local newspaper, in which he wrote:

“The question is whether the approximately 100,000 euro investment outweighs the benefits of being able to continue living in your own home in the near future, a home from around 1965, behind new window frames with triple glazing, insulating false walls of 26 cm thick, under a roof with 35 cm insulation, underfloor heating above a 16 cm thick insulation layer, a heat pump and finally being able to live in the clean air of a heat recovery ventilation system etc. ... And all that as a dream of the oat milk students of Delft politics, who do not care about someone’s security of existence. For them, there is only one obsessive reason and that is that the earth is warming up by approximately 0.000036 degrees less and that costs a lot of money, whether you have it or not.” (Delft op Zondag, March 21, 2025, p. 11)

It is clear that some residents in Delft have concerns, which are partly caused by misinformation, but also by feelings of powerlessness and uncertainty. Claudia and Joop believe that the municipality should take much more control, with Claudia emphasising that this should be done in consultation with residents. She indicates that there are neighbourhoods, such as where she, Joop and Peter live, where initiative could come from the residents themselves. A municipality should stimulate this. Then, the municipality’s attention can be focused on more vulnerable neighbourhoods, where involvement is lower due to high moving rates and inequality of opportunity. Now, 015Duurzaam often knows better what is going on at neighbourhood, street and home level, as the organisation stands among the people with a view behind the front door. This informality is a positive added value of a voluntary party. The energy coaches can guide people and combat misinformation. It is a significant barrier that many residents do not know how to make their homes more sustainable or what to prioritise. Peter and Joop indicate that by providing tools and

knowledge, a resident can learn for themselves which buttons they can push. However, 015Duurzaam only reaches residents who were already taking action to make their homes more sustainable for whatever reason. Moreover, Joop, Peter and Claudia emphasise that the lack of funds for 015Duurzaam and the lack of direction from the municipality and other government parties are significant challenges in this transition. In addition, Joop and Claudia mention that 015Duurzaam takes over tasks where the municipality falls short. Yet 015Duurzaam does not have the funding or the organisational capacity to take charge in the circular and energy transition.

015Duurzaam informs and connects people. It is a hopeful collective that thinks about a more sustainable city. The conversations with residents provide new insights. Based on my own experience, as well as that of Joop and Peter, it appears that most residents gain a better understanding of their situation after consulting with us. For example, a resident who had previously struggled to understand their consumption gained insight because we connected the equipment to an electricity meter. Another resident gained better insight into cold bridges in the thermal shell. On the other hand, I have learned from these conversations to start from the existing situation and better understand what residents' concerns are when making their homes more sustainable. It is more than just the upfront costs; there are financial risks, setting priorities, not knowing what the regulations are, or not knowing who to call in. An energy coach can then engage in a conversation with an individual and brainstorm a plan of action. However, in fact, professional parties, such as municipalities, as well as architects, urban planners, and researchers, should also come together to develop plans in consultation with residents, with an even greater emphasis on circularity than what individuals or volunteers can achieve.

3.3 Gemeente Delft

The progress of Delft's municipality's approach for the energy transition

The last chapter discussed the volunteer network of 015Duurzaam, which works towards a more sustainable Delft from the bottom up. Yet, the municipality of Delft is also working towards an action plan for 2026 to 2031 to make its housing stock more sustainable, consistent with the national and EU-wide aims for a circular housing sector by 2025, and the national obligation that municipalities have to present an updated action plan on renewable energy sources every five years. Since this project investigates a community-based approach for a circular Tanthof, examining the municipality of Delft's plans for an energy-neutral housing sector can be valuable. This chapter discusses the municipality's implementation of national and EU-wide goals for circularity, based on document analysis as well as insights from a presentation by its policymakers on April 8, 2025. During this presentation, the municipality outlined the progress of the 2026 action plan to members of 015Duurzaam and other interested citizens. This chapter not only provides insight into the municipality's technical plans, but also into its relationship with its citizens and the challenges that still exist in getting everyone on board and involved.

Former Plans

In 2021, the municipality presented its last energy-neutral action plan, called Warmteplan 2021 [Heat Plan 2021]. The municipality used analyses of PBL¹ as a basis for the plan, supplemented with input from professional stakeholders (including housing corporations, TU Delft and 015Duurzaam) and local stakeholders (i.e., local businesses and residents). This plan indicated the preferred energy source technique per city district (see Figure 3.1). These techniques included all-electric systems (i.e., heat pumps with solar panels), a collective heat network, or renewable gas.

The municipality itself added several disclaimers to this plan. Namely, that at this scale level, there may still be differences within a district considering dwelling types and ownership situation. In addition, they also wrote that renewable gas is still too uncertain in availability and affordability and therefore not applicable in the short term. And more pressing, the participation of residents and local businesses was lower and less diverse

¹ Planbureau voor de Leefomgeving: a national governmental institute that makes strategic policy analyses regarding nature, the environment and spatial planning

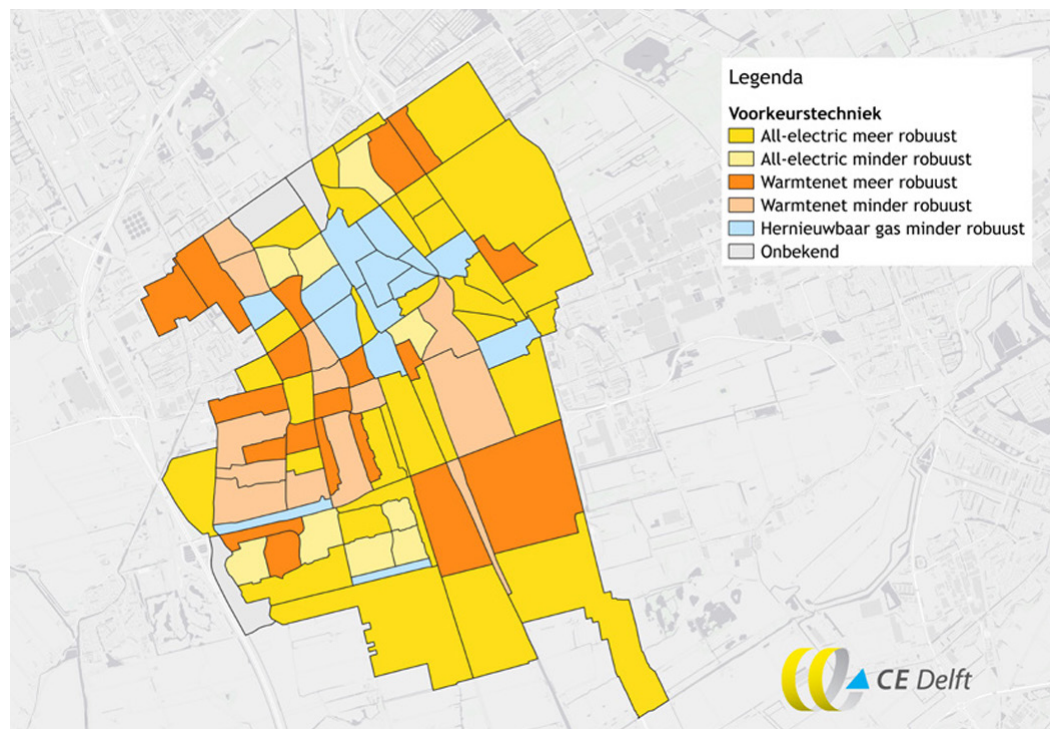


Figure 3.1 Heat Plan, Municipality of Delft (Gemeente Delft, 2021)

than they aimed for. The municipality had reached approximately 1,800 residents through soundboard groups and surveys; however, this number is not representative of the total of 103,595 residents. The residents they had reached were mostly homeowners and 60 and over, which is also not representative of Delft's demographic. Besides, these residents were critical of the plan, as written in the Warmteplan 2021:

“Several members of the sounding board group believe that the final reports of phases 1 and 2 do not provide sufficient accountability for the method used, explanation of the input data used and its sensitivity to the outcomes.”

Claudia from 015Duurzaam also criticised the municipality's lack of knowledge and sense of scale, stating that “if you think about a district, there are flats, houses from the 1800s, the 90s, 60s and 30s, and they made a cross section of all of it. With that cross-section, you can of course do nothing anymore.”

The Energy Transition Plan for 2026-2031

Drawing lessons from their previous action plan, as well as plans from neighbouring municipalities, the municipality of Delft has revised its approach for the updated plan, set to be presented in 2026.

Firstly, they have become more concrete on the first phase of their plan, which is set to

be executed in 2026 in the districts TU campus, Voorhof and Buitenhof. The municipality has chosen to prioritise these areas because most of it is owned by housing corporations, and the density is relatively high. These factors make it easier to execute a heat network. Additionally, they can collaborate with TU Delft, which has developed a heat source station for extracting geothermal energy. Since this station is placed at the TU campus, it is most logical to include the campus and neighbouring districts as a starting point.

There are some promising aspects to this first phase. Not only does the homogeneity in ownership situation and dwelling type increase the feasibility, but also their new approach for citizen engagement. The municipality has commissioned policy research agency Populytics to design an online tool for participatory value evaluation, with which “participants sit in the policymaker's chair for 20 minutes” (Gemeente Delft, 2025; Populytics, n.d.). With this, they were able to give the residents of Voorhof and Buitenhof a better idea of what the residents think the municipality should do in the development of the heat network. The response rate was 15%, with 577 participants out of a total of 4,000 residents of Voorhof and Buitenhof. In addition, the municipality has launched a Construction App, and in collaboration with 015Duurzaam, they are in the neighbourhood at a construction shed, called the Buurkeet, to inform residents and activate them for the heat network. In terms of participation, the municipality has taken many steps compared to the 2021 heat plan. However, the business case is not yet complete. The municipality aims for a so-called “offer-you-can't-refuse”, they said at the meeting on April 8th. However, decisions still need to be made about the relationship between private and public control. For this, however, they also look at their residents. Another online survey, developed by Populytics, was used to map city-wide opinions on affordability and financing.

During their presentation on April 8th of 2025, the policymakers emphasised that they want to work together with homeowners, based on their intrinsic motivation and not through seductive tactics. The online surveys exemplify their open-ended approach, as well as their proposed think tank, a group of 25 residents representative of gender, education, age, dwelling type, and neighbourhood. The policymakers acknowledge that 25 people are not representative of the city, but they argue that conducting this research on a larger scale is not financially feasible. This transparency was also evident during the presentation, as seen in their remarks about the previous heat plan. For example, they indicated that renewable gas is too unrealistic, and the PBL's assumptions about all-electric vehicles are too optimistic.

It remains to be seen how this approach will work out. It should also be noted that no decision has yet been made about many districts, including Tanthof. Leading to disappointment of those present in the room, who were expecting more clarity and leadership from the municipality (see also the previous chapter).

In sum, the municipality of Delft is making a noticeable shift in its approach towards sustainable heating and circular housing, learning from the critiques of its 2021 Heat Plan. The new emphasis on transparency, resident involvement, and collaboration with knowledge institutions, such as TU Delft, represents a more grounded and adaptive strategy. Yet, many

uncertainties remain — from unresolved questions around financing and governance to the lack of clarity for neighbourhoods like Tanthof. While the municipality's participatory efforts appear more serious and structured than before, it remains to be seen whether this approach will result in concrete outcomes and broad community support.

As the municipality continues to develop its strategy for 2026 and beyond, the question is not only how technically feasible or economically viable its plans are, but also how inclusive, adaptable, and future-proof they can be. This is particularly relevant when considering community-driven initiatives such as O15Duurzaam, and the broader themes of technology adoption and empowerment explored throughout this research. The next chapter will reflect further on top-down and bottom-up approaches through insights from researchers who are currently studying behavioural patterns and techniques during the energy transition. Thereby creating a complete picture of the energy transition from a citizens', government and academic perspective.

3.4 Expert Interviews

Researchers' Perspectives on the Social Side of Circular Housing

A significant part of the transition towards circular housing is the energy transition. The last two paragraphs focused on top-down and bottom-up strategies in Delft to help people insulate their homes and adopt renewable energy sources. However, the energy coaches only reach those residents who are already affected and living more sustainably. Additionally, while the municipality of Delft is making progress, it still has some unresolved issues regarding resident participation and finding fitting solutions on a neighbourhood and building scale. Therefore, this chapter examines insights from researchers investigating the broader context of sustainable housing renovations and resident behaviour during the energy transition. This paragraph is a summary of semi-structured interviews with four PhD candidates from the Management in the Built Environment department of the TU Delft conducted in December 2024. Ladislav Krutisch is researching homeowners' perspectives on sustainable housing renovations as part of the Align4Energy project. Stefanie Horian is also part of Align4Energy, and she is researching residents of social housing during large-scale renovations. Ragy Elgendy is studying homeowner associations (HOAs or in Dutch: VvE's) and how to upscale energy renovations for HOAs by identifying viable business models of integrated home renovation service providers. He is part of EU-LIFE, a pan-European project researching HOAs. And lastly, Diletta Ricci is researching how to engage residents in vulnerable neighbourhoods. She is part of JustPrepare, a research project examining the social and societal aspects of the energy transition. This paragraph will discuss their insights into the greatest challenges in the energy transition, as well as social approaches and architectural interventions that can facilitate the transition, based on their findings.

Greatest Challenges in the Energy Transition

All interviewees highlighted that a major challenge in this transition is the need for widespread adoption of innovative solutions across the entire building sector. According to Ricci, the circular transition requires structural changes at the organisational level, improving the collaboration within the design team, but also with the residents. Horian points out the same thing, but also remarks that in a tenant/owner situation, there is a split incentive dilemma that complicates the renovation process. What Horian means

is that the homeowner, for example, a housing association, has to make the large-scale investments, while the benefits, such as higher living comfort and lower energy costs, lie with the tenants. Conversely, it is also challenging for the housing association to engage the tenants, since they will only notice the benefits of the renovations much later. Horian states that the challenges in this transition are integral, as it is a social, technical and policy issue. Coordination with different stakeholders is key. Krutisch adds to this line of thought, emphasising that educational institutes (e.g., trade schools, architecture schools) must also update their curriculum for a circular future.

Part of Elgendy's work aims to identify and categorise barriers within four domains. He explains that in his research and earlier studies, four barrier types have been identified: financial, legal, technical and social barriers. The financial barriers for homeowners are, for example, the high upfront costs, while the benefits come later on. Regarding legal barriers, Elgendy suggests that "there are a lot of bureaucratic regulations that bring about so much disturbance for homeowners that they will just quit." As an example of a technical barrier, Elgendy mentions the shortage of trained professionals. This is in line with Krutisch's remark on education. Lastly, Elgendy mentions social barriers. According to EU-LIFE's research, these are issues such as a lack of awareness, but also biases and stigmatisations that are deeply entrenched and resistant to change.

Social Approaches

Building on this, the second interview topic involved social approaches during the energy transition. Ricci, who studies vulnerable neighbourhoods, remarks that residents should be empowered, yet even before empowering them, their needs and characteristics must be investigated. She emphasises the importance of understanding differences between communities as well as individuals. As an example, Ricci points out that some residents in vulnerable contexts might have a higher energy usage, due to an illness and certain medical devices. Such specific situations also need to be considered in the decision-making process.

In addition, Ricci suggests that learning to understand a community's interests better is also beneficial for improving engagement and participation. She points out that in some neighbourhoods, it has proven to be helpful to combine an informational session with another community event that the residents are already interested in. As she explains:

"It's important to understand what the interests of the residents are, and what their abilities and preferences might be. For example, there are some communities that really enjoy cooking. In the Dutch context, some organize dinner nights — it's something they love doing, and it becomes a social moment for them. These events can also be used as opportunities to talk about renovations or energy use — to share information, not just through letters or home visits, but by integrating these discussions into activities that people already enjoy and feel comfortable with. In that way, it also feels like you're giving something back to them — like a gift, a shared moment." (Diletta Ricci)

Horian also emphasises that it is a challenge to explain renovations or new technology to different people. She mentions that it is important to be aware of personal differences.

Thus, she is researching different personas and their behavioural patterns in renovation processes. In addition, Horian mentions it is important to educate tenants about the renovation beforehand, but also carefully decide when and how much they are involved. Early engagement can lead to more awareness and even collaboration, yet it is also important that the housing association does not get overburdened.

The interviewees also discuss psychological phenomena that have proven to be useful in the energy transition. Elgendy mentions Rogers' theory on Diffusion of Innovation (see also Chapter 1.2), as well as, for example, the theory of Planned Behaviour: a theory that is often used to understand and predict human behaviour, particularly in contexts where a person is making deliberate, reasoned decisions (Ajzen, 1985). This theory identifies certain factors, such as social pressure, attitude and perceived control. Elgendy and his colleagues use this theory to understand what influences people to renovate. So far, Elgendy and his colleagues have found that most homeowners have a positive attitude towards sustainable housing renovations, as it increases the value of their homes. Along a similar vein, Krutisch talks about combining concepts such as feedback loops and spillover effects (see also Chapter 1.2 and Krutisch et al., 2023):

"As a municipality, for example, if you have data showing that small, low-effort interventions raise awareness — you might give people a voucher to change their lightbulbs. That's a small action, but it can raise general awareness of energy use, and maybe later make people more likely to think about larger renovations. But of course, with both spillovers and feedback loops, you need to be careful. You can have negative spillovers and feedback loops, too, which do the opposite of what you want." (Ladislav Krutisch)

Both Krutisch and Horian also affirm the nudging effect of smart meters, as it gives residents direct insight into their consumption. In addition, Krutisch mentions that the positive framing of smart meter apps provides encouragement and causes possible spillover effects. He also points to the principle of nudge-plus, in addition to a positive framing, also a reflective layer:

"With a smart meter, you might get a notification saying you saved a certain amount of energy. That's a basic nudge. But if it also explains why this is good for you — like, you're saving money and helping the environment — that's the nudge-plus, because it helps you reflect on your behaviour." (Ladislav Krutisch)

Architectural Interventions

In addition to social approaches and incentives, the stimulating role that architecture can have has also been discussed in the interviews. As mentioned earlier, spillover effects can lead a person or a group into sustainable renovations or steer them away. Elgendy builds on this principle, suggesting pilot projects to raise awareness:

“[The renovation rate] is still very low. So if you walk through the streets in Delft, for example, you might only see one or two buildings that have been renovated to a higher energy label — and those are usually older buildings. This low rate makes it risky for people to invest in such innovations as a solution.

What we suggest is to have pilot projects in neighbourhoods. For instance, if I have a neighbourhood — let’s say four blocks — I would recommend that the municipality or the government invest in one project there. Then, people can actually see it, and they can draw influence or inspiration from that example.” (Ragy Elgendy)

Both Krutisch and Elgendy remark that the visualisation tools that architects have are very useful for the energy transitions, as they give residents the option to experience the renovation beforehand. Also offering different packages of alternative solutions is an effective strategy to increase acceptance from residents, as Ricci remarks. According to the research of her and her colleagues, this strategy helps to uncover patterns of interest of the residents of a particular building. Such feedback promotes the inclusivity of the design. Horian also mentions more direct communication between architects and residents, not only as a designer but also regarding engagement and education by explaining the process and answering open questions. A role that is preferably also supplemented with the help of a local energy ambassador, a well-informed resident who promotes energy saving within the building, advises fellow residents and acts as an intermediary between the housing association and the tenants.

In addition, Krutisch and Horian both emphasise the need for architecture and building technology that is easy to understand and use for residents. Systems that are easy to use with direct effects or feedback. Krutisch also mentions the benefits of low-tech architecture:

“Take, for example, clay or rammed earth constructions — they often allow for simpler, more low-tech solutions to comfort and energy issues. You don’t necessarily need complex ventilation systems if the architectural design already responds well to the environment.” (Ladislav Krutisch)

Yet Krutisch also mentions that with renovation, this is more complex. As the building has originally been planned with a specific idea in mind, a resident might have chosen their home because of certain aesthetics or charm.

On the other hand, Ricci suggests that architects, with their knowledge of architecture theory and design, might enhance the original design and quality of life. She and her colleagues are researching the benefits of renovations with a design team that applies a holistic approach rather than quick fixes. She notes, however, that renovations with more architectural effort currently can lead to higher rent for tenants, which is undesirable. Instead, she argues for funding for promoting innovation and combining as many interventions as possible for an integral renovation.

To conclude, the interviews with these four researchers have highlighted the need for structural changes across the building sector for a circular and energy-neutral upgrade of the existing building stock as well as new build projects. Krutisch emphasises that these changes start with educational institutions, which must make bigger steps in integrating circular principles in the design. Horian and Elgendy also note that the supply chain and installers should be better equipped to execute sustainable and circular renovations. Yet, the building sector spans beyond the building professionals. Better coordination and collaboration with residents is also key for the energy transition, according to Ricci and Horian. Both argue that a greater investigation into different residents and neighbourhoods is needed, in practice as well as in academia. By doing so, participation and empowerment can be increased, and the transition process becomes smoother when approaches for different resident types – or personas – have been developed.

As Horian’s current research focuses on identifying personas, Elgendy and his colleagues identified the barriers themselves, categorising them into financial, legal, technical and social barriers. Elgendy is combining this knowledge with theory from behavioural sciences, such as Ajzen’s planned behaviour and Rogers’ adopter types. He remarks that even though most homeowners have a positive attitude towards sustainable renovations, the transition is still in the early stages. Elgendy also mentions that pilot projects could be a strategy to influence people locally. This can be seen as a spillover effect, another concept that Krutisch is researching. He mentions combining concepts such as nudging, spillover effects and feedback loops as incentives for residents. Yet, Krutisch also warns of the adverse effects of these strategies. A successful tool that uses nudging and feedback loops is the smart meter. Both Horian and Krutisch mention that smart meters make energy usage tangible for people as they can see the direct link between their behaviour and their footprint.

Another strategy in which the architect plays a major role is proposing different alternatives. Ricci suggests offering different renovation packages to residents of a building. This allows designers and planners to engage with residents in a targeted manner and gives residents options. This strategy ties in with Horian’s comment about carefully deciding how much and when to involve residents, because such packages provide a clear framework for the relationship between the design team and the residents.

Lastly, the remark of Krutisch and Elgendy on architects’ ability to visualise future plans could also play a bigger role in promoting a Circular Economy, making a Circular Built Environment more tangible for people.

Through these expert interviews, this chapter presents key systemic insights from within academia and professional practice. The following discussion chapter now turns to a broader reflection, comparing the findings across fieldwork, interviews, and literature, and asking what they reveal about fostering inclusive, circular, and energy-neutral urban environments.

Discussion

I aimed to explore the facilitating role that architects can play in creating an energy-neutral and circular living environment for all dwellers in the Dutch context, with a particular focus on the Dutch Delta Region, specifically Midden-Delfland. Through my study of literature (Part 1) and a combination of interviews, fieldwork, document analysis, and painting (Parts 2 and 3), I provide an overview of the current status of the circular housing transition. I also offer possible improvements and recommendations to facilitate this transition.

Different Approaches for Adopting Circular Living

This report discusses several community efforts in creating a circular living environment. My examination of the broader urban context of the circular transition has been informed through fieldwork with 015Duurzaam, as well as small-scale circular housing projects, such as Geworteld Wonen, Boschgaard, and Aardehuis Olst. These four fieldwork studies allow me to compare experiences, challenges, and opportunities for an inclusive transition.

These analyses support Ostrom's and Gibson-Graham's plea for creating space for community and collective action within our economic system. The case studies demonstrate how much people can achieve if they organise themselves for a collective cause. The idealistic initiators of Boschgaard and the Aardehuizen have shown that it is possible for citizens to break through many legal and bureaucratic frameworks to create a more communal and sustainable living environment. Nevertheless, it should be noted that this came with great sacrifice from its residents. For example, the Aardehuizen had to move to another municipality to find an alderman who was willing to support them. At Boschgaard, the original squatters had to put in great efforts to make their informal housing arrangement permanent. Although the projects are successful and their current residents are content, other potential residents have left due to these hurdles. In addition, although the struggles faced by both communities were unique, it is common for ecovillages, housing cooperatives, and Community Property Owners (CPOs) in the Dutch context to encounter legal, financial, and social hurdles. These are sacrifices residents have to make to live in a circular built environment.

Geworteld Wonen is an exception in this respect, as the project was not motivated

by its residents, but rather by a professional proposal from the architectural firm INBO and Beyond Now, who later recruited and involved residents through inspiration and design sessions. The concept, development, and construction of the plan originated from professional parties; however, residents have a say in the housing interiors, program, and design of the garden. This can be considered a big contrast to the planning of Boschgaard, for example, where the design was planned by Superuse beforehand, yet the residents devised the development and concept. Similarly, de Aardehuizen was spearheaded by residents from idea to delivery and beyond, with professional parties facilitating the technical aspects. Later on, they reorganised their internal organisation to work more efficiently, dividing the community into 'expert' resident groups with executive decision-making power within their domain.

As mentioned in Chapter 1.2, resilience stems from the combined efforts of the government, market, and community. These three cases show different relations between these three entities. The case studies demonstrate how these three residential communities collaborated internally and with professional parties (i.e., contractors, architects, and developers) to realise the project. The project influenced several factors, but the most noteworthy are internal harmony and the safeguarding of core values. Geworteld Wonen is primarily planned externally, and therefore, there are some aspects, such as the concrete main support structure and the sale by the realtor, that cause dissatisfaction. On the other hand, the residents are more flexible and friendly towards each other, as they recognise that there are many things over which they have no influence or do not wish to have any influence. The residents of Geworteld Wonen that we spoke to were very satisfied with the opportunity they had to determine the layout of the house as a household and the creative freedom they had to set up projects in the garden. The Aardehuizen we spoke to were very attached to their environment, which they had set up entirely on their own. Nevertheless, some former residents had left because of irreconcilable differences with the rest of the community. On the day we visited Boschgaard, there was notable dissatisfaction about differences of opinion and commitment. Perhaps because this community had only been living together for a year, compared to Geworteld Wonen and the Aardehuizen, which both will have inhabited for ten years by 2025. However, Boschgaard is by far the most idealistic and also has a much more communal division of space. It therefore requires more dedication than Geworteld Wonen and the Aardehuizen, where the private rooms are much more spacious.

Surprisingly, the sense of community among the residents of Geworteld Wonen seemed to be much higher, as indicated by conversations and observations, than at Boschgaard, where the residents shared more. The opportunity to design their garden and home was enough satisfaction for the residents of Geworteld Wonen. Additionally, the residents noted that they appreciated the housing project did not consume much of their time and did not disrupt their professional lives or other interests. Kuenzli and Lengkeek remark that in our current society, many people are entangled in a network of different commons. This makes the commons more efficient, yet also more diverse and intangible. On the other hand,

it can be argued that these commons are therefore better suited to local circumstances. The case of Geworteld Wonen demonstrates that having a literal common ground for its residents, while allowing sufficient space for other private and professional endeavours, has created a satisfactory living environment for its residents. This is supported by the works of Gibson-Graham et al. (2013), Ostrom (1990) and Kuenzli and Lengkeek (2022)

The analysis of the Earth Houses reveals how the community has become more resilient over time through trial and error. Due to time constraints, the Aardehuizen decided to speed up the process by outsourcing specific tasks to internal subgroups. Despite the dropouts from Boschgaard and Aardehuizen, as well as other personal sacrifices, their accomplishment in realising their circular and communal vision is an argument for greater community self-governance, as Ostrom also advocated.

However, it can also be argued that professional parties, such as architects and/or developers, should play a perhaps greater role in helping circular communities get started. The opportunity for the residents to appropriate and adapt is crucial, but so are independent parties who draw up well-researched frameworks and plans for this. Idealism should not come at the expense of residents' living comfort, but it is currently lacking in the housing sector. As a result, groups such as Boschgaard and Aardehuizen are taking matters into their own hands, which can take a toll on the community.

The efforts of 015Duurzaam also demonstrate that some citizens have a passion and drive to work towards a circular future. The work of 015Duurzaam's energy coaches is unpaid, which raises the same concern as the initiatives of Aardehuizen and Boschgaard. Within our current political and economic system, it seems that the transition towards a circular build environment is built upon volunteering and sacrifices from those who are most concerned about our climate. As researchers Graziano and Trogal state, "[the] reliance on free labour problematises the vision of a smooth transition towards circular economies and post-work futures" (2019, p. 103). They argue that unpaid labour devalues the skills of the volunteers. Although the circular communities, as well as 015Duurzaam, demonstrate that valuation can take forms other than money, it can be argued that relying on early adopters who sacrifice their time and money for a collective and circular future is unsustainable. In addition, the diversity of these communities is low, which hinders social support and spillover effects.

Spatial factors and Architectural Interventions

Through fieldwork and interviews, this study identified six spatial or architectural strategies that foster circular living.

1 – Respond to local context

In Part 1 of this research, I advocate for a social and local approach to circular living, based on arguments presented by scholars such as Krutisch (2023), Ceinos et al. (2024), and Woods & Berker (2022). As Krutisch argues, the home, being an intimate and

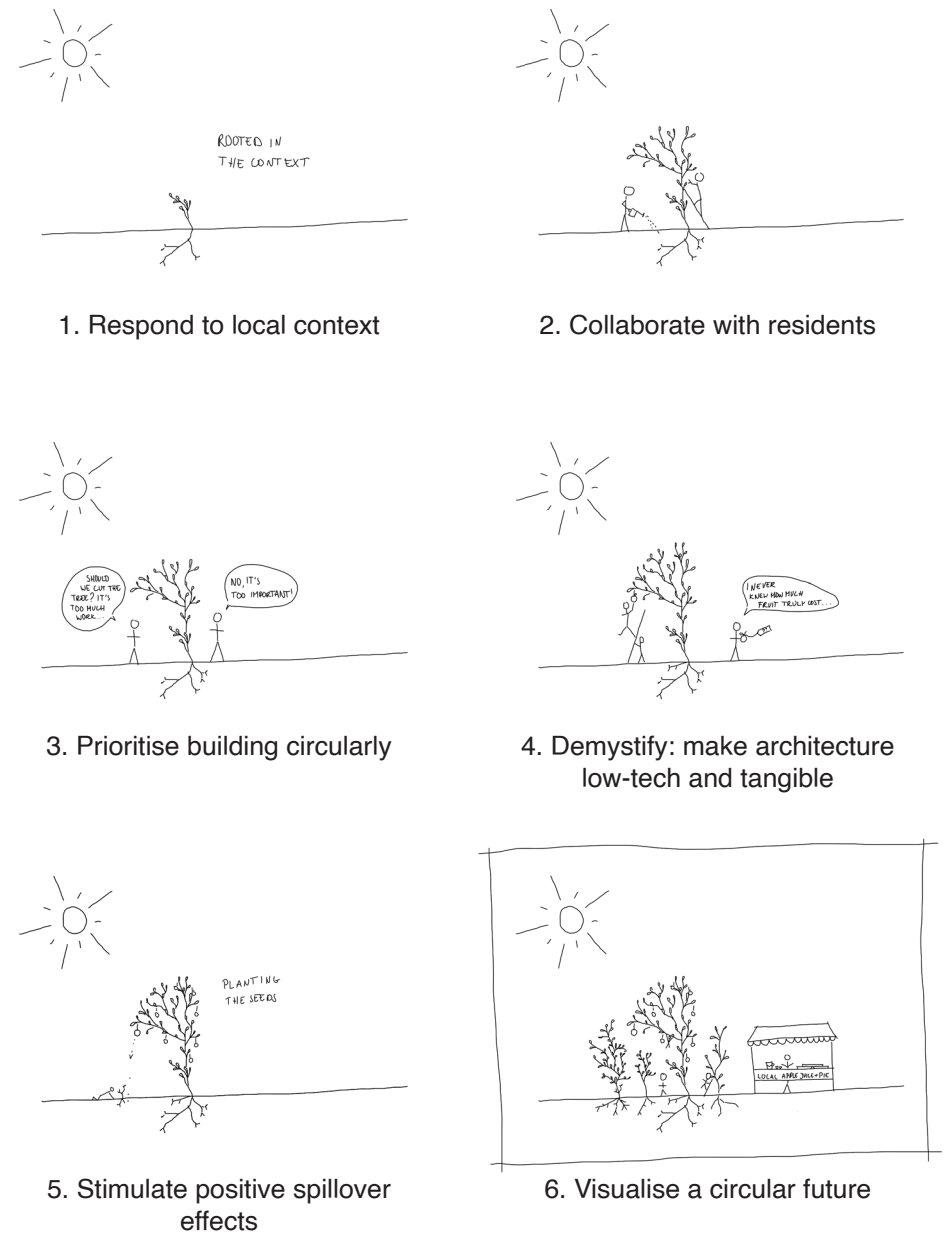


Figure D.1 Six design principles: Circular Living as a Growing Tree
(Work by author 2025)

private space, necessitates input and motivation from the residents themselves. Ceinos et al. and Woods & Berker assert that local knowledge is just as valuable as technical knowledge and that designers should build upon that knowledge, rather than seek one-size-fits-all circular solutions. Rogers' theory of Diffusion of Innovation also posits that technology adoption requires appropriation by local communities.

Ricci's research responds to this insight, as she and her colleagues have found that this understanding of the community can lead to more effective participation methods. In addition, understanding the residents can explain the link between their behaviour and their consumption patterns. This is valuable information, since the prime principle of the Circular Economy is to reduce. The case of Boschgaard shows the importance of responding to social infrastructure as well. The activities they organised for and with their neighbours led to support for the development of the building plan for Boschgaard as a residential complex. So for Boschgaard, their strong connection with the neighbourhood was essential to remain viable.

The municipality of Delft is also taking steps to utilise local knowledge better and to gain a deeper understanding of its residents, for example, through online participation tools and local events. Studies such as what Ricci and Horian are looking into could help improve municipal strategies by creating participation events that are more tailored towards a specific community. The efforts of 015Duurzaam also create insights into the local community, as the energy coaching sessions provide an opportunity for one-on-one talks with residents about their questions and concerns regarding sustainable home renovations. The collective of energy coaches possesses a vast collection of personal stories and experiences of residents in Delft. This knowledge could help the municipality make better informed decisions.

2 – Collaborate with residents

In addition to understanding the local context and its residents, collaboration is key for appropriation as well. Geworteld Wonen is a successful example of this collaboration. The design team has left the residents with a satisfying amount of space to appropriate within a well-defined frame.

The municipality of Delft is also looking into the balance between top-down steering and leaving space for citizens' initiatives. Examples from Claudia and Joop from 015Duurzaam show that there are neighbourhoods where people can organise themselves, as research from Ostrom (1990) and Gibson-Graham et al. (2013) also argues. Claudia, therefore, contends that the municipality should welcome such initiatives so that it can focus on more vulnerable neighbourhoods.

Regarding vulnerable neighbourhoods, Ricci argues that offering design options as packages of sustainable interventions gives residents a well-defined frame to choose from, and it provides the design team with feedback on local desires. Horian also states that designers and housing associations should make clear choices on how and how much to involve residents beforehand and ensure that they are educated about the

plans.

The circular transition requires designers to respond to local knowledge by creating spaces that people can appropriate. Therefore, collaboration is key.

3 – Prioritise building circularly

Furthermore, during the interviews, the researchers argue that structural changes are needed in the entire construction sector and supply chain. Krutisch mentions that in education, there is too little attention paid to circularity. Elgendy's research, as well as the observations from the fieldwork at 015Duurzaam, confirm a lack of trained professionals. This workforce issue is not merely technical; it is also societal, since circular trades and practices could be promoted more. Krutisch also emphasises that new build, opposed to adaptation and renovation, is still not fully circular, even though we have the knowledge to design and build circularly. Adapting buildings that are not circular to a circular building is much more difficult, so prioritising circular practices in the early design stages is essential.

Examples such as the Aardehuizen and Boschgaard show the possibilities of completely circular living environments. These projects were only possible due to the safeguarding and prioritisation of their residents. Examples of this prioritisation are Boschgaard's urban mining efforts and the Aardehuizen, who chose space for greenery over car accessibility.

4 – Demystify: Make architecture low-tech and tangible

If people understand their own home and behaviour better, it gives them the opportunity to change and renovate. This argument is not only put forward by the coaches of 015Duurzaam, but also supported by research from Horian and Krutisch, which shows that smart meters influence people's behaviour because they have a better understanding of what they are doing.

Low-tech architecture also helps in this regard. Currently, high-tech solutions and installations are creating a web of unknown and low-quality materials and things at home that are polluting and causing unidentified illnesses and allergies (McDonough & Braungart, 2002). The energy coaches of 015Duurzaam remark on a similar issue, stating that people are becoming so overwhelmed by the amount of information on installations, such as heat pumps and PV panels, that they forget about passive and low-tech measures, including behavioural changes and insulation. Krutisch also argues that simple, low-tech measurements are easier to understand for residents, as they can perceive and feel the effects of these, for example, vapour-permeable materials, unlike the black box of high-tech installations, such as an HVAC system.

5 – Stimulate positive spillover effects

A concept from the behavioural sciences that is being researched is spillover effects. Krutisch is researching this, for example, how smart meters can lead to more savings

with subtle nudges and feedback loops. Elgendy is also examining similar theories and suggests that circular prototypes in a neighbourhood can have an impact on their neighbours. The sustainable housing routes that 015Duurzaam organises at the neighbourhood level work the same way; people are given the opportunity to talk to their neighbours about their experiences with sustainability. Krutsch does warn that spillover effects can also be negative; if someone has a bad experience with sustainable measures, that person can influence themselves or others in their environment against making their homes more sustainable. For example, during conversations with residents as an energy coach, some people were very sceptical about gas-free living because of what they had heard from neighbours, friends or on TV.

On the other hand, the case studies also show how far spillover effects can reach. Boschgaard resident Eugenie made a career switch to a circular profession because of Boschgaard's self-build experience. Moreover, Aardehuizer Gerard indicated that because of his self-build experience of his own house, he now picks up jobs much more easily in and around the house. His neighbour Frans-Jan also mentioned how being together and working with others leads to a positive spiral of ideas. The food forest where we worked is an example of this.

Therefore, the results might suggest that spillover effects always lead to a positive outcome among early adopters. However, based on the observations, a more plausible explanation is that we have spoken to the residents who entered a positive spiral. As most residents of Boschgaard and the Aardehuizen were absent during our visits.

Being aware of the duality of spillover effects is crucial. Therefore, I refer back to the earlier remarks of this discussion; a strong and well-defined space for appropriation by residents, so that the circular transition is not a sacrifice for the individual but is carried by the entire community with sufficient support and guidance from designers and planners.

6 – Visualise a circular future

Lastly, scholars such as Ingold et al. (2020) and Woods and Berker (2022) state that the strengths of the architectural discipline are its ability to explore multiple future scenarios through design. Elgendy and Krutsch also mentioned during the interviews that architects can help residents gain a better understanding of renovation plans through visualisation in VR or renderings. Visualisation is a powerful tool for the circular transition, as is also proven by the case of Geworteld Wonen. INBO's visualisations convinced the municipality of Rijswijk to explore the concept.

In addition, such visualisations, just as prototypes do, can trigger and inspire new ideas too. As Lucas (2020) states, paintings and sketches leave room for new interpretations by the viewer. Renderings, therefore, unconsciously create spillover effects because they appeal to the human imagination.

The Social and Sustainable Infrastructure of Delft and Tanthof

As I have advocated throughout this research, circular housing requires a context-specific approach; therefore, this research includes analyses of the contexts of Delft and Tanthof.

The presentation by the municipality on April 8th, as well as a document analysis of their previous policy approach for the energy transition, shows that the municipality is committed to innovative techniques in combination with a high degree of citizen input. The city of Delft has a strong knowledge economy and a large proportion of technically educated residents. The municipality also has a strong bond with the TU Delft, which has developed many innovative solutions for the energy transition in the areas of participation and technology (e.g., Populytics and Circular Environment Hub) and is also the largest employer in the region. However, there are also other voices in the city from people who have fewer ties to academia and more scepticism towards the local government and housing associations, for example. Local energy collective 015Duurzaam tries to enter into and continue a dialogue with these people, but they also indicate that this is a significant challenge.

There is something to be said for the fact that both top-down and bottom-up work is being done in Delft on an inclusive transition. Thanks to the enthusiasm of the municipality, 015Duurzaam has been able to reach people in energy poverty and influence local politics. However, there is a lot of uncertainty on both sides about funding. The municipality is still working on their business case for the energy transition, and within 015Duurzaam, there are mixed feelings about the voluntary basis of the organisation. 015Duurzaam would rather be more inclusive, but the volunteers are often pensioners. On the other hand, the volunteers are not monetarily motivated but work from their own passion for sustainability and the environment. 015Duurzaam's accomplishments through collective action show hope and promise for a circular and sustainable future.

Both the municipality and 015duurzaam have the ambition to create more space for citizen initiatives in neighbourhoods like Tanthof. The residents' plan for the redevelopment of the Abtswoudsepark indicates that there are residents within Tanthof who are motivated to care for their environment. There are many planned activities and amenities in the neighbourhood, as well as an active neighbourhood association, BHTV. Tanthof is a neighbourhood with quite a homogenous dwelling typology, mainly row houses built between 1970 and 1990. This makes it easier to exchange ideas among residents, as is also evident from 015Duurzaam's sustainable housing route.

The district lends itself well to strategies indicated earlier in this chapter, such as spillovers through prototyping and knowledge exchange at other neighbourhood events. Therefore, Part 4 of this report will propose a vision and design for a circular Tanthof that is grounded in the context and meant to be empowered by its people.

Recommendations: What the role of the architect could be in fostering an inclusive, energy-neutral and circular living environment

I argue that architects could play a much greater role in the circular transition, learning from the idealistic early adopters (i.e., energy coaches and circular communities). The leading role Architecture firm INBO had taken in developing the concept of Geworteld Wonen shows that the role of an architect can be a convincing force for change. Combining technical knowledge on circular systems with visual tools, an architect can tell a convincing story for possible futures.

Architects and planners are in a privileged position to possess similar knowledge as energy coaches, yet from a paid position. As discussed in Chapters 1.2 and 1.3, scholars and researchers emphasise that dialogue with others and the understanding of prejudices and biases are vital for gaining new perspectives (Woods & Berker, 2022; Elliot, 2022; Latour, 2004; Gil-Fournier, 2019). Talking to residents as an energy coach showed how important it can be for residents to have a better understanding of the building physics of their homes. Krutisch suggests in our interview to make architecture more tangible and low-tech (See Chapter 3.2). In a similar vein, McDonough and Braungart argue that crude products in our homes have led to health issues. With low-tech and simple designs, comprised of local materials, architects can localise and demystify the design and construction. That way, it becomes more tangible for its users, but it also makes architecture more part of the local ecosystem.

It is our responsibility as architectural designers to intervene and create spaces that have a restorative effect on our environment.

Conclusion

Through this research, I explored the role architects can play in ensuring an inclusive, energy-neutral, and circular living environment. Based on a broad explorative analysis of the current efforts towards a circular living in The Netherlands, I concluded that combining local knowledge with low-tech and straightforward solutions, as well as creating a well-defined and informed frame of collaboration between residents, policymakers, and building experts, are essential factors to consider in circular housing projects, whether existing or new-build. The results indicate that there are six approaches to explore for fostering circular living: understand, collaborate, prioritise, demystify, stimulate and visualise. Yet, further research is encouraged to add more approaches to this list.

Based on an extensive literature study into the Circular Economy and other economic paradigms (e.g., Community Economy, Doughnut Economy), I developed an argument for more collective action and increased space for community and non-monetary activities within a circular economic system. Therefore, I also reviewed Sociological and Anthropological theory to gain insights into what motivates people to innovate and care for their (natural) environment. This included Rogers' theory of diffusion of Innovation on adopter categories, supplemented with Moore's Chasm Theory, as well as Latour's notion of learning to be affected and Ingold's and Lucas's plea for Architectural Anthropology. From this review, I concluded that affection and understanding emerge from direct contact and conversation with others. Thus, I hypothesised that caring for the environment would be stimulated through interaction and confrontation. To further explore this theory, I conducted fieldwork and interviews with early adopters of circular living, specifically the residents of Boschgaard, Aardehuis Olst, and Geworteld Wonen, three housing projects with a strong focus on circularity. In addition, I joined the energy coaches of 015Duurzaam to be in contact with the early adopters of circular living in Delft, my colleagues, as well as part of the majority, the residents we helped. I also analysed the current efforts of the municipality of Delft through notes and document analysis. Lastly, I conducted interviews with TU Delft researchers who are looking into residents' behaviour during the energy transition.

The research findings clearly illustrate the significant impact that can be achieved

through the passion of citizens to improve their environment. Additionally, these findings indicate that such efforts can spill over into other behaviour or onto other people. Yet this research also raises questions about negative spillovers and responsibility. The result also shows that the effort required for an individual or community to live circularly or even renovate their home is extensive and not feasible for everyone. The potential residents who dropped out of Boschgaard, Geworteld Wonen and the Aardehuizen show this, as do the fieldwork observations at O15Duurzaam and the interviews with researchers.

Based on these conclusions, architects should consider the six approaches mentioned earlier to ensure an inclusive transition.

Based on these conclusions architects should consider to aforementioned six approaches to ensure an inclusive transition:

- 1) Understand the local context and tie into local knowledge;
- 2) Collaborate with residents within a well-defined framework;
- 3) Prioritise circular building at every step;
- 4) Demystify by making tangible and low-tech designs;
- 5) Stimulate through spillover effects;
- 6) Visualise circular future scenarios.

Limitations

A couple of remarks must be made about the limitations of this research. The focus on anthropological and ethnographical research, placed me as an observer and participant in a dual position. As argued in the methodology, standing among the research subjects is essential for gaining understanding and being affected by others. However, the results are therefore not objective and inevitably influenced by my presence. In addition, given the limited time frame of the circular communities' observation, these findings cannot be claimed to reflect ongoing patterns. Furthermore, focusing on social dynamics gives insights into these communities, yet these insights are not quantifiable, also due to the small sample size of three circular housing projects. However, it must be stated that the aim of this research was never to quantify or generalise, but to emphasise local differences and the strength of playing into local conditions. To better understand the implications of these results, the study of circular lived spaces should be explored further through additional case study projects and further discussions with residents.

Furthermore, the choice was made to conduct expert interviews with PhD candidates who are currently conducting research on the energy transition. This decision was made to focus on the most recent developments in research on residents in this transition. Nevertheless, this does mean that many of their findings have not yet been published or peer-reviewed. The conversations were about findings and new insights, but no concrete and hard conclusions were drawn. Further research and upcoming publications will allow for more conclusions to be drawn about engaging and empowering residents during the

circular and energy transition.

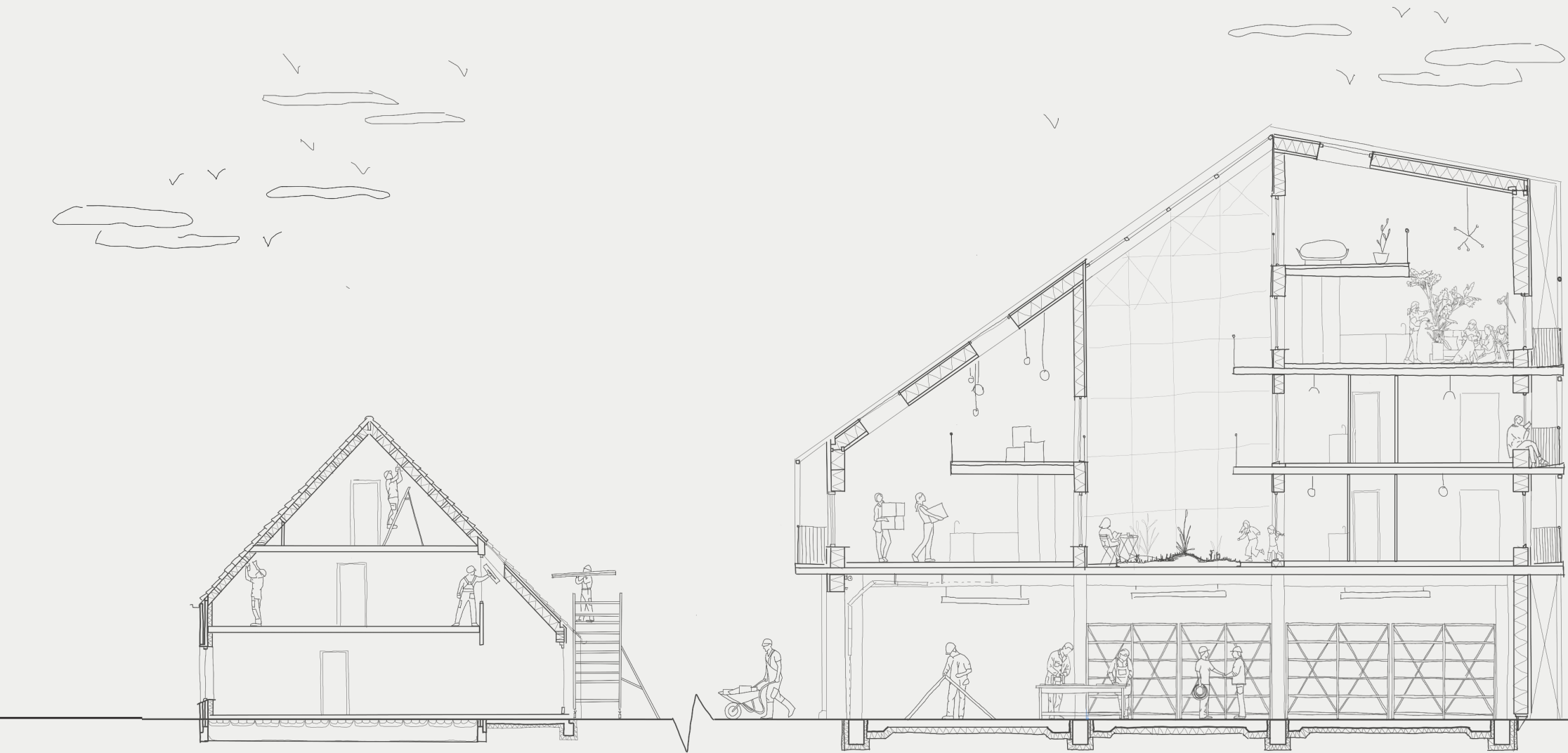
Despite these limitations, the study provides valuable insights that contribute to a broader understanding of circular community living and offer a foundation for further research.

Final remarks

I began this thesis by acknowledging the urgent need to rethink our architecture, as the building sector bears significant responsibility for the depletion and degradation of our natural environment. I want to advocate for an alternative approach towards architecture through local and low-tech collaborative designs, to break the long and polluting black box of supply chains, and to provide more comprehensible and suitable solutions for the local context.

Additionally, I addressed the gap in social and people-based research within the Circular Economy and Circular Built Environment paradigms. With this research, I took steps to create a collection of people-based cases for circular living, combining knowledge from the fields of Architecture, Anthropology, Sociology and Economics. Collecting more data, in the form of stories and images, on circular housing projects could enrich the understanding of circular living, as well as help alleviate common existing hurdles and thereby bridge the gap between early adopters and the majority.

Lastly, I want to end by echoing Ostrom's call for collective action, as she stated that "For thousands of years people have self-organized to manage common-pool resources" (Ostrom et al., 1999). My research, albeit far less extensive than Ostrom's, also shows potential for locally led community action in restoring the environment. Collective action offers hope for a circular, energy-neutral and inclusive living environment. In the next part, I aim to illustrate a version of a circular living environment where local communities serve as a catalyst for circularity.



Part 4

A Catalyst for Circularity

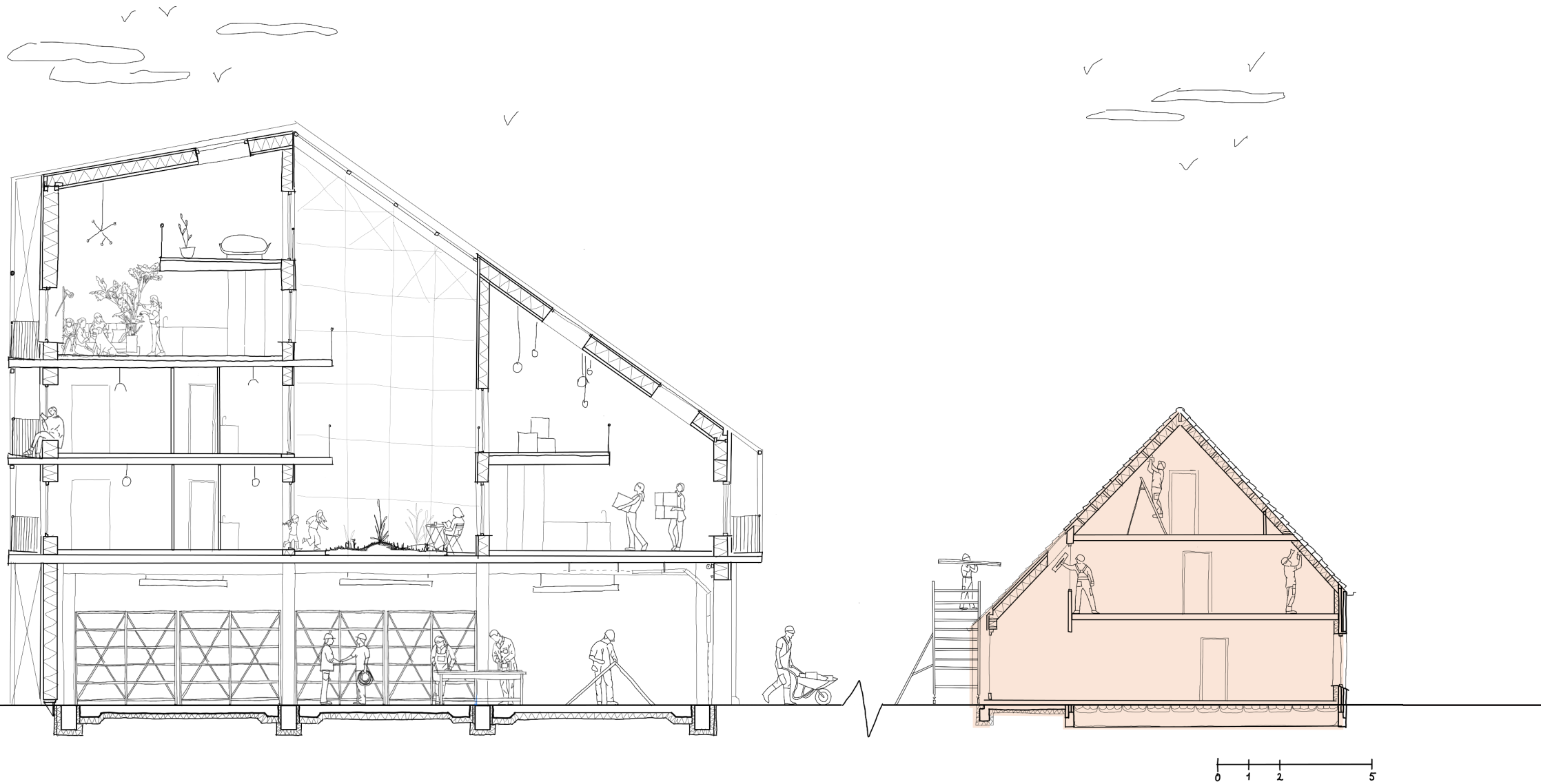
Masterplan

The project location is like a palimpsest; you can still see traces of the historic farmland in the polder, which has been overlayed by the 1970s master plan, which turned the area into a residential area. The citizens of Tanthof are also redesigning the park as we speak. And lastly, there is the plan of Redesigning Deltas for the next century of which I have made an elaboration for the P1 in collaboration with Diya Sharma, Joaquim Boendemaker and Rinaldo Pibia; a redesign of the park as a transition zone between the city and the wet land, working with sloping dikes, water storage and at the same time preserve the recreational properties of the park.

So this map shows three scenarios: the past in black and white, now in light green and the far future in dark green. Though our plan, was to embrace the water rich nature of the area, the current plans are more subtle and emerged from long collaboration between residents. My project is at the north western edge of this park, and this project will consist out of three spatial elements; the existing 1980's row houses, a workshop and new housing. The latter two elements will be housed in one building, with the workshop in the plinth and the housing on top.



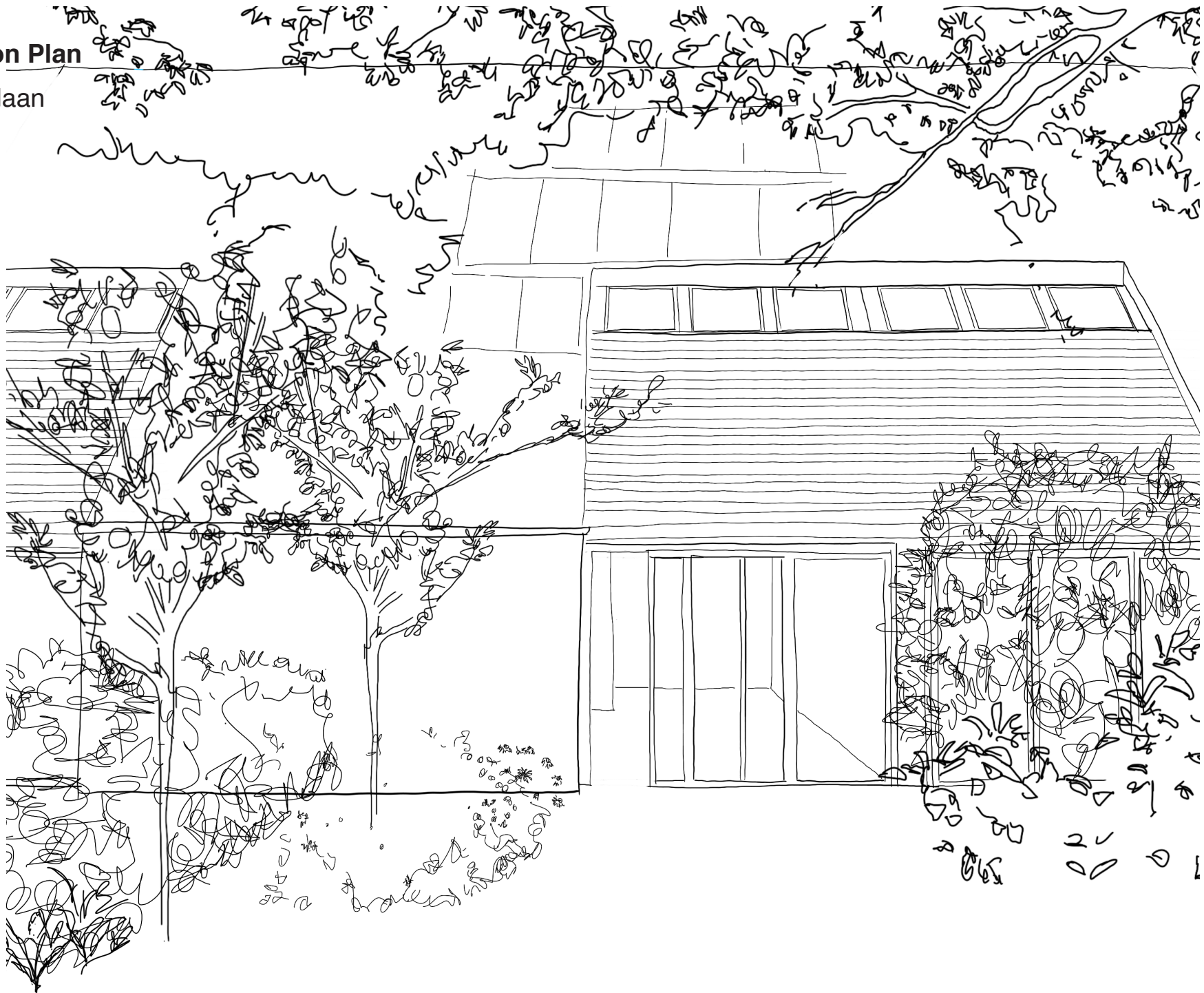
Section



This section shows three spatial elements of the plan: the existing row houses, the workshop and new dwellings. The row house is highlighted in orange; this is the first element of the plan.

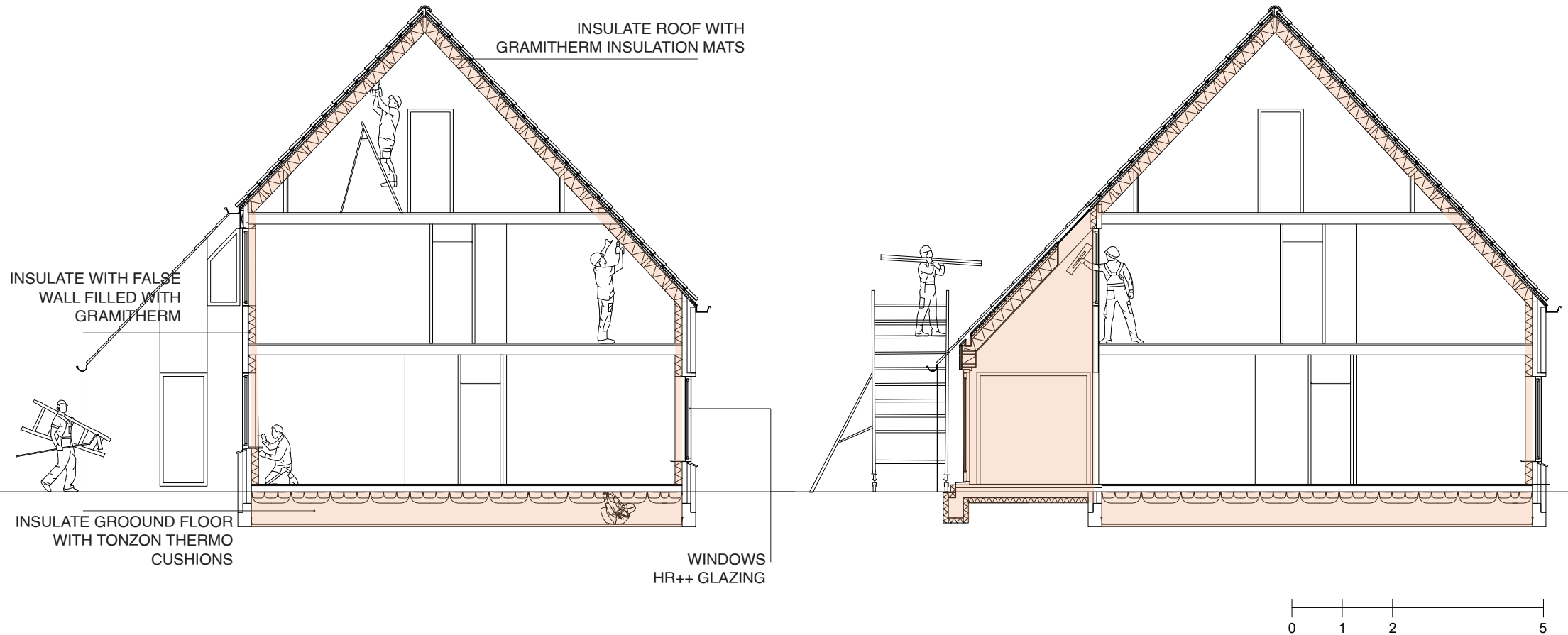
Renovation Plan

Cubalaan

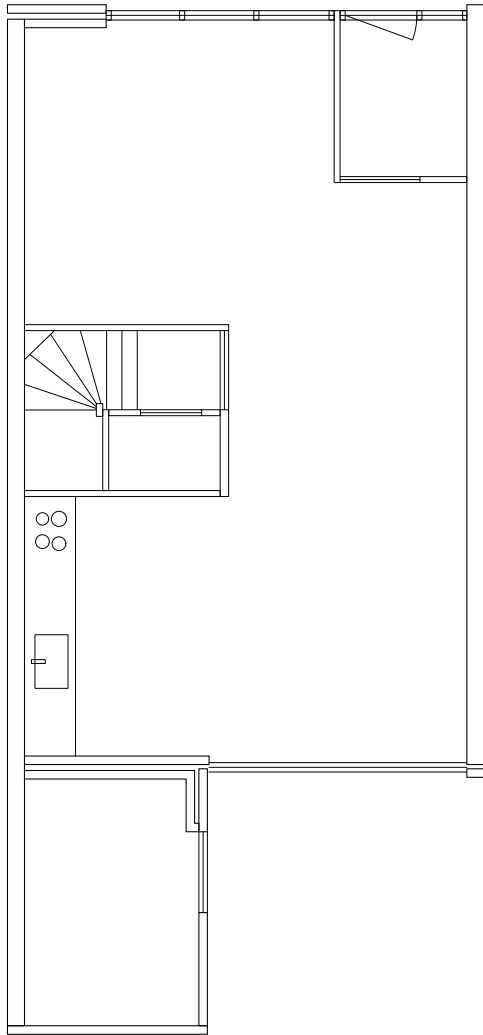


Renovation Plan

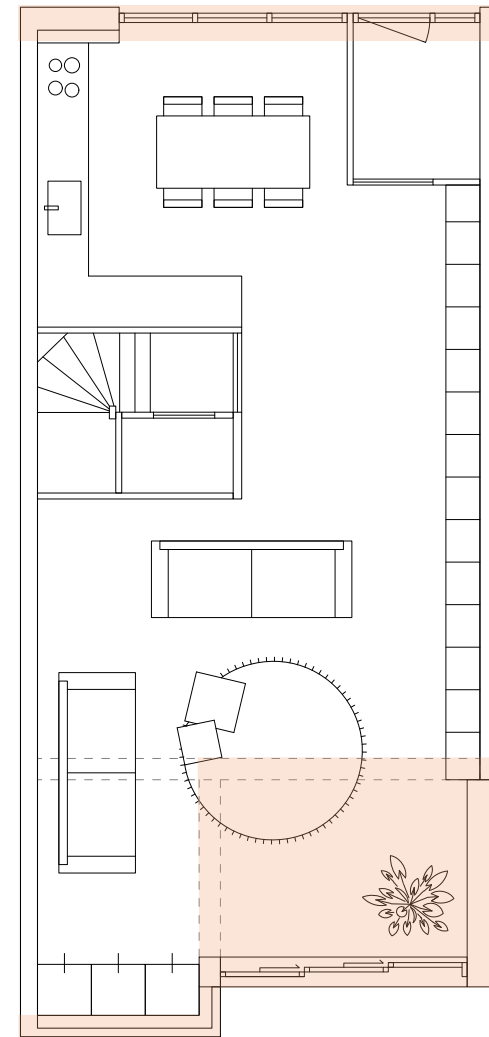
Sections



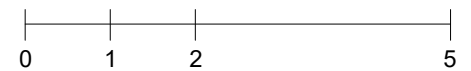
These are the sections of a row house on the Cubalaan. The left shows an option to renovate the shell. The right shows an option to renovate and extend.



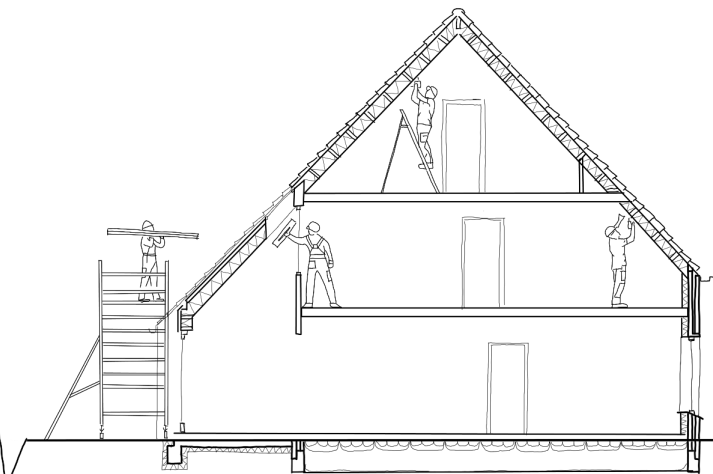
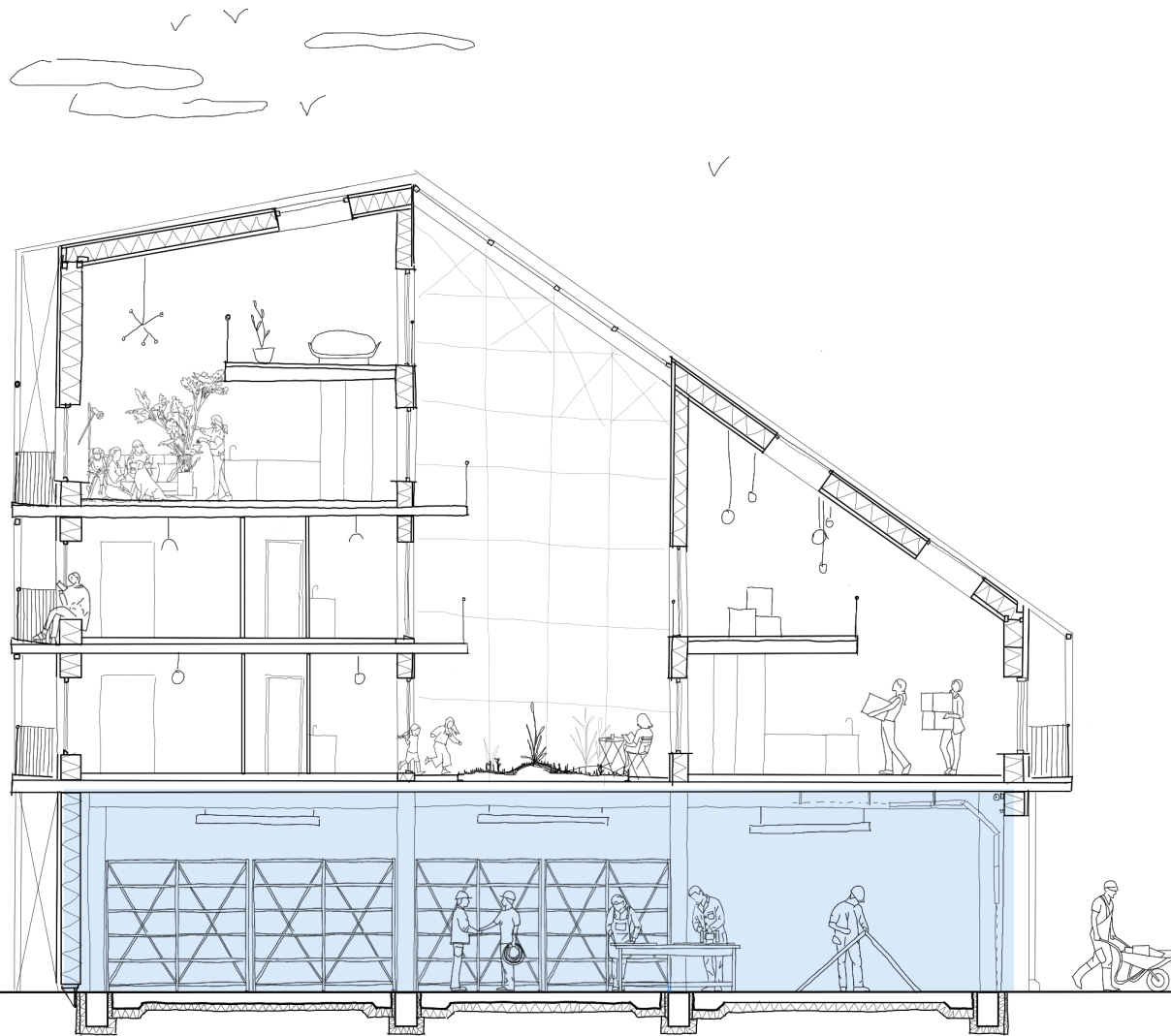
Existing floorplan of a house on the Cubalaan



Extended floorplan of a house on the Cubalaan



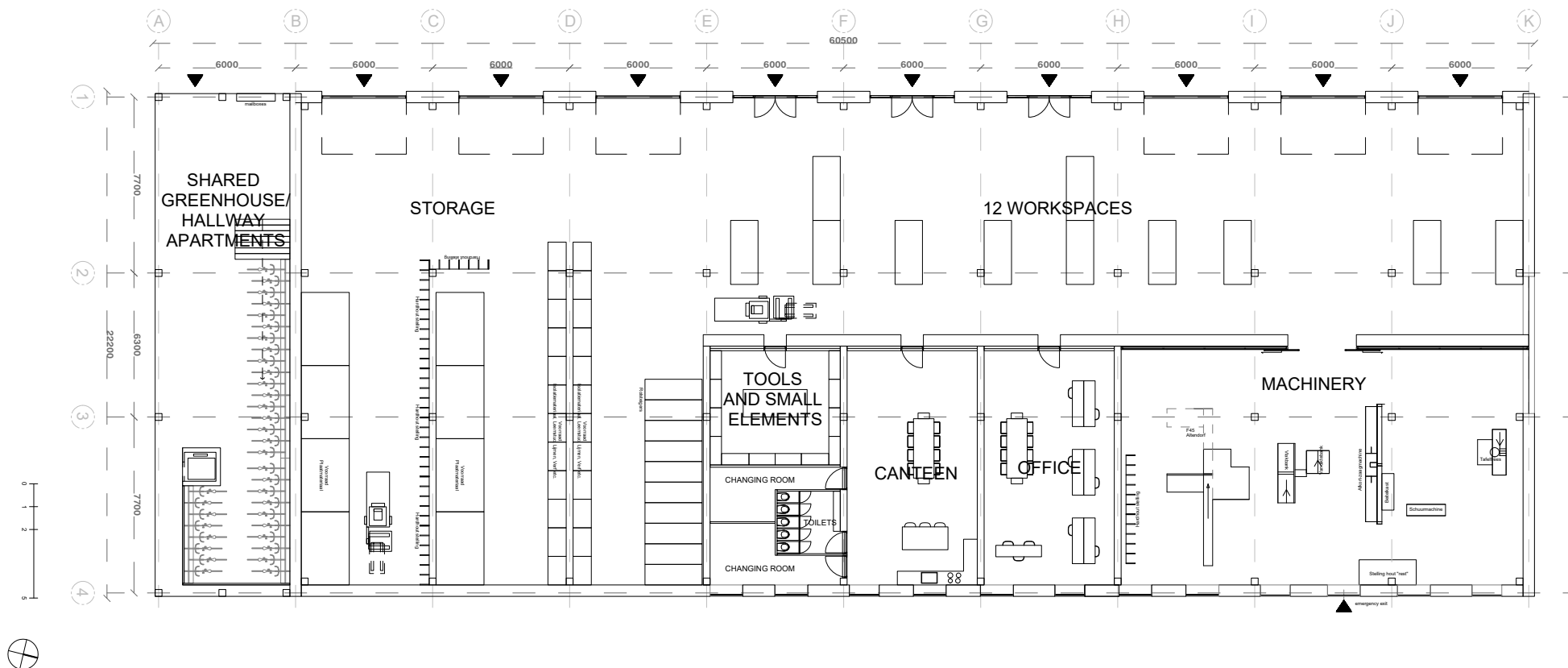
The Workshop



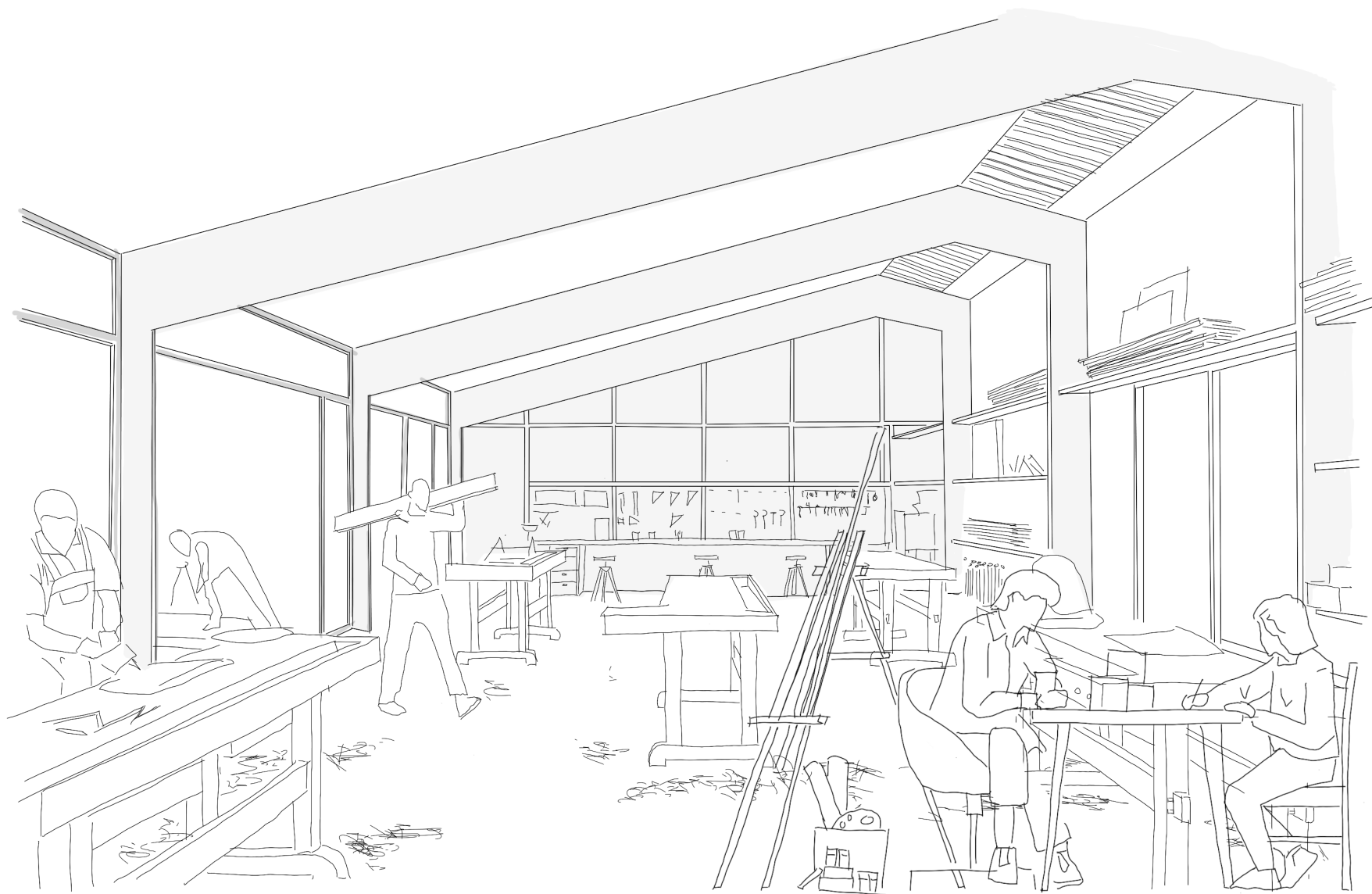
The second element: the workshop.



In this workshop, the materials and tools needed are provided, as well as volunteers and staff for the building process. Ideally, this staff will consist out of energy coaches, carpenters, plumbers, civil servants from the housing department, and installation experts. Providing knowledge and tools locally is essential, not only to simplify the renovation process, which is a complicated, fragmented and uncertain, but also because knowledge is an interaction. The residents themselves have unique knowledge about their houses, their neighbourhood and their community which should always be an addition the expert knowledge.

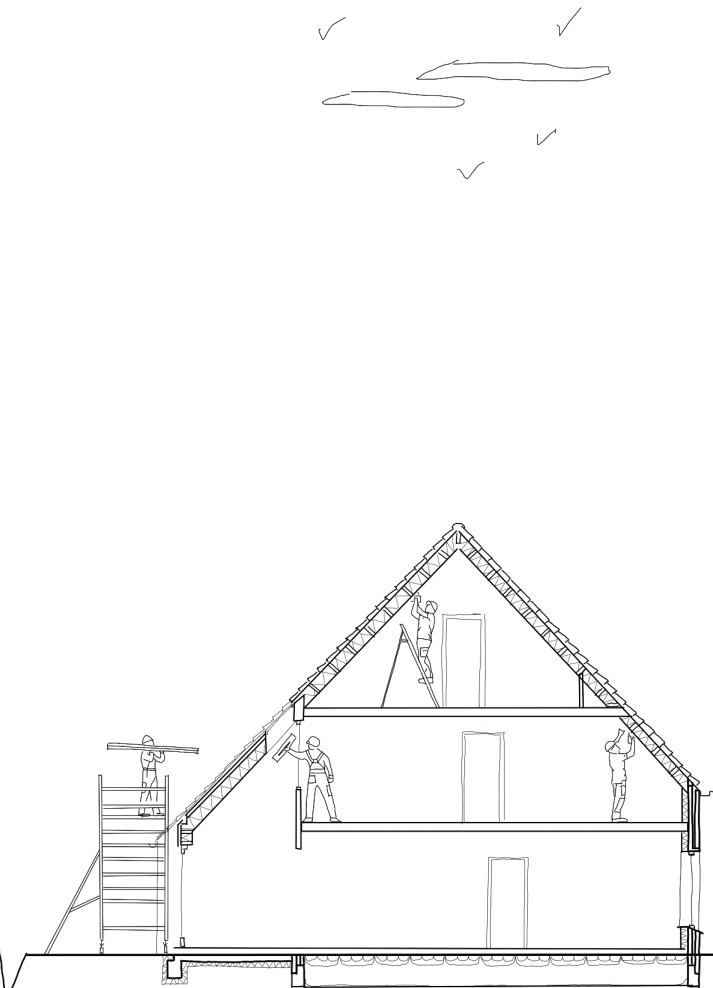
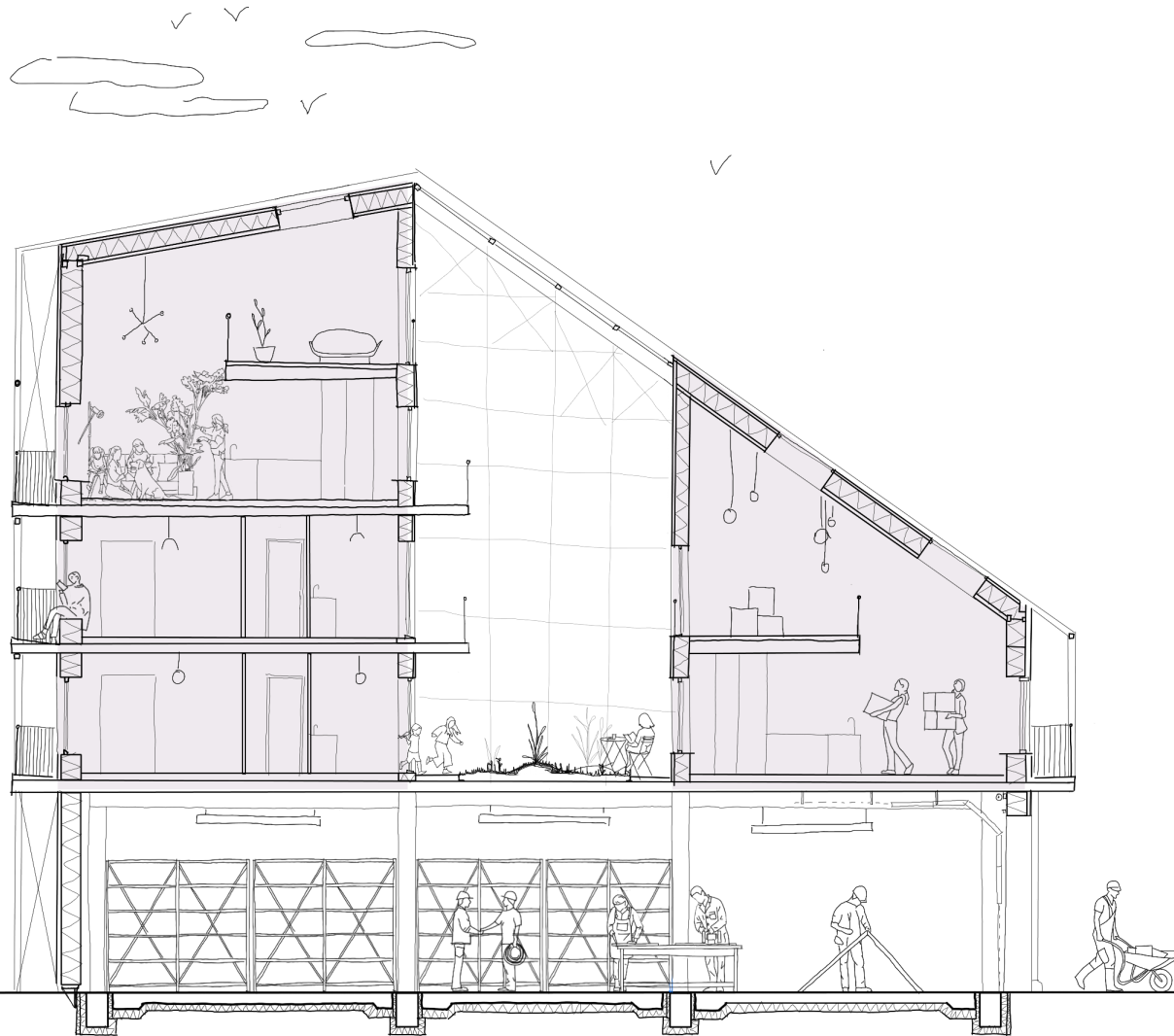


Floorplan of the workshop.



On the terrain there is also an extra shed, inviting people to collect or make things from the scrap material from the renovation such short pieces of timber, paint, saw dust or maybe even the insulation mats. So before discarding these materials for recycling, I argue that we should first give room for things to be reused or repurposed locally.

New Apartments

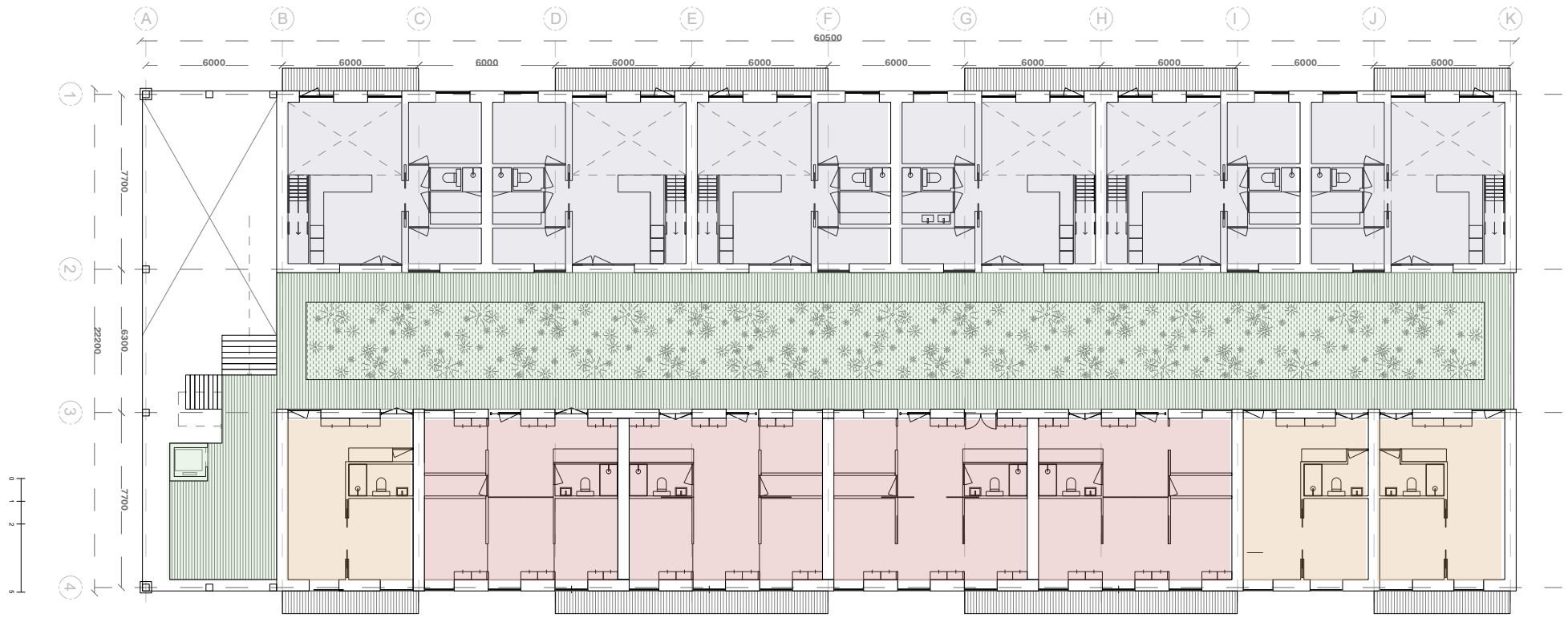


0 1 2 5

The third element: new dwellings.

First Floor

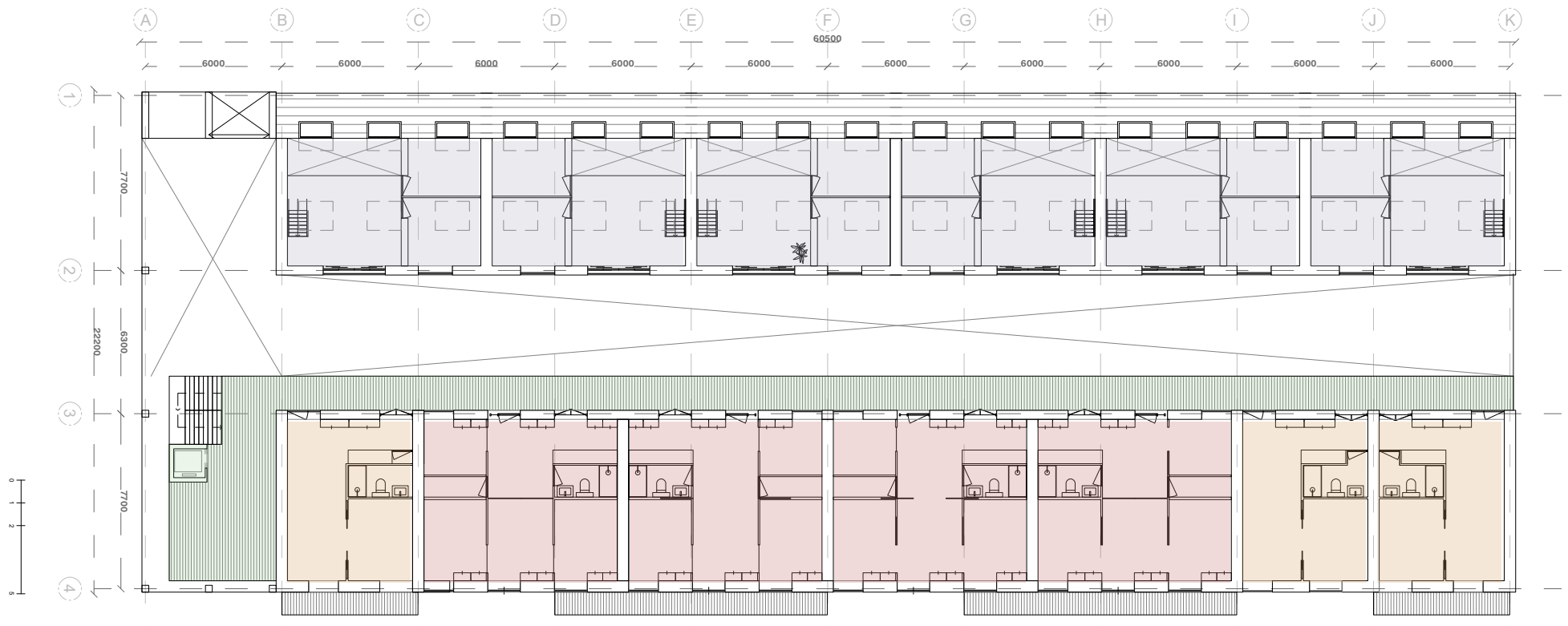
- Apartment type A (39m²)
- Apartment type B (60m²)
- Apartment type C (100m²)
- Shared space



Above the workshop, there will be apartments, targeted for two specific groups. The duplex apartments (purple, type C) are short-stay for the neighbours who are working on their house. The other apartments (orange, red, Type A-B) are targeted for dwellers who have a certain affinity with sustainable building and they share that knowledge in the workshop as an employee or volunteer.

Second Floor

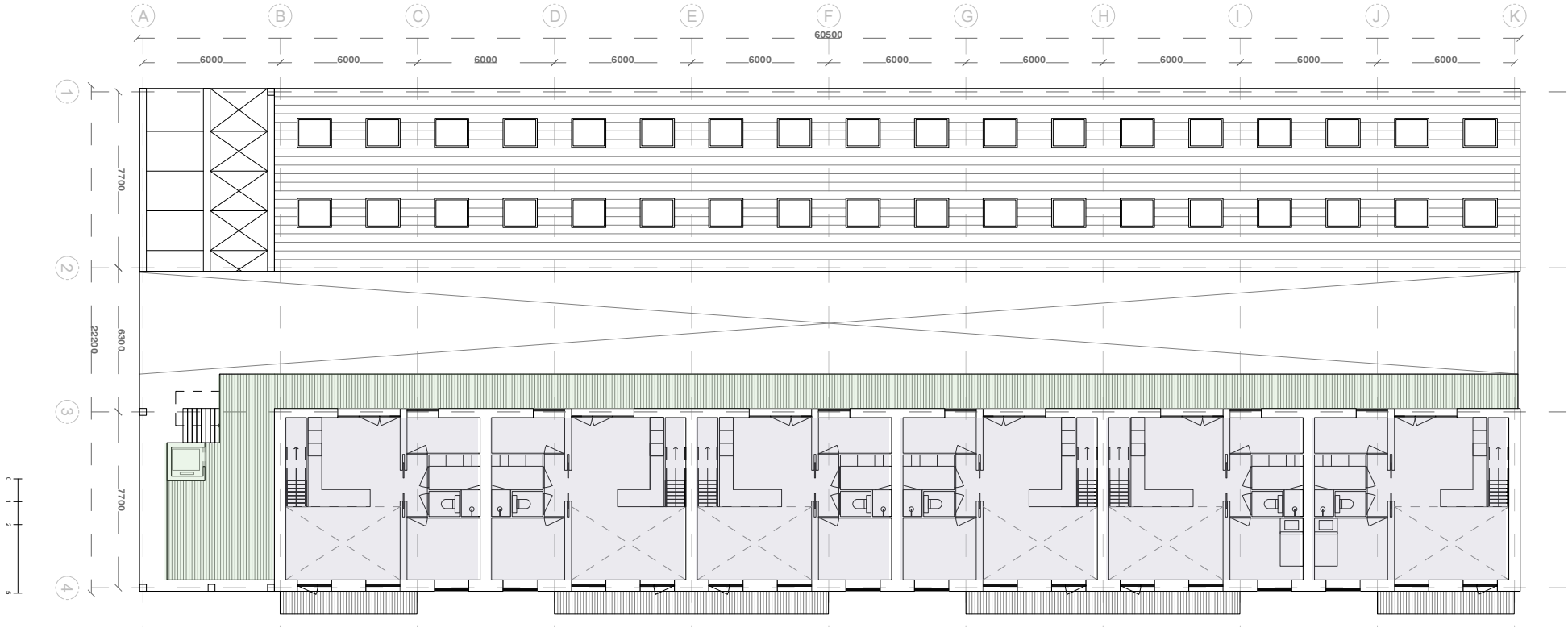
- Apartment type A (39m²)
- Apartment type B (60m²)
- Apartment type C (100m²)
- Shared space



In essence, the plan divides the demographic into two categories; the early adopters, who live in apartment type A and B, and the majority, the current population of Tanthof, who take turns staying temporarily in the duplex apartments.

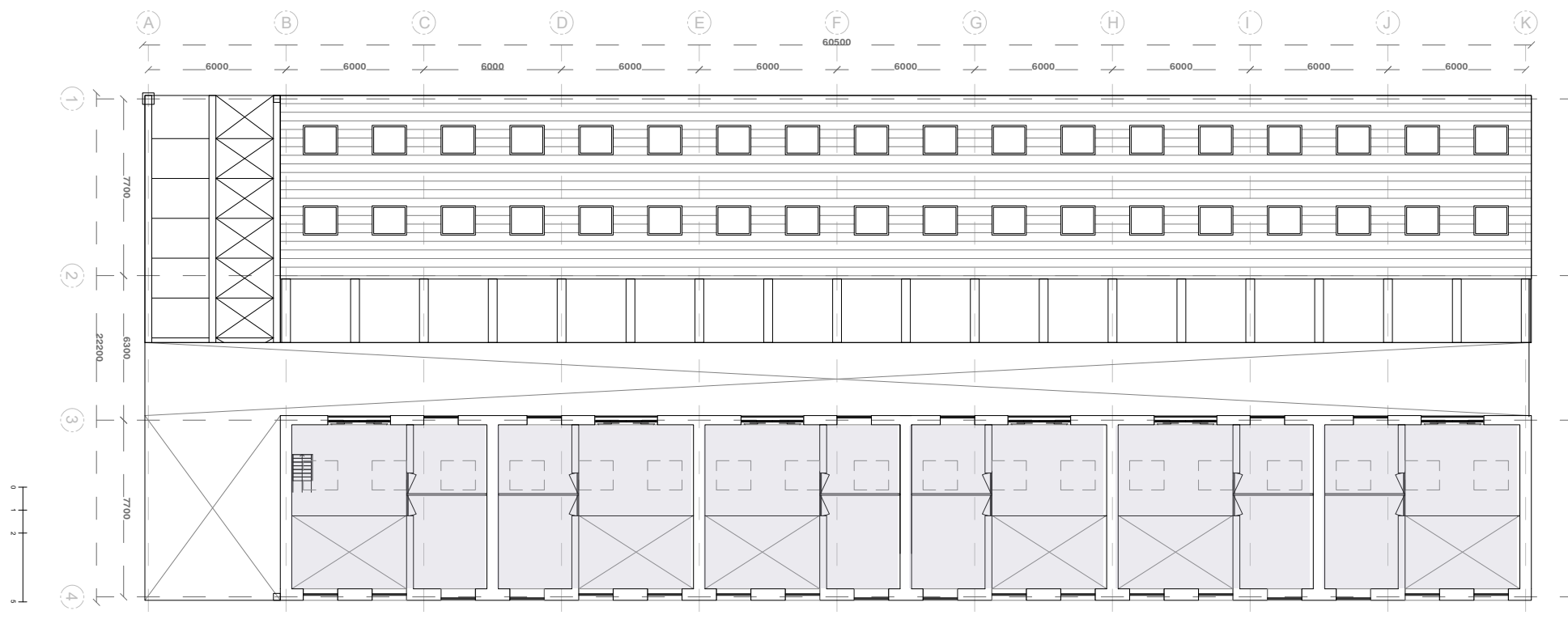
Third Floor

- Apartment type C (100m²)
- Shared space

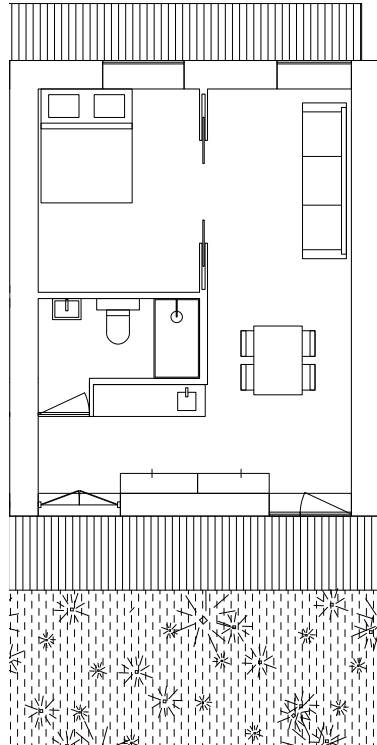
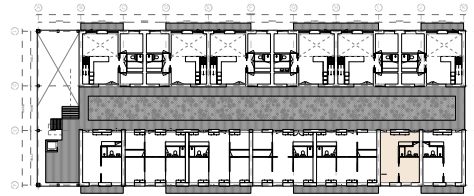


Fourth Floor

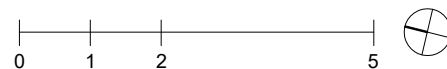
Apartment type C (100m²)



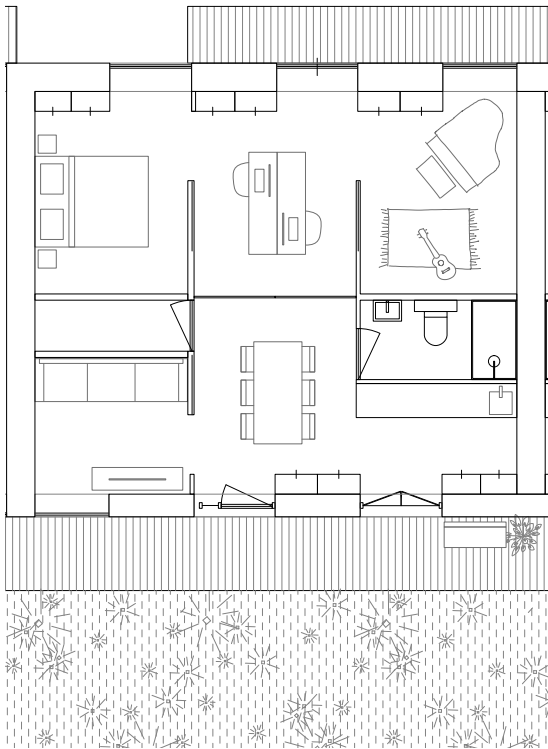
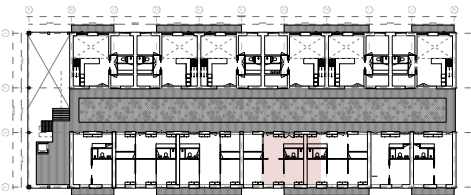
Apartment Type A



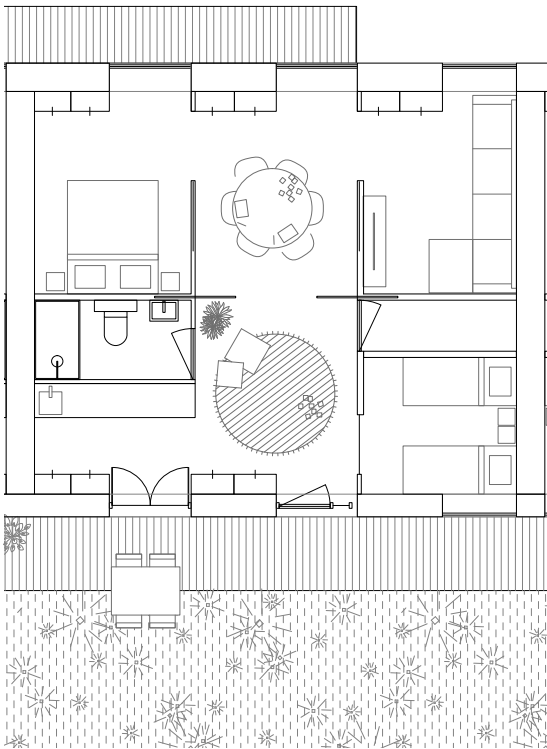
The apartments are more flexible in floor plan. Spaces can be used for multiple purposes. In apartment type B, for example, the same spaces can be used for sleeping, living, eating or working according to the wishes of the residents. The sliding doors also provide the possibility to use two spaces as one. In this way, one household can live with a spacious communal living space and the other with more privacy. Residents also have the possibility to change everything for special moments, such as a party, to receive more people. Apartment type C does not have sliding doors, but here the flexibility lies in the excess of the living space. Finally, all apartments have French doors to the roof garden or gallery, so that the living space flows into the communal space.



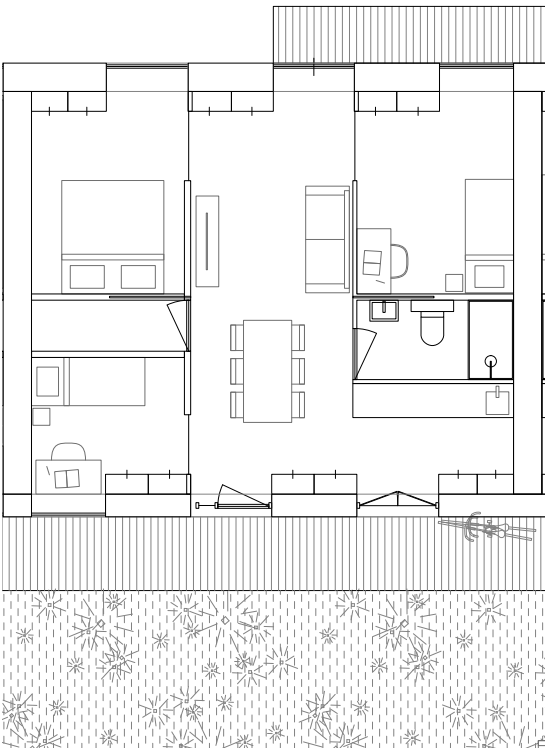
Apartment Type B



Couple



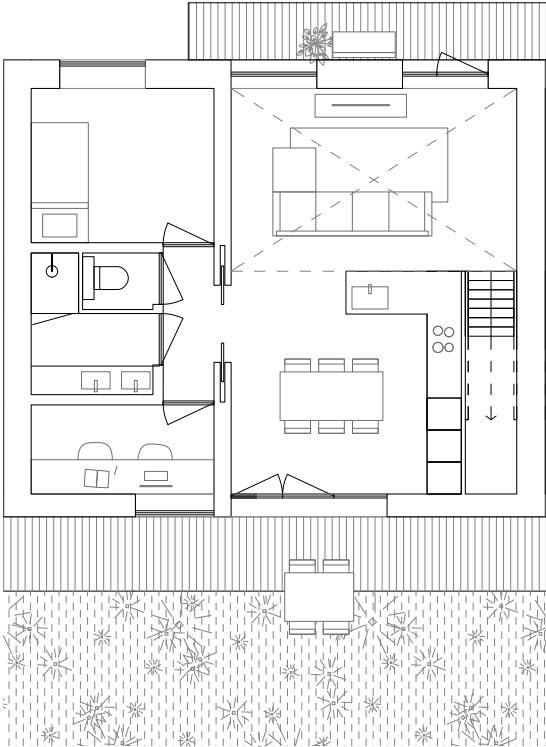
Young family



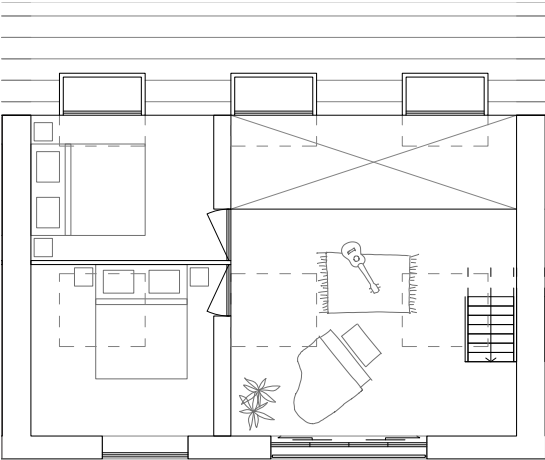
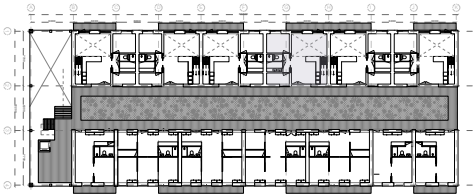
Family with teens



Apartment Type C



first floor



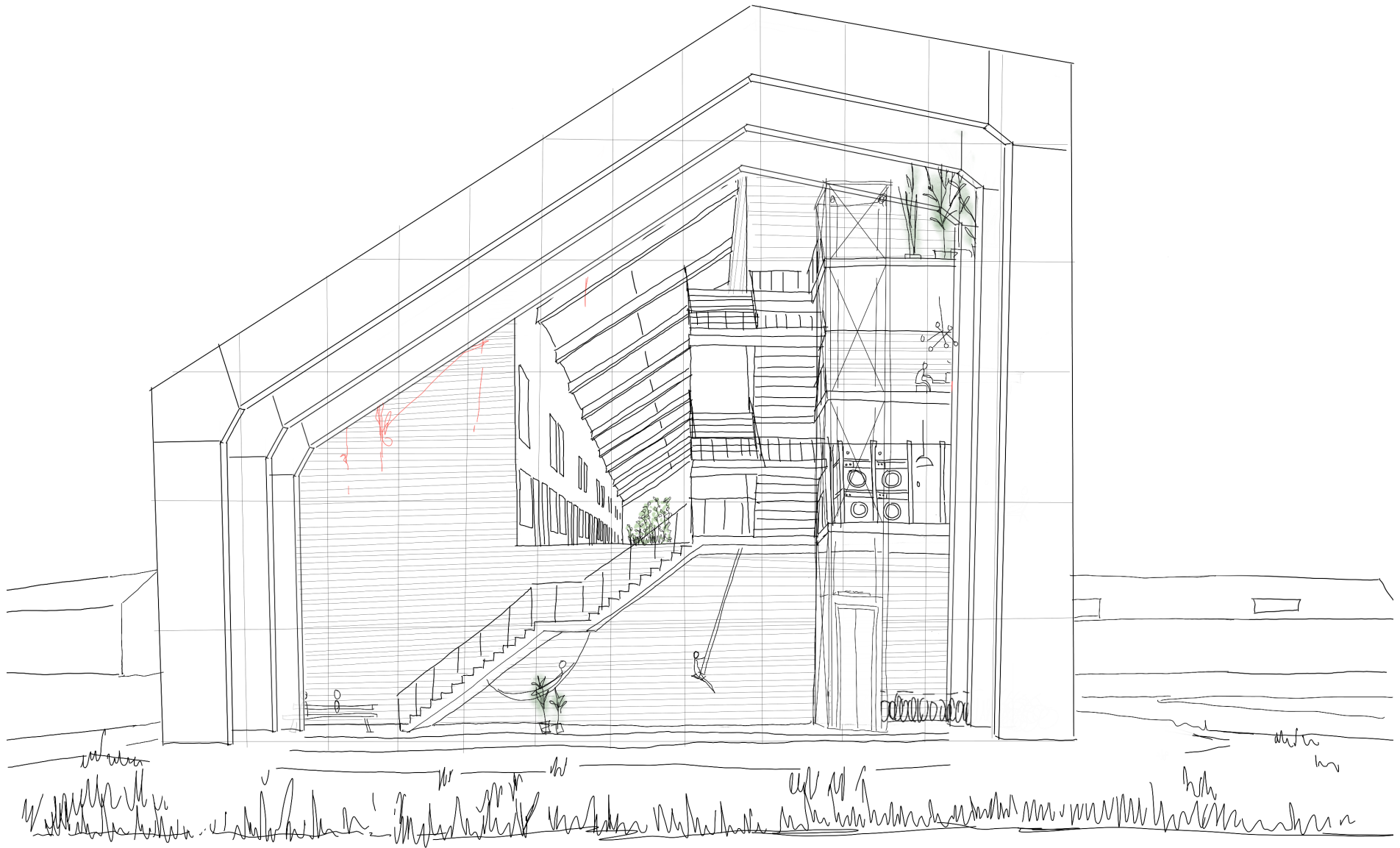
second floor





This image shows apartment type B with the sliding doors and the roof garden in the background. The materialization of the interior is natural. The walls are finished with clay plaster and the doors and floor are made of wood.

Shared Spaces



This image shows the shared entrance of the apartments: a greenhouse for gardening and leisure.



An impression of the shared rooftop garden.



Figure 2.11 (Work by author 2025)

What makes the concept more flexible is the excess in circulation space which can double as communal space, so residents can use these spaces too, for tasks such as laundry, or shared storage, but also for leisure or gardening, since it is a greenhouse.

In addition, the residents share a shared rooftop garden, so they can walk out of their apartments into a shared yet intimate space, as an extension of their living space.

Building Technology

Structure

- Biobased (timber frame and timber columns)
 - Sound-proof
 - Strong and Rigid
- Multifunctional (assembly hall/ dwelling)

Facade

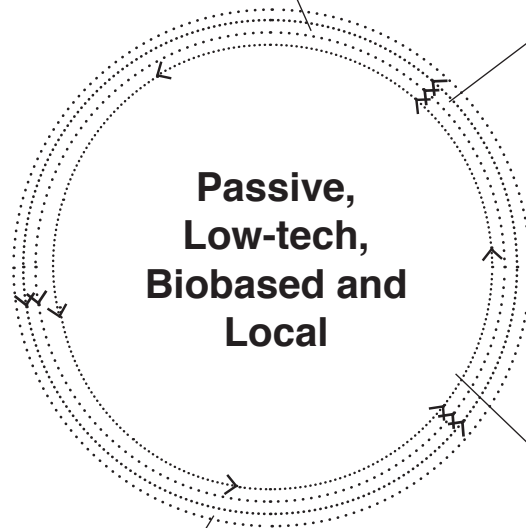
- Biobased cladding and insulation
- Protective
- Resilient

Climate System

- Thermal Mass - thick walls
 - Greenhouse buffer zone
- Tangible and comprehensible systems

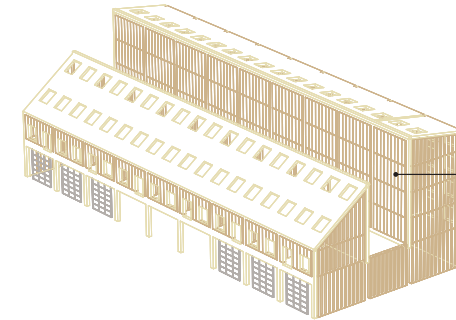
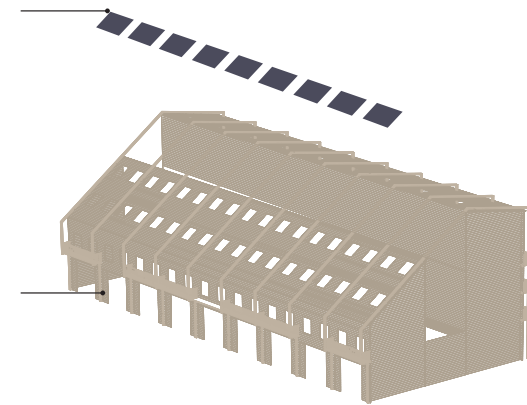
Site

- Using local and biobased materials
- Local knowlegde
- Orientation



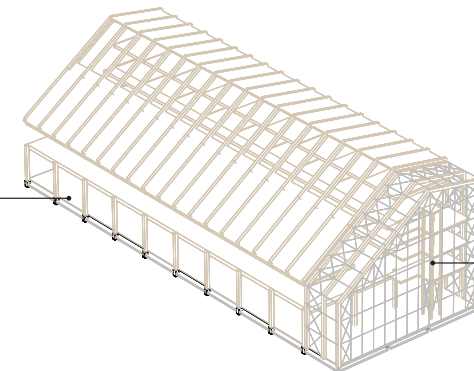
solar energy for electricity (heat, water)

hydro-thermally modified wood cladding (low-heat)



strawbale construction, finished with clay-plaster; tactile and low-tech

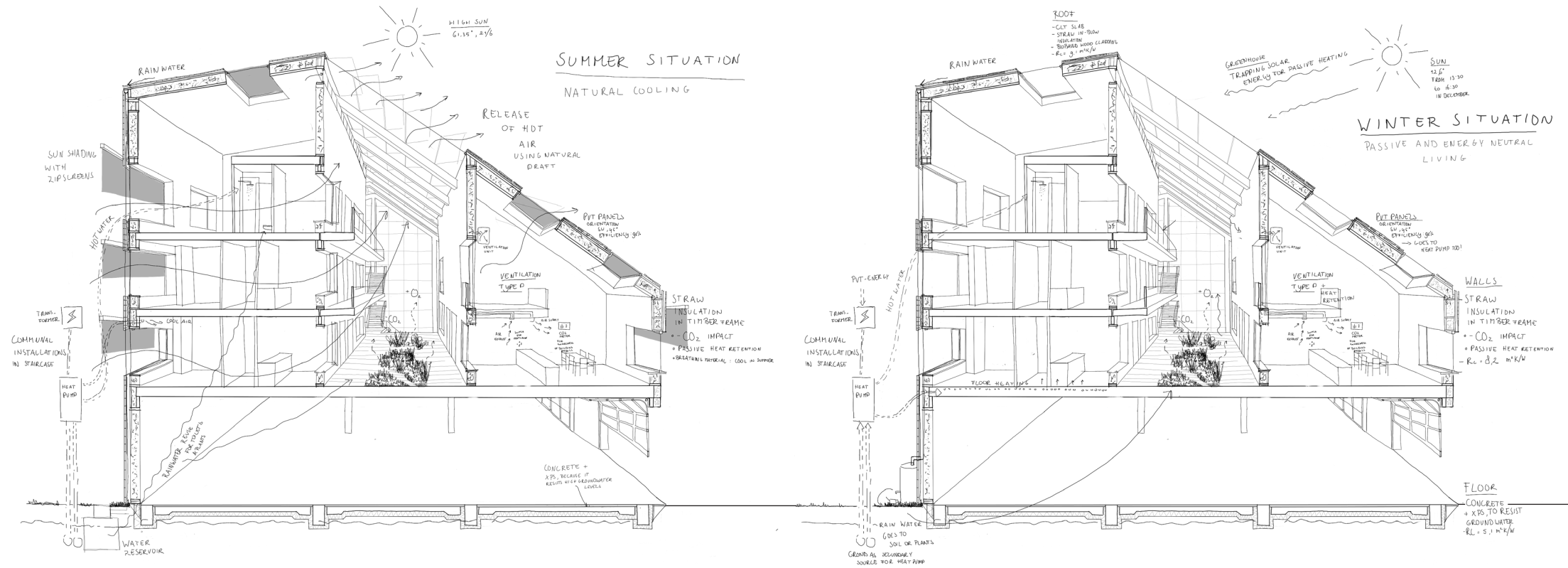
detached colmn and beam structure to prevent noise from workshop hall to apartments



greenhouse as bufferzone and for cultivating plants

In terms of building technology, circularity is the priority. Slightly inspired by the Layers of Brand, the diagram on the left shows which circular measures have been taken. The most important thing is that circularity must be low-tech and tangible for people.

Climate Concept



Climate concept of the building, showing the passive system. On the left the summer situation and on the right the winter situation.

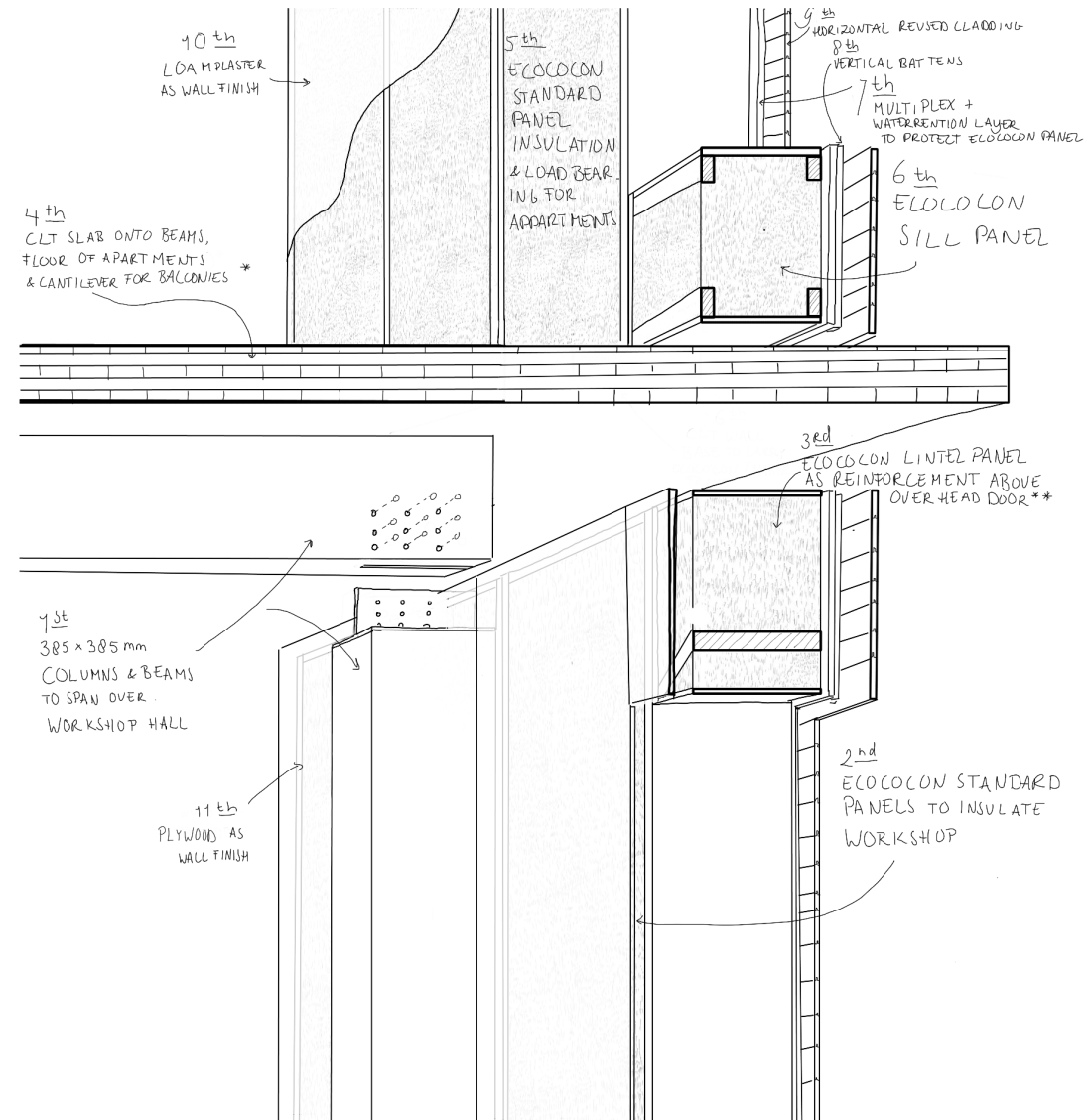
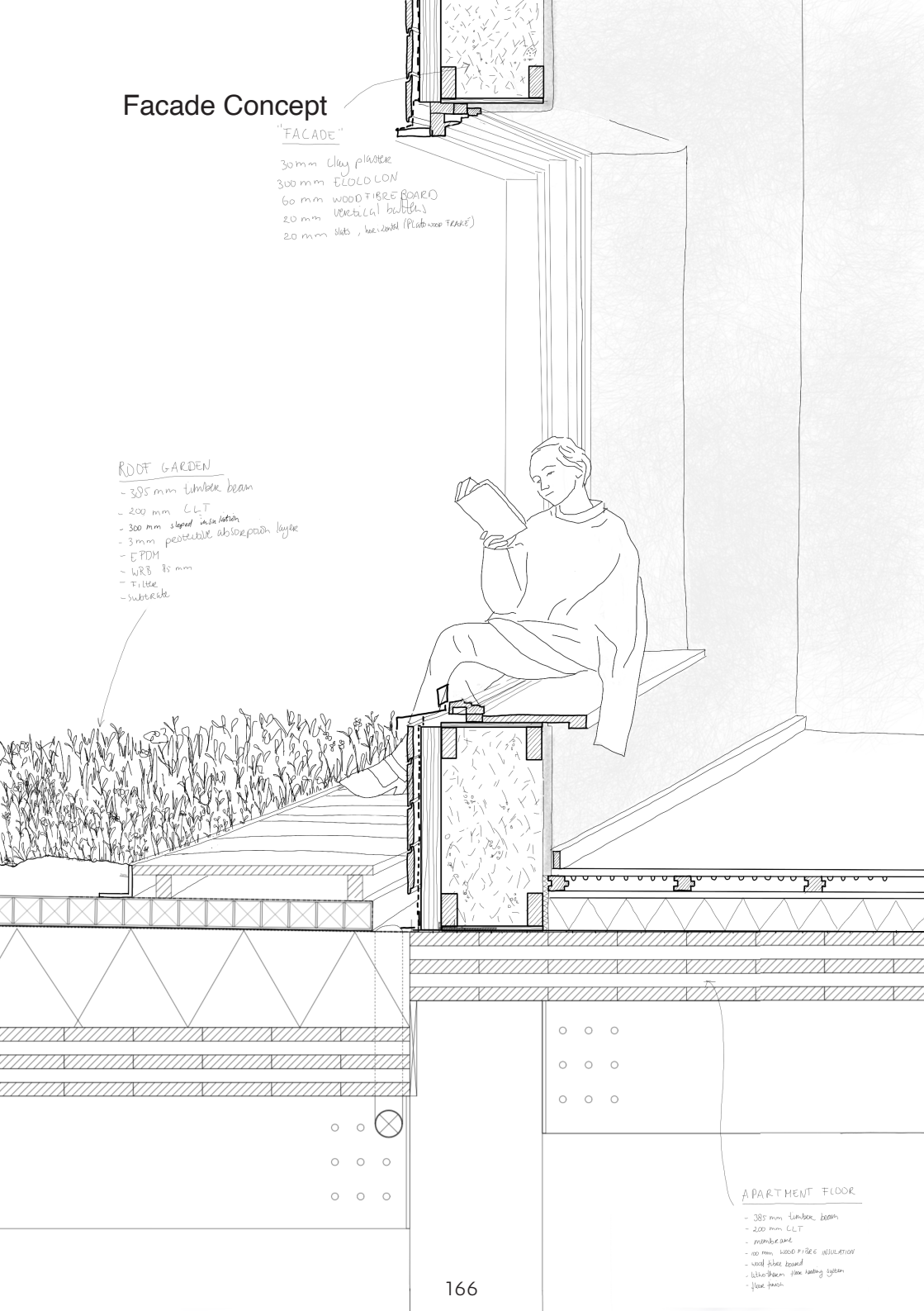
Facade Concept

"FACADE"

- 30 mm Clay plaster
- 300 mm ECOLCON
- 60 mm WOOD FIBRE BOARD
- 20 mm VERTICAL battens
- 20 mm slats, horizontal (Plywood frame)

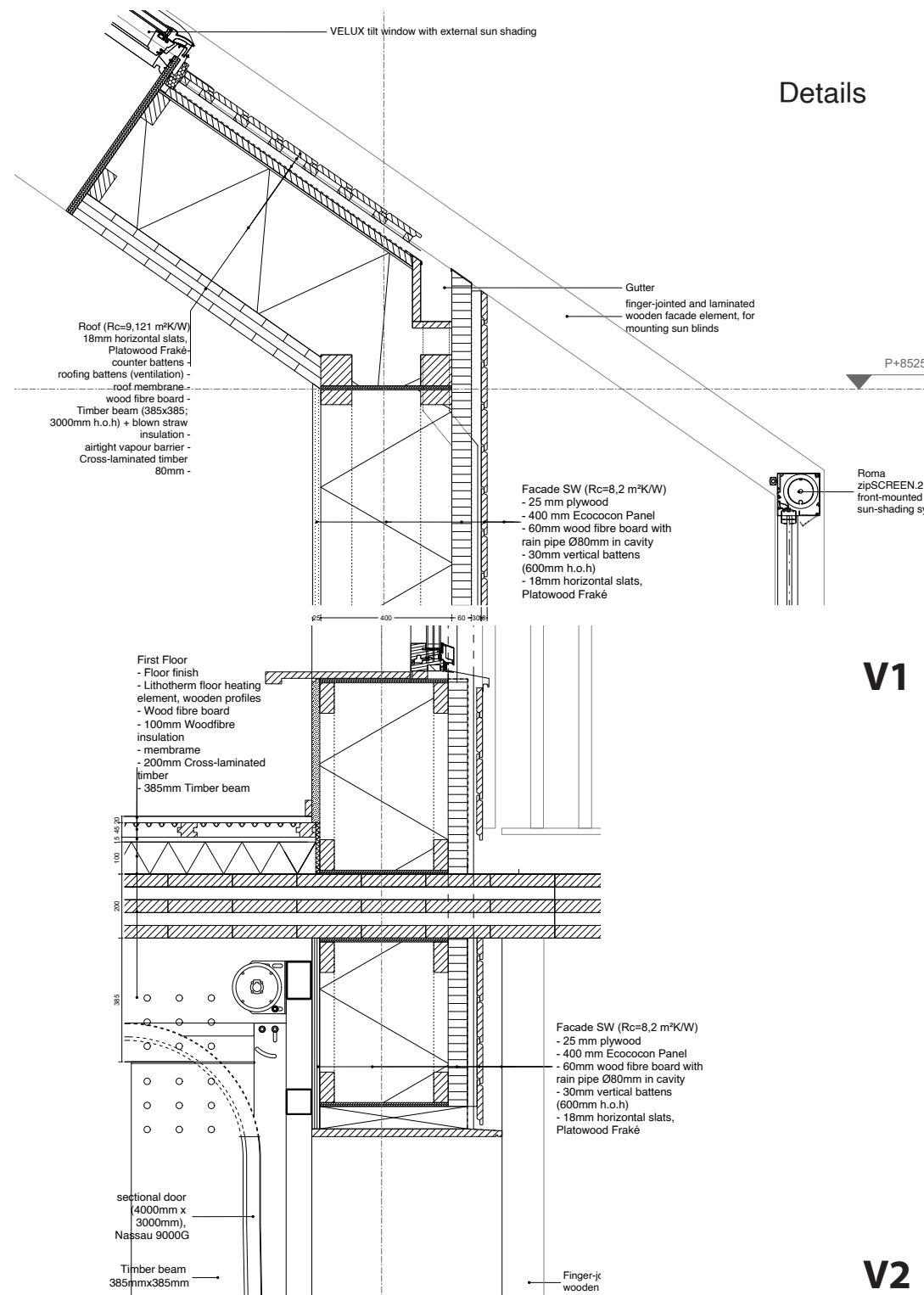
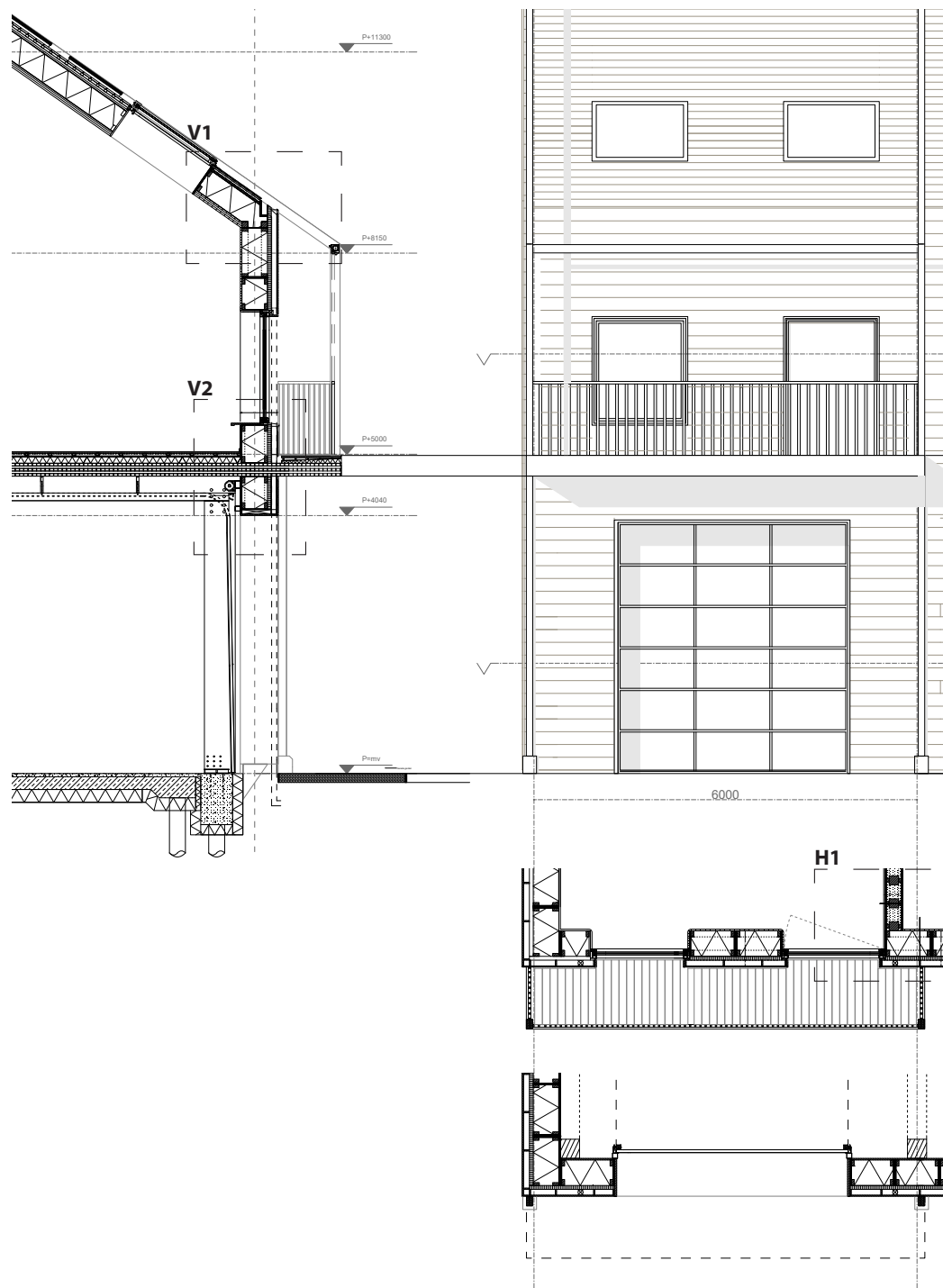
ROOF GARDEN

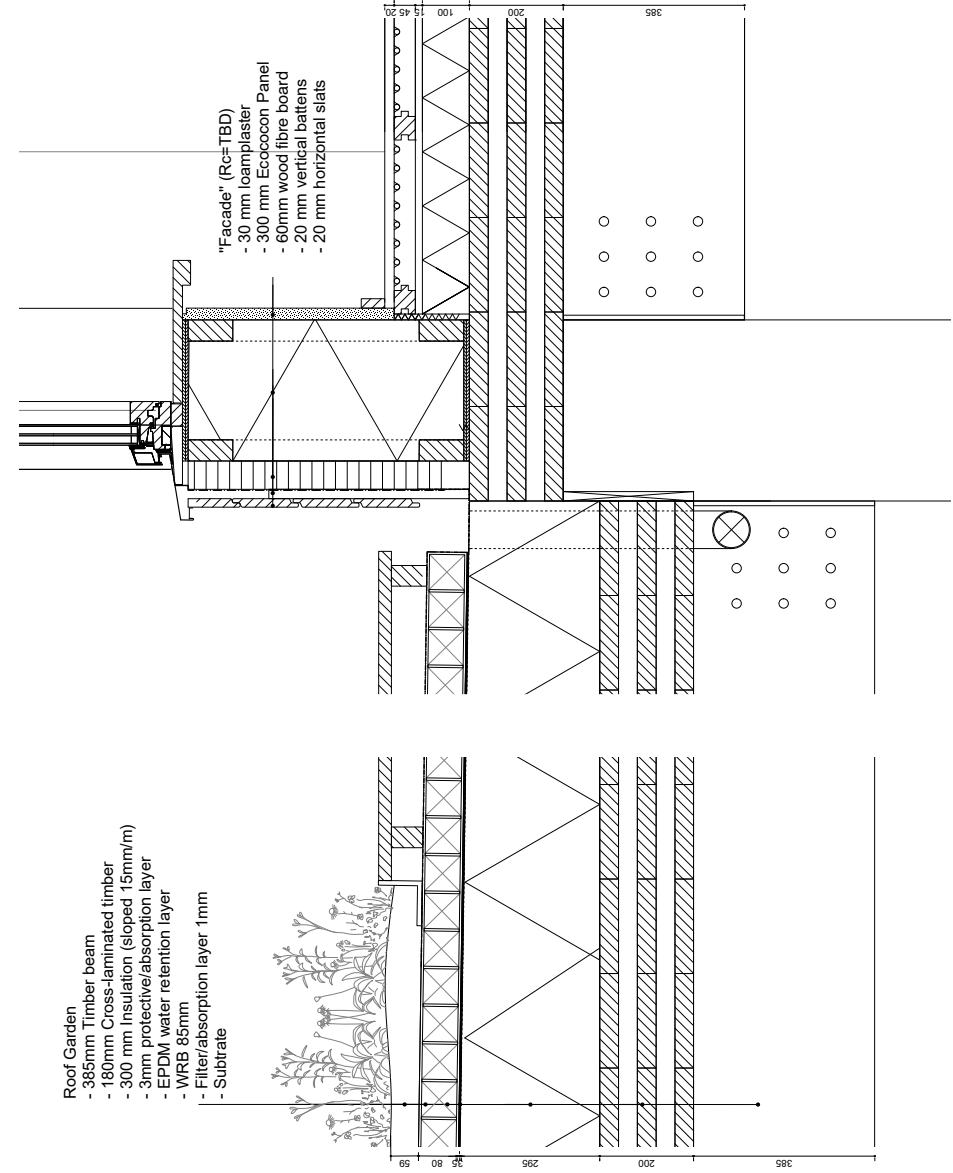
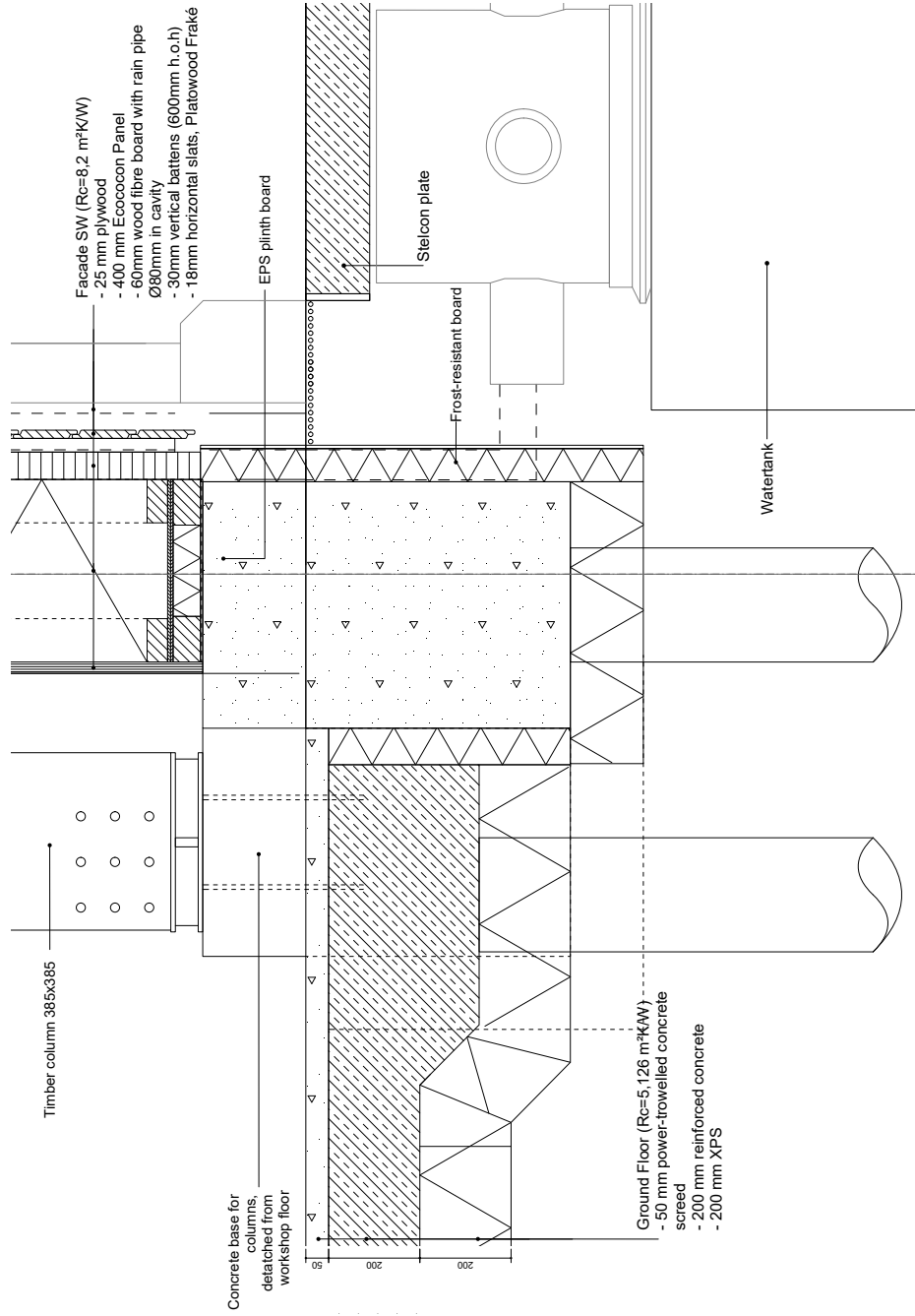
- 385 mm timber beam
- 200 mm CLT
- 300 mm sloped insulation
- 3 mm permeable absorption layer
- EPDM
- WRB 85 mm
- Filter
- substrate



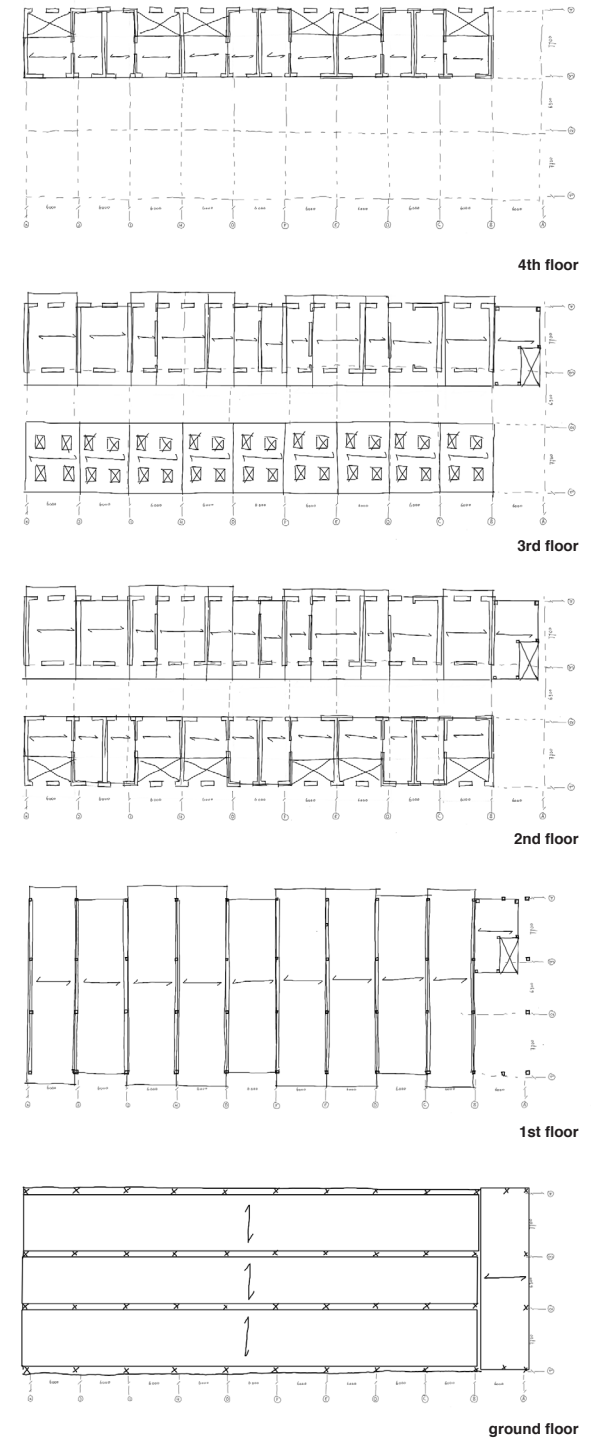
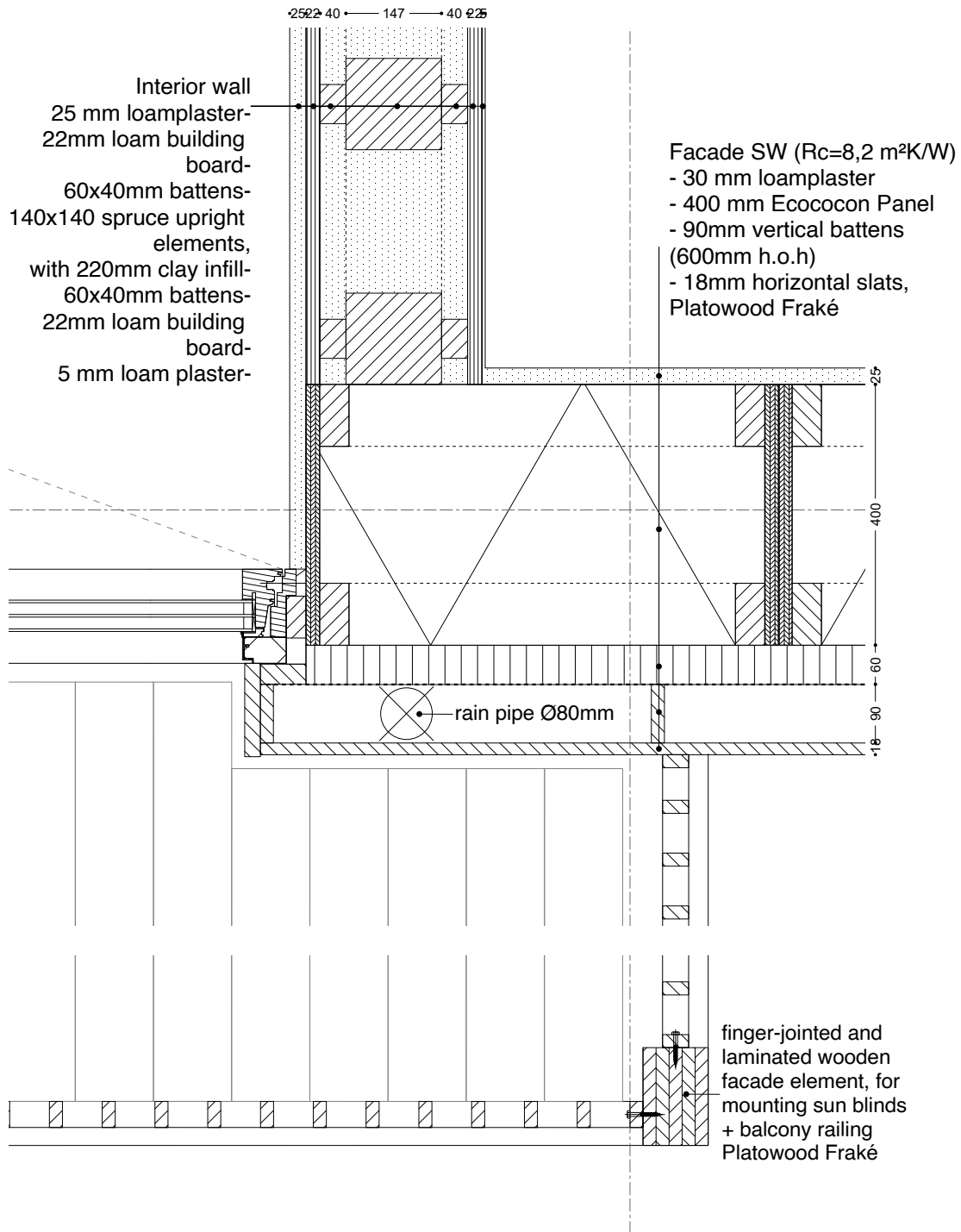
- * FLOOR INSULATION, HEATING, INTERIOR FINISH & BALCONY FINISH IS NOT INCLUDED IN THIS IMAGE
- ** WINDOWS & DOORS ARE NOT INCLUDED IN THIS IMAGE

These images show the relationship between the building concept and the use.



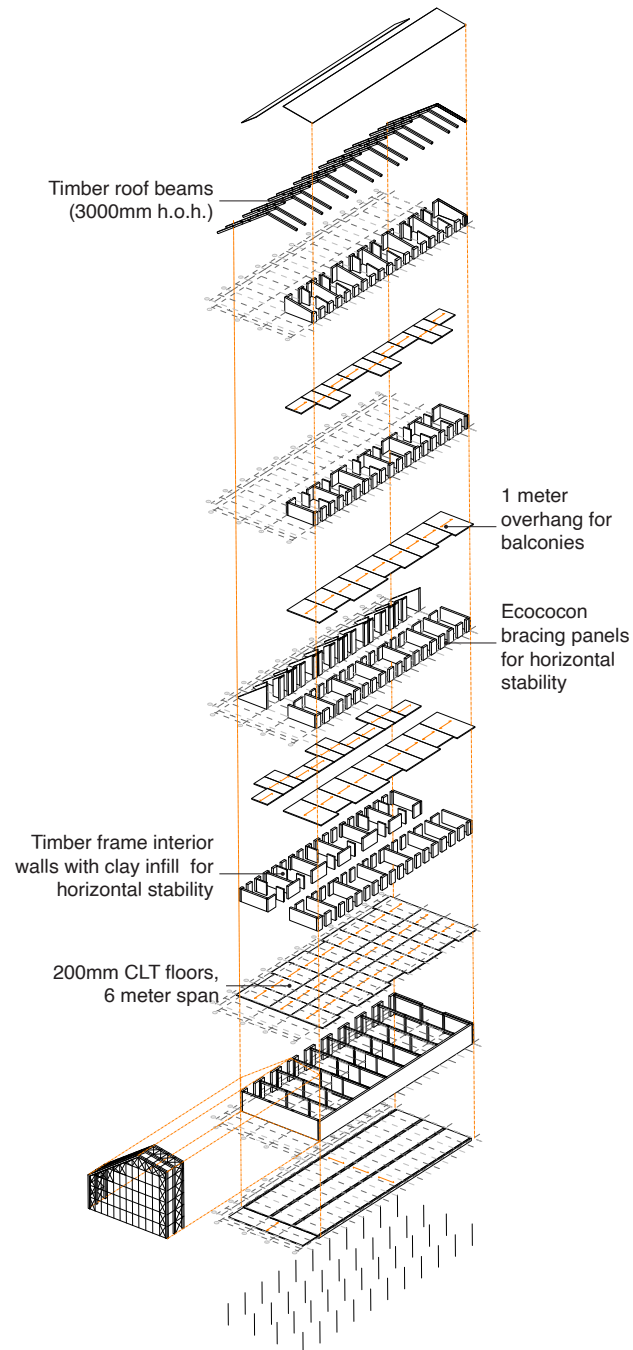


Structural Concept



Reflection

by Zedi van Oostrom, May 14th 2025



When I started studying at the Faculty of Architecture and the Built Environment in 2019, Prof dr ir. Andy van den Dobbelsteen said during the introduction lecture that we, as a new generation of designers, had a responsibility to build more sustainably to protect our climate. He continued by stating that this would mean most of us will work on renovation and adaptive reuse. That lesson stayed with me; I understood it as a generational challenge to adapt our entire Built Environment for a more sustainable future. As I understood it then, it was of the essence that we would find an approach to build less destructively.

Sustainable Architecture and my fascination for social and societal issues drove me to choose Advanced Housing: Ecologies of Inclusion as a graduation studio. I wanted to focus on the human dimension of circular building, as the Circular Economy – and, in particular, the Circular Built Environment at this faculty – has been argued as the necessary paradigm shift for a sustainable future. I understand the appeal as a master student of Architecture, yet as a citizen, I wondered how it is possible to achieve an inclusive transition towards an energy-neutral and circular housing sector. I knew that many people have little to no understanding of the technical aspects of their homes, yet their input and efforts are needed to adapt housing to future challenges.

With this project, I wanted to explore the following research question: “What role can architects and designers play in fostering an inclusive, energy-neutral and circular living environment?” I argued that this required a multidisciplinary approach. I conducted a literature review on Economics to define the research gap in the Circular Economy (and Built Environment) framework. Per my assumption, many researchers criticised the Circular Economy paradigm for focusing on technological fixes and one-size-fits-all solutions, with too little focus on social issues. Instead, scholars argued for a greater emphasis on communities and behavioural change.

Therefore, I also needed a theoretical framework drawing from Sociology and Anthropology, including works on technology adoption and the study of communities and lived space. Building upon Rogers (1962), Ostrom (1990), Latour (2004), Lucas (2020), and Stender et al. (2022), I shaped my methodology. I studied various communities within the Dutch context, with a special focus on my project location, Tanthof (Delft), and categorised these groups along Rogers’ Diffusion of Innovations curve. I conducted

informal and qualitative research, including participant observation, semi-structured interviews, painting, and sketching. These findings were supplemented by interviews with PhD researchers from the MBE department.

Using multiple research methods helped increase the validity of my work. In the discussion, I compared all research findings and recommended that architects take on a greater and more steering role in the circular transition. I concluded with six design principles: respond, collaborate, prioritise, demystify, stimulate, and visualise. (There is a lot more to these than just the buzzwords, but for this reflection, I keep it brief.) I am confident these principles are essential, as they are based on findings from various disciplines and sources. For example, the principle of stimulating spillover effects draws from behavioural insights observed in fieldwork at ecovillages, interviews with energy coaches, Latour's theory on "learning to be affected" (2004), as well as insights from Gibson-Graham and Roelvink (2010), Gil-Fournier (2019), and expert interviews with PhD candidates Ladislav Krutisch and Ragy Elgendy.

Of course, there were time constraints and personal biases, as is often the case with qualitative Anthropological research. Personally, these six principles have now become guiding principles for my position as an architectural designer. Yet knowing the limitations of my research, my hope is that these principles will evolve over time, be supplemented or even challenged, as I encounter new insights and perspectives.

Beyond the principles, I think the greatest lesson for me is that architecture does not have to be destructive – it can be restorative. During this project, I attended a lecture by Fuminori Nousaku and Mio Tsuneyama. While it did not explicitly end up in the report, it deeply influenced my position and design. They argued that architects can radically shift the supply chain by making conscious material choices. That lecture made me more hopeful about the architectural profession and inspired me to create a more hopeful narrative.

My design is a visualisation of a circular future, grounded in its site and empowered by its people. Throughout my research, I constantly reflected on my findings and sought to implement them in my design. I was fortunate that sometimes the process flowed both ways: I would design something, and days later find data that supported that decision. For example, on December 7th, 2024, I wrote in my logbook:

“new idea inspired (strongly...) by Object One: flexible building structure with a woodworking shop that accommodates the building process for the building itself, but also the houses in the surrounding neighbourhood.”

A few days later, conversations with energy coach Peter, researcher Ragy Elgendy, and a visit to an ecovillage all reinforced this direction (See also, Figure R.1; R.2; R.3; R.4).

Conversations with my tutors were essential in concretising both design and research. Initially, I had the idea of a completely circular building, meaning only biobased and reused materials and a fully demountable structure. My tutors helped me introduce more nuance — for example, to think in terms of fixed and flexible, and to reconsider the assumption

that demountable structures are always the most adaptable solution. Ruurd especially helped me refine my technical story and align it better with my design and research. He encouraged me to show not just that circular design is possible, but also to strongly focus on why that matters and how all building elements are working towards that aim.

In my report, I argue that responding to local contexts and collaborating with local actors is essential for adopting circular living. Therefore, part of my research and most of my design is specific to the local conditions in Tanthof and not directly transferable. However, I argue that the six design principles are generalisable and valuable for other circular housing projects in the EU and beyond. In addition, exploring ecovillages and energy coaching through an Architectural-Anthropological lens is a novel and useful perspective for other designers and housing professionals. I was happy to receive feedback from an energy coach I interviewed, who now plans to visit one of the ecovillages I studied. It's a small impact, but perhaps it will spark new insights or conversations beyond this project.

In terms of ethics, I received written consent from all participants and shared a draft report with them on May 2nd so they could object or suggest changes. Some did, and I made adjustments accordingly, such as anonymising residents. I am aware that this research contains personal biases, and that researching homes always risks invading privacy. That is partly why I opted to use drawings instead of photographs. My fellow energy coaches were aware I was using insights from our volunteer work, but the residents were not, as it was never my intention to highlight individual homes. I only used generalised notes from these conversations to write about common patterns and barriers. I did not ask for formal consent from these residents because I was primarily there as an energy coach, not a researcher, and maintaining trust in those conversations was essential.

All in all, I look back on this project with contentment. I have developed a deeper awareness of residents' perspectives in housing projects, and I aim to carry that forward in my professional practice. It was a long process, and it allowed me to dive deeper into topics than I was able to before. It also led to new questions, such as how can I ensure that I use these findings in my career? But also on a social aspect, I am still curious how certain conversations with residents, researchers, energy coaches, friends, colleagues and tutors have influenced my design process. I can name at least thirty people who have given me input and insights that sparked new ideas for my narrative and my design. On the other hand, when I have pitched my design, I could see that everyone would have a different interpretation of the concept. I hope to be able to explore collaborative design in the future, and look into the question: how do stories and storytelling inspire new ideas?

- * de open kalend
- parkin: a common place; open common
 - now city

TO DO 6-12 middeag

- studio back: inbouw
- meubel: verstoren
- A, B, D
- beginnen aan Kavel Delft

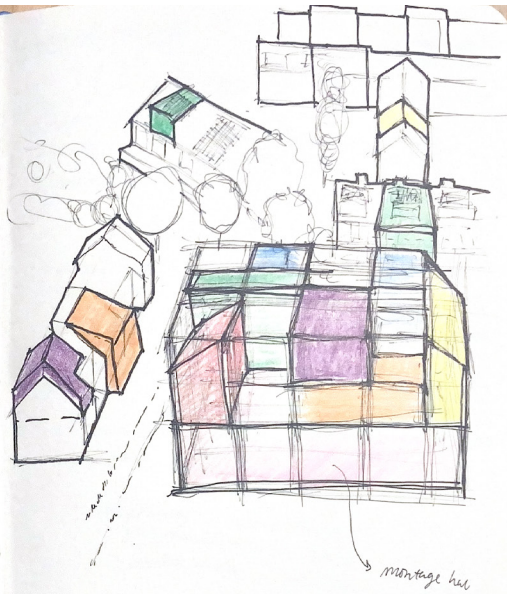
7/12

SPALL & MATTHE: Object One

- A multi-residential building designed to change
- Open-Building Principles (habraken?)
- Structural system that accommodates and encourages changes throughout its lifespan

→ new idea inspired (strongly...) by

Object One:
flexible building structure with a wood-working
shop that accommodates the building process
for the building itself, but also houses in
the surrounding neighborhood



its local 'prototypes'

maximal grootte een "klein" & "groot" bestaand
& "klein", "groot", "medium" nieuw bouwen

GESPREK MET PETERLOIS DUURZAAM

OP 8 DEZ 2024 10:00 - 12:00

- Peter & ik hadden afgesproken als voorbereiding van het energie coach gesprek vrijdagdag.
- Peter is project ontwikkelaar geweest voor de gemeente Rotterdam, Schiedam & als laatste Delft, nu is hij gespecialiseerd & vrijwillig energie-coach. Enthousiaste man.
- Hij legde zijn normale plan van zaken uit:
 - eerst contact leggen met bewoners & de vraag om het vloerplan te tekenen
 - hij zocht zelf ook het een uit:
 - energie label wijk & buur
 - planviewen → openvlaktes
 - Sonetview / Google maps → zonwanden & schaduw buur.

het gesprek

- eerst een praat over kachis & kachis: Peter merkt meestal een als leuks op aan de hand
- de gaten aan tafel & Peter vraagt nog meer waarom de bewoners contact op heeft gezocht met een energie coach. (kont gesprek je)
- dan lopen ze het huis door
- tenslotte noden ze af met een gesprek aan tafel over de verduurzamingsplan, als de bewoners daar nog anderszins ook leeft.
- Enkele af
- benadruk of voor de bewoners met plan van zaken

Peter heeft op One Nite een heel groot puntje om met de bewoners te spreken. Overstelt werkt hij die niet af.

- Peter gaf aan dat een gesprek v een uur, max 1,5 uur moet duren de gading informatie is voor een bewoner. Het gaat erom dat je een gesprek hebt met de bewoners aan de tafel zit. en je eigen voorbeelden aan de tafel zet.
- De meeste energie coaches zijn gespecialiseerd in de bewoners met een tekort aan kennis van de bewoners. Maar het is van belang dat het verhaal niet af te maken het is van belang dat de bewoners de meeste technische kennis, want de bewoners de meeste kennis af.
- Daarnaast is Duurzaam heeft 100 gesprekken gehad op 10/15 jaar. Dat is 1/30 ste v/d waarvoor. Koud v Delft. Vooral huurders zijn moeilijk te bereiken.
- Wat Peter zo mooi vindt aan dat werk is dat het heel laagdrempelig is voor mensen; het gaat om een eigen huis, niet een lezing oid. Dit kan de zin vullen.
- Peter heeft voorbeelden voor eigen bewoners t.o.v. huurders, omdat die zelf alles kunnen vinden, maar hij noden ook een beetje meewerken die huurders kunnen doet.
- Het is belangrijk dat mensen de kennis en ervaring krijgen. Vaak zijn mensen ook de bewoners het bos niet meer, maar dat er is een huis vast.
- winst van motivatie voor Peter & andere coaches (vrijwillig): duurzaamheidsplan. Volgens Peter valt er heel veel te winnen. De kennis opbrengt is groot & er zijn veel goede dingen waar je geen invloed op hebt. Maar op je eigen omgeving wel. Peter is zelf nu bezig met het afsluiten van een woning plan, met het afsluiten van een plan, waarvoor hij ook een plan heeft. Ook heeft hij een plan voor een woning plan, met het afsluiten van een plan, waarvoor hij ook een plan heeft. Ook heeft hij een plan voor een woning plan, met het afsluiten van een plan, waarvoor hij ook een plan heeft.

Figure R.1 Notes from 07/12/24: Preliminary concept

Figure R.2 Notes from 09/12/24: Talk with Peter from 015Duurzaam

14-12 Aardhuizen Olst

Vraag

- hoe raak & leefbaar?
- hoe lang & reeds om aan te sluiten?
- Verhaal over verhuizing
- kom wissel ontwerp + bouw? nog steeds?
- geleend over
 - omgeving
 - huis
 - gedrag
- met duurzaamheid
- plek die u fijn vindt?
- plek minder fijn/verander?
- Kun je lyke inrepen toe om?
- hoe tot stad gekomen?
- bent u in gedrag veranderd?
 - elementen uit geb. omg. die daan aan bij gedrag hebben?

aan de
"het gezonde eigenwone mens is wel hoog keur."
- plek verleggen onder de brand
- heeft men een over plan
- katten app: appo die katten poepen
- doet de vogels kom binnen

Geen and over zelf kiezen:
"nieuwe churk in dat wel meer"
b. het bouwen van een eigen huis

Conclusions & 10 jaar

Offer low-tech tangible
solutions
- supported by Elgendy, Karboun,
Aardhuizen, Energy Council

planned behaviour

- step by step influencing decisions
- other incentives the saving money
- health (air quality)
→ tools to show CO₂

current renovation rate in Europe
is less than 1%
- still a risk for people to invest in innovation

architect's role

- make clear for people what to expect
- visualise!
→ online 3D tools
- talk to people
- prototypes for standard building types → architects can work on more value solutions

Laetia Karboun challenges to solve

- 1) the buildings that are already there 80%
- 2) new-build → which is not being built currently now (already behind), how long it takes

- cultural thing, people are not use these new typologies
- still lack of education
→ not mass phenomena
- bigger shift in education & training

social aspects
cognitive biases
- sunk cost effect
- spillover effects

→ have lots to do with that
- proactive municipalities

architectural intervention

- low-tech
- tangible
- giving people the options experience beforehand → VR ex.

Figure R.3 Notes from 14/12/24: fieldwork at Aardhuis Olst

Figure R.4 Notes from 12/12/24: Interview with Ragy Elgendy

Afterword

This project would not have been possible without the support and guidance of my tutors—Olv Klijn, Alejandro Campos-Urbe, Brook Haileselassie, and Ruurd Kuijlenburg. Thank you for meeting with me throughout the year, for your valuable tips, inspiring references, and your critical questions that helped shape this work.

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I am deeply thankful to the residents of De Aardehuizen, Geworteld Wonen, and Boschgaard for their openness, hospitality, and willingness to show us around. Gerard, Frans-Jan, and Ted—thank you not only for all the insights but also for the soup and lessons about trees. Eugenie and Peter, thank you for telling me more about my grandparents' former home. Liesbeth and Ruud, thank you for the wonderful lunch. Every place I visited during this project made me feel genuinely welcome, often leaving me saying “thank you” on repeat.

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