Accelerating an inclusive energy transition in owner-occupied and rental housing

The sustainable governance of Utrecht Overvecht's existing housing stock

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Preface

The picture on the front page is a typical 10-storey apartment building in Utrecht Overvecht. It looks like it was taken shortly after construction. Back then Overvecht was considered to be a neighbourhood answering the desires of the 60s. Large green areas, large shopping centre and the ability to use the car to the fullest extent. This was considered modern. Nowadays these flats have aged and are in need of renovation. Socially it is the weakest neighbourhood in Utrecht and the in the 60s considered pinnacle aspects are sometimes harming its future. But I think it could be changed for the better.

Before you lay my master thesis: *Accelerating an inclusive energy transition in owner-occupied and rental housing*, where I try to add to the debate around the energy transition in combination with sustainable governance and inclusion. This focus on inclusion was a personal desire as in the political landscape of the Netherlands there is a large debate ongoing about what to do with the energy transition. Some parties call for ignoring the transition altogether in order to save people the expenses and others make it their leading argument. I wanted to find out whether we could arrange a transition that would remain inclusive and made sure that everyone could benefit in a reasonable way, preventing a transition which is solely for those who can afford it.

I want to thank my internship Arcadis, in offering me a chance to do my research, surrounded by people where I could ask my questions, discusses the issues or to take a stroll talking about the weekend. The knowledge and people at Arcadis definitely shaped my research where I felt motivated to continue and to do my utter best. Special thanks to my mentor Fenna, you helped me shape my thesis and helped me to get around the company. Another special thanks to my peer group of interns, where we discussed everything related and unrelated to Arcadis, thesis and life in general.

I want to thank my teacher Gertjan Wijburg in assisting me in creating order in the chaos, helping me make the best demarcation for the research and to create the best thesis that I could possibly write. You were always available to assist me in need. Even though on the other side of the ocean, we were able to discuss theory, chapter ordering and everything else thesis related.

Of course, do I thank my family who read the thesis even though it was inconvenient in timing and far too long to be interesting. Always ready to ask how I was doing and hearing me out about the energy transition while their interest was already dwindling away as I went on and couldn't get to a close.

Thank you all.

I invite you to read into the process and the governance of the energy transition in Utrecht Overvecht.

Bram Ravestein
06-09-2019

Summary

Sustainability has become one of the most important global issues that needs to be addressed. In the Paris agreement, 186 nations agreed to stay within 2 degrees Celsius temperature increase. Each nation has to translate this agreement to their own policies and then translate it to concrete changes. The energy transition is one of these policies. This research looked into the feasibility and the governance of an inclusive energy transition in residential housing. It combined sustainability with the complex local context by merging urban and sustainable governance.

The energy transition must be seen as a social transition, rather than a technical/financial one. With millions of households needing to change their energy supply before 2050 many of whom have not sustainability as one of their top priorities. In the end, the technical/financial side of the transition must be arranged correctly if the transition is to be successful and inclusive, and thus cannot be overlooked.

There are two approaches to the energy transition, the social approach with means attaching the transition to something residents desire, so that they are willing to pay for it. Or, the technical/financial approach, wherein the transition is arranged in a way in which it removes the burden of transitioning entirely. These two approaches deal with the social aspect of the transition differently. The interplay of these approaches in different neighbourhoods remains unclear.

In order to make sure that the sustainability is improved, an overarching goal needs to be set. However, in order to make sure that the implementation in the complex local context is feasible, owners of houses need to be involved in the process. This research presents a model wherein both the goal setting, as the local context is implemented by assigning different goals where actors can have an influence in. In the last step, the implementation is based on many actors working together. Resident initiatives may have an important role in this implementation as they may be able to tailor the policy to the local context in which they operate.

Keywords: Energy transition; inclusive; Utrecht Overvecht; sustainability; governance; housing.

Content

1 Introduction

1.1 Introduction in the topic

One of the world's biggest challenges today is the prevention of potentially disruptive and man caused climate change. As climate change accounts for increases in extreme weather, changes in the food production capabilities and increased chances of flooding and draught, it may lead to a collection of environmental problems that challenge our existing ways of living. In the 2016 Paris agreement 186 nation-states across the world agreed on a maximum temperature rise of 2 degrees Celsius and agreed to try to stay below 1,5 degrees (Bridge et al., 2013; UN, 2016; IPCC, 2018). In order to accomplish this goal, there is a global need for large CO_2 emission reductions and every country should do its part in reducing emissions.

In the Netherlands, housing is one of the sectors that emits large amounts of the CO_2 as the total built environment accounts for about 20% of all Dutch emissions (Vringer et al., 2016). The current energy system is based on the use of natural gas. Natural gas was found in northern regions of the Netherlands in the 50's (Treffers et al., 2005). After the discovery of these large natural gas reserves within the Dutch borders, the Netherlands doubled down on natural gas as a main energy source for heating. Most of the houses in the Netherlands use central heating systems powered by natural gas (Hoek & Koning, 2018; Huisman, 2018a). Currently 7.2 million (2017) houses rely on natural gas for their warm tap water and heating out of the 7.7 million houses that are currently occupied in the Netherlands (Huisman, 2018a; CBS, 2019). Out of all the energy used by houses in 2016, 72 percent was drawn from natural gas (CBS, 2018). Natural gas is deeply imbedded in the roots of the energy system of the Netherlands, with a natural gas distribution network covering a total distance just under 100.000 kilometres (Sodm, N.D.). However, the Dutch government decided in 2018 to move away from natural gas and to become a natural gas free country in 2050. Both to further the energy transition and because natural gas extractions are causing earthquakes which has set off a national debate about the use of Dutch natural gas and its downsides (Rijksoverheid, 2019). The effects of the decision to become natural gas free means that the over seven million houses need to be transformed from natural gas heating to an alternative energy source, i.e. electricity, central heating district, hydrogen gas or another solution (Huisman, 2018a).

In academic literature and popular debates, this transition is called the 'energy transition', i.e. the gradual or abrupt replacement of fossil fuels by sustainable energy sources (Loorbach, 2010; Bridge et al., 2013; Koster & Anderies, 2013; Loorbach et al., 2017). A transition is a "*substantial change and movement from one state to another*" (Shove & Walker, 2007, p.763) in which the current regime is phased out and a new regime takes its place and becomes institutionalised and stabilised (Loorbach et al., 2017). In the case of the energy transition fossil fuel-based energy will be replaced by sustainable energy sources whilst maintaining a stable energy supply. The energy transition will require different kinds of changes at various scales and levels; from residential housing, to housing blocks, entire neighbourhoods and various districts of cities. Every company, household and citizen must change their structural way of consuming energy as they heat water, warm their house and power the appliances. Realising these changes mean an investment into different elements of the

urban built environment, often transforming the current ways in which energy systems are functioning and neighbourhoods are arranged. An open mind in evaluating the required governmental, legal and spatial challenges allows for an understanding of the possibilities and limitations of the energy transition. When understanding the possibilities and limitations of transitions, as well as their contradictions and tensions, transitions can be guided more efficiently (Loorbach, 2010; Loorbach et al., 2017).

In this research three pillars of the process of the energy transition are recognised: social feasibility, financial feasibility and technical feasibility. These are derived from transition literature (Loorbach, 2017; Hölscher et al, 2018). Social feasibility is about getting people ready to accept the change of their energy provision and uses at the level of human action and cognition (Innes, 1996; Assefa & Frostell, 2007; Wüstenhagen et al. 2007; Laurian, 2009; Perlaviciute & Steg, 2014; Vringer et al., 2016; Loorbach, 2017). Financial feasibility is about being able to finance the energy transition, including the ability to generate capital (Byrne et al, 2016; Hall et al., 2016; Loon & Aalbers, 2017; Polzin et al., 2017; Wijburg et al., 2018). Technical feasibility is about creating solutions and innovations that provide the required energy levels in a sustainable and economically efficient way (Levi, 1997; Kern & Smith, 2008; Bridge et al., 2013). These three must all be sufficient enough in order to lay a foundation for the successful implementation of the energy transition. Without the support of one of these pillars it is unlikely that energy transition solutions are implemented.

Cities differ from one another, they have different economic qualities, different sizes and different policies in place. This implies that the forces which drive the energy transition will be different from city to city, leading to different ways and strategies to implement the energy transition. The energy transition has many faces and in this research the focus will be on the energy transition in houses. The owner of the house has partially the responsibility for the energy transition. There are generally three types of ownership of houses: public, private and owner-occupied (Geltner, et al., 2001). Rental housing generally has a private landlord or a large corporation as an owner; the corporation can either be public or private. Owner-occupied houses are generally speaking owned by families or households with a mortgage owning. They maintain the building themselves.

There is a lot of literature about the energy transition (Koster & Anderies, 2013; Byrne et al., 2015) that describes the general aspects of the transition or institutions that have an effect on the transition (Shove et al., 2007; Loorbach, 2010; Loorbach et al., 2017; Hölscher et al., 2018). Some research has analysed the energy transition specifically in the Netherlands (Winston, 2014; Leeuwen et al., 2017), with a more general or urban scope (Bridge et al., 2013; Hoppe & Bueren, 2015; Moss et al., 2015). Other literature has focused more specifically on low carbon cities (Hodson et al., 2013), energy systems to power cities (Goldthau, 2014; Hall et al., 2016) and literature about changing real estate investments towards sustainability (Byrne et al, 2016; Hall et al., 2016; Loon & Aalbers, 2017; Polzin et al., 2017; Wijburg et al., 2018). Lastly there is literature about the governance in urban systems and sustainability (Jessop, 1998; Stoker, 1998; Kearns, 2000; Kemp et al., 2005; Hysing, 2009; Rhodes, 2007; Zeijl-Rozema, 2007; Obeng-Odoom, 2012; Wegener, 2012; Lange & Driessen, 2013; Newig et al., 2018). However, relatively little is written about the process of the energy transition from a housing point of view with governance as a vessel to understand the process. With a scope that has a

focus on sustainability, the process of the energy transition and how that works through governance, this research combines multiple aspects of the energy transition that are often researched separately. Therefore, can this research add to the understanding of the energy transition of existing housing in a more thorough way, where the feasibility and the sustainability of the transition are safeguarded.

Throughout the entire research, inclusiveness will be a main point of view. Inclusiveness is important because there must not be a divide between those who can and those who cannot afford and access the energy transition. When implementing the energy transition in a way that it enables those with limited capital or abilities to participate—or gives them solutions to overcome these limitations—then the energy transition is accessible to everyone and everyone has a sufficient energy supply.

For a better understanding of the governance networks the case of Utrecht Overvecht will be used. This neighbourhood generally has lower incomes which leads to difficulties when keeping the energy transition inclusive. There is also an aging built environment and public spaces that need renovations. The municipality of Utrecht has selected Overvecht-North to be the first neighbourhood where the natural gas lines are removed altogether.

1.2 Research question, objectives and relevance

The main question that is central in this research concerns the energy transition and how we can add to the acceleration of the implementation. As mentioned before, there are many components of the energy transition, of which houses are a vital place where people live and reside. Therefore, the energy transition in houses has less of a technical feeling to it, but a more personal as a person's home needs to be adjusted. The energy transition must not be seen as an individual problem, whole neighbourhoods and blocks have similar objectives. Consequently, this research aims to add to the answer of this basic question: *how can we accelerate the energy transition in neighbourhoods*? Acceleration means a change in the current process where the implementation of solutions can add to a complete and stable new energy regime where people enjoy the comfort of reliable heating and power for their appliances for manageable costs.

This research will incorporate the previous mentioned elements and present an analysis on the implementation of the energy transition. The analysis will contain an overview of the process of the energy transition based on important stakeholders, e.g. government, owners of houses, public utility companies, etc. This process will be analysed and made clear using the case of Utrecht Overvecht. Lastly a debate on the governance models that arise from the literature and which are expanded using the interview data.

The central research question will be: *How and to what extent is an inclusive energy transition in residential housing feasible and how must the governance networks operate to accomplish this goal?* There will be three sub-questions:

- What national, regional and local policies are facilitating and enabling the energy transition in Utrecht Overvecht?
- What is the critical reflection and policy recommendation on the current trends regarding social, technical and financial feasibility in Utrecht Overvecht?

- How can governance networks operate more generally to accomplish an inclusive energy transition?

The relevance of this research and contribution to the society is twofold. First, the energy transition at present remains in its infancy with many challenges, as there is a lot of uncertainty about possible solutions to tackle all the different layers which potentially involve the energy transition, whilst maintaining a good quality of energy supply for everyone. This research tries to add to the ongoing search to further the energy transition by focusing on the process and trying to find social, technical, financial and governance methods of acceleration towards a good and stable outcome of the transition. Which is relevant to those who need to change their energy supply in the future, the millions of houses in the Netherlands and others worldwide. Ideally, with greater understanding of the process, the implementation may be more efficiently streamlined, leading to solutions that better fit the requirements of different neighbourhoods. By focusing on lower social class neighbourhoods, the most difficult neighbourhoods are being studied. This focus on inclusion should allow the research to be applicable to other cases throughout the Netherlands as well.

Second, this research tries to make the energy transition more attainable for everyone by using governance networks to further the energy transition, which has a societal goal to lower carbon emissions and create a more sustainable future. This research sees the energy transition through a governance perspective, and this can create a greater understanding of how cities can use governance to meet the global, national and local sustainability goals. This research also focusses on the relation of the energy transition to other goals and how multiple goals interact in governance networks. In ways it helps cities with the governance of the transition.

The scientific relevance has two elements. First, this research has a focus on inclusion which is a different scope than most of the academic literature concerning the energy transition, where there is mostly a technical focus. Looking at the energy transition, differently than most of the current literature, makes that this research adds to the literature debate on the energy transition from an alternate perspective. A perspective where inclusion is paramount, which means rather a social focus than a technical one. Second, as said with the societal relevance, the other perspective of this research the governance of the energy transition. This approach also adds to the urban and sustainable governance debate in light of cities becoming sustainable. This research also creates a workable model out of the two governance approaches which is altered by the gathered data adding a practical perspective on the model. Many cities struggle with this challenge and the academic discussion is also still ongoing, so discussing the energy transition, along with this model, helps cities with the transition and adds to the academic discussion.

1.3 Reading guide

This research is constructed around the theoretical framework (chapters two, three, four and five) where chapter five discusses the operationalisation where the results section builds upon. Chapter six lists the methodology used in this research. The seventh chapter details the results in three parts were the sub-questions are systematically answered. And the eighth and ninth chapter are the conclusion and discussion.

2 Sustainability contexts

In this chapter the context surrounding the sustainability debate—scientifically and socially—will be discussed in two parts. First, an overview of what sustainability is and how we came to our current understanding of it. And secondly, an overview how transitions work, what the process is and how one can lead to a wanted outcome.

2.1 Sustainability, what does it mean?

The sustainability debate has been going on ever since the second world war. But it has experienced three moments with increased public interest, or so-called 'wake-up calls' by Cramer (2014). Herein the perception of the sustainability challenge changed as well as the responses to the issues at hand. The three wake-up calls will be shortly explained, mainly from a Dutch perspective. Thereafter the current developments on sustainability will be explained. Lastly, there will be a short introduction to the definition and the current point of view of sustainability.

2.1.1. The three wake-up calls & current developments

The first wake-up call came as a reaction to the visual pollutants that people saw and experienced. These pollutants came into view after the fast industrialisation that the reconstruction after World War II brought (Cramer, 2014, p.13). Local pollutants created a realisation that the industry was having a negative effect on the environment as heath issues were pertinent and large soap foam clouds were floating on the rivers. These visual and clear effects led to an immediate response from the society who collectively agreed that there had to be clear changes. This reaction was partly fuelled by international literature on the limitations of the—then current—economical model. '*Limits to growth*' (1972) by the Club of Rome explained that resources were to diminish in the future due to the model of using and discarding resources immediately (Cramer, 2014, p.13-15). This book, and the visual pollution, created a broad movement for a cleaner environment. The government responded and created legislation that acted on the visual and noticeable pollution. The government also created governmental bodies that had the responsibility to measure and understand what environmental pollution meant (Cramer, 2014, p.17-34).

The second wake-up call is mainly around the publication '*Our common future*'—known as the Brundtland-report—published in 1987 (Cramer, 2014, p.35). The report was a reaction to '*Limits to growth*' and provided a clearer understanding that the environment and economic progress are deeply linked together and that there was a need for a new kind of economic progress: sustainable development (Cramer, 2014, p.35). In this era the idea of PPP (People, Planet, Profit) got traction, where there is a minimum bar that companies need to strive towards in order to be able to conduct sustainable business. This meant that not only governments were tackling the environmental issue but companies as well (Cramer, 2014, p.60-63, 69-70).

The third wake-up call was again sparked by a book, '*The inconvenient truth*' of Al Gore in 2006. It was one of the first to broaden the idea of global warming, now referred to as climate change. Where climate change affects the weather conditions and creates dangers to the people living in vulnerable

areas like coastal areas (Cramer, 2014, p.71). In this era the scientific and societal debate around sustainability became clearer; the consequences of climate change, the rising population and the increasing pressures on vital resources were more extreme than anticipated before (Cramer, 2014, p.71-76). It became clear that beyond the visual pollution there was more to tackle.

As said in the introduction, the Paris accord laid the groundwork for today's global climate approach. Article 2a says: "*Holding the increase in the global average temperature to well below 2°C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5°C above pre-industrial levels, recognizing that this would significantly reduce the risks and impacts of climate change"* (UN, 2016, p.29). This means that almost all counties—and all the large polluters—agreed upon the prevention of too much climate change. However current CO_2 and other greenhouse emissions gasses are still increasing. In 2017 the emissions of all gasses increased with a total annual increase of 1.3% reaching a new CO_2 equivalent record of 50.9 gigatons. The division was where China accounted for 27% of all worldwide greenhouse gas emissions, the US 13%, the EU 9%, India 7% the Russian Federation 5% and Japan 3%. India showed the largest growth of 2.9% (Olivier & Peters, 2018). This means that the current emissions are about 55% higher than in 1990 and 40% higher than in 2000. The greenhouse gas emissions worldwide have exponentially increased since the beginning of this century. Leading to 2017 being the warmest year on record, without an El Niño (Olivier & Peters, 2018). The 10 warmest years on record were in the last 10 years with one in 2015 which means that the record for the warmest year is being broken consistently within the last 10 years.

2.1.2 The definition of sustainability

General sustainability can best be defined according to the Brundtland-report as: "*sustainable development makes guarantees that current generations have enough means to live sufficiently without reducing the means for future generations to live equally sufficiently*" (Priemus, 2004; Winston, 2012; Cramer, 2014, p.35-37). Key elements of this definition are providing a sufficient living standard, acknowledging the ecological borders and maintaining quality in and between generations.

This research has a focus on the built environment, a more precise definition can be given following the sustainable urban development (SUD) framework: "*SUD is perceived as improving the quality of life in a city, including ecological, cultural, political, institutional, social and economic components without leaving a burden—e.g. the result of a reduced natural capital and an excessive local debt, on the future generations—and thus forming the sustainable city*" (Yigitcanlar & Teriman, 2015 p341-342). This definition uses the idea of not harming future generations from Brundtland but applies it to the built environment where people interact with buildings and space in a city. This research will use this definition to define sustainability where the social aspect of sustainability is more embedded.

2.1.3 The energy transition

The energy transition is a shift from the use of fossil fuels towards sustainable energy supply. The key idea is that all consumed energy ought to be generated in a different way using sustainable sources like wind, solar, biomass, hydropower, geothermal energy and hydrogen (Panwar et al., 2011; Miller & Spoolman, 2012, p.401-420).

There are two technical sides to the energy transition story: consumption and production, but also the organisational—governance—side. First, on the consumption side, energy use levels can be significantly reduced, providing that more 'energy efficient' uses are applied in a more optimal way (Miller & Spoolman, 2012, p.390-400). Electricity consumption can be reduced by using different forms of appliances and lighting. Reducing the demand for energy can be done by using more efficient heating and cooling appliances and applying better thermal isolation in buildings to retain the warmth and cold better. Another form of reducing the consumption of energy is to reduce the energy losses that occur in the system. A lot of potential energy is lost because it does not fit the required use or it is lost during transport (Miller & Spoolman, 2012, p.391-392). Some industrial uses require a high energy source and when the energy becomes too degraded (i.e. cooled down), it is no longer viable and discarded. Creating a network that collects the discarded energy for other uses increases the energy efficiency. Energy transport also consumes or loses energy. For instance, oil transport vessels use oil themselves to create motion. Also, with the transportation of electricity over long distances electricity is lost, leading to more electricity generated in order to meet the demand. In this case, shorter travel distances and smarter use of the electricity grit allows for less losses.

Second, on the production side, renewable–and in the medium to long run more sustainable—sources of energy can replace or gradually substitute non-renewable, fossil energy sources. There are five different forms of energy generation that have less of an impact on the environment and are renewable: wind, solar, biomass, hydropower and geothermal. Renewable means that the source is not finite like fossil fuels (Panwar et al., 2011; Miller & Spoolman, 2012, p.401-420). Difficulties for energy sources like wind and solar is that their supply is not constant. There needs to be a back-up system for when there is little sunshine or low winds. Positive features are however that these systems can be deployed locally and generally do not require large scale investments (Miller & Spoolman, 2012, p.401-409). Biomass as solution has a major downside that it requires vital agriculture land to generate energy, but it can be applied easily within the current system of liquid fuels (Miller & Spoolman, 2012, p.411-416). There are many forms of hydropower, some have a large spatial disruption and others have less. Hydropower potential is large but often requires large dams or technics that are still in their infancy like blue-energy (Bartle, 2002; Miller & Spoolman, 2012, p.407-408; Jia et al., 2014). Geothermal energy uses the earth's crust to either warm or cool. Almost everywhere geothermal energy can be utilised. However, geothermal power plants using the earth's heat can only be located on specific sites where enough energy reaches the earth surface (Miller & Spoolman, 2012, p.416-418). Lastly, hydrogen can be an excellent energy carrier. Only are they energy losses rather high and there needs to be energy available—like electricity—to create hydrogen (Miller & Spoolman, 2012, p.418-420).

The energy transition requires a different way of thinking about the energy supply. There is a need for a collection of energy solutions, connected to a smart grit where energy is produced, consumed and shared with one another (Miller & Spoolman, 2012, p.421-424). This makes sure that the benefits from each energy source can be utilised and as little as possible has to be created. One option may be decentralising the energy provision by using a polycentric approach rather than a centralised system where large distances need to be overcome. This polycentric approach is a method where energy is organised beyond existing scales and borders to accommodate the new diverse grit of energy

solutions (Goldthau, 2014). In order to achieve this new approach—where far more actors are involved then currently—there need to be new ways in which the actors are organised and managed, the governance of the energy transition. Table 2.1 shows an overview of the different elements of supply, demand and possible solutions.

Table 2.1: Supply versus demand and solutions

Supply	*Characteristics*	**Demand**	*Characteristics*
Wind	Endless but not consistent energy supply.	*Energy efficiency*	Energy efficient appliances, use of thermal isolation.
Solar	Can be locally implemented.	*Less energy loss*	Production that fits the needs of consumption more specific.
Biomass	Use of vital agriculture land. Works with current ways of consumption.	*Use of discarded energy*	Using industrial waste heat for other uses.
Hydropower	Can have a spatial disruption. Either existing technics (damns etc) or technics in its infancy (blue-energy)	*Transportation of energy*	Shorter distances for less loss via transportation. Local power sources rather than centralised power sources far away. Use a form of transport that uses less energy itself.
Geothermal	Large power generation only on specific sites. Warming and cooling can be used almost everywhere.		
Solutions	*Characteristics*		
Differentiated production	A mix of energy production where the weaknesses of one source are mitigated by the other.		
Smart grid	An electrical grid where energy is distributed, shared and stored efficiently to allocate supply and demand efficiently.		
Polycentric	Short distances resulting few losses, but still manageable with many small centres.		

2.2 Transitions, how do they work?

This part will focus on the theoretical process of transitions. First with a general definition of a transition. Secondly, how the process of a transition looks like. And finally, how the outcome of a transition can be steered.

2.2.1 General definition of transitions

Throughout history transitions have constantly changed our civilisation. From ships using wind to sail across the seas towards ships using the coal steam engine. The emergence of the transistor and the internet which has transitioned our ways of communication. Transitions have led the world to constant changing states and regimes. Now the energy transition is about the change of the use of one type of energy (fossil) towards another (renewable).

In the introduction a transition was generally defined. However, Loorbach (et al., 2017) defines it more specific as: "*the process of change from one system state to another via a period of nonlinear, disruptive change*" (p.605).

Therefore, a transition entails change from one state to another state via an unpredictable and not necessarily linear process. Grin et al. (2010, p.11-12) explains five characteristics of transitions:

1. Transitions are co-evolution
2. Transitions are multi-actor processes
3. Transitions are radical shifts
4. Transitions are long-term processes
5. Transitions are macroscopic, i.e. organisational fields

These characterisations need some further explanation. The co-evolution is the requirement of change in both the technical aspect of the transition as well as its use; the societal application. For the technology this means, for instance, the development of novelties and new industries. For the society it is about the adoption by consumers as well as the societal acceptance of the new technology as a whole. The multi-actor aspect means that transitions entail the interactions between many different actors from different social groups: companies, policymakers, social movements, scientific communities and users to name a few. The radical shift means radical in scope, not necessarily in speed. Transitions can happen either stepwise or gradually with the long-term process in a range of 40-50 years to completely transform to the new state. Breakthroughs however can happen more abruptly and within shorter time spans (e.g. 10 years).

Transitions thus consist of momentous change that happen over a long period of time which involves changes in both technologies and society, and effect all kind of layers and actors within the society. Therefore, transitions are analysed on the organisational level in order to understand the process and find ways to steer the course of a transition.

In the transition literature three analytical scales at which change takes place are recognised: landscape, regime and niche (Kern & Smith, 2008; Loorbach et al., 2017). The landscape scale contains the long-term external changes, for instance climate change which puts social and environmental presses on the regime (Kern & Smith, 2008). Underneath the landscape are various regimes, a regime is "*a dominant and stable configuration in a societal system"* (Loorbach et al., 2017, p.605). In the energy transition the socio-technical—both societal and technical—regime would be the fossil fuel-based economy (Kern & Smith, 2008; Loorbach et al., 2017). The current society is arranged around a dominant and stable regime which is currently being destabilised and becoming more fragile. Transitions often occur at the regime scale as they change both the technology as well as the social order that has been constructed around the technology. At the niche scale alternative (novelties) and new technologies are created, tested and–if possible–diffused or spread to the regime level. In the case of the energy transition these are often new energy solutions. These innovations develop on a small scale and slowly gain momentum by early adopters (Kern & Smith, 2008; Loorbach et al., 2017). In figure 2.1 the three scales are visualised.

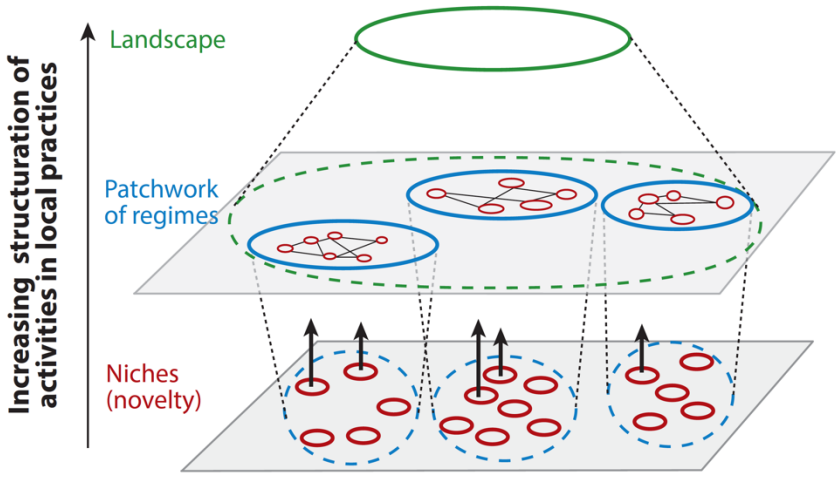

Figure 2.1: The three scales of transitions (Loorbach et al., 2017)

2.2.2 The process of a transition

Transitions work within the three scales and all these scales have an influence on one another. The strongest movements are bottom-up, from the niche to the regime and then from the regime to the landscape. Figure 2.2 is similar to the previous figure (2.1) but is accompanied with the influences and effects that the scales have on one another. Generally, a movement from the niche towards the landscape can be observed. The cycle begins when the landscape and regime's long-term movements motivate niches to develop. For instance, the discovery of a changing climate due to global human activities, issues niches to find alternatives that mitigate climate change. These niches start to develop and after enough development time the niche starts to compete with the regime, leading to a destabilisation of the dominant regime. The regime will eventually change, which has an effect on the movement of the long-term landscape.

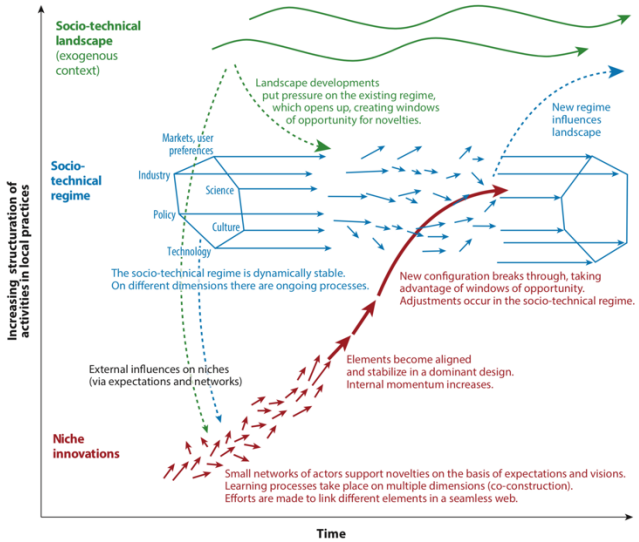

Figure 2.2: Transition movements in the landscape, regime and niche scale (Geels & Schot, 2007)

The chaos model can further explain the process that transitions go through when niches start to affect regimes. Transitions create the change from one regime to another however, this changing of

a regime is not a process that happens without conflict. In figure 2.3, the change from one regime to another is visualised with its uncertainties. When the current dominant regime is challenged by developing niches, the regime is destabilised as the niches gain traction by experimentation and implementation via early adaptors. These experiments and early adaptors make the niche become larger. And as it gains ground on the dominant regime, there comes a state of chaos. In this state, it is clear that the old situation will not continue as before, but it is unclear what the new regime will be. After the chaos, a new regime can institutionalise and stabilise and then truly become the dominant regime while the old regime beaks down and phases out. The old regime is then lost. It is certain that the old regime will phase out while it is uncertain that the new regime truly becomes stabilised or perhaps needs a new wave of transitioning before it becomes a new stable regime. Before inevitably the process repeats itself somewhere in the future as new niches trigger a new transition (Loorbach et al., 2017).

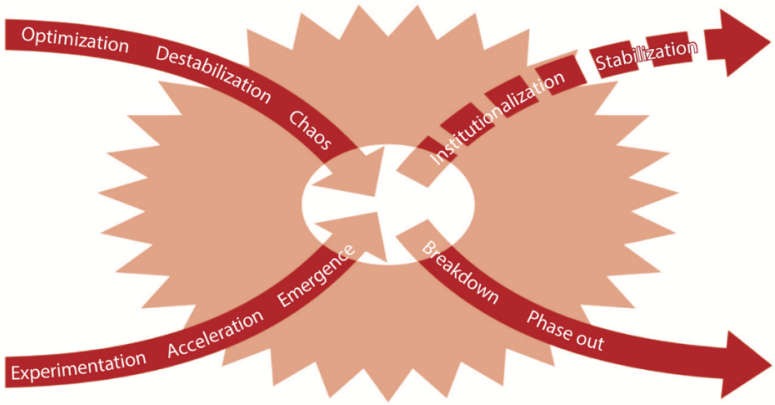

Figure 2.3: Change from one state to another (Loorbach et al., 2017)

2.2.3 Leading transitions towards a wanted outcome

There is a societal need to react to the current issue of climate change, which is in terms of transitions, altering the course of the long-term landscape. In order to change the course of the landscape, there needs to be a new regime, i.e. a disruptive change. However, facilitating inclusion while transitioning to a new regime, meaning that citizens need to have a certain social baseline like maintaining energy quality, preventing unreasonable costs and a process that is not unreasonably limiting their choices. This has the result that everyone can shift towards an alternative and not those with limited capital or limited options remain stuck with an ending infrastructure. Transitioning with these standards requires a guided process, and an outcome that contains a stable regime in which people enjoy sustainable energy security. In the end, with the energy transition there is a societal need for a stable process and outcome.

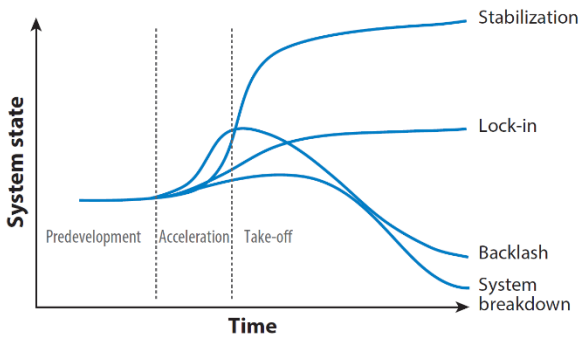

Figure 2.4: The possible outcomes of a changing regime (Loorbach et al., 2017)

Figure 2.4 shows the possible outcomes of a system in transition. System breakdown and backlash would be disastrous outcomes where the energy supply cannot be guaranteed. A lock-in would be an unwanted outcome as this would increase costs and does not allow for further development in the future. A stabilised outcome—as said before— would be best to deliver the quality that is societally wanted.

Transitions can happen without any influence of a government as it is a social process that is influenced by many (non-)governmental forces. On the other hand, some regimes that transition have a strong societal imbedding, which requires the aforementioned wanted outcome. Transitions can be steered into this wanted outcome. However, usually not by a government alone. Governance can be an answer to the issues that transitions bring. According to Loorbach & Rotmans (2006) transitions can be managed by influencing and adjusting the course. "(…) *the direction and pace of transitions can be influenced, even if not controlled directly*" (Loorbach & Rotmans, 2006, p.191). This means that when there is a need to influence the outcome—or the path that the transition takes—there is a need for governance to steer the transition towards the wanted outcome. The multi-level aspect of, the required long-term involvement and the societal aspect of transitions all share the influences governance has on a society. Therefore, can governance assist in the steering of transitions. The aspects of governance and the different variants will be discussed in chapter 3.

3 Transitions through governance

When wanting to steer transitions, governance is required to make sure that the result is within the societal needs. This chapter will discuss the governance possibilities and how governance should look like in order to achieve the set goals. First the spatial scale of the energy transition will be discussed leading to an overview of the urban governance debate and the deeply connected sustainable governance debate. Then the two concepts will be fused leading to a governance framework that theoretically fits the energy transition.

3.1 The energy transition, a spatial transition that differs in different cities

The energy transition is a part of the broader movement towards sustainable development, according to Wegener (2012), sustainable development has a distinct spatial dimension: "*The utilisation of space by humans for production, reproduction, consumption and leisure determines the consumption of material and energy, the locations of land uses and the pressure on the natural environment*" (Wegener, 2012, p.159). The location of activities has a strong impact on the above-mentioned sustainability of activities. These locations are mainly decided by private actors like firms and households whose choice leads to a spatial distribution of activities. Public actors, from local governments to for instance the European Union, have an important effect on this as well. Wegener (2012) also argues that in recent times the scale of our activities has increased greatly creating interconnected regions and locations where people, energy and materials flow through. While the problem sphere increases, the decision-making scale remains the same, creating more separation between them.

Secondly there has been a described movement from government to governance where there is a change from the hierarchal governing structures towards modes of governance where different levels of government govern using networks and soft policy instruments (Hysing, 2009). This shift happened because the government was unable to pursuit collective action. It had problems to "*impose its will on society because the governing challenges are too complex, diverse, and dynamic*" (Hysing, 2009, p.647). The story of the shift from government to governance tells a government that tries to find other ways of coping with the changes in society. Nation states in—for instance the European Union—see power moving towards higher branches of government like that of the EU and downwards towards other private actors and institutions. In order to influence these processes, governments use alternative ways of governing, making a move towards governance instead of using the power of government (Hysing, 2009). Section 3.2 will further dive into the meaning of governance.

The energy transition requires spatial answers in a larger scale then governments often work in. This means that a vital part of the transition is the cooperation between different public actors to coordinate the transition in all its aspects and scales. Private actors cannot be dismissed for their activities in the spatial dimension play a vital role in in the energy transition. While on the other hand, *"The state remains a central actor, especially with respect to legitimacy and accountability*" (Lange & Driessen, 2013, p.407).

3.2 Urban governance

Governance is a term that encompasses many aspects and features. The basic underlying point of view is that there is less of a hierarchal government and more a rescaling of the of the state. Often there is a decentralisation process and more cooperation by the state with the civil society and the market (Wijburg, 2019). From a top-down governmental approach towards a—in different forms—cooperative approach where the government works with private actors to solve problems (Jessop, 1998; Stoker, 1998; Kearns, 2000; Rhodes, 2007; Obeng-Odoom, 2012; Lange & Driessen, 2013). A general definition of governance can be best described as: *"(…) the development of governance styles in which boundaries between and within public and private sectors have become blurred. The essence of governance is its focus on governing mechanisms which do not rest on the recourse to the authority and sanctions of government."* (Stoker, 1998, p.17). Generally, another way of pursuing common societal goals. Rhodes (2007) identifies four key ideas of governance:

- Interdependence between organisations.
- Continuing interactions between network members.
- Game-like interactions, which are rooted in trust.
- A significant degree of autonomy from the state.

Many authors have different sets of ideas to describe governance. For instance, Stoker (1998) presents in his article five propositions of governance:

- Governance refers to a set of institutions and actors that are drawn from but also beyond government.
- Governance identifies the blurring of boundaries and responsibilities for tackling social and economic issues.
- Governance identifies the power dependence involved in the relationships between institutions involved in collective action.
- Governance is about autonomous self-governing networks of actors.
- Governance recognises the capacity to get things done which does not rest on the power of government to command or use its authority. It sees government as being able to use new tools and techniques to steer and guide.

The propositions of Stoker (1998) mostly aligns with Rhodes (2007). In the end, governance is governing through networks which makes governance broader than a government alone. However, with the aforementioned ideas, there is still an abundance of different forms of a governance network. Who operates in the network and which power relations do public and private actors have?

For instance, authors debate the amount of governance where Jessop (1998) stands on the one side with his meta-governance and on the other side Rhodes (2007) who argues for self-organisation of the society. With meta-governance the central government plays a major role in steering and organising the governance network to answer the complexity of governance issues. Meta-governance does not lead to an enormous governance 'monolith' but works with the still existing markets and hierarchies. Where the government is not the sole authority but takes control in the governance process. The self-organisation—Rhodes calls it network governance—is a bottom-up approach where the central government is less needed in governance networks. Governance with a central

government leads to unclear power relations and undermines the power of bottom-up constructions (Rhodes, 2007).

Urban governance is a specification of governance where there is a focus on the way local governments govern. On other words, the mobilisation of public and private actors for a collective action within the urban context (Obeng-Odoom, 2012). The role of urban governance has shifted over the years as local urban issues crossed borders. This led to a need of cooperation between more actors then before (Kearns, 2000; Obeng-Odoom, 2012). This happened along with a national government that is pulling out of the local landscape, leaving local governments to solve these issues by their own. Urban governance can operate within multiple scales; local, neighbourhood, region or national and thus multi-level oriented. Urban governance can therefore help structure issues that work on multiple levels and scales.

Obeng-Odoom (2012) argues that urban governance emphasises partnerships and relies on collaboration, leading to spreading the power of the state to other actors within and beyond a multi-level public context. Urban governance also uses the power of the market—he calls it entrepreneurialism—where there is a more efficient use of resources than to the government approach. Kearns (2000) reinforces this argument, the use of the market can mitigate the cutbacks that occur when the central government retracks and decentralises the power. Kearns adds that urban governance can increase the social inclusion because it opens the decision-making process more to the public, allowing the public to address local needs. When it comes to answering collective problems arising with decentralisation of the decision-making process, an urban governance approach can add to the structuring of the power relations, harnessing the qualities of the market and opening to public influence.

Successful collaborative governance is difficult to achieve. However, it is something a government can strive towards in order to increase the inclusiveness of the governance process. It needs to create a climate wherein actors trust, share commitment, share accountability and are willing to share risks (Johnston et al., 2010). This means that all relevant actors are included in a way that the process is organisational and timewise manageable. A way to allow participation in a governance process is by blending the formal and the informal side (Legacy, 2017). This way participation of informal structures can be added to the formal—state-let—decision-making process.

3.3 Sustainable governance

Sustainable governance can be sees as an extension of urban governance where the focus lies with the ability to improve the environment (Newig et al., 2018). As it has the same basic principles, a sustainable governance structure should answer sustainability problems as extra-urban problems. Kemp (et al., 2005) discusses governance and sustainability and how these two concepts interlink. The basis lies with sustainable development where four key elements arise:

- Current paths of development are not sustainable.

If nothing is done, the current way development works is unsustainable and will eventually end. Development is largely based on fossil fuels where there is a limited supply of. Secondly there is an overuse of natural resources which means that these too will eventually run out.

- Sustainability is about protection and creation.

Not only is sustainability about protection of important amenities—like nature, natural resources and cultural diversity—sustainability is also about advancement or creation. Creation of a better, and more just, world.

- Requirements of sustainability are multiple and interconnected.

For sustainability not only technical elements are considered. There is an incredibly important social element as the mindset of people must change. Also, long-term thinking must be integrated as sustainable development is inherently long-term oriented instead of short term.

- Pursuit of sustainability hinges on integration.

Lastly the elements of social, economic and ecological considerations must all be combined in one comprehensive approach. The scale of this approach ranges from the global objective to the local implementation.

Sustainable governance should give answers to the four aspects of sustainable development. Kemp (et al., 2005) states that merging sustainable development and governance requires three objectives: 1) governance must accompany all the elements of sustainable development, 2) governance must not assume the wisdom of the market and 3) there is no single or best form of governance as governance is influenced by the local context. Governance can only guide the transition to sustainable development and must always take a long-term view. There are various modes of governance which have different effects on the sustainability of developments. Sustainable development calls for collaborative, deliberative and polycentric governance models (Lange & Driessen, 2013). "*These modes are regarded as being able to handle the complex, multi-scale, cross-sectoral and long-term temporal aspects of SD in a more adequate manner than hierarchical ones.*" (Lange & Driessen, 2013, p.418). This means that horizontal and vertical cooperation is an essential part of sustainable governance. However vaguely guiding the necessary form of governance, governance must form to the required prerequisites of sustainable development which depends on the issue at hand. This means that the energy transition requires another form of governance than other sustainable issues. Also, different modes of governance can lead to sustainable outcomes, it cannot guarantee them (Lange & Driessen, 2013).

Hufen and Koppenjan (2004) identify four different modes of governance where the central government remains a steering actor:

- Rational governance; a problem-solving character via instrumental methods.
- Governance though policy networks; tackling the decision-making process via interaction between actors in networks.
- Governance though values; steering society via values, the right visions and words are important for the success.
- Governance from a distance; implementation using contracts and covenants, stakeholders participate in the discussion around the decision-making process.

In these four modes the amount of government steering is once again on a scale from more to less influence. Within the decision-making process there remain different approaches and different levels of influence by other actors. Zeijl-Rozema (2007) sets a framework where there are four quadrants with different approaches to sustainable development issues (figure 3.1).

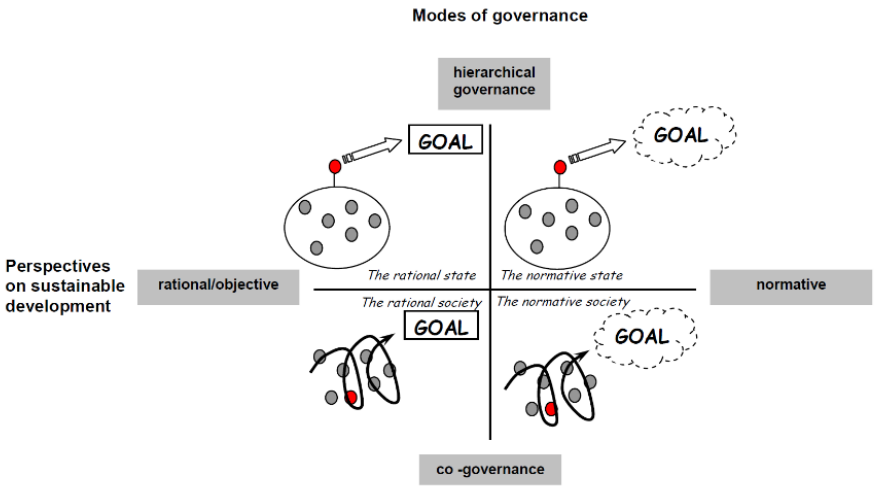

Figure 3.1: Conceptual framework of governance for sustainable development (Zeijl-Rozema, 2007)

In figure 3.1 there is on the vertical axis a hierarchal government, where the goal and the network are controlled by the government using a linear process to a co-governance approach where there is goal seeking by the government and the society and where there is an unfolding uncertain process. And on the other axis a rational/objective approach, where there is an ultimate goal which is measurable to a normative approach where there is a vague goal contextually determined. Multiple modes of governance can be found in the four quadrants of this framework.

A mode of governance that is best fitted to tackle the energy transition is—as of yet—difficult to say. The local context has an influence that is too strong for one all-inclusive type of governance that answers the entire energy transition. However, guidelines of governance can be given. Some authors argue that there is a need for more government (Wegener, 2012) instead of more governance (Rhodes, 2007) to tackle large scale and long-term issues. When addressing the energy transition, the self-organisation governance model may not be the best as a leading government may best find solutions that work locally as well as in the national and international scale, and are protecting the minority groups that have difficulties to defend themselves. Further chapter will deal with the inclusive part and will try to combine the two governance perspectives.

4 Inclusiveness and feasibility

The process of the energy transition is a process that has a strong impact on the lives of people, requires large financial investments and makes major changes in the technologies used for energy production and consumption. In order to have an inclusive solution to the energy transition, all these three elements must be present. This research therefore defines three 'pillars' that carry the energy transition: social feasibility, technical feasibility and financial feasibility. Without one of these feasibilities there will not be enough support to further the energy transition. These feasibilities are not stand alone as they have an influence on each other as well (Assefa & Frostell, 2007; Grin et al., 2010, p.11-12; Loorbach, 2017). In this section the thee feasibilities will be theoretically explained and defined.

In figure 4.1 the three types of feasibilities are ordered in two pillars. As can be seen the social feasibility is separated from the technical and financial feasibility. Social feasibility–in comparison to the other two–must deal with the human aspect of the transition, whilst the technical and financial feasibility can be seen as feasibilities that need work but not require the human aspect. They can be seen as checkboxes that need to function.

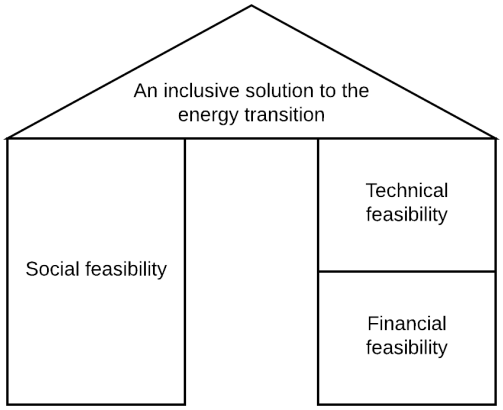

Figure 4.1: Three pillars to an inclusive energy transition

4.1 Social feasibility

As one of the key pillars of the process of the energy transition, social feasibility is a broad concept where there are various parts that influence the total social feasibility. However, this research defines social feasibility into three indicators where the scope of the concept—regarding an inclusive energy transition—will become clear: social trust, social perception and social acceptance. Together these three indicators form the theoretical basis for social feasibility of the energy transition.

The social feasibility is different for owner-occupied housing than for rental housing. The differences will be made clear when defining the different indicators.

Social trust means that there is a trust relation working in two directions, either the government/governance to the society and the society to the government/governance (Laurian, 2009; Perlaviciute & Steg, 2014). This trust includes elements like honesty, security and politics. With honesty it is mainly the government/governance that is honest with the way it approaches the energy transition (Laurian, 2009). This means that the government/governance is allowed to take time in order to find a solution and that knowledge about the possible solutions may be temporarily incomplete (Innes, 1996). But honesty also means that the government/governance shows a realistic timeframe and is open about the relevance of the issue at hand (Innes, 1996). Security is about creating and maintaining a guarantee. Security as in not raising living costs, the value of the property and security that the performance of the system is sufficient (Perlaviciute & Steg, 2014). Lastly, there must be trust in the political discussion, i.e. political stability and clarity so that the society and the governance network know what they can expect in terms of formal rules and regulations on the long run. Forming shared social values can be a foundation of said trust in the politics (Laurian, 2009; Perlaviciute & Steg, 2014). Shared social values make actions by a government more predictable and increases the willingness of others to participate. Trust must be maintained as it is easier lost than gained. Trust can be influenced by the amount of knowledge that actors have as a lack of knowledge effects the willingness to participate. The amount of knowledge makes that people do or do not understand the effects that the energy transition has on their lives (Innes, 1996; Assefa & Frostell, 2007; Laurian, 2009; Vringer et al., 2016). This knowledge can either be a lack of technical insight and/or not understanding the motives and intentions of stakeholders—governance— (Wüstenhagen et al., 2007).

Social perception is about the perception that people have about the energy transition (Assefa & Frostell, 2007; Batel et al., 2013). This perception is shaped by the comfort of the energy transition, the way actors in the transition work together and the way the energy transition may improve the ease of use/quality of life. Comfort is shaped by realisation of the technological side, e.g. construction activities and the amount of change in the houses. Working together allows for vocal citizens to raise their concerns and be heard. The government/governance should be open for the responses and be willing to alter the plans to fit the needs and desires of the society better (Batel et al., 2013). This adaptiveness creates a stronger basis to act out the change because people have a say in the solutions that are presented. Lastly, the ease of use or quality of life. The perception of the energy transition as a sole reason to make large changes is a limited scope. Value creation by addressing public space along with the energy transition makes the energy transition a part of a larger change that brings more than only a different energy source (Perlaviciute & Steg, 2014). It creates improvements in the neighbourhood that are more visible and that can tackle local issues specific to that neighbourhood.

The last indicator is the social acceptance. Build upon Wüstenhagen et al. (2007; Grin et al., 2010, p.11-12), acceptance is the linkage between social trust and social perception. Social acceptance is about accepting technologies and policies by the public, the key stakeholders and the policy makers. Working together and establishing trusting relationship between the society/community and the governance network creates acceptance to the change because all actors understand each other and have an influence on the change themselves. Important notion in with community acceptance is the time dimension. It often follows a U-curve where in the beginning there is usually a high acceptance,

shifting to a low acceptance during orientation before going back up to a higher level of acceptance once the project is in the implementation phase. The amount of acceptance draws from the aforementioned trust in the governance network and the knowledge that people have.

4.2 Technical feasibility

Technical feasibility encompasses all the technical aspects that come into play during the energy transition. This research has identified three main components of the technical feasibility. First a precondition for a well implemented energy transition, the scale and space of the technology of the energy transition and lastly the effect that the type of building has on the technology.

Kern & Smith (2008) identify the transitioning energy system to be a socio-technical transition, which works on "*the linkages between elements necessary to fulfil societal functions*" (Geels, 2004, p.900). In this case the technical side of the transition delivers the energy services like heat, light and power (Kern & Smith, 2008). The aforementioned dominant regime is fossil fuel based which has created all kind of technologies that serve this regime and cannot be easily fitted to serve another regime.

The precondition for a well implemented technology of the energy transition is the chance of a lock-in situation when selecting desirable technology pathway for the energy transition. According to Kern & Smith (2008) the technology-based decisions that need to be taken in de coming decade affect the structure of the energy supply for many decades to come. Choices for certain technologies create a path to where sometimes there is no chance of return, or at high costs. The path dependency literature gives the definition: "(…) *once a country or region has started down a track, the costs of reversal are very high. There will be other choice points, but the entrenchments of certain institutional arrangements obstruct an easy reversal of the initial choice*" (Levi, 1997, p.28). See figure 4.2 where the entrenchments are visible. Regarding making the choice for a specific technology one must try to steer away from creating new lock-ins for the costs of an exit increases the longer the path is followed (Pierson, 2000; Kern & Smith, 2008). Companies and other stakeholders look at the government for selecting a pathway, however governments should not select technologies directly themselves but

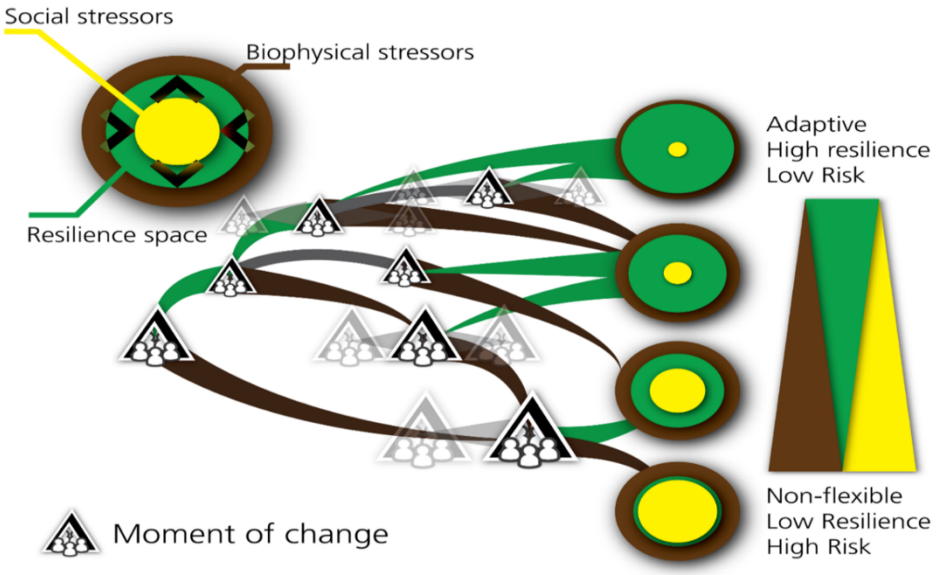

Figure 4.2: Moment of change

must make that decision together with the stakeholders. Often the government is criticised by stakeholders for being unreliable and inconsistent which makes stakeholders reluctant in the selection of a desired technology. As collective decisions have the most potential to select the most wanted type of technology, cooperation is thus wanted (Kern & Smith, 2008).

Secondly scale and space matters when it comes to technology. Bridge et al. (2013) talk about the spatial forms of energy technologies and how these technologies have distinctive differences in the spatial application and their scale. For instance, infrastructural networks for energy can have different values in connectivity, proximity and their (de)centralisation of capacity and supply. The distinctive differences between technologies make that a technology needs to fit a specific spatial context in order to supply the necessary energy. Technological solutions are best decided on smaller scales like a neighbourhood approach rather than a city-wide solution. This way technology best fits the need of the neighbourhood without creating a technological inefficiency for another neighbourhood.

Lastly the technical feasibility is influenced by the age and type of building at hand (Hoek & Koning, 2018). Generally older buildings are less energy efficient and thus require larger investments and technological changes in order to be able to use sustainable energy sources. Some buildings can currently not be transitioned to low temperature heating, which means that they must either be demolished or heated by current adapted technologies (e.g. biogas). The type of building thus determines the use of certain technologies. For instance, apartment buildings need different changes then row houses or detached houses.

4.3 Financial feasibility

Financial feasibility is about the affordability and the ability to finance the transition. Financial feasibility applies to the costs of the investment and the ability to get finance for the investment.

First the costs of the investment. There is the techno-economic side of the energy transitions where the variable resources, demand and infrastructure come into play (Cherp et al., 2018). Resources mean all the different resources of various forms of energy that influence the selection of a technology. Demand is about the type of energy and the energy intensity that is needed. Infrastructure encompasses all the types of existing infrastructure for extraction/generation, transportation and use of energy. From an economic point of view, a large portion of selecting a viable alternative is often decided trough the cost balance between the old system and the new system; the balance between what is costs and what it delivers.

In the previous section the age and type of building determines the availability of technical alternatives. Tied into this are the costs of a type of investment. Older buildings require larger investments to be energy transition proof (ready for an alternative energy source) (Hoek & Koning, 2018). Type and age of a building partially determines the costs of the transition and therefore also the financial feasibility of the transition.

In order to strengthen demand for types of investments specific subsidy programmes can be used to lower the initial costs of an investment and motivate actors to choose a certain alternative (Lorenz & Lützkendorf, 2008). This can counteract the possible increased costs of applying a new technology.

Getting finance for an investment, the scale of the investment matters greatly. For instance, institutional investors operate by using certain rules when selecting investment opportunities. Institutional investors are pension funds and insurers, companies with large portfolios who want to invest with a long-term vision (Flammer & Bansal, 2017; Loon & Aalbers, 2017; Krueger et al., 2018). They also want returns that mainly serves as an inflation correction along with a limited profit. The scale of the investment must fit the scale at which capital is available. Otherwise the investment may be economically feasible but not financeable.

5 Operationalisation

In the previous sections this research has highlighted how long-term sustainability goals and socio-economic transitions are processed in and through governance networks. This was done by explaining that the energy transition requires substantial change in the way we consume, produce and organise energy and that we need to make changes in order to make sure that enough energy can be provided now and for future generations. This means moving towards a more sustainable city where the quality of life is improved without leaving a burden on future generations. Transitions entail a change from one system state to another and they are long-term processes where many actors come together. This means that leading a transition to a certain outcome—in this case inclusion—requires governance. A government alone cannot steer transitions that have a socially imbedding. Urban and sustainable governance then have different approaches that argue for a different amount of interference from the state.

Subsequently, this research has emphasised the importance of inclusiveness and feasibility. Moreover, it argued that an energy transition that needs to take place in the homes of people requires their cooperation, thereby considering three different types of feasibility, namely social, technological and financial. All three feasibilities must work in order to realise the energy transition. With social feasibility, governance has one of the most important roles to create societal support for the change. Technical and financial feasibility need to work in order to make the change happen, without a good technical solution and without ways to afford the technology, there will be no transition.

Based on these theoretical steppingstones and concepts, this research has developed the following conceptual framework for further analysis in the next sections. It payed particular attention to the need of 1) grasping the different types of feasibility during an energy transition and 2) conceptualising how long-term sustainability goals are processed within more complex and hybrid urban governance networks in which different power relations of (governing or governed) actors may challenge, contest or reinforce those long-term goals. Consequently, the conceptual model consists of two parts which both focus on different analytical levels of scale.

5.1 Feasibility on MESO level

First, a focus on the feasibility components of an energy transition. The feasibilities were introduced in chapter 4 and work on a MESO-level. This means that the feasibilities do not measure the individual as well as the complete network of actors. They rather measure how the energy transition is feasible for a group of individuals, for instance a neighbourhood or a part of a neighbourhood. In chapter 4 different indicators were mentioned. In researching the feasibility of the energy transition these indicators will be used. In table 5.1 these indicators are listed.

Table 5.1: The use of indicators in analysing the results

Theme	***Indicators***
Social feasibility	Social trust
	Social perception
	Social acceptance
Technical feasibility	Pros & cons types of installation
	Scale and space
	Typology building/neighbourhood → technical possibilities
Financial feasibility	Investment costs
	Typology building → costs
	Scale of the investment

5.2 Difficulties in governance MACRO level

Second, because the energy transition both touches on the reinforcement of sustainability but operates in the urban arena, both the urban and sustainable governance apply. This means that there is a focus on the potential difficulties of achieving long-term sustainability goals within an urban governance network and a pre-existing socio-political environment where social relations have historically and institutionally constrained the opportunities for sustainability transitions. Uneven development of institutional cultures and governance networks may create different opportunity structures for political and sustainable reform. A fusion of urban governance with the focus of sustainable governance allows for a stronger framework when tackling issues that are either of an urban and sustainable nature. This model then operates on the MACRO-level where a possible governance approach is discussed more abstractly.

Based on the literature discussion (chapter 2, 3 & 4), this research will try to create a conceptual model that may work best when there is a local implementation and a wider goal setting to reach sustainable progress. In the model the first step is the creation of a set goal that allows for stakeholders and partners to work towards a sustainable goal. There is clarity that stakeholders can be held accountable for achieving the sustainable results, which makes that monitoring has a stronger presence and function. The second step is the implementation, which is influenced by the local context, so there is a need to have a more cooperative approach to find the right solution that fits the context. Due to the complexity of the local context, the sustainable solutions can probably not be implemented directly. Harnessing a different approach for each step which results in less conflict in the governance network. The previously discussed feasibilities make up the local context. Therefore, a governance approach that first defines the goal to strive towards and secondly uses collaboration to achieve a locally embedded answer, is most appropriate for finding a middle ground position in either the urban or the sustainable governance approach. Figure 5.1 shows this theoretical energy transition governance mode with the two steps visualised using the figure by Zeijl-Rozema (2007) as a basis.

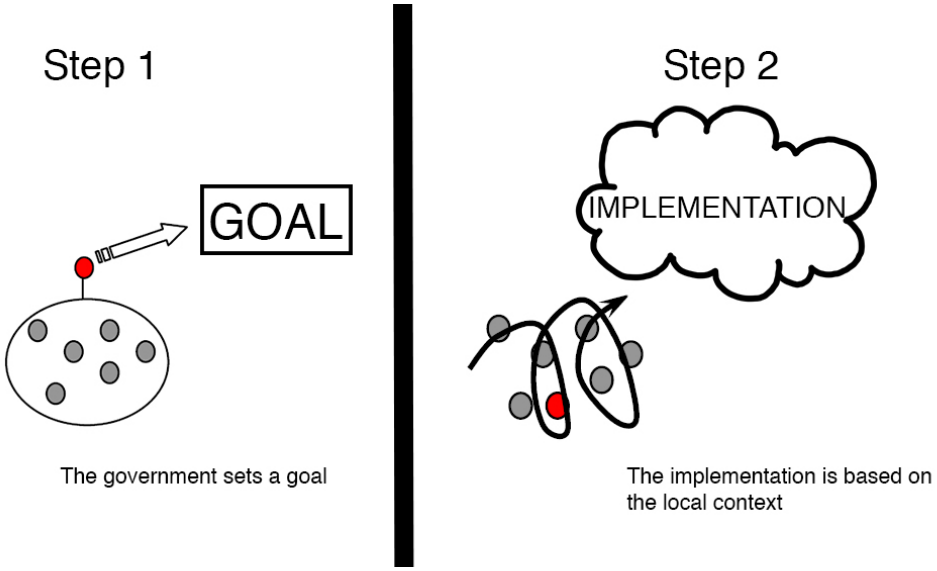

Figure 5.1: possible governance solution – own creation

5.3 Synthesis

Taken together, both the conceptual frameworks assist in addressing the research questions introduced in the introduction (chapter 1) and methodology section (chapter 6) of this research. Whereas the former focuses more practically on the inclusiveness and feasibility of energy transitions, the latter focuses more broadly on how transitions can be governed in general. This not only helps to reconstruct pragmatically the different goals, challenges and policy reflections of energy transitions; it also helps to further reflect on the nature of sustainability transitions and governance networks in general. As such, a vital empirical and theoretical contribution to the emerging field of sustainable urban governance and energy transitions can be made this way. In the next section the research methodology will be developed the case study analysis.

6 Methodology

In this chapter the methods used in this research will be discussed. First, an overview of the methods used regarding general methods, the methods for data collection and the analysis of the data. Second, the focus on housing is explained. Third, the case selection and the applicability of the case in the wider context. Fourth, the internal and external validity of this research and lastly an introduction into sustainability in the Netherlands and a description of Utrecht Overvecht.

6.1 Methods used in this research

6.1.1 General methods

This research has applied a mixed method research methodology where the three sub-questions have different research methods. This research begins with a literature review of what we already know of the energy transition in the Netherlands accompanied by a share of quantitative data such as descriptive statistics to shape the context of the energy transition. Utrecht Overvecht is being introduced using policy documents and descriptive statistics. The first sub-question is mainly based on policy documents and information from the interviews. The second and third sub-question are based on in-depth and critical interviews with key actors that operate within the governance network of Utrecht Overvecht. The same methods are used for the two sub-questions, but the coding is different to differentiate the two.

In table 6.1 the methods regarding the three sub-questions are listed. The main analysis and the case analysis will be based on qualitative interviews. The different policies and the evaluation will be based on the experiences of experts in the field. The process in the neighbourhood is researched by looking at the relative actors and institutions via a qualitatively way.

Table 6.1: the methods according to the chapters and sub-questions

Chapter / sub-question (SQ)	Data collection method	Analysis method
Theoretical framework	Literature review	
Case description	Policy documents	Qualitative analysis
	General statistical analysis	
SQ 1	Policy documents review	Qualitative analysis
	Explorative semi-structured interviews	Transcript/encoding
SQ 2	In depth and critical interviews with key actors	Transcript/encoding
SQ 3	In depth and critical interviews with key actors	Transcript/encoding

This research will test the theoretical assumptions using a case study. The case study is meant to illustrate the process of the energy transition and to understand what the Dutch perspective and more specifically the perspective of Utrecht Overvecht. It gives the real live context of the governance, and the governance model, used in an inclusive energy transition. The use of the case in this research is to test the literature in real life (Flyvbjerg, 2006) to a neighbourhood that is not necessarily unique in the Netherlands. The case of Utrecht Overvecht can be applied to other neighbourhoods as well, as will be made clear later.

6.1.2 Methods for data collection

Literature review & policy documents

This research began with a literature review, creating a theoretical background to the question at hand. A second literature review was created looking at the current policies put in place nationally, regionally and locally. This literature review is part of the results section and contains a review of relevant policy documents.

Descriptive statistics

Descriptive statistics are used to shape the context of Utrecht Overvecht. The statistics used are based on public numbers provided by the municipality itself. They contain demographics, neighbourhood statistics, ownership ratio's, etc. These figures are neighbourhood specific and can therefore be used to better understand the position of the neighbourhood in relation to the rest of the city. This statistical analysis creates the context of the area of research. Also, with this statistical data, better questions can be asked to key actors operating in the energy transition in Utrecht. Key questions concerning their approach to the specific demographics and ownership ratio's in the neighbourhood make that more details can be uncovered.

Interviews

The interviews are conducted using a semi-structured method (Bryman, 2016, p.471), asking relevant questions regarding the topics as well as allowing the respondent to bring information that may not have been the focus but could be relevant for the research. This also allowed the respondent to talk freely and explaining the transition more of his/her point of view. This means that the interviews sometimes went differently than expected. But it allowed for the method where statements form the respondent were followed up to get the most details out of the interview. It also allowed for rich data where the perspective of the respondent was centred (Bryman, 2016, p.470).

In the end 20 people were interviewed in 17 separate interviews. Table 6.2 shows all respondents and the corresponding interview number. The names are redacted to provide anonymity to the respondents.

Table 6.2: List of respondents

Interview no.	Location/medium	Date	Respondent type
1	Amersfoort	12-06-2019	Arcadis – consultant technical installations
2	Amersfoort	13-06-2019	Arcadis – consultant real estate
3	Amersfoort	13-06-2019	Arcadis – consultant public rental housing
4	Utrecht	13-06-2019	Municipality Utrecht – city official
5	Utrecht	14-06-2019	Deloitte – partner financial consultancy
6	Utrecht	21-06-2019	Bo-Ex (public housing) – project leader
7	Utrecht	21-06-2019	Two private social workers
8	Utrecht	21-06-2019	Nyenrode Business University – professor
9	Utrecht	24-06-2019	Utrecht Overvecht-North – consultant
10	Utrecht	28-06-2019	Energie-U – energy transition initiative
11	Utrecht	02-07-2019	Eneco – transition manager

12	Utrecht	02-07-2019	Utrecht University – assistant professor
13	Phone call	04-07-2019	Mitros (public housing) – manager
14	Utrecht	09-07-2019	Municipality Utrecht – city official
15	Amersfoort	11-07-2019	VEH (homeowners association) – two consultants
16	Phone call	15-07-2019	Overvecht-North local initiative
17	Amersfoort	19-07-2019	MVGM (Real estate service provider) – manager

During the interviews various methods were used to get the most out of all the interviews. For instance, the same question was asked in the beginning of 11 interviews. The respondents were asked to give their view on what kind of energy transition they expected to get. This was done by presenting a small matrix (table 6.3) with four scenarios. The four scenarios were not explained by the interviewer but were left to the own interpretation of the respondent with only the elements of the matrix to choose from. This way the interviewer received a better understanding of what kind of energy transition the respondent foresees, often answering some of the prepared questions without asking. It gave the interviewer a clearer understanding of the type of respondent, allowing for a more critical and in-depth interview then without the matrix. It also allowed for the respondent to open up and get comfortable with the interview.

Table 6.3: scenarios of the energy transition

Disruptive	Scenario 1	Scenario 2
Systematic	Scenario 3	Scenario 4
	Individual	Collective

11 out of the 17 interviewees were shown and asked to comment on the model (figure 5.1) from the operationalisation. This way respondents could reinforce the results from the literature review or respond critically about them. These reactions formed the basis of the improved model presented in chapter 7.3.2.

Unfortunately, interview 10 had a corrupted recording allowing for less usable information then wanted.

6.1.3 Analysis of the data

The analysis of the data was done to answer the main question and the sub-questions presented in the introduction. The main question was: *How and to what extent is an inclusive energy transition in residential housing feasible and how must the governance networks operate to accomplish this goal?* The three sub-questions used different ways of analysis. The first sub-question--*What are the national, regional and local policies are facilitating and enabling the energy transition in Utrecht Overvecht?—*

was based on an analysis of the policy documents where there was a choice made which policy documents to research. The energy transition touches on many different aspects of policy so only policy measures that have an effect on the case were considered. Not analysing other aspects of the energy transition such as inevitable changes to the electrical grid, policies surrounding supply and demand and policies in the changes with mobility. These policies have an effect on the energy transition but not in the scope of this research, with the existing housing stock in the built environment of Utrecht Overvecht. For the differences of the different owners there where additional codes used (beyond those presented table 5.1). These are listed in table 6.4. With these extra codes the opinions about the different policy measures were sorted out, along with the effects for the different owners.

Table 6.4: The use of indicators in analysing sub-question one

Theme	***Indicators***
Different owners	Owner-occupied
	Public rental
	Private rental
Policy	Municipal policy measures
	Governance

For the second sub-question—*What is the critical reflection and policy recommendation on the current trends regarding social, technical and financial feasibility in Utrecht Overvecht?*—the analysis was based mainly on the interviews by coding the interviews according to the in the operationalisation mentioned indicators (table 5.1). These indicators are based on the literature review and further defined in the operationalisation chapter. The data is, in this case, mainly consists of experts that were asked to describe and reflect on the process of the energy transition. This data is then used to form an overview on how the process currently works in Utrecht Overvecht(-North). Many statements of the respondents fell into multiple indicators which made coding sometimes difficult. Some statements therefore received multiple codes. The quotes however, mainly fell into one code as they needed to be strong statements.

The third sub-question—*How can governance networks operate more generally to accomplish an inclusive energy transition?*—is for the large part discussing theory with the respondents. From the data, two different approaches could be distilled that have an effect on what kind of governance is required. These approaches are introduced in the second sub-question and are discussed more in-depth illustrating the pros and cons of the approaches in the third sub-question. Because of the methodical approach of uncovering the opinion of the respondents to the theory presented in the first part of this research, the interviews were used partly to generate theory (Bogner & Menz, p.48). In the case of this research, the interviews were used to sharpen the theory and to fuse the theory with the practical workings of the energy transition. The governance model was presented to those who work as an actor in the model, or to those who have studied the workings of the energy transition. This means that the theory was generated using 'experts' of the energy transition (Bogner & Menz, p.48-52). The conclusion is based on the three sub-questions together and—in the synergies presented—sub-conclusions.

6.2 A focus on housing

In this research the focus lays on housing. As the energy transition encompasses an enormous part of all human activities, a choice had to be made to limit the scope of this research to a manageable size.

Housing is a place where the effects of the energy transition come together with a very personal place of people. People have the comfort of a home, and the energy transition deals with an important factor of this comfort, heating. This social aspect of the energy transition is therefore especially interesting and observable in housing. This research focusses on this dynamic and tries to understand how we can implement the energy transition is such an important part of people's daily life.

As said in the introduction, there are generally three types of home ownership: public rental, private rental and owner-occupied. These owners will have a key role in selecting an alternative and making the investment. This research therefore focusses on all three owners and makes the differentiation clear when there is a difference between the three owners in terms of policy and the governance. The largest distinction is between rental and owner-occupied. On the one hand few owners with many residents and on the other many owners with relatively few residents. This distinction is a key difference for the governance network and is therefore included in this research.

6.3 Case selection

In this part there will be a description of the case and why the case was selected. Followed by an overview of the sustainability and energy transition in the Netherlands and lastly an introduction into the neighbourhood Utrecht Overvecht.

Utrecht Overvecht can be seen as a critical case wherein the theoretical model can be tested and refined (Yin, 2009, p.38). The case of Utrecht Overvecht is a neighbourhood which is generally occupied by low- and middle-class citizens, the availability of capital is limited, and the houses generally need a lot of improvements in order to become natural gas free. Achieving inclusion means that all of the residents in Utrecht Overvecht can participate in the energy transition. Overvecht was chosen because it is the first neighbourhood to become natural gas free, and there is an ongoing effort to make that happen. Because of this, can this research go beyond the theoretical part and test the theory as well in practice. The case will also be used to make the abstract aspects of the energy transition more tangible.

Overvecht has characteristics that make it applicable to other neighbourhoods in The Netherlands—and perhaps internationally—as well. Built environment that is aging, in combination with public space that needs renovations, in a fast-growing urban region and a mixed social class with generally many low-income households which makes Overvecht a case which is somewhat representable for other neighbourhoods with elements of these characteristics as well. As said in the literature, the local context inherently different per city or neighbourhood, but generally, the governance models—and how that works within such a neighbourhood—remains the same.

An overview of sustainability in the Netherlands and the specific characteristics of Utrecht Overvecht will be explained later this chapter. This introduction into the case is made so that in the results section there is no introduction required and the sub-questions can be answered directly.

6.4 Internal and external validity

6.4.1 Internal validity

This research has made an effort of researching all relevant policy documents and news articles. Based on this review of documents the interviews were prepared as mentioned in 6.1.2. With these in-depth interviews, this research tried to create a set of respondents that cover all relevant actors, owners or representatives. Covering all individual owners in Utrecht Overvecht-North was out of the reach of this research, but all groups of owners and residents were covered using representatives. Because all of the different owners were represented, along with key stakeholders in the process of the energy transition of Overvecht-North, this research has covered enough ground with the conducted interviews. The data was analysed using the codes defined in the literature as mentioned in chapter 5, without bias from the researcher.

6.4.2 External validity

The case of Utrecht Overvecht is a specific case which cannot be applied to every other neighbourhood. However, as said before, the spatial elements of Overvecht are not unique. Utrecht Overvecht is a representative neighbourhood where sustainability is going to become a major challenge to overcome along with social issues that need to be addressed as well. Other neighbourhoods that face a similar challenge can learn from the approach of Overvecht so far. The exact implementation, which is part of this research, may vary to other neighbourhoods and to other cities. But the theoretical and more abstract elements of the governance network can be applied to neighbourhoods with similar issues like the aging and type of housing stock and type of resident. Secondly, by focusing on lower social class neighbourhoods, the most difficult neighbourhoods are being studied. This focus on inclusion should allow the research to be applicable to other cases throughout the Netherlands as well.

6.5 Case characteristics

In this part the history of the energy transition in the Netherlands and the characteristics of the neighbourhood Utrecht Overvecht are explained.

6.5.1 Sustainability and energy transition in the Netherlands

The issue of the energy transition of housing is about a limited amount of CO_2 emissions. All the built environment in the Netherlands accounts for 20% of all Dutch CO_2 emissions (Vringer et al., 2016). Housing accounts only 9% of total Dutch emissions (Middelkoop et al., 2017). Total worldwide emissions of CO_2 in 2017 was 37.07 gigatons (Olivier & Peters, 2018). Dutch CO_2 emissions were 163 megatons (CLO, 2018). This means that Dutch housing account for roughly 0.04% of all emissions worldwide. This means that the energy transition of houses has a marginal effect on the worldwide environmental effect. But it has a large effect on the energy dependency and the way the Netherlands heats its housing. Also, every part of the system must be changed in order to stop climate change.

The Netherlands has long been depended on the use of natural gas. Before the discovery of natural gas within the Dutch border, houses relied on coal for heating and people cooked on gas made from coal in local gas factories (Warner et al., 2009, p.20-21, 30). The discovery of natural gas made that the Netherlands found out that it had one third (current amount) of all European Union (EU) natural gas reserves within its borders (Warner et al., 2009, p.16). After the discovery it was decided that the natural gas would be delved by the NAM (Nederlandse Aardolie Maatschappij) where the national government owned 50% of the shares and the oil and gas companies Shell and Exxon Mobil owned the other 50% (Warner et al., 2009, p.31). After the discovery of the natural gas reserves the distribution network started to grow. Local governments payed for the technical changes to appliances that were necessary to be able to use Dutch natural gas (Warner et al., 2009, p.66). Citizens got a free conversion of their current stoves and water-heaters or a large discount on a new one. Different layers of government made the transition happen by making sure people would change towards natural gas and in the end have effectively changed the energy consumption of an entire nation to the current pathway.

Current societal pressures have made the government to finalise the use of natural gas in the Netherlands. Earthquakes in Groningen has led to frustration by citizens that the government is benefiting from delving the gas reserves and they are the one that pay the bill by damages to their houses and a feeling of insecurity (Hofs, 2019). After a strong earthquake in the beginning of 2018 the national government decided that the consumption of Dutch natural gas will end before 2030 (Hofs, 2019). This was a turning point within Dutch policy which has led the way towards the implementation of alternatives for natural gas and a policy measure that sparked the current urge for transitioning.

6.5.2 Utrecht Overvecht

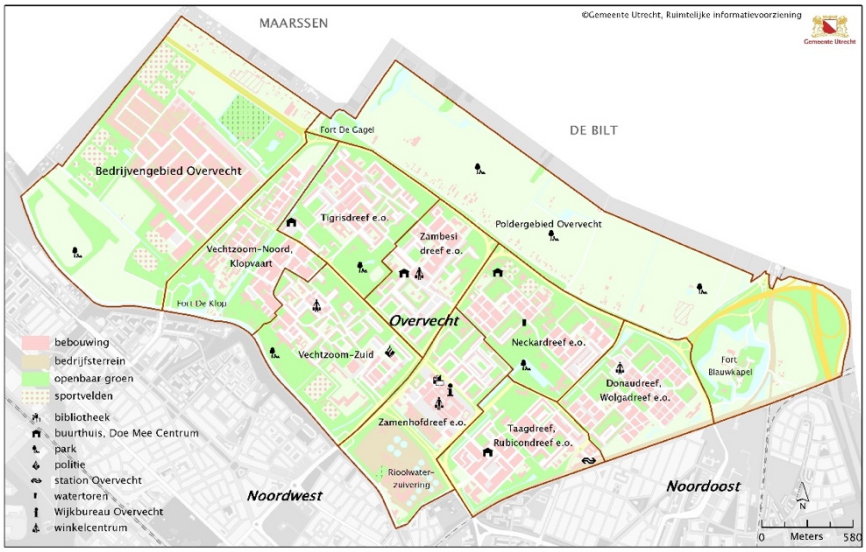

Figure 6.1: Utrecht Overvecht (Gemeente Utrecht, N.D.b)

Utrecht is the fourth largest city in the Netherlands with 352.941 residents in 2019 (WistUdata, 2019a) and is governed by a college of mainly left-wing parties (Gemeente Utrecht, N.D.a). 34.293 people (WistUdata, 2019b) live in Utrecht Overvecht, a large neighbourhood in the north of Utrecht. In

Utrecht Overvecht the energy transition is already being addressed as the municipality has decided that the process of applying other forms of heating then natural gas in houses will start in a sub neighbourhood of Overvecht: Overvecht-North. Here 17.815 people live (WistUdata, 2019c). The neighbourhood consists of eight sub-neighbourhoods (see figure 6.1), the energy transition applies only to the five sub-neighbourhoods in the north called Vechtzoom-North, Klopvaart; Vechtzoom-South; Tigrisdreef and surroundings and Zambesidreef and surroundings.

Utrecht Overvecht-North - typology

In 2016 Utrecht-Overvecht had the highest percentage of households with a low income of all neighbourhoods in Utrecht: 20,4% (WistUdata, 2016). Also, there are relatively a lot of elderly residents in Overvecht-North along with many residents with a migration background. With one sub-neighbourhood where almost 70% of all residents have a migration background (Gemeente Utrecht et al., 2017).

Of all 7.994 (2017) houses, 5.607 (out of 5.802) were owned by the three large public rental corporations—i.e. Mitros, Portaal and Bo-Ex—, 1.307 were owner-occupied and 791 were private rental (Gemeente Utrecht et al., 2017). These owners all have different kinds of real estate and therefore have different kind of stakes in the energy transition. There can be made a few conclusions based on the use of different forms of energy in Overvecht-North (Gemeente Utrecht et al., 2017):

- 83% of all houses are connected to the natural gas network;
- 55% of all houses all use electricity, natural gas and central district heating, these houses probably use natural gas solely for cooking;
- 28% of all houses have electricity and natural gas and probably use natural gas to heat their building;
- And 10% have only electricity and central district heating and do not require an alternative energy source.

Utrecht Overvecht is a neighbourhood where most of the buildings (59%) were built in the 60s and the 70s (Code Waag, 2015; Gemeente Utrecht et al., 2017), with exception of the Klopvaartbuurt which was constructed mid-80s (Code Waag, 2015). In Overvecht-North there is a large share of mid- and high-rise buildings; with 44% being apartments over five layers, 33% apartments with up to four layers and 22% single family houses (Gemeente Utrecht et al., 2017). Owner-occupied has by share the most single-family houses and public rental has by share the highest amount of mid- to high-rise buildings.

Over 70% of all houses belong to public housing corporations with many buildings connected to the central district heating network. For these buildings, a large share of the transition means removing natural gas solely for cooking. This has a limited effect on reducing energy consumption, however thermal isolation and good maintenance can decrease the demand for energy significantly more than only removing natural gas for cooking.

For owner-occupied houses it is the other way around where three quarters of the households (76%) uses natural gas for heating (Gemeente Utrecht et al., 2017). That means that this majority of the

owner-occupied houses needs significant change in order to be able to remove the natural gas from the entire neighbourhood.

For private rental houses the use of energy is evenly distributed between all-electric, natural gas and a central district heating connection (Gemeente Utrecht et al., 2017). Only 10% of all these houses use natural gas for cooking. So many of these buildings are already natural gas free, with a minority needing significant change.

7 Results

The results chapter will answer all three sub-questions in three parts. First the national, regional and local policies. Second an evaluation based on the feasibilities. And last a reflection on the theoretical models presented earlier in this research.

7.1 Policies and differentiation housing owners

In this part, this research will answer the sub-question: *What national, regional and local policies are facilitating and enabling the energy transition in Utrecht Overvecht?* Also is there a discussion about the differentiation of these policies for the different housing owners. These policies will set the institutional landscape in which the process of the energy transition—and thus also the governance networks—operates. Without an understanding of the policies at hand, there can be no reflection on the workings of the energy transition.

7.1.1 National policy

There has been many new national policies surrounding the energy transition. This means that the effects of the policy measures are often unknown, and many policies have not yet shown their local consequences. There are three major policy measures that need to be discussed. That is the Climate agreement (Klimaatakkoord), the Regional Energy Strategy (Regionale Energie Strategie; RES) and the shift from natural gas to an alternative.

Climate agreement

The climate agreement is a cooperation between many government and non-governmental actors. These include—among others—four ministries, various environmental organisations, trade-unions and entrepreneurs organisations (Klimaatberaad, N.D.). Within the climate agreement the government, along with the other actors, come to an agreement how to lower the carbon emissions, as agreed upon in the Paris Agreement and within agreements in the European context (Rijksoverheid, 2019). The main target that needs to be met is 49% CO_2 reduction based in 1990 in 2030. This target may increase to 55%, depends on the EU CO_2-reductions policy, expected in 2020. The climate agreement is partially a realisation via agreements of the climate act which was enacted in 2019 by the Dutch national parliament.

In the climate agreement, the vision for the built environment is written down. This applies mainly to the more than 7 million of houses that need to be transformed (Rijksoverheid, 2019). This transformation will take place stepwise over the coming 30 years (until 2050). Climate change is the principal reason to change our energy supply but also the issues surrounding natural gas production in the north of the Netherlands. The idea is that a structural approach is the most efficient but there is an understanding that the energy transition remains a social transformation, not a financial or technical one.

In order to facilitate the transition smoothly, the transition must take place on a neighbourhood scale (the neighbourhood approach) (Rijksoverheid, 2019). This neighbourhood approach means that municipalities need to find an acceptable alternative that fits the needs of a specific neighbourhood

and is best affordable. In the climate agreement it is decided that municipalities create a Heating Transition Vision before 2021 wherein it sets out a roadmap for becoming natural gas free. An essential part of the neighbourhood approach is connecting other problems then the energy transition to the necessary works that the energy transition requires. The national government assists in finding other issues that can be incorporated in the spatial design of the transition. The government commits itself with a 'Centre of Expertise for Heating' to support municipalities with the start-up of the neighbourhood approach. In the end, the national government sets out to realise a transition with the "*involvement of residents, real estate owners and other parties in the neighbourhood where the transition applies.*" (Rijksoverheid, 2019, p.25). Early involvement by the citizens allows for a better understanding of the perspectives, knowledge and the creativity of the neighbourhood. Therefore, there must be 'good' participation to form a better decision which creates higher acceptance. What good participation entails remains vague, as every neighbourhood requires its own amount and form of participation. The national government highlights the importance of communication, active participation by residents—for instance via initiatives—to further the transition away from natural gas. Other actors (e.g. environmental organisations, trade-organisations, interest representatives) are used to participate in designing this process, defining which kind of participation is needed and what ways of communication are necessary.

In order to finance this change, the idea is that the costs of living needs to remain the same. So, the costs of housing, energy and—if necessary—loan payback must not exceed the housing plus energy costs compared to no investment. Different and new forms of financialisation must facilitate capital to those who do not have it themselves. In situations where the costs of the transition exceeds the gains there must be support to find ways to facilitate the change anyway. The government has decided, with a broad range of financial actors, to better facilitate financialisation; via funds, taxations methods, experiments, new methodologies and standardisation. Also, using subsidies to compensate unprofitable investments.

Regional Energy Strategy (framework)

Within the climate agreement there are agreements regarding the RES. The RES is the continuation of the Paris agreement for the Netherlands in practice, and therefore transcends multiple elements of the climate agreement (Rijksoverheid, 2019). The RES has a framework on the national level and the implementation lies on the regional scale with 30 different regions with specific energy goals to fulfil. The RES has three functions: 1) a product wherein the region describes which targets need to be met at which moment in time, 2) an instrument for a spatial implementation and 3) a way to organise long-term cooperation. Within the RES the national government creates a national platform to find alternative heat sources. Cities and regions can access and harness this information in their pursuit to arrange an alternative to fossil fuel heating.

Shift from natural gas to an alternative heat source – transition drive housing corporations

As previously explained, the national government made the decision to stop using natural gas for the heating of houses. This led to the policy of beginning to remove natural gas in certain neighbourhoods called, experimental neighbourhoods (Rijksoverheid, N.D.a). The municipalities of these neighbourhoods receive extra financial assistance of the national government to arrange an

alternative. Overvecht-North is, among 26 other neighbourhoods, selected to be one of these neighbourhoods and receives these funds (Rijksoverheid, N.D.b).

The idea is that the energy transition in houses will take off after the neighbourhood approach is in full swing. However, the national government does not want to wait that long (Rijksoverheid, 2019). Therefore, it has agreed with the public rental sector that they will start with increasing thermal isolation in their houses and make them natural gas free or natural gas free ready (for when the neighbourhood approach finds an alternative). The target is 100.000 houses by 2022.

Summary style national policy

The national government favours mainly a methodical approach. Coordination of the transition is placed at the local level. The national government offers guidelines to streamline the process along with technical and knowledge support.

7.1.2 Regional policy

For the regional policies, only the RES has an actual regional impact. The rest of the policies are either national or local.

Regional Energy Strategy (implementation)

All 30 RES regions can shape their own organisation as long as it delivers the required products. For Utrecht the RES exists of U16, 16 municipalities within the province (Bestuurstafel Klimaatneutrale Regio RES-U16, 2019). It uses an existing network platform: U10/16—which focusses on housing, mobility, economy, green and the landscape—and extents it with the energy targets, because the RES has deep ties with the problems regarding the built environment (natural gas free housing). To organise this change, the RES-region has decided that all participating actors—municipalities, water boards and the province—are equal within the process. Along with Stedin (responsible for the electrical infrastructure) who has a special status as being the owner of an essential part of the infrastructure. Other actors that are relevant are proactively approached to give input.

Within the RES there is a Regional Strategy for Sustainable heating (Bestuurstafel Klimaatneutrale Regio RES-U16, 2019). Herein is described the availability of sustainable heating alternatives, the total required energy for heating and a description of the existing and planned infrastructure regarding heating. This supports the municipal energy transition vision (discussed below).

The target is a natural gas free built environment in 2050. This means that about 400.000 houses and 60.000 other buildings with mainly natural gas heating and poor thermal isolation (Bestuurstafel Klimaatneutrale Regio RES-U16, 2019). The way to reach the goal is still unclear. Mainly financialisation options are uncertain and there are still many questions regarding the support of the national government for municipalities to facilitate or force selected alternatives. Within the region, there is little known about the potential of sustainable heat sources. Lastly there are challenges in the local versus regional where technologies may work regional but are locally organised.

But in the RES is made clear that the first step is basically increasing the thermal isolation to lower the total amount of warmth required. The regional level clearly focusses on coordination between municipalities and the alternatives for different neighbourhoods. It does that by working together with all governmental actors and other relevant actors.

7.1.3 Local policy

Most of the policies of the local government, in this case municipality Utrecht, follow the directives set by the national government. This part will describe how Utrecht handles their tasks. Two measures are important to discuss, the Heating Transition Vision and the Neighbourhood approach. Then there is a social and a spatial program which needs to be explained.

Heating Transition Vision

The municipality is currently developing a Heating Transition Vision (Transitievisie Warmte) according to the climate accord. For this document, the municipality is trying to find a realist timeframe for every neighbourhood to disconnect from the natural gas network (interview 4). There is an existing document published by the municipality regarding alternatives and becoming natural gas free, in this 'Vision on the heat supply', the municipality lays down the different choices for a sustainable heat supply in Utrecht (Gemeente Utrecht, 2017b). It tries to realise the targets of the local government, which is becoming climate neutral in 2030. About a quarter of all the CO_2 emissions comes from heat generation. The core elements of this vision are (Gemeente Utrecht, 2017b):

1. New development projects are climate neutral.
2. A new heat supply that is sustainable, affordable and reliable.
3. When making decisions, all social costs and benefits are taken into consideration.
4. The heat vision will be embedded in other spatial policies.
5. Utrecht has the ambition not to replace any natural gas lines when there is an alternative available.
6. Steering towards an open, sustainable and low-temperature central district heating network where new sustainable heat sources can be fitted in.

The rest of the document is rather vague on the availability and possibility of sustainable heat sources. It only offers up guidelines and describes the role of the government in this part of the transition.

In the interviews the new Heating Transition Vision was clarified. It follows three strategies (interview 4): 1) continue with removing the natural gas in Utrecht Overvecht-North and Utrecht Science Park (second neighbourhood in Utrecht with this approach, but mainly educational buildings and businesses), 2) city wide approach remove all gas use for cooking and tools for making houses smarter and 3) the neighbourhood approach.

For the first neighbourhoods that must be natural gas free in 2030, it must be clear which alternative is preferred. For all the other neighbourhoods in Utrecht there is a data driven method of selecting when which neighbourhood will be taken on and what the preferred alternative is. This selection of which neighbourhood when, will be decided by the city council (interview 4). An important notion is that the solution will be offered to the neighbourhood, where people can choose whether to participate or not, it must not be a solution that is set in stone (interview 14).

The Heating Transition Vision is also about financialisation (interview 4), whether there is going to be a collective infrastructure or whether the solution will be individual. When it is going to be an individual solution then the municipality will help with collective purchase of heat appliances. And it will assist in the process, for instance, selection of suppliers. But with an individual approach there is no need to transform all the buildings at once for a large-scale collective system.

With the Heating Transition Vision there is cooperation of many different partners. For instance, a network of energy advisors for sustainable energy, the owner of the infrastructure (electrical and natural gas), housing corporations and the owner of the central district heating network (interview 4; 10). The Transition Vision functions as a start from which the neighbourhood approach will emerge where there will be more attention for the details and a more integral approach (interview 14).

Neighbourhood approach

The neighbourhood approach was decided by the national government and Utrecht must actively apply it in their process to become natural gas free.

First a short background on the process of becoming natural gas free so far. Utrecht decided to move towards a natural gas free Overvecht-North in the end of 2017 where it sent a letter to the city council with the notion that Utrecht Overvecht-North is the first neighbourhood in Utrecht to remove natural gas entirely (Gemeente Utrecht, 2017a). This was a bold move as no other cities in the Netherlands were making that choice at the time (interview 14). During the decision there was no national policy yet to support the removal of natural gas. The reason for choosing Overvecht-North was partially motivated by the age of the existing infrastructure (Gemeente Utrecht, 2017a; interview 14). Many natural gas pipelines in the neighbourhood require replacement and with a lifespan of 40 years it would not align with the policy to stop using natural gas completely. Therefore, it would be the ideal neighbourhood to start with the removal of natural gas to prevent unnecessary investments. Secondly public housing corporations own more than three quarters of the houses in Overvecht-North. So, with the corporations, mass could be created to make the transition economically feasible. Lastly the municipality reasoned that Overvecht-North was a neighbourhood that could socially benefit from the changes that the transition would bring. For instance, creating more living comfort, more employment and better future-proof houses (Gemeente Utrecht, 2017a). There was a plan in development to advance these social improvements, that plan is discussed later. There is also an argument that taking the extra time and effort and putting that into Overvecht-North the neighbourhood could become even better than it is today. Also, with the extra financial support by the national government an alternative could more affordable than other neighbourhoods following Overvecht-North (interview 14).

After the aforementioned letter that the municipality sent to the residents there was a negative response from mainly the owner-occupied households (interview 9). They felt that the decision was forced upon them and that they had no say in the process. They feared the extreme costs of the transition and asked the municipality about the why, but mainly the how. Some started petitions to fight the decision of the municipality (Huisman, 2018b). After the initial reaction the municipality and its partners—public housing corporations, public utility companies, local energy initiative and owner

of the central district heating network—worked together to write a transition plan that was ill received, it might have been to technical (interview 9). This plan is currently being rewritten. This new transition plan has three tracks: 1) technical & economical track, 2) a participation track and 3) the market track (interview 9). The first is focussed on knowledge, the second on participation and people and the third on businesses.

In the first document about an alternative for Overvecht-North—which outlines a more in-depth analyses of Overvecht-North—there were two types of solutions proposed. These are all-electric or expending the central district heating network (Gemeente Utrecht et al., 2017). Expanding the central district heating network can have two different versions, one where the high temperature is maintained and another where the network transformed to a lower temperature network. Using the natural gas network for another energy carrier (green gas, hydrogen gas) is unwanted because then the network would still need replacement.

Social program (Together for Overvecht)

The municipality published their social program for Overvecht this year, called: Together for Overvecht (Samen voor Overvecht) (Gemeente Utrecht, 2019). The essence is that it tries to improve the neighbourhood that within a few years the neighbourhood is significantly better than today. It lists five ambitions that the government strives towards: Pleasant living in a more diverse neighbourhood, Save districts, Strengthening the vision of the youth, Healthcare and support fitting and nearby and Participating and entrepreneurship.

The municipality wants to achieve these goals by using a development strategy that focusses on; place, chance, coalition. This means that a place has a chance that needs to be taken by a coalition. So, every place or chance uses another set of actors that try to better the neighbourhood.

For instance, the renovation of houses and the objective to make the houses more sustainable. These renovations in—mainly social housing—must also pay attention to healthcare, work, other forms of assigning housing, connecting owners, safety and the renovation of the public space. This way the increasing sustainability of the neighbourhood creates betterment for other aspects of the neighbourhood.

The power of Together for Overvecht is combining spatial, social and security in one. Two examples are relevant for the energy transition:

1. There are financial issues by many in the neighbourhood. The idea is to find solutions that take those issues away in a reasonable timeframe. Also giving assistance to those who need it in organising their financials.
2. Project O tries to connect people. It also develops the talent of those with a distance to the labour market. It tries to connect people with new developments in their neighbourhood, for instance sustainability.

In Utrecht, around 4 to 9,5 billion Euros will be invested in creating an energy neutral city. Finding the personnel to execute these renovations is vital. And the idea is that maybe youngsters in Overvecht

can be the new employees. Giving them a change to participate in the labour market and filling the vacancies that these renovations will generate. For instance, the Experience Centre that will be placed in Overvecht can interest youngsters into following education for the energy transition. The energy transition adds to a pleasant living environment, strengthening the vision for the youth and participation and entrepreneurship.

Spatial program (MPSO)

Utrecht has a spatial program called Multi-year Urban Development Perspective (Meerjaren Perspectief Stedelijke Ontwikkeling; MPSO). Utrecht is one of the fastest growing cities in the Netherlands and must accompany this growth. It has decided that this growth must take place within the borders of the city and within certain areas (Gemeente Utrecht, 2018). Overvecht is not one of these areas. Overvecht has a lot of green spaces, instead of building new buildings on those grounds Overvecht can use those areas to facilitate the aforementioned social program. Also is there a focus on improving the public spaces in Overvecht. Apart from one location in Overvecht-South there are no large developments planned.

Summary style local policy

The local policy of Utrecht can best be described as wanting to move forward with a hasty pace. But also finding out that the reality is more tenacious than expected. Now the municipality has lowered their pace and is trying to approach the matter more delicate and with more patience. However, the goals of the policy haven't changed: becoming natural gas free.

7.1.4 Differences in the three types of owners

The policies have other effects on the different types of owners, as they have alternate functions within the governance network. Therefore must, the differences between each owner be understood before discussing the networks of governance.

Owner-occupied

One of the most prominent difference for owner-occupied houses is that people need to be able to sell their house (interview 4; 15). Often are owner-occupied houses not in ownership as long as corporations, making long-term investments less appealing. Also, the energy transition is a process where there are going to be changes behind every doorstep, in essence in every house with every time a new owner with a new perspective and opinion (interview 15; 16). This means that, in comparison with housing corporations, they have less of a singular voice and are divided over many different individuals (interview 13).

In Overvecht-North, most of the houses reliant on natural gas are owner-occupied houses, with few of them connected to central district heating or being all-electric (interview 13). This means that the type of owner with the most diverse set of individuals has to make the most radical change in their house. If the municipality wants to succeed in removing natural gas in Overvecht-North, they must not overlook the interests of the residents of owner-occupied houses.

On the other hand, with the ability to decide themselves, owners of owner-occupied houses can have a stronger say in which alternative they want. For instance, resident initiatives arise where residents try to take the decision-making process more into their own hands. For the municipality that means that they have to work with a group of residents pursuing an alternative themselves.

Public housing

Public housing needs to provide a specific income group with housing. Therefore, is there often a focus on affordability, creating as much good and affordable housing as possible (interview 3). Public housing corporations often speak about costs of living rather than rental costs. That means that energy costs are included in keeping the house affordable. Improvements in the thermal isolation thus decreases the costs of living. Housing corporations have been renovating for long periods of time already. These so-called label A or B projects are about the renovation of a building to a certain energy label, not altering the way heat is generated but limiting the amount of heat necessary (interview 3). These are often thermal isolation improvements.

Often housing corporations work on their own, taking care of their own real estate property. Nowadays they start to work together more often (interview 3). Combining the purchase of infrastructure or doing maintenance together with other corporations. There is a common interest within the different corporations and that interest can best be met when communicating together with, for instance, the municipality (interview 3; 6; 13). Aedes (organisation promoting the interests of the social housing corporations) is motivating corporations to set out plans for themselves to lower CO_2 emissions. "*This makes housing corporations a true partner of the municipality in the creation of local plans, which allows for the interests of the housing corporation to be embedded in the local plans*." (interview 3). With a plan of their own, they have a stronger voice in process of the energy transition. For instance, the corporation Bo-Ex has set an ambitious goal for themselves, wanting to achieve a minimum of label-A(+) after a renovation (interview 6). However, working together with the local government in the neighbourhood approach asks a different way of thinking about maintenance. There must be a willingness to work together and not solely work one complex at a time but to shift maintenance towards all complexes in one neighbourhood instead (interview 13).

Private housing

Private rental housing is usually owned by an investor. Investors can range from large funds with a vision to do good for the society to private investors with a limited amount of buildings in their portfolio (interview 2). These investors are, just like anyone else, struggling with the transition and what to do with it (interview 2).

Foreign investors have a more short-term focussed model where the traditional institutional investors (pension funds & insurers) in the Netherlands have a long-term involvement which leads to more investments into the sustainability of their portfolio (interview 17). This can be observed as there has been an explosive increase in the amount of buildings being renovated the last years. Even the buildings that would previously been sold are nowadays being renovated and kept in the portfolio. These buildings were often older buildings with lacking maintenance but are now being addressed and renovated to a modern standard.

Other companies—for instance construction companies—actively seek out investors willing to renovate their buildings as these companies offer to do the entire renovation for the investor. Taking the technical part as well as the social part for their account (interview 17).

One aspect that can limit the willingness of an investor is that there is, at this moment, no real incentive for the investor to address the energy efficiency of the buildings as they do not profit from such change (interview 7). However, the long-term investors are improving the quality anyway to answer to a societal call for more sustainable housing (interview 17). When investing in the sustainability there is often a need for a rent increase. Is means that residents must approve with the changes (70% must agree) in order to be able to increase the rent (interview 17). However, there is usually a decrease in energy costs because of the improvements in thermal isolation.

In the end, investors must, like any other owner, participate in the neighbourhood approach. They have the same challenge as housing corporations as they must look not solely at their own complex one at a time but must look at them within the context of a neighbourhood and the planning for that neighbourhood.

7.1.5 Synthesis

The collection of policy measures can be described as trying to find a collective approach that takes the energy transition systematically by addressing the transition one neighbourhood at the time (see table 7.1 for an overview of the most relevant policies). However, the energy transition is mostly translated to the removal of natural gas. While CO_2 reductions are incredibly important to the climate agreement, as the locality of the policies increases, also the focus on natural gas increases. Where the neighbourhood approach is focused completely on the removal of natural gas. With the introduction of the climate agreement, a comprehensive policy agreement was created wherein all sectors must change the way that they use energy. For housing, this comes down to the neighbourhood approach, where the complexity of the local level must be solved.

There are few answers on what the transition is going to be like. Every owner is struggling with the choices that they have to make. As they need to change their own real estate but must also work together with the municipality to address all the buildings in a neighbourhood at once. For owners of owner-occupied houses, the ability to sell their house remains paramount. Public housing struggles with providing affordable housing while also being the assigned frontrunner of the energy transition. And private investors do not all share the same willingness to invest.

In the end, both the national as the local government have made a step forward by setting a goal, which created many tensions and reactions (positive and negative). Those have an effect on the willingness of people to cooperate in the transition, as people reacted surprised that the weakest neighbourhood of Utrecht is the first to stop using natural gas, with the technical/financial challenges associated with this transition.

Table 7.1: List of relevant policies

Scale	*Policy*	*Intention*
National	Climate agreement	Cooperation between governance and non-governmental actors. Reduction of CO_2. Removal of natural gas in 7 million houses before 2050. Via the neighbourhood approach → location oriented, not complex oriented.
National	Shift from natural gas to an alternative	26 neighbourhoods with additional funding as trial.
Regional	RES	U16: isolation first, lower demand.
Local	Heating Transition Vision	Roadmap for getting off natural gas, which neighbourhoods and when. With preferred alternative per neighbourhood. Cooperation with partners, but a city council decision. Overvecht-North first.
Local	Neighbourhood approach	Overvecht-North precursor to national policy. Based primarily on technical arguments. Now a focus on: - Technology and economy - Participation - Market forces

7.2 An evaluation on the process of the energy transition

This part of the research will answer the sub-question: *What is the critical reflection and policy recommendation on the current trends regarding social, technical and financial feasibility in Utrecht Overvecht?* This is done by discussing the feasibilities of the process of the energy transition: social, technical and financial feasibility. The, in the previous section, mentioned policies lay an institutional context in which the process must take place. However, governance networks are unpredictable and the interactions between the feasibilities are sometimes messy. As these policies are translated to the local context, they need to work for each feasibility but are perceived different by different actors. This section is about that process. When understanding the process, the governance network can be discussed better.

7.2.1 Social feasibility

The main issue, regarding the social feasibility, is that sustainable transitions must be seen as a social transition. Without trust or a wrong perception, there is difficulty in achieving acceptance for the transition and implementing the policy goals.

As said before in the operationalisation, the social feasibility was measured using three indicators. They will be discussed sequentially.

Table 7.2: social feasibility

Social feasibility	Social trust
	Social perception
	Social acceptance

Social trust

Social trust is about the trust that people have in the transition, in the outcome, in the government and in the process. Trust can be maintained, lost or gained. Trust is easier lost then gained and can derail a process wherein people's opinion is required (interview 8). If an actor wants to inflict change, trust must first be restored, otherwise there cannot be a constructive environment. Many residents are sceptical of the energy transition and what that means for their house. Even though there are many improvements it takes much effort to convince people of the change and that it is beneficial to them. There is often much distrust in the housing corporation as people feel that they do not keep their promises (interview 8; 13).

People really understand that sustainability is something that has to be done, they understand the urgency of the energy transition (interview 8; 9). But they also need somewhere to speak their concerns before they can move on and think along to a solution (interview 9). In the process there must be time to allow people to get accustomed to the idea and to feel that their concerns are heard. Therefore, the question must be asked whether people are really against the energy transition or have many remaining questions before they feel comfortable with it (interview 15). That does not deviate from the fact that there is a large group that is unsure about the energy transition, and that they need to be made less unsure before they feel comfortable about the outcome (interview 15).

"There is a large focus on the financialisation, which is only one side of the story. The other side is that people need assurances, and that is a terrain to discover." (interview 15)

Without clear first steps there is likely not going to be enough acceptance for the implementation. First step is issuing guarantees where there is uncertainty (interview 15). There is uncertainty about which technology there is going to be, and how much it is going to cost. When there are these uncertainties—which is the case in the first neighbourhoods like Overvecht-North—there must be guarantees that make sure that people can trust the outcome, even though the exact choice remains unclear (interview 15; 16). As a member of a residential initiative says: "*I believe that without insurances the technical-financial side of the transition will become incredibly difficult.*" (interview 16).

For the energy transition people need to understand what it entails. The energy transition is complicated, and some argue that making it simple will allow people to understand it better and then be more open to changes (interview 7). For instance, focusing on the basis which remains the same—there will be adequate heating, in the old and the new situation—rather than allowing people to worry about what is specifically going to change can increase the trust that people have in the change. They know that they can trust the outcome. Another approach may be not to bother people at all with the transition and what it costs (interview 5) and taking the entire process out of their hands.

When it comes to a renovation that makes housing so energy efficient that is has a net energy surplus, the owner can ask for a compensation because the tenants receive income from the excess produced energy. Public rental often houses more vulnerable people with a language barrier. Explaining how the compensation works, also in use of a house proves to be difficult and many fail to understand it (interview 6). But such compensation is essential in order to pay for the investment.

Social perception

Renovations create hassle for people. Keeping the amount of hassle at a minimum will make people more open to the change (interview 6; 9; 13). This mostly applies to rental for they cannot chose which kind of renovation it is going to be, but for owner-occupied residents also because they want to keep the amount of hassle and change at a minimum. In the case of rental apartments buildings, the renovation is always inconvenient for some. When following the neighbourhood approach, owner-occupiers cannot always choose the moment of renovation themselves, making it always inconvenient for some. This inconvenience makes that residents begin the process with a negative experience.

Adding the transition to something that people can touch or experience helps in the willingness to agree to a change. Public rental corporations usually renovate according to a schedule and instead of addressing the energy transition solely or doing structural maintenance they are often combined. This means that with large renovations that address the energy efficiency/consumption of houses there is often a visual element like a new bathroom or kitchen (interview 3; 6; 13). This way the renovation and changes brought by the energy transition also brings direct improvements to the house and limits the amount of hassle that people experience by having two separate renovations. This can also be in the form of new cookware when they transition to an electric stove rather than a gas fired one (interview 6; 13).

For owner-occupied the same can be done, developing an energy neutral model home where residents can see what an energy neutral building entails (interview 14). In Overvecht-North they build one that is natural gas free and it also had a climate resilient garden and people were enthusiastic about the possibilities of the garden (interview 14).

The idea that the energy transition is solely a change in the way energy is consumed creates a narrow scope. Shaping the energy transition in a way that people want it rather than resist it, can be done by making the concept transition broader than only energy. There three types of people, 1) a selected group of individuals find sustainability that much important that they let it influence their choices. 2) another small group that has no connection to the energy transition whatsoever. And 3), between those two is the majority that finds sustainability rather important but find other issues more important (interview 6; 7; 8; 15). There are multiple issues in Overvecht-North like the ground lease, a prostitution zone in the neighbourhood etc. which can change the priorities of people (interview 6; 7). As a social worker in Overvecht puts it: (about the technical alternatives to natural gas) "*I believe in the technical possibilities, go ahead. But let us focus on how we are going to engage with the people in the neighbourhood. (…) It is more a social transition than only an energy transition.*" (interview 7). The energy transition is thus more a social transition then a technical/financial one.

Social acceptance

There were two aspects given to increase the acceptance of residents to the energy transition, creating desire and finding a solution together.

The earlier mentioned largest group that has both interest in sustainability but other priorities, they can be motivated by finding something that speaks to their desires (interview 8). If you desire

something, then paying for it becomes less of an issue. As a professor at Nyenrode puts it: "*(…) People, planet, profit and in that order. What we say is that you first need to identify what drives people, then find something sustainable that enforces that drive and, in the end, think about money.*" (interview 8). If people desire something, they start to think about money differently and will find ways to pay for it. Making people desire the energy transition can be done by making the energy transition more fun or exciting. Showing the benefits of the transition rather than the costs shifts the focus on what it can bring rather than what it costs (interview 7). One respondent called it for instance, 'creating the neighbourhoods of the future' (interview 7; 8). Herein there is no mentioning of natural gas free neighbourhoods, but it is implied. And the focus lies on the positive side rather than on the costs and the hassle. However, it must align with the reality of the neighbourhood, when it doesn't align you are not tackling the issues that matter to the residents (interview 12).

Some argue that when finding the solution together is a way to increase the trust. This means creating a collective (interview 11; 15). A consultant of Overvecht-North natural gas free calls it his moral duty to incorporate people in the process of the energy transition, those who own houses and those who rent them (interview 9). Doing it together can also include the use of neighbours, for people often trust neighbours more than they trust organisations like the municipality (interview 5; 16). People find it easier to visit a neighbour than go to—for instance—a model home to experience what the changes entail. Also do neighbours follow each other, if one makes sustainable improvements, others in the neighbourhood are more likely to follow (interview 5; 8). Creating a collective together as neighbours, also means that neighbours must rely on each other, and that the choices of one influence the other. Neighbours can better correct each other on this kind of behaviour then a large actor like a municipality can (interview 16).

7.2.2 Technical feasibility

Technical feasibility is a requirement for the success of the transition, as was said in the previous sub-section. Without the possibility of getting technically an alternative in place, there can be no other form of heating. As said before in the operationalisation, the technical feasibility was measured using three indicators. They will be discussed sequentially.

Table 7.3: Technical feasibility

Technical feasibility	Pros & cons types of installation
	Scale and space
	Typology building/neighbourhood → technical possibilities

Pros & cons types of installation

There are various types of installations that can offer heat without the use of fossil fuels.

"It is not about one type of technology" (interview 16)

The energy transition requires installations that offer more than an alternative heat source. New installations can bring comfort and quality to a house. It depends on the current state of the house,

whether there is good thermal isolation present or draft is an issue. Then the investment and the improvements in the house will create much more comfort and quality (interview 1).

The high-rise buildings in Overvecht often use collective boilers that generate warm water used to heat the building (interview 1; 6). This warm water is then distributed centralised throughout the building. Implementing other forms of heating often means that the entire installations need to be replaced, changing the heat supply for many houses simultaneously. This also means that the residents cannot act alone for they are dependent on each other. The benefit of such a collective system is that heat pumps often work better when operating constantly, which happens when there are more houses connected to one system (interview 1). Individual systems operate less efficient then collective systems because collectively there is often a more constant stream of demand. Also, in collective systems parts can be shut down when there is less heat needed to save energy, e.g. two heat pumps where one only operates at peak demand (interview 1).

There is also a criticism on heat pumps, whether they really generate at efficiency that is promised (interview 15). If the efficiency is based on theoretical models and is strongly influenced by the use of the installation, how do people heat their house? The use of heating influences the proposed efficiency and can thus limit the amount of costs that it can save.

Besides heat pumps there is the district heating network. The temperature of a district heating network can be on three levels: high, mid and low temperature (interview 3; 11). High is around 90 degrees Celsius, mid around 70 and low around 40. When there is a lower temperature then there are less losses during transport. Alternative sustainable heat sources for district heating often generate lower temperatures than fossil fuels which means that an efficient sustainable system must operate at a lower temperature (interview 11).

When it comes to selecting a type of installation, many different factors come into play. For instance, what kind of building it is and what the current quality of the thermal isolation is. It happens that people invest in a new form of heating but find that the system and the house do not work together. They are unable to properly generate enough heat or distribute it correctly throughout the building. They have then often received poor advise, for finding a system that fits the needs of the building, it is very important to receive enough and correct advise about the limitations and the possibilities of a certain type of installation (interview 1). Without this advice, people end up with installations that do not fit their needs.

Scale and space

Scale and space have an influence on two aspects of the energy transition, both on collective solutions and on technical innovations.

"*There are multiple reasons to address the transition on a neighbourhood level, for instance collective infrastructure. You cannot solve that individually over a 30-year time period.*" (interview 4)

For district heating there are two aspects where scale comes into play. The share of households needs to be high enough to make an investment worthwhile and the scale of district heating makes that there are more alternatives available to generate heat from.

For a collective infrastructure like district heating, there is a required threshold of participants that needs to be met in order to get a system with enough capacity worth installing and worth investing in (interview 1; 9; 11). That percentage is around 70 to 80 of a neighbourhood to participate (interview 11). Also, district heating must be a one-size-fits-all network as: "*You are not going to develop two separate district heating networks*" (interview 12). It is vital that when there is opted for a collective system there is enough effort made to reach the threshold.

The resident initiative 'Nieuwe Energie Vechtzoom' (New Energy Vechtzoom) is a collective that spans around 115 houses. There is a chance that when allowing this initiative to choose another alternative then is best affordable for the collective, achieving the greater collective solution can become unreachable (interview 14). Overvecht-North is now in the explorative phase. So, when it comes to the final selection of alternatives it will become clear whether these initiatives have an effect on the greater collective solution or that the collective solution appeals to the initiative.

The scale of district heating allows for the use of more alternative heat sources. Geothermal energy requires large investments and can only work when there is enough demand for energy. Deep geothermal energy can supply for around 30 years which means that it needs a stable market to supply that energy to (interview 1). Expanding the district heating network is being opted as being one of the answers of the energy transition. However, this network needs to remove its dependency on fossil fuels as well in order to be a truly sustainable solution (interview 11; 13).

The three largest housing corporations work together in spurring new innovations that can increase the thermal isolation of buildings, is applicable to almost all their houses and is affordable (interview 6; 13). The corporations use their large number of houses that they control to allow new innovations to gain traction. Producers of thermal isolation materials could develop and then facilitate the isolation of thousands of houses. Making the effort and the investment worthwhile. While for the housing corporations they get the type of thermal isolation that they need specially for their houses.

Typology of the building/neighbourhood

There have been many changes in the way more sustainable housing in perceived. Manager at a private real estate management company: "*(…) a while ago it was installing double glazed windows and installing individual boilers over collective ones. That was considered acting sustainable. This approach is already dated. Maybe a hydrogen-based boiler? How do you cope with the uncertainty of the many promising technologies?*" (interview 17).

As said before, the technological installation must be right for the house in order to get enough heat. It is also dependent on the age and type of house at hand. As described in the case, Overvecht-North has many buildings constructed in the 60s and 70s. These buildings often have a large share of glass so replacing the windows and the windows frames creates large improvements (interview 1). But, offering these houses a stable heat supply means connecting them to a district heating network or

installing an all-electric installation (interview 1). However, replacing the glass in the building is not enough to be fit for low temperature district heating or an all-electric installation. That requires a house that has high levels of thermal isolation that buildings constructed in the 60s and 70s do not have. This means expensive and large investments like more and better thermal isolation, other types of radiators and the replacement of doors and windows (interview 1).

That does not mean that it is impossible to achieve a high energy efficiency within these buildings, as a housing corporation is experimenting with making a 10-storey apartment building, that was constructed in the 60s, net energy producing. This is an extreme example that can be realised using subsidies and is meant to experiment with innovative renovations (interview 6). Generally, apartment buildings use collective installations that just generate heat ordinarily. For these buildings, it is not possible to install individual heat pumps in apartment buildings. That would require for every house an outdoor component of the pump which is acoustically and practically unwanted (interview 1). For larger apartments buildings collective solutions are necessary, e.g. district heating or either a ground or water collective heat pump.

Renovating is costly. But one of the reasons that Overvecht-North was selected as the first neighbourhood because the buildings are all constructed within the same within same timeframe which makes that many of the buildings and the public space in the neighbourhood have come to a natural moment of renovation (interview 4). Renovations are required and it is wise to directly change more then only a renovation.

In the end, as a technical installations consultant said: "*I believe the energy transition isn't a technical problem at all.*" (interview, 1). Technically, already everything is possible, but the question is whether it is affordable for everyone.

7.2.3 Financial feasibility

The issue of affordability is incredibly important in achieving inclusion. Therefore is the financial feasibility a requirement for the success of the transition. Without the possibility of getting it properly financed there will be little chance of a successful transition. As said before in the operationalisation, the financial feasibility was measured using three indicators. They will be discussed sequentially.

Table 7.4: financial feasibility

Financial feasibility	Investment costs
	Typology building → costs
	Scale of the investment

Investment costs

"*Inclusion is guaranteed when the investment over time maintains the same living costs as before the investment*" (interview 4).

When it comes to investment costs and generating enough capital over time to pay for the energy transition, everyone argues that the investment must not exceed the cost of living, which is rent or mortgage plus energy costs (interview 3; 4; 9; 12; 17). However, housing corporation have limitations in how much they can increase the rent, which is sometimes necessary to finance the investment (interview 3). They prefer to use living costs then solely rent, which means that they have more leeway in increasing the rent to lower the energy bill. For the municipality, it is key that the investment is kept affordable within the costs of living (interview 4; 9).

What is tied to the investment costs is the guarantee that the investment will lower the energy bill, otherwise the investment cannot be paid back using savings elsewhere (interview 5; 12; 16). The savings must be guaranteed in order to keep the promise of keeping the investment within the costs of living. The question is, who is going to guarantee the savings (interview 16), and what kind of effect the use of building is going to be?

The municipality wants people not only to consume less natural gas but to get rid of their natural gas connection altogether. Only, removing the natural gas connection is not always a logical investment to do. A consultant for public housing corporation: "*For example, you need to pay in order to get the gas connection removed and you need to pay in order to receive a district heating connection. These do not create financial benefits for the tenant.*" (interview 3). Reducing the use of energy has an effect, disconnecting from the natural gas network is not necessarily a saving. Also, the first mover costs of the energy transition must be looked at. The public housing sector is selected to be the driver of the transition, they find it unfair the costs associated with being the first mover come to the expense of the poorest in the society (interview 3).

Subsidies are currently used to lower the costs of investment. For instance, the earlier mentioned 10-storey apartment building is being renovated using subsidies to further the development of the innovations necessary to be able to make such a building net energy producing. When they want to do a second apartment building the same way but then without the subsidies, there must be a substantial decrease of the renovation costs (interview 6). Normally such a renovation not be done within the budgets associated with public rental. Subsidies are also used for assisting owner-occupiers with their coming renovation, which are granted by the municipality. Subsidy for the use of advice, to receive an energy coach, for process guidance and subsidy when working together with neighbours (interview 14). The municipality offers many ways for people to get assistance and to be financially compensated.

Lastly, the use of loans and innovative ways of financialisation. In order to finance the transition, many need to take out a loan in order to pay for the investment. Public and private owners have less difficulty to generate that capital and take 30 years to pay back. Owner-occupiers have more difficulties in generating enough capital to pay for the investment as Dutch homeowners have incredible high mortgages and cannot all take out a loan to cover the costs of the investment (interview 12; 15). The municipality offers loans for energy transition investments and is working on a loan for those with a credit rating that is insufficient for a normal loan (interview 14). However, as two consultants at the homeowner's association put it: "*You want to be able to take out a loan safely and*

sustainably. Nowadays, in light of the energy transition all new kinds of financialisation are created which boil down to just another loan." (interview 15). They criticise the use of loans for there are many, also in Overvecht-North, that cannot simply get a loan without risks. An example as a new type of financialisation is the use of a ground lease to generate capital for the investment without the use of a bank (interview 5).

Typology buildings

The typology of buildings and the financial side of it ties in with the technical typology. When there is a significant decrease in the energy bill, these saved expenses can be used for the investment. Buildings constructed in the 70s can probably generate multiple tens of thousands of Euros over 30 years (interview 1). That means that the buildings that are generally found in Overvecht-North can generate the capital needed for the renovation.

There is a discussion on the costs of certain technologies as a manager for a housing corporation puts it: "*I haven't seen a technology that can be applied on a large scale in the Netherlands, not as of yet*" (interview 13). Investment costs are still too high. That is with all new products when they come for the first time (interview 13). That is why the housing corporations are trying to influence the market by allowing innovations to directly gain traction because of the guaranteed implementation of the technology in thousands of houses.

Scale of the investment

The basis for the scale of the investment is that there enough capital available is in the Netherlands to finance the entire energy transition (interview 12). However, this capital is not available for all energy transition projects. An economically viable investment isn't necessarily financeable. This is because the capital is allocated to institutional investors that work with a ticked size of tens of billions of Euros. Or it is available in small amount of loans to individuals (interview 12). Public housing corporations do currently not have enough capital to make all their properties natural gas free (interview 3). As a financial researcher at the university puts it: "*For the existing institutional investors the energy transition may not be financeable, even though it is economically sound. There is a need for financial innovation.*" (interview 12). New methods of financialisation are needed for the projects that are either too small or too large for current methods of investment (interview 12).

In the Heating Transition Vision, the municipality has contacts with banks and other financial institutions to finds methods to finance the energy transition (interview 4). Others think that the best solutions lie with the national government with arrangements like subsidies, financialisation and ways to take away the financial burden from the owner (interview 15).

7.2.4 Synthesis

For the social feasibility, it appears that there is a lacking focus on the social aspect of the transition. The local context, and its complexity, is mainly driven by the different perspectives from the residents. For them the transition is sometimes incredibly disruptive. There are measures to cope with these difficulties, but not yet to all, as different actors have different approaches. The technical feasibility is one that must work. Even though there are many technical challenges left, it is technically all possible

nowadays. However, a technical solution must be fitting for the residents. Finding such a solution, where everyone has an adequate supply of heating, is as of yet not found. In theory there is enough capital to make the transition happen. Only for those who cannot take out a loan may find themselves in a difficult position where there is no answer yet on how their renovations are going to be financed. As the removal of natural gas is not necessarily a benefit.

It has become clear that the energy transition is more a social transition then a technical/financial one. And creating an energy transition that works for the entire society makes that it needs to be approached differently than before. Before it belonged to those who are willing to alter their lifestyle for it, now it needs to work for the masses. What can be understood from the feasibilities is that new approach must either appeal to the desires, or to remove the burden of transitioning entirely. These two approaches, a social oriented approach and a technical/financial approach, will be discussed in the next part. The governance needed to accomplish feasibility and the new approach will be discussed too.

7.3 The two different approaches and the new governance model

In this part the last sub-question will be answered: *How can governance networks operate more generally to accomplish an inclusive energy transition?* It will discuss the two different approaches, as well as the new governance model now that the institutional context, and the process has been made clear.

7.3.1 Two different approaches

From the interviews two different approaches to tackle the energy transition can be distilled. In the interviews these approaches were discussed, and opinions were given about them. On the one hand there is the social approach, and on the other hand the technical/financial approach. They deal with the way the social feasibility is being maximised. While these approaches are based on the specific case of Utrecht Overvecht, they can be utilised more broadly as they are not bound to a neighbourhood. They are applicable more generally, with other governance settings aimed at promoting inclusivity.

Social approach

The social approach builds on the arguments presented in the previous sub-question where desire was linked to social acceptance. As said before, people will think differently of expenses when they desire something. Playing into that desire can be beneficial for achieving the willingness of people to cooperate in the transition.

The current movement is to link social issues to the energy transition, but that can also be turned around where the transition is linked to social issues instead. That is the core argument of the professor at Nyenrode (interview 8).

The social approach first identifies the current issues that play in a certain neighbourhood. This can range from safety issues, (youth) unemployment, not enough parking, not enough green spaces, not

enough playgrounds, low levels of education, bad maintenance of houses and so forth. These issues can be identified by asking residents what they want to change in their neighbourhood or via other forms of engagement. When identified, the energy transition can be linked to these issues. Ideally, and the end of the program there is an improvement in the social issues as well as the energy transition. For instance, the renovations of houses are done by employing previously unemployed neighbourhood residents and there can be an addition to the comfort of a house by modernising it. This way the social issues are mitigated, and the energy transition is propelled forward as well. These changes may be desirable, and because they answer relevant issues in the neighbourhood, residents may value them greatly. When that is the case, residents are more likely to accept the costs and the hassle that these solutions bring, and also find themselves on top of the energy transition. In the end there are lessened social issues and a more sustainable neighbourhood created.

This approach could work in Overvecht-North for there are many social issues present in the neighbourhood (interview 8). For Overvecht-North, there are multiple programs that try to create change, and the energy transition team makes an effort to find locations where solutions for those programs come together and where there are synergies (interview 9; 14). This effort has an increased difficulty because of the different departments that are responsible for the programs, so it takes large parts of the organisation to locate synergies. Residents in Overvecht-North appear to react positively and sometimes start to show desire for certain changes that the energy transition brings (interview 14). They are enthusiastic about the changes, for instance that they find inductive cooking interesting. Others resist the change and don't desire the technological appliances that are required to have a natural gas free house.

Respondents made clear that when applying the social approach, the technical and financial side has to be arranged carefully and that people often desire more knowledge of the details of the technology and how much it is going to cost (interview 9; 15; 16). These two feasibilities cannot be overlooked. Residents must still be able to get a qualitative renovation that is financeable.

Technical/financial approach

The technical/financial approach stands opposite to the social approach where instead of focusing on social issues whereto the energy transition can be linked to, there is a focus on solving the energy transition with a comprehensive solution that encompasses the technical and the financial side.

This approach builds on the idea of taking the burden of the energy transition away from the resident and not troubling people with the entire transition (interview 5). This applies mostly to owner-occupied houses where the individual owner needs to make decisions on what to do. Often these owners are lost in the amount of choices, the costs associated to the investment and the difficulty of finding good advice.

The idea of the technical/financial approach is that a trustworthy party—can be public-private partnership with the municipality—identifies the changes necessary to get an individual or a set of houses on a sustainable energy source. In the case of Overvecht-North that is mostly natural gas free. Then the owner is offered a package containing the renovation of the house, the installation of new

heating appliances and possibly future maintenance of the heating system. This is financed by using one of various financialisation methods in which the owner pays back the investment over a long time period, based on the energy savings that the renovations bring. This can even be in a way that the resident pays the same energy bill, but that a share of the bill is used for payback (interview 5). The proposed offer must be an 'offer you cannot refuse' to make sure that there are enough participating residents in the neighbourhood to reach the required scale. With this scale, prices can be lower than conventual individual renovations. Once the owner has accepted (s)he moves out for a while and upon return the house is natural gas free and sustainable.

Because the resident is saved the trouble of finding, understanding and financing a solution it has increased comfort in the process. There is an assumption that by offering to take away all the troubles, residents are more willing to accept a sustainable house.

There were some negative and positive reactions from respondents to this approach. Some argued that it is not the for the government to impose a certain type of solution to residents (interview 14). It can only advice and steer towards a solution and it is not its task to force residents: "*We got it figured out people, this is the best solution', is old-school governance, not suited for the challenge we're facing and not in accordance with our policy on the type of government we want to be for our citizens.*" (interview 14). Another respondent replied that it is especially social oriented to say to residents that the entire transition will be solved for them (interview 7). But at the same time the respondents doubted the accomplishment of this approach when it would be executed by the municipality.

Conclusion

These two approaches are not mutual exclusive (interview 15; 16). As the consultants at the homeowner's association puts it: "*(…) it will probably be somewhere in the middle. It differs per neighbourhood.*" (interview 15). There may be some neighbourhoods where there is a larger chance of success when there is a social focus, and there are other neighbourhoods where the best way forward is offering residents a package that solves the entire transition. For Overvecht-North it appears that the social approach will most likely be the preferred approach because there is a plenitude of social issues that are yet to be resolved. But by listening only will the energy transition not be resolved: "(…) *it is an interaction*" (interview 16).

The set goal must also not be overlooked. The discussion about maintaining and setting a goal will be discussed hereafter.

7.3.2 Improved governance model

The model presented in the operationalisation (figure 5.1) was shown to and discussed with the respondents. Based on their critical reflections the model has been adapted to fit the practical situation better. It still holds true to the urban and sustainable governance literature while also incorporating the insights from the interviews.

Explanation of the improved model

Figure 7.1 shows the improved model which is based on the same elements as the previous model but has an extra step in it, which creates a difference between the national and the local government. It has three steps where the previous model only had two steps. The steps range from focusing on the higher scale to the lower scale, from the national government to the local government to the neighbourhood.

The first step is a policy measure, or a goal set by the national government where the other authorities can work with, in the case of this research the phasing out of natural gas. The defined process of the phasing out of natural gas is laid out in the Climate Agreement (7.1.1). The second step is a set of goals which are more vaguely defined by the local government that incorporates the local context into national policy. The vaguely defined goals by the local government are a combination of an energy transition goal with other goals that can assist in finding common ground in the neighbourhood, so called synergies. For instance; public amenities, improvements in security, noise pollution, parking issues, nature in the city or traffic hindrance. In this phase the government sets out general plans for the city and some plans for the neighbourhood, like guidelines that can later be worked out. The third step is the implementation on the neighbourhood level, which is done within the network of the neighbourhood where the government is a cooperating actor with all the other actors that work in the neighbourhood. In this phase the type of solution is being searched for and worked out in detail.

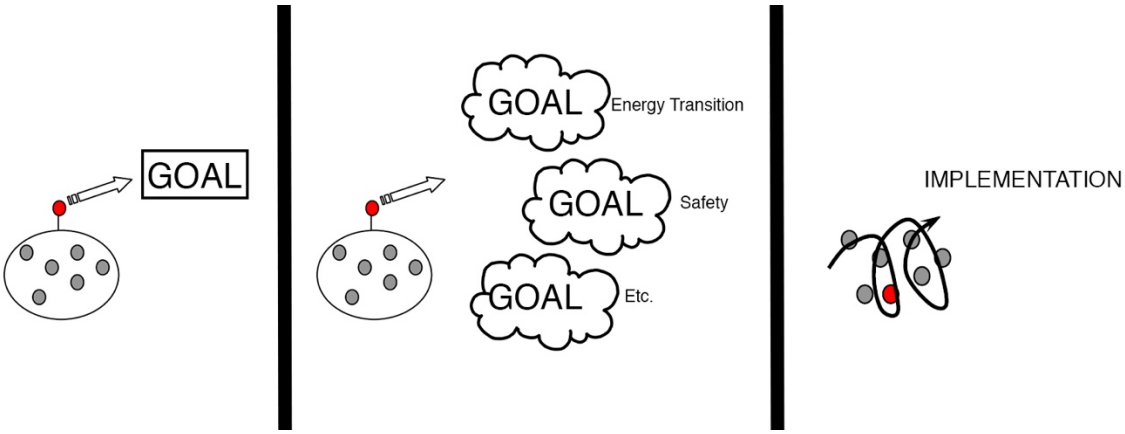

Figure 7.1: Improved governance model – own creation

Goal national government

The goal of the national government is explained in chapter 7.1.1 and focusses mainly on the removal of natural gas for something sustainable. Two elements have come up in the interviews; the end goal as a form of motivation and the questioning of what the actual goal is that needs to be achieved.

The policy by the national government creates a sense of urgency that motivates people to think about what the transition means for them and what they need to do to be ready for the transition (interview 5; 9; 11). It figures as a first step to define the end goal, in this case, being natural gas free in 2050. It lays down the groundwork for future discussions on how that transition is going to be arranged. Also, by setting the long-term goal, there is a clear message to the market to develop new technologies, as it is made clear that within these 30 years so many houses need to be transformed (interview 15). The

hope is that there will be new technologies with a better integration in the current system, which makes the transition easier implemented. On the other hand, respondents react to the goal by mentioning that it is not the removal of natural gas, which is the goal, but the creation of an energy neutral Netherlands (interview 4). Or that it is not the national government that sets the highest goal, but that it is the Paris agreement which has to be aspired towards (interview 15).

Goal local government

The local government translates the national goal to the local context. During the translation, the municipality can best ask the residents and other relevant actors to think along with the setting of the goal. That will make actors feel associated with the goal and make it more of their own instead of only the local government (interview 6). In the case of Utrecht can the goal of the local government be seen as the Heating transition vision. Which is created with consultation of relevant actors. But, in the end, it is a city council decision and therefore a product of the government (interview 4; 6). There is an effort to include all relevant actors in the process, but the definitive goal is set by the local government.

When discussing the social approach—mentioned in the previous section—a city official of the municipality said that there has to be a clear and singular goal (interview 14). Otherwise there is a chance of ending up with a different solution altogether which has nothing to do with sustainability anymore. This reinforces the idea of goal setting for sustainable governance mentioned in the literature. The goal is strictly set by the national government and the local government must execute that, but it can incorporate other issues as well, the synergies. As the city official of the municipality puts it: "*We have to focus on achieving our thematic goals but in the meantime searching for synergy with other themes is equally important.*" (interview 14). In its communication however, the municipality must be careful to present the goal of becoming independent from natural gas as the sole goal. By presenting the neighbourhood approach as solely finding an alternative for natural gas, people will then think that the rest of the issues will not receive equal attention (interview 8). Hereby referring to the first way the municipality announced that Overvecht-North would become natural gas free, as highlighted in a somewhat notorious letter the residents in 2017. Setting a goal is important, but the municipality must prevent that a goal becomes to solitary (interview 8). So, there is a need for a clear and singular goal but is has to be presented as a package of multiple focus points.

The municipality has a platform where it tries to create chemistry between relevant actors that operate within the energy transition, like owners of real estate, bankers, social workers, resident initiatives and others (interview 14). With this platform—called the City agreement Utrecht natural gas free (Stadsakkoord Utrecht aardgasvrij)—the municipality ties to bring actors together that may need each other when it comes down to the implementation the removal of natural gas. The municipality actively tries to shape the governance network necessary for the transition: "*We strongly believe that it's beneficial to bring together people that say: 'this is cool, let's cooperate.*" (interview 14). Respondents were uneven about the way this platform was arranged. One thinks that this platform was meant to find common goals within the city, to locate synergies (interview 6). Two others argued that becoming natural gas free is not the right goal to create a network for, lowering the CO_2

emissions is that goal (interview 7; 13). However, both respondents attended and participated while outing their discontent with moving solely to becoming natural gas free.

Implementation within the neighbourhood

It is going to be a challenge to implement the energy transition. There is a need for cooperation because the municipality doesn't own the system, the alternative heat sources, the current infrastructure and the buildings (interview 4). The municipality owns little themselves of what has to change. This means that the municipality has to work together with the actors who actually own parts of the transition. That also means that the approach has to be different in every neighbourhood. The Heating Transition Vision is only a piece of paper (interview 4), the implementation lies with a large range of actors. Because of the large range of different actors, the lack of ownership of the municipality and the lack of technical and financial consensus, the manager of a housing corporation puts it this way: "*I expect it to be an unpredictable process. Let me put it this way, the energy transition will not be something that can be planned for via a clearly defined route. It doesn't work that way.*" (interview 13).

Therefore, there is a need for the government to work with the network to accomplish the goal, for instance via resident initiatives. Resident initiatives want to cooperate with the government in order the get the best out of their neighbourhood (interview 10; 16). According to a resident initiative in Overvecht-North—which has recently proposed a process in which the about 115 residents can become natural gas free—must the process be as fast as people can fathom it (interview 16). Initiatives have also a better chance of getting residents behind their initiative. As initiatives are embedded in the neighbourhood, the resident initiative in Overvecht-North believes that can reach more people than the municipality can: "*I think that within out scope we have set down at the kitchen table for about 60-70% of the households*." (interview 16). Therefore: "*I think it is a winning strategy to have a combination of professionals and resident initiatives.*" (interview 16). When there are resident initiatives in the neighbourhood, the advice is to use them extensively to create the willingness of residents to participate in the transition.

Conclusion

As the set of actors differs in every neighbourhood, the transition of the policy to the implementation is going to be different in every neighbourhood as well. In this model, the level of abstractness allows the local contexts to find their own specific set of networks, goals and ways of implementation. This makes the model applicable to more than solely Utrecht Overvecht.

Below the relatively simple visualisation of the steps, lies a complex network where there are different perspectives on the goal(s) setting and where there is a need to have cooperation with all the actors during implementation. The implementation in the neighbourhood seems like a long process. This extensive process in which many individuals cooperate and are asked to cooperate, is probably not something that has to be repeated for every neighbourhood in the Netherlands. But it may very well be the right approach for the first neighbourhoods where the entire transition has to be in a way invented (interview 16). In later neighbourhoods the technical/financial side may be substantially improved in a way that it is no longer necessary to embark on this extensive implementation process.

The governance networks may start to mature in a way where there are fixed actors who have a strong influence and make the process go smoother.

7.3.3 Synthesis

There is uncertainty about which approach fits which neighbourhood. Both approaches however, need an overarching goal in order to get the right outcome. This goal setting is defined in the governance model where there are two types of goals dealing with the desires from the local context.

As said before, these approaches and the model are applicable to a wider scope of neighbourhoods. They are based on the institutionalised context, but many nations or cities have a similar (inter)national context. As many nations and cities must all strive towards achieving the Paris agreement, which can be regarded as the overarching international goal from which national goals emerge.

8 Conclusion

This research looked into the feasibility and the governance of an inclusive energy transition in residential housing. The energy transition—as well as sustainability—was discussed, where there is a shift from the use of fossil fuels to another sustainable source of energy, illustrating the current issues regarding supply, demand and possible solutions. In order to steer a transition towards a desired outcome, governance is needed.

There are multiple modes of governance, and this research has combined crucial aspects of both urban and sustainable governance into a model. In this model, governance networks are used to transcend general sustainability goals to an implementation in the institutionalised local context. The process of the energy transition was defined by designating three feasibilities: social, technical and financial feasibility. All of these feasibilities must be sufficient in order to successfully implement the energy transition in the existing housing stock. This research used the case of Utrecht Overvecht, where the energy transition has begun by the removal of natural gas for heating by 2030. Overvecht represents a neighbourhood where there is an aging housing stock and public space that needs renovation. In combination with generally lower-class residents, achieving inclusion is important for this neighbourhood.

In the policy review, it appeared that there is a desire to handle the energy transition systematically. The national government has both decided to lower CO_2 emissions as well as stopping the use of natural gas in houses. It has been combined in a comprehensive policy agreement in which all sectors must change the way that they use energy. Giving all sectors parts of the transition in order to include everyone. For housing, the neighbourhood approach is a crucial element. The energy transition in the existing housing stock will not happen per individual building, but rather per neighbourhood. For every owner there is a different hurdle to overcome. As 1) owner-occupiers need to be able to sell their house at any given moment. 2) public housing has to provide housing for the lowest incomes which collides with the policy of them being the frontrunners. And 3) private housing is owned by investors who not value sustainability as important for their business. Every owner is struggling with the implementation and the choices that need to be made in order to participate in the energy transition. In the end, someone has to make the first step forward, for Utrecht—and the national government—to say this is our goal, created momentum. Many respondents replied that this goal setting was a crucial step in starting the discussion on how to arrange the energy transition and who is going to be responsible for an adequate outcome of the transition.

There is a large focus on the technical and financial side of the energy transition. And the respondents regarded them as important feasibilities, which need to be sufficient and cannot be overlooked as they as of now not yet solved. However, many respondents indicated that both the technical and financial feasibility are more or less checkboxes. The social feasibility is going to be the largest battleground of the energy transition as the transition needs to be accepted by the public. The energy transition has evolved from a movement of mainly interested and concerned individuals to a transition that has to work for everyone. Without cooperation, there is little chance of succeeding in this challenge of applying the energy transition to more than 7 million houses using natural gas within 30

years. This challenge requires changes that takes access to all households. While many households will find an alternative via their landlord, owner-occupiers must all individually decide what they want as an alternative. Millions of households will have to think and decide what to do with the energy transition.

In this research, the respondents presented two different approaches where one is oriented around the idea that residents need to desire the transition and the other is about removing the burden of the transition by solving the technical and financial side for the residents. Both approaches can work in Utrecht Overvecht. However, it is not about which approach is inherently the best, but which approach is best fitting for a specific neighbourhood. When it is a neighbourhood with clear social issues the social approach might create the best results for the residents. While in a neighbourhood which does not have clear social issues the technical/financial approach might be most valuable for them. But even in this distinction, there was no consensus with the respondents which neighbourhood requires which approach. As an argument for the complete reversal—removing the burden from those on a lower social class—could be considered being incredibly inclusive for those who are unable to solve the transition themselves. Probably these two approaches are going to be intertwined, both happening in neighbourhoods at the same time or following each other in the process as they apply to different groups of residents.

There is abundant evidence that (trans-)national governments in recent years have embraced urban sustainability and the general reduction of CO_2-emissions as a major policy goal, which are currently being implemented. However, this research has focused particularly on how such policy initiatives have been implemented at a local scale. As such, it has contributed by showing how these policies are trying to systematically give actors a role in the energy transition. Setting long-term goals while allowing the local context to be managed on the lowest level possible, makes that the current policy has implemented elements of both the urban and sustainable governance. And yet, defining the local goal remains a discussion for many, who do not agree with the focus upon the removal of natural gas.

The transition literature has captured how transitions in society evolve from socio-political interactions between landscapes, (dominant) regimes and niches, combined with an implementation in the complex local context. This research has contributed to this literature by illustrating that the transition is not going to be a predictable process. As top-down forces try to solve the transition, bottom-up forces react by designing a process themselves in order to maintain the narrative guard their desires for the feasibilities. Resident initiatives are actors that allow niches to develop while controlling and tailoring them to the local context. This way they keep themselves managing the inclusive part of the energy transition. Consequently, going in against the neighbourhood approach. The neighbourhood approach could be regarded as a regime itself. Thus, the energy transition has already multiple processes that strike against each other, making unclear with approach or which group of actors will become dominant.

Urban governance scholarship has increasingly addressed the need to study urban resilience and sustainability issues in times of global political change and disruption. However, while sustainability is such a holistic category involving meta-governance and complexity, this research has proposed not

just to study the ‘urban governance of sustainability’, but rather ‘sustainable governance’ in its own right. In doing so, this research has found that governance is about actors interacting in a network in order to work with the complexity. Sustainable governance is more about setting, and dealing with, a goal to strive towards. Also, when there are two approaches that have a profound difference between them—that also carry different sub-goals that need to be met—there are multiple groups of actors working on them. These actors must find each other and sometimes they must work together. As the approaches are not mutually exclusive and may occur simultaneously in neighbourhoods, the two actor groups must be able to find each other and work with one another. These networks must be managed, maintained or set up by someone, which could be a role for the government. Maybe the City agreement Utrecht natural gas free could be such a platform for Utrecht.

Concluding, the energy transition could also be a chance to address issues within the buildings, with an increase in comfort and quality people’s houses could be modernised if not done so yet. Especially in neighbourhoods with an aging housing stock. Going even further into the possibilities of the energy transition. The energy transition could be seen as a tool, a facilitator of an inner-city modernisation of the existing housing stock. It could be the motivation to move the modernisation of the existing housing stock forward. This requires an integrated approach in which all facets of the neighbourhood as a whole are combined with the changes necessary to pull the neighbourhood into the 21st century. In this case the energy transition would be associated with other changes besides the transition that improve the quality of life in the neighbourhood. There is in this way an overarching goal to be met, and there is a clear understanding of where to strive towards in the process. Seeing it this way makes the energy transition not one sole goal, but a useful tool to create better housing while also increasing the sustainability of these houses. Maybe it is the energy transition that can be the carrier of the modernisation of neighbourhoods with an existing housing stock.

9 Discussion

This research has looked at three feasibilities, transitions, different owners, governance and inclusion. With so many different elements, the specifics of all of them are not always uncovered. What this research set out to do, was to give an understanding of the process of an inclusive energy transition through the lens of governance in the case of Utrecht Overvecht. The aforementioned conclusions are the results of this research. However, all the theoretical elements could be specified more deeply, something that was not feasible for this research due to its scope. In the end, this research has made valid and vital observations to the process of the energy transition, something many nations are just starting to cope with. For instance, with defining two approaches and presenting a model for the sustainable governance part, a better abstract understanding of the transition is made. Regard the importance of the social aspect of the transition as the prime message of this research. Processes that fail to include the social aspect sufficiently are going to—in the eyes of this research—fail. How all the elements are intertwined, is up for further research in order to get an even better understanding of them.

This research has covered many theoretical elements, trying to combine them, and then testing it to a practical case. Certain theoretical aspects were difficult to define, such as social feasibility. Measuring the workings of a human in the energy transition brings uncountable elements forward. Therefore, it was decided to limit the social feasibility to three indicators which would enable distinctions between them and in the end parts of the social feasibility have been uncovered. Social feasibility could be an entire study on its own. Further research into this could create more understanding of this incredible complex part of the transition.

Because this research used one case, it could dive deeply in the workings of the energy transition in Utrecht Overvecht. Even though Overvecht is representable for a type of neighbourhood, verification of the developed model in other neighbourhoods—same and other types as Overvecht—is beneficial to the possible wider usefulness of the model. Whether the model works the same in other neighbourhoods or other types of neighbourhood is an unanswered question. Can inclusion be maintained there as well, or does it work differently? These are important questions to ask.

From this research, three extra ideas about future research emerge. First, a more in-depth study into the workings of the two approaches to the energy transition—with real world cases—create more understanding in the workings of the two approaches. This research could not uncover how the two approaches interact and how they affect each other. In this research the approaches could only be observed and kind of be reflected in Utrecht Overvecht. A study with proven cases could further develop the approaches and create better understanding of how they interact with each other.

Second, guarantees were mentioned as important part of social trust and it is clear what they generally entail, but it is unclear what the exact application of these guarantees must be. Also, who is going to give these guarantees? Who is going to be responsible? The guarantees can be in construction, financial constructs and within policy, all with different specialisms.

Lastly, the governance network was discussed as well, the specifics of such a network are unclear, who will bring the actors together? Who is going to facilitate the network? How must such a network be developed? The specifics of a network wherein the goals can be met, and approaches can be a study in itself.

Therefore, based on the aforementioned arguments, can this research be the basis for further research on a social and inclusive energy transition. The process and the governance networks can be understood more in-depth in research of their own.

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11 Appendix

11.1 Interview topic lists

See appendix file.

11.2 Interview transcripts

See appendix file.