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Tegenstroom in Haarlemmermeer

An unconventional approach to local energy

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This thesis is the result of five years study at the Faculty of Spatial Sciences of Groningen University during which I developed my interest in the field of spatial planning and became more and more interested in how people affect their living environment and vice versa. This past year and a half studying Environmental and Infrastructure Planning have let me learn more about how environmental change and how infrastructure development can evolve in preparation of this. This has resulted in a thesis thoroughly focused on a social aspect of the energy transition, a subject that I care deeply about.

Although it has most certainly been difficult, the freedom to choose and develop your own research from the ground up, it has also been rewarding and an opportunity to learn much more about a place I have called home for nearly 25 years

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Having said this, finishing my thesis is the final part of over 22 years of school and studies and is the final part in becoming an actual real-life adult. Therefore, I hope you enjoy reading through my efforts as much I have enjoyed finishing it!

Abstract

This thesis is centred on how municipal level energy generation can assist in the current energy transition. We employ a qualitative case study approach of the municipality of Haarlemmermeer in the western Netherlands, to investigate the impact of the local sustainable energy company, called Tegenstroom, it has set up. By analysing its context, the management spheres employed, area-based approaches and the importance of local engagement as well as the unique relationship between the Haarlemmermeer and Tegenstroom we find that Tegenstroom is a unique initiative that has been relatively successful in its initial aims. However, lack of tactical oversight and insufficient reflexivity by the municipality are hampering Tegenstroom's further growth and mean it is running into familiar issues regarding similar initiatives. Hence, the ability to develop similar initiatives elsewhere is limited and dependent on strong actors and the identification of suitable starting projects. The ability that a similar initiative would allow a municipality to directly steer the energy transition is promising but needs further development.

keywords

Local Energy, Energy Cooperatives, Energy transition, Municipal Energy Company, Complexity, Area-Based Approaches

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List of Abbreviations

Abbreviation:	Meaning:	Explanation/Translation
ABA	Area Based Approaches	
CBS	Centraal Bureau voor de Statistiek	The Dutch National Statistics agency
NASA	National Aeronautics and Space Agency	The United States space agency
NIMBY	Not In My Back Yard	
PCR	PostCodeRoos	Policy measure allowing the sharing of solar panels on roofs or land not owned by the panel holder
REI	Renewable Energy Initiatives	
RVO	Rijksdienst Voor Ondernemend Nederland	Dutch national Entrepreneurial department.
UNFCCC	United Nations Framework Convention on Climate Change	United Nations body to monitor climate change and stimulate mitigation measures

Chapter 1 Introduction

The climate is warming up. The use of fossil fuel resources is emitting so much greenhouse gasses into the atmosphere that an average temperature of more than 2 degrees Centigrade is close to becoming reality (NASA 2018). In an attempt to tackle the situation, the Paris Agreements provided a historical global agreement to curb emissions (UNFCCC 2016). Similarly, European targets have been in place for some years to reduce emissions and make the energy system more sustainable (European Commission 2010). In these agreements, the Netherlands has been assigned a target of 14% renewable energy of its entire energy demands by 2020 (CBS 2017). In order to meet these targets, the Dutch government has recently adopted "the most ambitious" new climate policies yet (Klimaatakkoord 2018). Locally generated energy is coming to play a central role in this.

As part of this, municipalities are encouraging local initiatives to step up and for citizens to contribute to the transition in any way they can (Rijkswaterstaat 2013). Often, this comes in the form small energy cooperatives. These are small entrepreneurships consisting of people joining together and investing their own time and money on a voluntary basis to try and improve their direct surroundings. More specifically they often focus on energy and problems such as solar panels on shared roofs via PCR or improving home insulation (RVO 2015a). A key feature of these cooperatives is that they do not have a profit objective and that they are directed by their members, who are also all equal shareholders (RVO 2014). They are favoured by municipalities due to their self-guiding principles, their independence and their closeness to citizens (Rijkswaterstaat 2013).

The municipality of Haarlemmermeer however is doing things a little differently. Five years ago, they founded their own local energy corporation called Tegenstroom. It was funded with the explicit aim of furthering the municipal energy transition and help in achieving their municipal energy goal of becoming "energy positive". It maintains the aims of the municipality and strives to produce local energy for local customers. In doing so they promote more equal relationships between customer and energy providers and help people reduce their ecological impact (Tegenstroom 2014a). It was founded alongside and is intrinsically linked with a sister initiative called Meermaker, a sustainable investment company that promotes and aids green investment that might otherwise fails to secure funding (Energeia 2013).

The challenge of Tegenstroom is that it does not fit the regular profile of an energy initiative. What is most interesting about this case study for researchers is two-fold. First is the creation of a municipal energy company, harkening back to the start of the 20th century Dutch electricity market (CBS 2015). Where before centralization municipalities often provided their own electricity, now most is generated by a few, often multinational companies. It is interesting to see how a municipally held not for profit social enterprise may fit into such a marketplace. Secondly, the scale at which Tegenstroom operates is of interest. Due to Tegenstroom being a municipal energy company it operates at a higher geographical scale than usual street or neighbourhood level cooperatives. However, it also operates at a smaller scale than initiatives lobbying and educating, or clusters of cooperatives with greater impact at regional or national levels, or indeed, traditional energy companies. At the same time, it also doesn't really fit with regular energy supplying companies either because it does not employ a profit objective, actively pursues energy integration and sustainable energy development as well as energy equality and independence within the Haarlemmermeer and is owned by a single municipality.

For planners specifically, this thesis might be of interest due to the uncommon nature of Tegenstroom. Having been founded by the municipality with the explicit aim of furthering the municipal energy objective, the new combination of municipal parent, local energy corporation and several predetermined projects allows the municipality to more actively nurture bottom up energy generation,

instead or alongside of facilitating small cooperatives. This proactivity may be appealing in achieving ambitious local energy goals whilst maintaining professional distance and core municipal tasks.

As such, the goal of this research has been to provide an overview of the Tegenstroom initiative and how/if it is different than other sustainable energy initiatives. The aim was to find out if it has had a positive influence on the energy transition in the Haarlemmermeer and if it is unique to its local circumstances or something that may be duplicated to other areas as well to aid in the bottom up energy generation that will be fundamental in the transition towards sustainability.

The energy transition and area-based approaches, as well as the close municipal involvement, are key returning features throughout the thesis and require an overview of theory. De Haan and Rotmans (2011) and Rotmans et. al. (2001) provide the basis for the transition theory upon which this thesis is founded, supplemented by Loorbach's (2010) transition management. The literature on decentral energy is developing quickly (Boreyevich et. al. 2010; Tenti Kuldi and Ulli-Beer 2016; and Caldognetto 2018) and focusing increasingly on local generation and integration. This often involves the use of energy Initiatives (De Boer and Zuidema 2015; Beermann and Tews 2017) also more generally referred to as grassroots initiatives (Blanchet 2015; Kooij et. al. 2018). The literature on energy initiatives varies greatly in subjects, ranging from the policy implications of initiatives in an international context (Kooij et. al. 2018), in an urban context (Blanchet et. al. 2015) or how emergent behaviour of initiatives requires active policy change (De Boer et. al 2018b). There are also advocates for laboratories of innovation to safeguard innovation (Beerman and Tews 2017) and accounts on local integration and development (De Boer and Zuidema 2015; De Boer et. al 2018a), as well as specific research to the effects of policy implementations such as the Dutch PCR (De Boer et. al. 2018b). Finally, there is a focus emerging on how to understand initiatives in their contexts and how they affect local and regional relations (Sehested 2003; Hasanov and Zuidema 2018). Aside from this theses articles provide evidence that local initiatives make citizens more aware of their local energy conditions (Blanchet 2015) and actively pursue policy changes (Blanchet 2015; Hasanov and Zuidema 2018) but remain constrained in their success by lock-in effects, vested interests and unwelcoming conditions (Beermann and Tews 2017; Kooij et. al. 2018). However, in the Netherlands, most bottom up focused energy initiatives are in the form of cooperatives, micro-businesses set up and run by energetic citizens (Rijkswaterstaat 2013). According to Hieropgewekt.nl (2017a) there are only a handful municipally run local energy initiatives. The potential benefits of these practises have, in not yet been researched, hence this thesis.

To achieve the central goals, the main research question was formulated*: **does the seemingly unique set up of Tegenstroom allow it different options than other energy cooperatives and how might this impact the Dutch energy transition?***

This is then broken down into several other sub questions regarding different aspects of the research, the first is meant to provide an overview of the Haarlemmermeer and its energy initiatives: "***What local circumstances have shaped Tegenstroom and is Tegenstroom viable outside of these?***" This will include a description of the physical and social aspect of the municipality, a description of Tegenstroom and a schematic overview of other initiatives and actors involved with Tegenstroom, in the area. The second sub question deals with the local energy transition and innovation by using Loorbach's (2010) multilevel framework as a guide for analysing the implementation or embeddedness of Tegenstroom within the local energy transition. Hence, question two reads: "***what is the role of Tegenstroom within the municipal energy transition?***" In sub question three a closer look is taken at what impact local specific knowledge and decentral energy generation have had so far and what the role of Tegenstroom has been in the municipality regarding local specific knowledge and local projects. Therefore, sub question three was formulated: "***is Tegenstroom unique from local area-based perspective?***" Finally, the fourth sub question deals with matters of governance and how Tegenstroom and the municipality

interact with each other. This is of importance because of the exceptionally close relationship between the two, that isn't usually found with other initiatives. Therefore, the fourth and final sub question is set up as: "***is Tegenstroom unique from a governance perspective****?"*

Following now, chapter 2 discusses complexity theory, transition theory, area-based development and challenges regarding decentral energy, diffusion of innovation and governance renewal before ending in a theoretical model that highlights similarities and links between the different theories. Chapter 3 dives into the methodology of this thesis, discussing ontology and epistemology, the theory behind a choice for case study and why the choice for semi-structured interviews was made, as well as ethical considerations and data handling. In chapter 4 the data is presented in the form of a case overview and on the hand of sub questions as described above. Chapter 5 presents the conclusions based on chapter 4 and discusses these findings considering what can be learned from this. Chapter 6 finally offers a reflection on the thesis process itself and what we would have liked to see differently and what has been learned in a more general sense.

Chapter 2 Theory

This chapter sets out general theories that are of use in understanding the (Dutch) transition towards a decentral energy system. It starts with a general overview of complexity theory, followed by a section on the government/governance debate. Then follows a detailed description of transition theory and transition management theory, supported by a section on the diffusion of innovation. The second to last section of this chapter considers some of the general challenges facing renewable energy generation and is followed by an overview of area-based development. Finally, the chapter closes with a section that brings these concepts together in a conceptual overview that is then used in chapter 4 highlight links between theories.

2.1 Complexity theory in rapid pace

Complexity is far too vast a field to try and summarize in a single thesis, let alone a small section. Nevertheless, here follows a very brief overview of some of the most important features of complex systems and complexity in planning, meant to elucidate the transition debate and provide background to other theory that follows.

This section is included because complexity underpins many of the other theories used in this thesis as well as the case described in later chapters. It is therefore, necessary to provide a short overview, so as to be able use a complexity perspective throughout this further thesis. Complexity helps understand how to view relationships between various objects or actors and it paints a general background for the theory to follow, as according to Loorbach (2010) societal complexity has increased on multiple levels with society itself, the problems it faces and the way society deals with these problems have all become more complex as time goes on. In other words, as society becomes more complex, so do the troubles it faces, and complex problems do not have simple solutions. Practically this means that dealing with these problems solutions become more complex as well, branching into governance theory and transition theory for instance.

Byrne (1998) discusses complex systems and several of their key features. The first of these features is that complex systems are made up of many different actors all acting independently. Secondly reality in a complex system cannot be reduced to its individual parts to understand it. It is a holistic image that cannot be reduced. Thirdly, change within complex systems occurs evolutionary, meaning it is both non-linear and non-reversible in time (also known as emergent behaviour). This means that small changes in parts of the system have unpredictable effect on other parts of the system, hence why a holistic view is paramount. These unpredictable effects caused by many different actors are the main cause for uncertainty within complex systems. Uncertainty means here that the consequences of actions cannot always be overseen and can only do as best as we can (Byrne 1998).

While considering the holistic view and the fact that a complex system is made up of many different interactions, Byrne (1998) also describes the way that there are generally several key variables that characterize the system as a whole. These key variables are needed to describe how complex systems adapt to changes. Byrne (1998) describes that a system in equilibrium will generally stay in equilibrium unless disturbed. It is these disruptions that affect the systems shape and form and they can happen in two general patterns. If a disruption does not affect the key variables of the system, it will not change too much and can absorb the change relatively easily, maintaining its general shape and form. However, if a disruption does change these variables, change can come quickly and radically (Byrne 1998). In this instance the shape and form of a system can change radically from their originals. This is due to bifurcation in paths of the key variables, where each new path has further bifurcations, very quickly branching into incredible amounts of options. This also explains the susceptibility to very small changes early on in the life of a system leading to incredible variance later on (Byrne 1998).

2.2 Governance renewal

This section focuses on the changes in government and the steering of society. The overall trend has been increasing involvement of citizens and market parties and the move of government from a traditional steering role towards a guiding or facilitating role. Central in this section is figure 1, De Roo's Holy spectrum of planning (De Roo 2010).

The governance debate is closely linked to the complexity argument. This is due to the increasing interaction between increasing numbers of actors and different responsible bodies. With increasing concerns and increasing interactions, complexity increases and society becomes more difficult to steer coupled with increasing uncertainty. This overall overview is meant to provide insight in transition theory and the decision-making landscape that surrounds us these days. For this case De Roo's (2010) account on complexity in planning is used to create an image on how the governance debate has developed after the second world war. It is then linked it to the complexity debate that seemingly permeates everything.

De Roo (2010) provides a tool for understanding the debate more clearly by placing the governance debate on a spectrum. This spectrum is a visual aide, that depicts planning based on philosophical knowledge and debate. The spectrum borrows concepts from other social sciences such as sociology to provide analytical tools that may be used in planning. Above this is an arched line that depicts the so-called planning spectrum, with modernist rational-choice planning opposed by post-modernist communicative rationale planning. It is important to know in this instance that these are ideological extremes and not necessarily found in real life situations

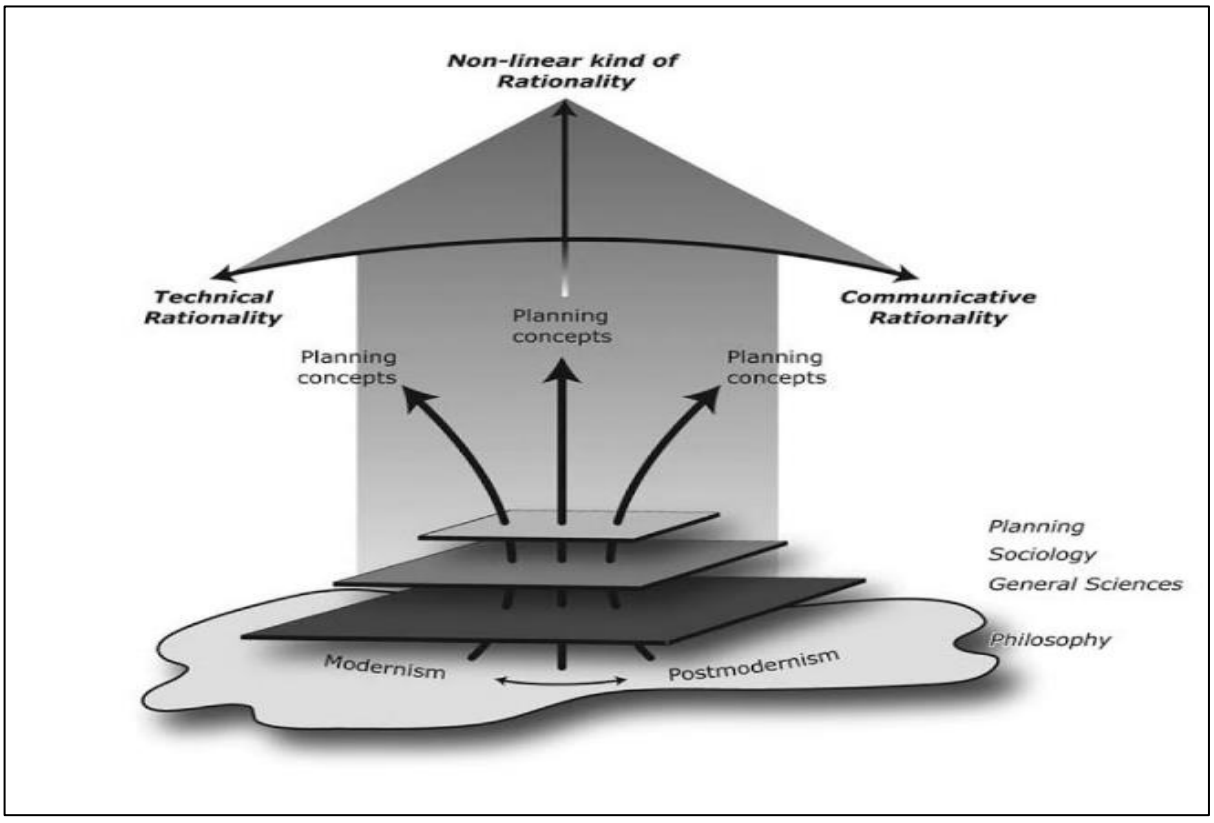

Figure 1 The Holy Spectrum of Planning by De Roo (2010)

The opposition of technical rationality and communicative rationality in the spectrum is intentional as it symbolises two opposing ideologies, that are still of use today. De Roo (2010) states that this spectrum is not merely a spectrum of the planning debate, it is also a depiction of complexity. When viewed as such, the technical rationality represents simple problems with simple solutions, where standardisation can be of great benefit, like traffic lights. Similarly, communicative rationality concerns itself with the most complex situations where Foucauldian ideal speech situations need to be guaranteed to ensure all involved actors have a similarly important voice in dealing with planning issues and handling uncertainty and complexity in planning (De Roo 2010).

The government/ governance debate comes forth from the duality in paradigms during the 1980/90's (Frahm and Martin 2009). This duality was formed by the government paradigm versus the market paradigm that have both synthesized into the governance paradigm (Frahm and Martin 2009). Where the government paradigm was primarily concerned with how to govern, and the market paradigm was concerned with efficiency, the governance paradigms combines the two and pays closer attention to the relationships between the governing body and those it governs. This increases the communication between different players and is a method of dealing with uncertainty in planning (De Roo 2010).

The governance paradigm is characterised by the importance of network theory and how relationships between actors work. Similarly, governance also implies that the traditional state is no longer the dominant actor in for instance the planning process. Instead it is one of many actors that give shape to governance. This is based on the principle that *"no single actor, public or private, has the all-encompassing knowledge, overview, information or resources to solve complex and diversified problems"* (Sehested 2003; p. 89). This is of course also closely related to the communicative rationale in planning, where shared meaning and interpretation are very important (De Roo 2010).

The fact that government is no longer the dominant actor in for instance the planning process and the fact that the traditional branches are becoming more and more intertwined are both symptoms and causes of complexity in governance and planning. As citizens become more vocal and start voicing their opinions and preferences, problems become more complex due to the need to account for their needs desires and concerns. This in turn requires new solutions for problems and the interfacing of different branches of government, market and civil society to come to new solutions by working to together. Meanwhile, this cooperation also increases the complexity of government and governance itself, as there is no longer a single responsible actor and instead complex networks that deal with complex issues are formed and responsibility and accountability become shared (Frahm and Martin 2009).

2.3 Transition Theory and Transition Management Theory

This section discusses general transition theory, what is a transition, how to model transition within this thesis, how does change take place and how can transitions be guided? These are central questions in this section that structure it throughout.

2.3.1 What is a transition?

Rotmans et. al. (2001) describe a transition as a gradual continuous process of change that fundamentally changes the structural character of society or a sub-set of society. Transitions can happen on different scales, levels or time periods and involve a wide range of possible development paths but generally span at least 25 years. Similarly, De Haan and Rotmans (2011) describe that although the world around us generally appears stable, this relative stability is on occasion disrupted and replaced with a new stability of a different order and a new functioning of the systems that make up society or societal system or sub-system. In complexity terms this means that a change in the key variables that make up the system cause a fundamental change to the system (Byrne 1998). Adhering to structuration theory, De Haan and Rotmans then define a transition as a "fundamental change in the structures, cultures and practises of a societal system, profoundly altering the way it functions" (De Haan and Rotmans 2011 p. 92). Rotmans et. al. (2001) follow up their description of a transition by stating that it is the cause of developments in different domains that results in a self-reinforcing spiral due to the interconnectedness of different domains such as technology, the economy or culture. This multiple causality and interdependencies between domains or societal systems is attributed by De Haan and Rotmans (2011) to the complex adaptive nature of the world and the societal systems it comprises.

Key in this description is the phrase societal system and it is something that is referred to often. De Haan and Rotmans (2011) define a societal system as part of society that has been attributed a specific function and it is through this function that society meets its societal needs. An important feature of societal systems is that they change slowly over time, adjusting to fit its environment or the landscape and adapting to fit changing societal needs. De Haan and Rotmans (2011) elaborate on this ability to change by decoupling functioning of a societal system from its individual actors and cultures. For instance, different energy systems can fulfil the same societal function, despite consisting of different actors' cultures and structures. Rotmans and De Haan (2011) regard this robustness of societal systems functioning as emergent behaviour, allowing them to view the functioning of societal systems separately from the specific processes or actors involved.

2.3.2 Multilevel model

There are two methods used in Dutch transition management theory. The first, the multiphase model, uses four distinct phases to model the fast and slow dynamics identified in transitions (Rotmans et. al. 2001). The second, called the multilevel model stays close to structuration theory and instead use *structures, cultures and practises* for interpreting transitions. Structuration theory posits that the repeated actions of single or individual actors create structures cultures and practises which then in turn limit and constrain, but also enable the subsequent actions actors will take.

- In structuration theory, the repeated actions that create structures and cultures are known as *practises*. They create and shape structures and cultures but are themselves also shaped by the existing structures and cultures. Practises can change quickly and are subject to influence not only by their related structures and cultures, but also by outside influences of for instance newcomers or niches.
- *Cultures* are formed by these repeated practises and give shape to them in return by influencing the thinking and actions undertaken by individual actors. Cultures are therefore

the “discursive, normative and ideological aspects of functioning involved in the sense-making” (p3. De Haan and Rotmans 2011), or the intangible aspects of society that shape our thinking.

- Finally, *structures* are the formal organisational rules that guide, inhibit or enable actions and by individuals. These are laws, rules policies, but may also be physical or economic constraints shaping practises and are based on the dominant cultures.

Because the speed at which these concepts change and interact varies greatly, with practises being the quickest to change and cultures being much slower to do so, De Haan and Rotmans (2011) also include the notion of a fast and slow dynamic. This is also what distinguishes a transition from being merely an accumulation of incremental changes over time, as the transition leads to a new, relatively stable equilibrium.

Rotmans et. al. (2001) then continue by saying that transitions can happen at various levels of society, which they call macro for global conglomerates, nations or federations; meso for networks, communities and organisations and on the smallest scale is the micro level which consists of individual actors. This division fits closely to studying changes in society by dividing it in niches, regimes and socio-technical landscapes (Rotmans et. al. 2001).

In this division, the niche level relates to individual actors and local practises, the regime level relates to dominant practises rules and shared assumptions whilst the socio-technical landscape relates to material and immaterial elements at the highest level such as infrastructure, world views or paradigms (Rotmans et. al.2001). An important characteristic of the socio-technical landscape is that it both shapes the lower levels but also adjusts itself to slow change, changing its shape, hence the landscape moniker.

De Haan and Rotmans (2011) elaborates on this division. Earlier it was mentioned that societal systems cater to the societal needs. De Haan and Rotmans (2011) expand the concept of societal system, by stating that because the needs of society can be so diverse or even contradictory, a societal system can be seen as a composition of societal subsystems. *A transition occurs when one societal subsystem is replaced by another to improve the fit of the entire societal system.* De Haan and Rotmans (2011) name these societal subsystems *constellations*, and the manner in which it has subdivided, or the makeup of the societal system they call its *composition*.

2.3.3 When things change

These denotations become important when considering why and how these systems change, something touched upon earlier. As mentioned before, societal systems are formed for fulfilling a societal need, but societal-needs change and so societal systems must also be subject to change. De Haan and Rotmans (2011) identified two main reasons for change in their article, and each of these reasons has several further subdivisions.

The highest-level division that is made is on whether change comes from within the societal system or from without. Change from the outside in is first elaborated on. De Haan and Rotmans (2011) call these types of change *tensions*, as they come forth from the societal system not aligning properly with other systems. Tensions can come forth through problems with the physical, infrastructural, economical, formal and legal aspects of the relation with the environment (other systems). This is known as *structural tension* (De Haan and Rotmans 2011). The second form of tension De Haan and Rotmans (2011) identified was *cultural tension*, which comes forth due to problems concerning the cognitive, discursive, normative, ideological aspects of the relation of the societal system with its environment.

When a new regime from outside the current societal system successfully replaces the current regime, this is called *reconstellation* (De Haan and Rotmans 2011).

Change from within can come in two forms, which De Haan and Rotmans (2011) call *stress* and *pressure.* Stress is the result of when the "dominant way of functioning of the societal system, embodied in the regime, is in itself inconsistent or inadequate" with the needs of society at that point (De Haan and Rotmans 2011). Pressure is the result of the rise of a new constellation within the societal system that challenges the current regime (or dominant constellation). If the new constellation successfully manages to replace the old regime this is called *empowerment* (De Haan and Rotmans 2011). Alternatively, if the current regime manages to stay dominant by integrating features of the challenger this is known as *adaptation* (De Haan and Rotmans 2011).

2.3.4 Transition management

Having discussed the theory behind transitions and how they are shaped, attention quickly turns to how they can shape or guide transitions to society's benefit, or if this can be done at all. Rotmans et. al. (2001) provide several key features that transition management must fulfil to be successful. They have rooted these features in general transition theory and tied them to personal observations and experiences (Rotmans et. al. 2001).

The first feature they mention is a long-term vision (at least 25 years), that is anchored in a transition objective and a transition vision. The transition objective should be a multidimensional objective that is open to evaluation and re-adjustment as time goes on. It is described as a "net policy corridor for key variables, indicating that the margins within which the risks are considered acceptable" (Rotmans et al. 2001 p.23). An example might be the maximum accepted range of temperature rise due to anthropological climate change.

> *The transition vision must be a realistic vision, that is used to mobilize social actors to the cause of the transition. It needs to be realistic in the sense that it is aware of the reality of possibilities of the societal subsystem it represents. it is like the objective, open to change over time as new information comes in and new discoveries are made (Rotmans et. al.2001) The greatest known example of such a vision would be "to put a man on the moon".*

Secondly, transition management must be characterised by multi-domain, multi-actor and multi-level thinking. This means that transition management must be aware of the complex nature of the issue, and take into account the interconnectedness of societal subsystems, actors and processes. Dealing with these issues can then call for a more inclusive approach such as the communicative rationale in De Roo's holy spectrum of planning (De Roo 2010)

Thirdly, Transition management according to Rotmans et. al. (2001) must maintain a focus on learning-by-doing and doing-by-learning. This essentially means instituting a robust method of evaluating, reflecting, re-evaluating and adjusting transition objectives and methods to better deal with changing circumstances in a societal (sub)system.

Fourthly, transition management must be about bringing system innovation whilst striving for system improvement. This means that whilst striving towards a new equilibrium (the transition vision which is also the envisaged system improvement) you must also strive to make the current conditions as good as it can be. This is done, according to Rotmans et. al. (2001), as part of the evaluation process, where there is room to reflect on parts that are going well, evaluate experiments and criticize things that are holding the transition back. Here, the importance of an open playing field and the ability for actors to voice concerns and share experiences becomes more apparent.

Evaluation of progress requires the creation of interim objectives (Rotmans et. al 2001). These are content objectives that are derived from the main transition objective. Basically, milestones along the way to the main objectives, using interim objectives allows both progress evaluation, as mentioned, but also for incremental adjustment to changing circumstances. A second aspect of evaluation that Rotmans et.al (2001) discuss is the review of the transition management process itself, allowing vocalization of concerns when, for instance, a single party is dominating the process. Finally, evaluation allows for effective use of learning strategies to adjust to new knowledge as the transition unfolds itself.

Finally, Rotmans et. al. (2001) say that the aim of transition management must also be to keep a wide-open playing field and to create public support. Especially this final statement seems like an afterthought in their handling of transition management, more so given how they emphasize that people are the main subject of a transition in societal subsystems. It is their changing needs that drive change and initiate transitions and it is people that will live with these changes and their consequences.

For this reason, Rotmans et. al. (2001) is used as a general guideline but preference is given to the more recent analysis of Derk Loorbach (2010) in their view of transition management. Although most of the general themes are shared between the two, Loorbach benefits from a more practical experience and a more developed body of transition literature.

Similar to Rotmans et. al. (2001), Loorbach (2010) sets out several key features or tenets for complexity-based governance as they call them. Some of these, like the long term thinking flexibility and adjustability, a focus on learning and maintaining a variety of options and perspectives, overlap with Rotmans' key features. However, clear evolution of theory is also visible as Loorbach also pays careful attention to other factors such as;

- Content and process are non-separable, insight in how the system works is critical for success and a mere process management approach is doomed to failure.
- The importance of timing, crises provide windows of opportunity, disequilibrium allows an opportunity to steer the system in a new direction.
- Allow for safeguarded, protected experiments with new forms of regimes to provide direction for investment of time energy and resources
- Steering should happen from inside the societal subsystem rather than from the outside. Doing so allows for the adaptation of structures actors and practices within their own contexts, rather than through outside enforcement.
- And finally, what was missing from Rotmans et. al. (2001) in our eyes; participation from and interaction between stakeholders is crucial for developing support for policies and engage them in reframing problems and solutions through social learning.

Using these tenets, Loorbach (2010) created a descriptive multilevel framework to analyse transition management from. In this framework they differentiate between four types of governance activities or spheres;

The strategic is the sphere with the longest timeline. It spans the entirety of the transition period. This sphere focusses on the transition vision and discussions that alter the landscapes or culture of a societal subsystem over time. As mentioned earlier, this includes the norms and values, ethics and the importance to society. Due to the long-term aspect, uncertainty is very high. This also allows room for alternative voices and influences to come into the debate. Loorbach (2010) rounds this sphere of by stating that these types of very long term thinking often have no formal institutional basis in policy making and that creating such a base must be a fundamental ambition for transition management.

The second sphere is the tactical sphere. It concerns itself with steering dominant structures or the regime of a societal subsystem. This includes rules and regulations, as well as networks and routines. This level concerns achieving goals (like the interim objectives) on a 5-to-15-year time span. The tactical level is almost always solely concerned with its own performance and rarely how they impact the whole system. This often leads to fragmentation of policy and achievements and underlines the importance of full system evaluation.

The operational sphere is the third and concerns itself with a short timeframe. It generally concerns innovation that may lead to new behavioural practises. This is highly important as this may lead to new structures, cultures, routines and actors, keeping the playing field wide open and opening up new transition pathways. This level is closely related to the niche level and is described as being driven by individual actors.

The final sphere Loorbach (2010) describes is one that concerns monitoring and evaluation as well as public perception of ongoing change. Here Loorbach describes several of the things Rotmans et. al. (2001) also mentioned, whilst elaborating on the social importance. Amongst the similarities are the importance of learning and adapting and of research. These show the importance of reflexivity in research, which must be an intrinsic part of the transition to allow for adjustment as the process unfolds itself, rather than finding out after the fact. Here it is that Loorbach (2010) also calls out the importance of the public. Public opinion of changes nowadays can be hugely impactful, especially given the availability of knowledge through for instance the internet. If a change is undesired, this may lead to backlash from the public. This may trigger an adjustment within one of the other spheres, changing the transition pathway.

2.4 Diffusion of innovation

Here an overview of how innovation is spread among a population is provided. This is based of Rogers (2010) fundamental theory of diffusion of innovation. This theory is used as a way of understanding how Tegenstroom and other initiatives are capable of aiding the energy transition in a bottom up manner.

The basic theory of diffusion of innovation is closely related to contemporary transition theory. It does however also provide useful insights in how new ideas, information and innovation spread throughout a population that can benefit the analysis. As such, provided here is a brief oversight of some of the main concepts of Rogers (2010) primary text on diffusion of innovation. It is in no way an exhaustive discussion of the concept but does provide useful additions to what has been discussed already.

To understand Rogers' (2010) theory for diffusion of innovation three key concepts are fundamental. First is the concept of uncertainty. This is defined by Rogers (2010) as; "the degree to which a number of alternatives are perceived with respect to the occurrence of an event and the relevant probability of these alternatives" (p 6). In other words, it means the number of possible actions one can take when something happens and in how far the consequences of these actions can be overseen. The second key concept Rogers (2010) uses is that of information. They use a definition borrowed from Rogers and Kincaid (1981 p64) which reads: "[information is] the difference in matter energy that affects uncertainty in a situation where choice exists among a set of alternatives". This means that information affects the choices people make by changing their overview of the choices possibly opening up new options. Finally, innovation is defined by Rogers (2010) as the "perceived newness of an idea for an individual" (p11) as well as being the way in which people tackle uncertainty by converging and combining new information to open new options to choose from. The link with complexity and some of its most important features is clear here in the use of uncertainty and how information affects this, especially considering that more views offer different options in transition management.

With the knowledge of these key concepts and Rogers' definition of innovation, follows an explanation what exactly is understood by diffusion. Rogers (2010) defines diffusion as the process by which innovation is communicated through certain channels over time to the members of a social system. As such, this means that diffusion of innovation is the convergence of new information that affects uncertainty and is spread through special agent-client relations (Rogers 2010). This may then in turn result in a societal change, where societal change is defined as the alteration of structure and function of a societal system. This means that following structuration theory the adoption or rejection of new ideas and information/ innovation changes the choices and options that are open to actors and results in different consequences for society, changing its path (Rogers 2010). As such, diffusion of innovation is the way in which innovation is spread and new options or pathways open or close. Again, the similarity with complexity and transitions seem obvious, given the close links with structuration theory, the subdivision in societal systems, the open playing field and how it is affected by uncertainty and the change in societal systems that it produces.

Getting back slightly to the definition of innovation, the perception of newness of and idea is crucial in this regard, as it refers to how different actors can react to when confronted with a choice and new information. What this means is that innovation spreads gradually throughout a social system and not all actors come into contact with new information at the same time. Based on this Rogers (2010) differentiates between five different actor types in regard to how they handle new information and whether they actively seek out innovations. These actor types are:

- Innovators
- Early adopters

- Early majority
- Late majority
- Laggards

This represents a scale at which the actors differ in quickly they adopt something relative to its introduction into the social system and how much they depend on near-peer information to come to a decision, which can be presented in an S-curve as shown below (figure 2). In this the innovators are an exception in the sense they operate in a near-peer information vacuum and instead are the ones spreading the first wave of information and combining information to create new opportunities (Rogers 2010).

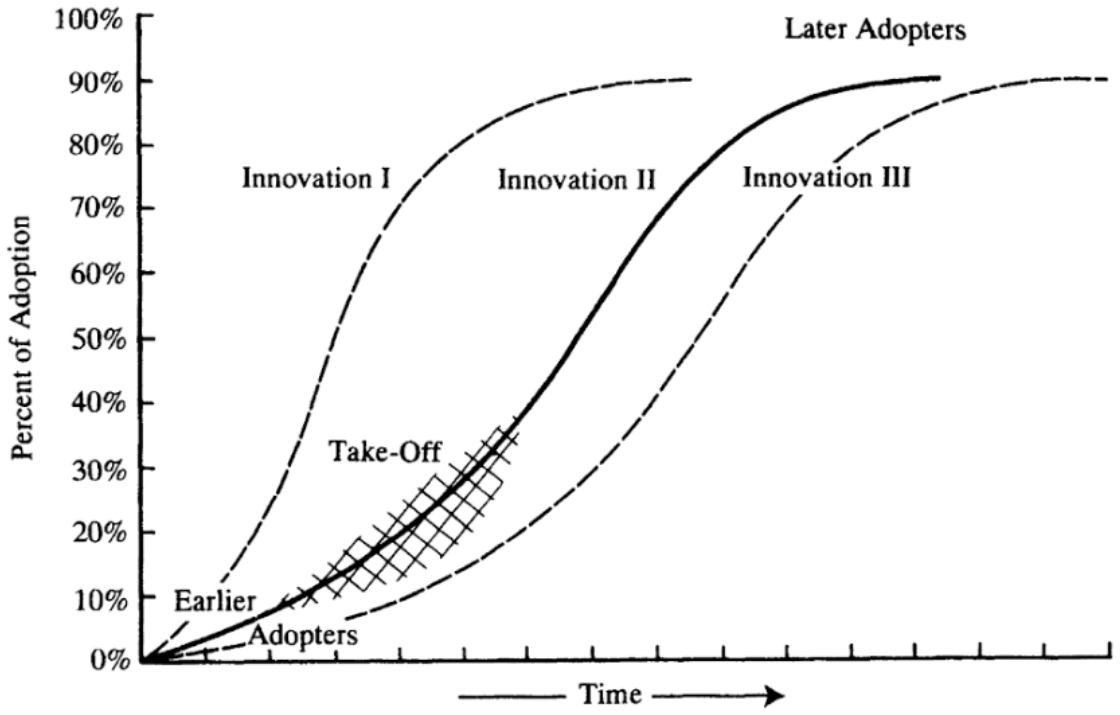

Figure 2 S-Curves of innovation by Rogers 2010

As the figure above shows, the adoption rates of new innovations are very similar the multi-phase model. The main benefit of laying these different theories side by side however is not the visual similarity of the S-curves. Instead it is Rogers theory on how innovations spread that can aid in understanding how transitions take shape. It is the perception of innovation and the near-peer information spreading that are of note here. Especially given the change from near invisible energy generation towards highly visible decentral renewable energy generation. It is through seeing other people adopting the technology and spreading information that renewable energy becomes more accepted and accessible to other actors also known as familiarity effects (Hasanov and Zuidema 2018). As it becomes more and more adopted it becomes more visible and the transition pick up speed. Similar to Blanchet's (2015) SAF and how small, relatively powerless actors can change a system by seizing opportunity and exploiting shocks to the system to press established actors into change, so can innovation spread due to changing conditions.

2.5 Decentral Energy generation

In this section follows a discussion on the changing nature of the energy system itself, why it may be changing and how it may be changing. The section discusses microgrids proposed by Tenti and Caldognetto (2018) and different types of networks by Krohn (2012). It then then discusses the importance of changing awareness and global agreements before ending with a discussion about the lack of clear definition of energy initiatives.

Now then, having discussed what an energy transition is, as well as what transition management entails and the benefits of employing several key concepts from the diffusion of innovation discussion it is also beneficial to discuss the actual energy system. This is due to the different loads that renewable energy developments will bring to the grid compared to the current system, such as greater load spikes caused by photovoltaics. As such, here follows a discussion on some of the reasoning behind the current changes in existing energy networks and the surrounding policy domain, as well as what these changes may look like.

Let's start of by signalling a change in the overall composition of the energy system in its broadest meaning, which can be associated with a transition as various authors on this subject do (De Boer and Zuidema 2015; De Boer et. al. 2018a; De Boer et. al. 2018b; Hasanov and Zuidema 2018; Kubli and Ulli-Beer 2016; Tenti and Caldognetto 2018, etc.). This energy transition as any good transition, is made up off many interrelated parts, as befits a complex system (Byrne 1998). Some of the most fundamental changes driving the transition can be divided into two categories, policy changes and structural changes, although each begets the other due to the interrelated nature of complex systems.

Let's first look at some of the expected changes to the physical electricity grid. Tenti and Caldognetto (2018) argue that a move to renewable energy is a move towards microgrids. In their reasoning, microgrids can become the building blocks of the new energy system (Tenti and Caldognetto 2018). This is because, they argue, it allows for extended flexibility that it allows distributors to move away from one directional energy delivery (Kuldi and Ulli-Beer 2016). Additionally, it allows distributors to improve demand response efficiency and voltage regulation by actively managing microgrids, also known as local area energy networks (Boreyevich et. al. 2010). Simultaneously, microgrids might allow consumers and communities to empower themselves in the energy market by providing in their own energy demand or delivering surplus energy back to grid, whilst maintaining backup power facilities (European Commission 2016).

However, Tenti and Caldognetto (2018) argue that in their current form microgrids are not yet suited to the role they envision them to fulfil. Microgrids need to undergo a radical revolution to be able to become the building blocks of the future energy system. For this to happen, microgrids need to enable meshing together, whilst improving reliability of renewable energy provision through storage and expanded interconnectivity. This means sharing power between microgrids in a dynamic way whilst preventing needless power circulation within the overall grid. Additionally, national steering for overall power demand and grid stability needs to be extended to include microgrids, granting energy monitoring stations the ability to actively call upon microgrids in large number, similar to current energy generation capacity methods but divided into many micro plants instead of a few central energy facilities (Tenti and Caldognetto 2018).

This reordering of the grid means that rather than the centralized systems of today, or decentralized systems following a hub and spoke model the energy grid might become more of a distributed network as can be seen in figure 3 from Krohn's (2012) explanation of different networks. This is similar to Ackerman et. al. (2001) who in their definition include the generation of energy on the consumer side, in a distributed energy network. In turn, this also involves an increase in complexity, involving more

actors and generation facilities, involving more uncertainty and requiring more coordination than current systems.

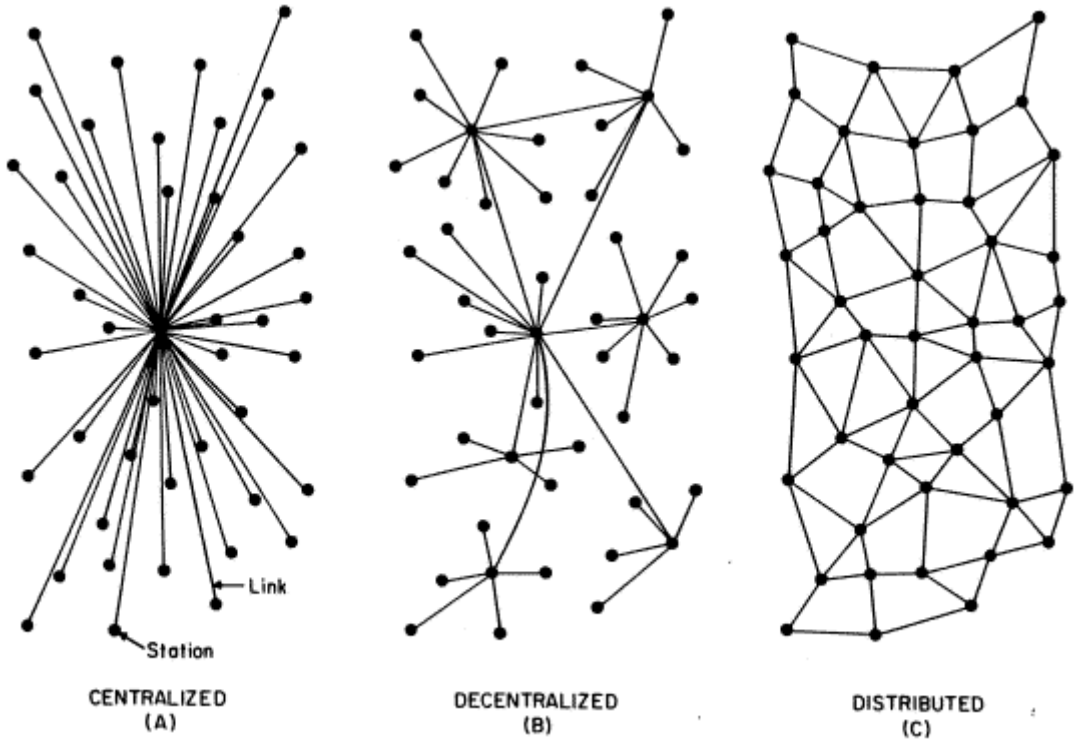

Figure 3 Types of Networks by Krohn (2012)

The domination of physical measures and physical oriented policies block out regional initiatives, decentralisation dynamics and networks effects in the Netherlands (Stern 2014). Especially so given local actors motivations to choose for renewable energy generation, which may include: environmental concerns, increased independency from the grid and increased energy security, as well as what Stern (2014) calls familiarity effects, meaning actors are more likely to generate their own renewable energy when people near them in their social network also do so, or the diffusion of new inventions within a population (Rogers 2010).

Along with the rise in environmental awareness has come increased environmental policy. Some of the most influential in recent years has come from the European Union in the form of the Europe 2020 agreements (European Commission 2010). In short, these agreements set goals for the overall Union to decrease GHG emission by 20 % of 1990 levels, increase the share of renewable energy to 20% and gain 20% energy efficiency, all by the year 2020 (European Commission 2010). This is presumed to be the result of cultural tensions in the societal systems, caused by a changed perception of how humanity should treat the environment, thereby forcing change in the way the systems function (De Haan and Rotmans 2010). Another very influential and high-profile agreement came forth in 2015 in the Paris Agreements, where almost all nations in the world agreed to more actively combat anthropogenic climate change and try to keep temperature rise below two degrees Celsius, through local nationally tailored contributions. What was most perhaps most special about the Paris Agreements was the inclusion of the world's largest polluters in the form of China, India and the USA which had previously generally stayed outside such agreements. (UNFCCC 2016).

Following these agreements, particularly the European goals, the Dutch Ministry of Economic Affairs, responsible for energy policy in the Netherlands, shifted its focus towards more decentral energy

generation and energy systems (Van Leeuwen et. al. 2017). These policies are slowly focusing on phasing out the Dutch reliance on natural gas by 2060 and stop using its own natural gas resources by 2030. Aside from gas reduction other policies focus on energy neutral buildings from 2020 onwards, large scale energy renovations of the housing stock, renewable heating scheme subsidies stimulation of investment in photovoltaics increasing public awareness of renewable energy potentials and increasing electrification of energy consumption (over non-renewable sources) (Van Leeuwen et. al. 2017). Despite its proven importance to the energy transition and the realisation of a low carbon economy, public opinion and engagement is often left behind or only generally sensed remotely, not empirically grounded or made central in new policy measures (Demski et. al. 2015)

This lack of personal connection and public opinion making in large projects and policy writing is where small local energy initiatives can provide a crucial link to the realisation of at least the 2020 goals and eventually a low carbon economy (De Boer and Zuidema 2015). It also shows an important deficit in the Dutch energy transition by previously preferring technical rational measures for highly complex issues Stern (2014). By shifting towards more bottom up enabling policy, the government is slowly recognizing the importance of shared information and the ability of niche level actors to innovate and for small actors to upset current power balances (Blanchet 2015; Rogers 2010).

Unfortunately, there is no single clear definition of what exactly an energy initiative is. Beermann and Tews (2017) for instance lack any definition of an initiative in their argumentation for niche level safe spaces to allow the development of innovation, outside of calling them generic grassroots initiatives. Blanchet's (2015) definition shares many similarities with De Boer et. al.(2018a) and De Boer and Zuidema (2015) in calling these initiatives generally bottom up and community led. Kooij et. al. (2018) and Hasanov and Zuidema (2018) are much more elaborate. Both still refer to the grassroot origins, but also stress the importance of "open dynamic bottom up activities that seek to provoke changes that go beyond or against the orchestrated paths of transition" (Kooij et. al p.52 (p1)), and of local involvement, community ownership, grassroot innovation, citizen participation and individual motivation in the creation and success of energy initiatives (Hasanov and Zuidema 2018).

These are still more a summation of keywords than a proper definition, but this may be due to the nature of grassroot initiatives in general. They can be placed within the niche level of Rotmans et. al.'s (2001) multilevel model and are produced by individuals who see opportunity to improve, much like Rogers' (2010) Innovators. This is why initiatives can be so diverse and why transition management must remain an open view and allow for innovation to come from all levels, keeping open as many transition pathways as possible. Energy initiatives may concern themselves with local generation for instance or sharing said energy. They may concern themselves with reducing the energy use of local buildings or with storing energy locally to improve local independency and improve stability. They may even concern themselves with lobbying for policy change to improve conditions for other initiatives (De Boer et. al. 2018a).

2.6 Area-based development and integrated energy landscapes.

In this section area-based approaches and integrated energy landscapes as posited by De Boer and Zuidema (2015) are discussed. The section starts with a discussion on the nature of what area-based approaches actually entail and moves onto an overview of integrated energy landscape theory, the importance of local linkages and the role bottom up initiatives may play in this.

De Boer and Zuidema (2015) define integrated energy landscapes and area-based approaches in the energy transition. They argue that embedding small renewable energy initiatives in their geographical surroundings and their landscape through local linkages increases their viability and maximizes their potential.

However, while they do provide an overview of key features and benefits that are associated with area-based approaches, they do not provide a clear definition of what they understand area-based approaches to be. As such, here the definition provided by Sanderson (2017) is used and then linked to De Boer and Zuidema's (2015) arguments in favour of area-based development to this definition. Sanderson provides the simple definition that area-based approaches (ABA's) are "geographically based in a specific area, engaged in participatory project management methods and multi sectoral in nature" (Sanderson 2017, p.1). They elaborate on this by stating that the most valuable benefit of ABA is the multi sectoral approach that it focuses on community in their respective contexts and addresses local problems and accounts for how local problems fit together physically and functionally. Bringing this back to De Boer and Zuidema (2015) this involves the importance of the physical and socio-economic landscape and how people perceive initiatives and how initiatives can be fitted into people's daily lives without (perceived)negative consequences in a collaborative planning process.

The integrated energy landscape debate is very closely linked to the general transition theory and with it the energy transition (De Boer & Zuidema 2015). As mentioned earlier, general transition theory describes how a societal system moves from one point of equilibrium to another. This is caused by tensions in the relationship between the needs of society and a societal systems ability to provide in these needs. Regimes are subject to pressures from both the slow changing landscapes, as well as innovations at niche level vying for their chance. Change is then guided by learning processes and evaluation (De Haan and Rotmans 2011; Loorbach 2010)

Now, with the knowledge that change comes from niche level innovation as well as changes in the landscape it is important to focus more on the transition that is taking place in the energy system. In this case it is prudent to operationalise what these terms mean in a more practical context. This means that the landscape is not just a metaphorical concept. De Boer et. al (2018a) stay close to the definition provided by the European Landscape Convention (2000) when they interpret the term landscape as both a geographical and metaphorical expression of different practises, actions and interactions that shape a complex system. In this definition De Boer et. al (2018a) see six different (societal sub-) systems that interact with each other across four different spatial scales to form a holistic whole that is the energy landscape. According to them, this energy landscapes consists of:

- The Community System
- The Governance System
- The Physical Infrastructure System
- The Bio-Physical System
- The Economic System
- The Energy System Itself

It is on different scales that linkages between renewable energy initiatives (REI's (Hasanov And Zuidema 2018)) and their surroundings take place. De Boer et. al. (2018a) identified linkages on four different scales. These scales are the local, regional national and global scales and for a transition interaction between these scales is vital as is also described by Rotmans (2001) by multi domain and multi-level interactions. This thesis focusses mostly on the local level with links to the regional and national described by De Boer et. al. (2018a).

To understand the role of energy initiatives De Boer et. al. (2018a) employ a spatial perspective of energy initiatives. They define the development of such initiatives locally as occurring in niches (De Boer 2018a). In this sense, niches are where innovation occurs based on local physical and socio-economic conditions and are created through shielding nurturing and empowerment (De Boer et. al 2018a; Loorbach 2010). It is the local influences that create variety in niche developments (or area-based niches (De Boer et. al. 2018a)) and as such, local influences are also very important to local energy initiatives. This is partly because of the sensitivity of current renewable energy developments to their physical surroundings, you can't effectively produce hydroelectric energy in a flat area like the Netherlands for instance (De Boer and Zuidema 2015) and partly because of how innovators combine information to develop new ideas (Rogers 2010). When the information differs due to local influences the innovations taking place there will also differ. An example of local circumstances affecting opportunities might include the availability of area to lay solar panels, in an agricultural setting this will may be simpler for a single actor, whilst in an urban environment a cooperative between actors might be required (De Boer and Zuidema 2015).

De Boer and Zuidema (2015) attribute local linkages to the success or failure of energy initiatives. Due to the more visible nature of renewable energy generation, properly embedding new REIs in its local nature can provide greater viability by reducing NIMBY tendencies in local residents by involving them in the initiative or its vision (De Boer and Zuidema 2015). This is because local initiatives are dependent and make use of locally available resources and thereby impact the local physical landscape, which may lead to resistance if improperly communicated. This dependency on locally available resources also creates a co-dependency of parties and actors as access to physical resources (like rooftops) and is directly linked to spatial planning regulations of land ownership according to De Boer et al. (2018a). This means that the systems that compromise the energy landscape are interdependent and linking them depends on local actors. In this co-dependency of local actors, local energy initiatives also incorporate their initiatives into the local community and economy by engaging others and reinvesting locally (De Boer et al. 2018a). What this means is that the embedding of energy initiatives is vitally dependent on local embeddedness as De Boer and Zuidema (2015) argue. Similarly, Hasanov and Zuidema (2018) found that it was "crucial to establish a local, community-driven project with which residents could identify themselves" and that successfully doing so would lead to a higher impact rate. To do this, local initiatives must have access to adequate social capital and a large social network as this helps in the diffusion of ideas into the local community and enhances participation by local people (McBride 2014). A final point to consider is that when the local energy initiatives institutionalise their practises and encounter regulatory hurdles they engage in regulatory reform through lobbying higher institutional levels (De Boer et al. 2018a). This then leads to higher scale levels such as the regional and national levels. Finally, Blanchet (2015) use an SAF framework approach to describe how relatively powerless actors, like local initiatives, can upset power structures and the status quo of the energy system by seizing opportunities caused by external shocks and uncertainty. The creation of new policy goals by for instance Europe 2020 or the Paris agreements, and changing public awareness can therefore be very important to a changing energy system.

The regional national and international scales are defined by their potential in relation to their institutions (De Boer et. al. 2018a). These links are crucial as they condition possible interactions dynamics and regime shifts, as evident from the lobbying for regulatory change from lower levels. Additionally, higher level scales allow for information sharing between different socio-economic and geographically situated initiatives and thereby learn new approaches and adapt to circumstances by using outside knowledge, formed in different circumstances (De Boer et. al. 2018a). In other words, sharing information from different spheres to innovate (Rogers 2010). Hasanov and Zuidema found higher level influence in for instance support organisations providing strategic advice to, -or brokerage between small initiatives and private sector parties (Hasanov and Zuidema 2018), similar to the higher-level strategic sphere of Loorbach (2010).

A clear example of regime influence on lower scales, and how local niche level development can change this is the PostCodeRoos (PCR) policy in the Netherlands. Before the implementation of the PCR there was no institutional niche for small initiatives to join forces. This resulted in difficulties in delivering projects and often limited local implementation to singular projects (De Boer et. al. 2018b). The regime changed to account more for these small local forms of communal energy generation as a result of pressures from below to allow policy innovation and pressure from above to increase the share of clean energy in the Dutch energy usage (De Boer et. al. 2018b).

As the example of the PCR demonstrates, energy initiatives can transcend the boundaries of their local geographical scope as their interactions with other actors and their institutional context prompts others to experiment as well (Hasanov And Zuidema 2018). Additionally, it is their swift reactions to new local conditions that drives energy initiatives forward and leads them to innovate and drive the energy transition forwards (Hasanov and Zuidema 2018)

2.7 Bringing it all together in a conceptual model

This chapter has provided an overview of important theory is it relates to the energy transition, local energy generation, energy initiatives and governance renewal, or as it may relate to Tegenstroom and the case study.

The chapter started out with a short summary of complexity and how small changes lead to potentially very different outcomes and how this uncertainty comes to be through bifurcation of development paths and leads to evolution of systems. Transitions and transition management are an attempt to deal with the uncertainty of complex systems and steer the society in a desired direction whilst staying aware of the many different aspects and key variables to work towards a desired change. By utilising the multi-level model consisting of macro-meso and micro levels and closely related to the landscape, regime and niche levels of socio-technical systems, the diverse needs of a societal subsystem may be accounted for. To do this a wide open and inclusive playing field is required to allow for change to occur from within the system or be induced from outside the system. A trend towards more inclusiveness has been found in the shift towards governance that society is being steered with. It is this inclusive thinking, caused by the government no longer being the sole dominant actor driving change forward in the governance process, that has allowed niche levels and individuals to become more involved in the energy system and energy transition. Spreading niche level innovation in the governance domain on the individual level by combining information from multiple domains on the local level to increase effectiveness or efficiency and come up with new locally tailored and unique solutions to problems. By involving local actors and activating local engagement as well as using cross sectoral knowledge and opportunities, renewable energy initiatives become more embedded in their surroundings. An open playing field also allows for feedback between levels, resulting for instance in PCR, thereby facilitating the energy objective.

To clarify the links between the theories, that have been identified between different theoretical perspectives, an overview schematic is provided. Within this schematic each link is clarified and labelled corresponding with a number:

1) Complex, area-based solutions to a national/global issue. Multi-level/ multi-domain thinking.
2) As new innovations allow energy initiatives to form, feedback from these initiatives may lead to further changes in regimes or other levels.
3) Niche level innovations on energy initiatives may further the transition.
4) Local energy initiatives may identify missing links and be better embedded in their surroundings
5) New innovations are integrated at the local level and are spread through interaction
6) A shifting relation between government society and market leads to new niche level innovation and cooperation (institutional) complex issues require complex solutions
7) Regime changes and increasing cooperation lead to new projects and new ways of experimentation (practical)
8) Local storage and generation require local integration of measures and local adaptation.
9) A shift to lower level thinking requires multi- level and multi domain coordination and policy suited to lower level adaptation of energy.

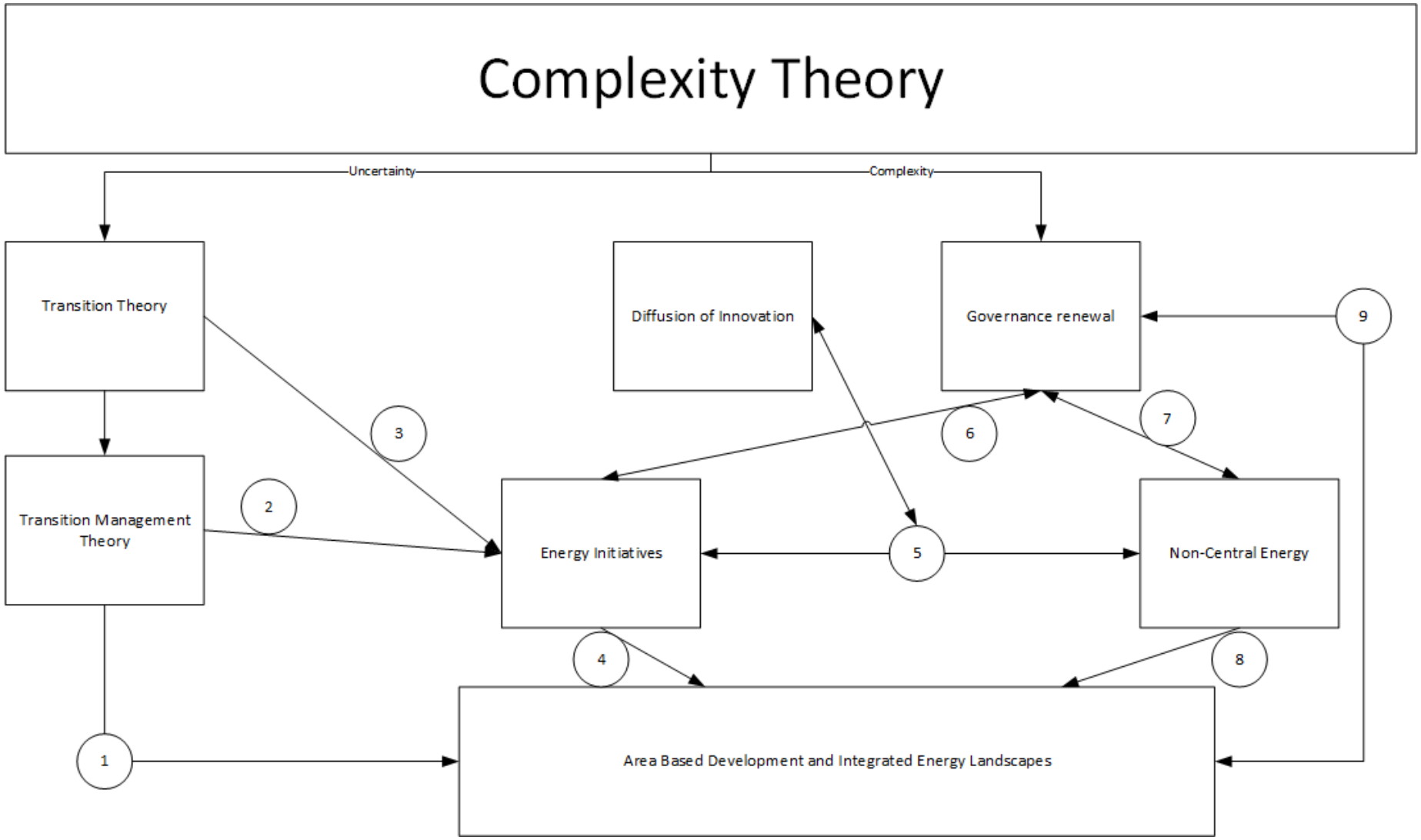

Figure 4 Modelling Theory, an overview

Chapter 3 Methodology

In this chapter the very first short introduction to the case study is given. Secondly, it is explained how the relativist ontology and the nature of the research subject push this thesis towards a primarily qualitative epistemology. As a third, in this chapter it is explained why the choice for a case study was made. The chapter is finalized in a review of ethical handling of data and concerns over anonymity in such a detailed case study approach.

3.1.1 Ontology and Epistemology

Allmendinger (2017) in his book, differentiates between what he considers the two most important views of planning. In this regard the first view Allmendinger discusses is the positivist view, that is based upon neutral observations and the independence of data from its interpretation (Allmendinger 2017). In addition, Zuidema (2016) explains that logic-positivism added to the dominance of instrumental rationality and the confidence in coordinative model of governance in planning theory dominant in the 1960's.

This dominance was challenges in the 70's by the rise of what is post- positivism, an umbrella concept that denotes the move away from the search for universal laws in social studies and planning theory (Allmendinger 2017; Zuidema 2016). This is the second view Allmendinger discusses, and stems from criticism of positivism and its assumption of rational actors, facts and assumed objectivity (Allmendinger 2017; Clifford et. al. 2012; Hennink et. al. 2010). The most important characteristics of post-positivism are the central role of power and discourses from works of Foucault, the role of culture and a "recognition of indeterminacy, incommensurability, variance, diversity, complexity and intentionality" (Allmendinger 2017; p37). Zuidema (2016) connects this with the rise of the relativist ontology, and the increasing importance of intersubjectivity in social research.

This philosophical dualism in research is also fundamental in the way data is collected. With the rise of modernism and positivism the main focus of data gathering from a realist point of view is to isolate variables and disconnect them from their context to be able to make generalisations based on empirical inquiry (Zuidema 2016). This quantitative way of data gathering originally stems from the natural sciences and involves "the use of physical concepts and reasoning, mathematical modelling and statistical techniques" to gain a better understanding of phenomena (Clifford et. al 2012; p5). Opposite this is the use of qualitative techniques, which include among others, techniques such as in-depth interviews, participant observations and focus groups (Clifford et. al 2012). These techniques are based on the relativist ontology and argue that human behaviour is far from rational and instead is "subjective, complex, messy. Irrational and contradictory" (Clifford et. al 2012; p5)

Given the social nature of this thesis, the nature of the main research question; "*does the seemingly unique geographical scale and municipally founded not for profit private company form of Tegenstroom allow it different options than other energy cooperatives how might this impact the Dutch energy transition?*", and to investigate and understand the role Tegenstroom has the choice for a qualitative research ontology was made. This method is explicitly well suited to map the processes, actors, projects and other goings on in and around Tegenstroom. Perceptions, practises cultures, values and structures are motives for human action and shape daily life as discussed in chapter 2. They shape people, social and spatial processes, such as the energy transition alike. These intrinsically human qualities and choices which are part of the transition process and the complexity narrative are why qualitative research methods are exceedingly well suited to investigate Tegenstroom and her influences within the Haarlemmermeer.

The research presented here consists of the collection of primary data via first party interviews and the exploration of the research area via secondary document analysis intended to elucidate the research field and provide historical context to the lifespan of Tegenstroom. This means that this research is situated squarely in the qualitative research ontology, as mentioned, using a mixed methods approach. The mixed methods in this case means the triangulation of data from various sources (Clifford et. al 2012). each of the separate methods provides a different perspective. The interviews provide insight into the reasoning, actions and background processes, whilst the document analysis provides clarification with historical processes and opportunities to fact check the narratives. In this, the effort has been focused primarily on fitting stories together and finding links between the stories. Common ground between different stories provides stronger evidence via triangulation in the case study.

3.2 The case study

This section provides an overview of Tegenstroom as case, and why the choice for this specific case was made. In this research, the choice was made to do a single in-depth case study. The theoretical relevancy of case studies has been heavily debated within the scientific community, and therefore the reasoning behind the choice is extensively discussed in appendix A). In short, the choice was made based on the beliefs that; context bound knowledge is becoming more valued within the scientific community as a whole, generalisation issues of case studies may be overcome by careful selection of strong examples and confirmation bias is generally smaller within qualitative case studies due to the in-depth study providing more rigorous falsification opportunities (Flyvbjerg 2006). In the appendix A), a detailed nature of case study research is also discussed.

In this case, Tegenstroom and the municipal context surrounding it were selected as a subject for research. Tegenstroom, as has been stated in the introduction, is a small energy company that has been set up by the municipality of the Haarlemmermeer. It concerns itself with providing locally sourced sustainable energy, both electricity and gas. Unfortunately, true green gas is not produced in enough quantity in the Netherlands and therefore they may only provide natural gas. The energy provision is mainly focused on local consumers and in doing so furthering the sustainable energy transition in the Haarlemmermeer. The nature of Tegenstroom as an independent private company, set up by-, with all shares owned by- and a very close relationship to the municipality is a very unusual situation and something that is returned to frequently throughout the chapter 4. Apart from this, it requires mentioning that Tegenstroom is located in my hometown and the familiarity with the context this provides has been crucial throughout the thesis and has been an important deciding factor in performing a case study on Tegenstroom. The context is after all, crucial to conducting a case study, (Yin 2014; appendix A).

From its founding in 2014 and the process preceding the founding date, Tegenstroom has been intended to both deliver energy and focus on several key projects, several of which are discussed in chapter 4. Zooming in on some of these projects allowed for closer investigations of the relationships Tegenstroom has with its customers, business partners and the municipality. The four-year time span since its founding, means that some of these projects have since ended, whilst some other are currently in the execution phase. This allows for a look into Tegenstroom’s and the municipality’s strategy for the future.

3.3.1 Primary data collection through interviews.

Interviews are an integral part of qualitative data collection. They provide an excellent method for increasing the depth of research (Clifford 2012). By establishing motives for actions and reasoning or empathy for interactions, increased understanding for the driving reasons of the founding and operations of Tegenstroom, its projects, its bonds with its surroundings and its role in the municipal energy transition can be gained. Interviews are also crucial in tying together separate documents' meanings and providing overview of the lifetime or narrative of Tegenstroom.

Three interviews were conducted though five were initially planned. This limited number is due to the highly specific nature of the case and is reflected upon in chapter 6. The first interview was with the sole employee of Tegenstroom. They are responsible for client relations, customer relations and partnerships in projects. Because Tegenstroom only has a single employee and a director however, they are intimately familiar with the goings on of Tegenstroom. The employee was able to provide insight into the functioning, reasoning and activities of Tegenstroom as well as Meermaker.

The director has been involved in with Tegenstroom since before its founding, having been attracted initially to develop the initiative and identify the initial projects that lead to its founding. They were responsible for identifying cooperative partners and possesses an extensive social network that has been invaluable in the foundation and operation of Tegenstroom and Meermaker. As such, in the second interview, the director was able to shed light on the founding and the importance of social relations with many actors and the good relationship with the alderman for sustainability.

The alderman was therefore identified as the next interview candidate due to their prominence in various sustainability articles concerning the municipality and the initiative, as well as a very strong recommendation by the director and the employee. From document analysis it was also clear that the alderman has been vital in the development of many sustainable initiatives in their municipality as well as the set up of the sustainability programme. It was therefore exceedingly disappointing when they declined an invitation for an interview due to scheduling conflicts involving summer break and an offset election season in the municipality. This is further discussed in chapter 6.

In their stead, the alderman did provide an interview opportunity with a senior municipal sustainable policy advisor. In the alderman's stead, they were able to provide extensive background information and insight into the municipal sustainable strategy and involvements with Tegenstroom, the municipal mindset, the sustainability programme as well as its ambitions and practical difficulties.

Finally, the intent was to interview someone of a similar position within the provincial government as well. This was meant to provide a similar overview as was provided by the municipal policy advisor and how the municipal policy fit into the regional policy. Unfortunately, after six weeks of repeatedly reaching out, the provincial government gave notice that no willing candidate was available due to the near summer break. The next available opportunity was unfortunately after the deadline for this thesis.

In the three interviews that *were* conducted the choice was made for semi structured interviews. The strength of semi-structured interviews lies in their flexible nature. As the conversation progresses it is possible to steer it in different directions and request clarifications whilst maintaining a very open and friendly character thereby putting the respondents more at ease. By providing certain topics of discussion or requesting clarification, it was for instance the policy advisor which provided most of the municipal background which could then be corroborated though documentation. The interviews were eventually conducted during the month of July 2018 which unfortunately meant that the proximity of the summer holiday decreased availability of many potential respondents. The interview guides used are available in appendix B) and C).

The data that has been collected has been recorded with the consent of the interviewees. From repeatedly listening to these recordings the narratives could from the interviews could be established. These narratives are used to paint the general outline of chapter 4, backed up with theory and document analysis, used to triangulate the data. By repeatedly listening to the interviews several highlights sprang out at different times as the sub questions of chapter 4 were developed, thereby naturally evolving into the end product.

3.3.2 Methods of desk research through literature review and document analysis

The use of desk research has been multifaceted for this thesis. The first and perhaps most important role has been the literature study, identifying important theories mentioned in chapter two. This is meant to explain and provide additional information, to help guide and interpret the data collected from interviews and to support conclusions based on the primary data collection. The theory from chapter 2 forms the backbone of chapter 4, giving it structure and explaining comments by the respondents. The literature study was guided by previous knowledge of the subject and several main articles, as well as deliberate searches for subjects closely related to them. For instance, the article by De Boer and Zuidema (2015) was part of compulsory reading material, but through lead to other, similar publications and the development of the area-based approach sections.

The document analysis was just essential in identifying questions and subjects to as discuss in the interviews as the scientific literature was. Therefore, the second part of the literature review concerns the desk research aspect of the case study. This includes the information required for the case description and the identifying of key stakeholders and actors in the Tegenstroom initiative, as well as identifying and corroborating claims and information by respondents. This is because the use of secondary data provides context to a spatially concentrated, qualitative research (White 2012). By increasing the context of the case study, to not only include data gathered first hand, but also using it to set the scene, globally, at the European level, nationally and locally whenever possible. Secondary data demonstrates for instance, the need for a change in how society meets her energy needs, but also the importance of the alderman of sustainability in most of the projects related to the sustainability programme in the Haarlemmermeer. Providing context and background information is also a crucial aspect in executing a case study research design, as the contextual factors might be highly pertinent to the phenomenon studied (Yin 2014). This context is also what guides and gives form to the semi structured interviews, in combination with the theoretic literature. For this guidance, primary focus lay on municipal publication regarding Tegenstroom, sources from around its founding, sources concerning its projects and its partners.

Finally, through triangulating data between multiple sources and looking for points of convergence, as well as employing interview techniques that ensure comprehension, a certain robustness is provided in the data, that is backed up by checking and rechecking statements from interviews against available literature (Clifford et. al. 2012; Yin 2014). This secondary data has been interwoven with the findings from interviews and theory to provide four narrative research questions regarding Tegenstroom and its primary context, the municipal energy transition, area-based approaches and the role of governance.

3.4 Ethical concerns and considerations.

Longhurst (2012) says in his chapter that two of the main ethical concerns in conducting interviews are anonymity and confidentiality. This is also where a so-called ethical dilemma arose for this research. In conducting a case study of a very specific subject in a specific region makes it incredibly easy to find out the identities of interviewees, not just in the energy initiative itself, but also the people surrounding it, like the Alderman mentioned earlier in this chapter. This makes it very difficult to maintain anonymity for this research. As is there are three apparent options in dealing with this, which, ranging from strictest to loosest, are:

1) Do not name anything: this option comes the closest to ensuring anonymity for participants/interviewees. By not naming the case, region/municipality or the energy initiative itself it is possible to try and ensure no identities are found out and anonymity is preserved. Of course, this is not fool proof, as the nature of the case study demands detailed descriptions of circumstances and context (Yin 2014), that may still lead to a loss of anonymity. Secondly and more practically, it would have made it much more difficult to properly write this thesis.
2) Do name the municipality and the energy initiative but leave personal names out: this option would name the case, region and initiative, but leave out the names of participants/interviewees. This would be more in line with standard practise and provide a certain degree of anonymity to the interviewees. However, the identities of the respondents would be easy to find out through a quick internet search as the initiative is only small, and their names are advertised on their website. Furthermore, it would leave public figures such as the Alderman open to a loss of anonymity as well by naming the municipality.
3) Name everything. By requesting permission to name the interviewees, the practical issue is resolved, but the ethical situation of anonymity is far from ideal. Even though this particular thesis might only ever be read by a supervisor and a second reviewer, it is still accessible through the thesis archive and leaves their names open to discovery.

Despite this thesis not covering a fundamentally hazardous social issue, that may put respondents/interviewees at risk when found out, as well this information being publicly available on the internet, it is very important to take these matters into consideration and try to ensure anonymity if the interviewees so desire. In consultation with the respondents, the choice was made for the second option, to leave names out of the thesis text, yet still name the initiative and municipality. This was expressed as preference by two of the three respondents, where the third did not express a preference for either other options.

Longhurst's (2012) second ethical consideration concerns confidentiality. To ensure this all data and transcripts are stored in a non-publicly available, password protected computer. Furthermore, permission to record and transcribe was always asked beforehand, and the option to terminate at any time was clearly presented at the start of each interview.

Chapter 4 Data

In this chapter are present the findings from interviews and desk research through four sub questions. These sub questions start out with the contextual factors and case description of Tegenstroom and the Haarlemmermeer and how these impact Tegenstroom. This chapter also features an overview of various actors and initiatives based on the multi-level model by Geels and Kemp (Rotmans et. al. 2001), a further explanation of which can be found in appendix 1. Secondly, the role of Tegenstroom in the local energy transition is reviewed by using Loorbach's four spheres of transition management. Thirdly, the role of discussion moves to the importance of personal connections for local embeddedness and discussing microgrids, to finish in the fourth section where the governance perspective is discussed in the form of Tegenstroom's deep connection with the municipality. To aid in presenting the data and answering the sub questions a visual representation was developed in section 2.7 figure 4. The links between different theories are highlighted in figure 4 and called out throughout this chapter though numbers corresponding to the links in section 2.7. Each section features a separate conclusion in which the relevant sub question is answered, which are returned to in the overall conclusion and discussion of chapter five.

4.1 Sub question 1: Context

*In this section an overview of Tegenstroom and its context is provided. This is done by firstly, describing Tegenstroom itself in some more detail, how it operates, the projects it has undertaken and the way it was founded. Secondly, this section provides an overview of the Haarlemmermeer. This includes population statistics and its location within the Netherlands after which the section focusses more on infrastructure and land use. The section will close of with an overview of other energy initiatives in the Haarlemmermeer and relevant domains. As such, section 4.1 revolves around the sub question: "**What local circumstances have shaped Tegenstroom and is Tegenstroom viable outside of these?**", the intent is to provide background information, centred on a quote by De Boer and Zuidema: "Depending on local and regional circumstances, such as the characteristics of the landscape, weather and the economic activities taking place, certain renewables will be more favourable than others" (2015, p 2).*

4.2.1 The Haarlemmermeer

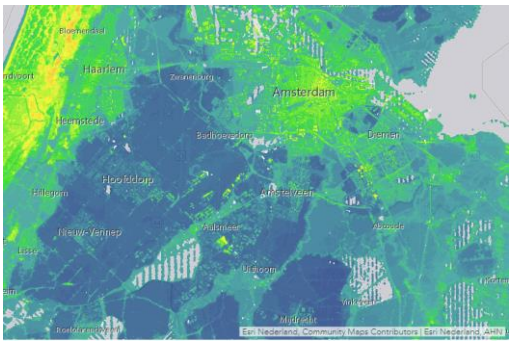

Figure 5 Height map of the municipality and surrounding area

The Haarlemmermeer is a polder municipality near the cities of Amsterdam (north-east) and Haarlem (north-west) it is perhaps best known for being the location of Amsterdam Schiphol Airport, one of the largest air traffic hubs in Europe. Aside from this, it was one of the largest lakes to be drained in Dutch history as it threatened Amsterdam, Haarlem and Leiden with floods and nowadays consists of flat agrarian land with fertile clay soils. To provide context to Tegenstroom an overview of the municipality, its physical geography, several energy initiatives and projects by Tegenstroom or Meermaker, as well as population statistics, land use statistics and other important information, is provided.

As De Boer and Zuidema (2015) describe it, physical characteristics of the landscape go a very long way in determining what types of renewable energy can be utilised in a region. For instance, the relatively flat surface of the Netherlands is poorly suited for hydroelectric energy generation on a large scale, though there are some cases of power generation within flood defences and river management systems. What flat, often open areas are well suited for however is the use of wind power and solar power.

The national wind map of the Netherlands for instance, shows average windspeeds between 7.5 and 7 meters per second at 100 meters altitude (RVO 2017). Whilst not the highest numbers in the vicinity they are well adequate for the wind turbines. Combine this with the open character of the mostly agrarian land use with few trees and large tracts of land, the municipality seems very well suited for the use of wind turbines (8). As such, in 2008 an action group advocated for the creation of a wind park in the south of the municipality (Windpark Haarlemmermeer Zuid 2015a)(4 5 6 7 8). Their proposed site was outside of the noise contours of Schiphol and not within known migratory bird paths, and the municipality was in favour of a park of up to 15 windmills for the site (interview 3)(. However, the park was blocked by the provincial government citing increasing urbanisation and the proliferation of windmills as cause for concern and wanting to maintain the open character of the

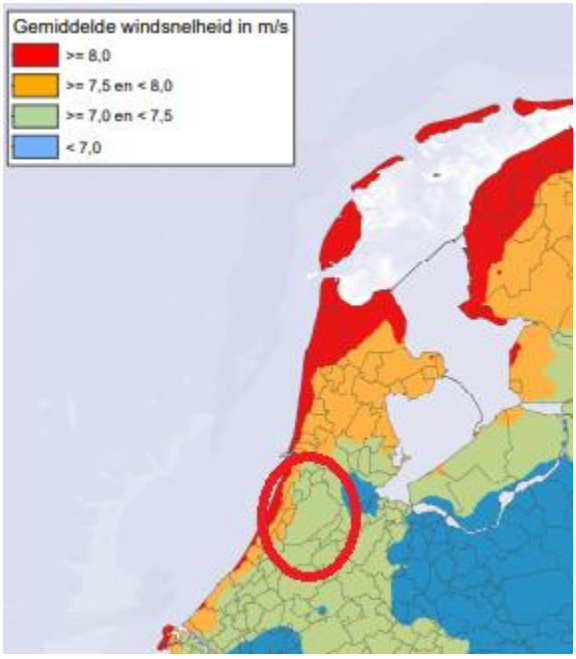

Figure 6 Windmap of the Western Netherlands

Figure 7 Proposed location of wind park in the south of the Haarlemmermeer

municipality as the southern tip is located in what is formerly known as the green heart of the Randstad metropolitan area (Interview 3) (7).

Development of wind and solar is seen as regular urbanisation practises, which are actively discouraged by the province to "maintain the open landscape and character of the area" (interview 3 Provincie Noord-Holland 2018) (6). Coupled with local resistance the park has been successfully blocked in the "Raad van State", the overarching body of provincial governments. This means that the wind park in its envisioned form will not come to be (HCnieuws 2016) (9). Thereby severely hampering the ability of the municipality to increase its generation capacity, especially considering the fact that, "after all homes have been fitted with solar panels in the municipality, we will still need twice the size of park 21 to achieve our energy goals" (interview 3). That is over 2000 hectares of solar panels just to make the municipality energy neutral (8) (see also figure 12 for reference).

The province is not the only one to block initiatives however, as for instance water safety also plays an important role (1). Underground heat cold storage solution for instance run into issues with the waterboards when they are too deep and risk interfering with the fresh water, "water mirror" that keeps brackish water from infiltrating into agrarian land. Due to the low-lying nature of the municipality (as low as 6 meters below NAP Figure 6) salt water wells up from the surrounding water bodies through ground layers and without adequate care could endanger the municipalities water supply, agriculture and nature areas.

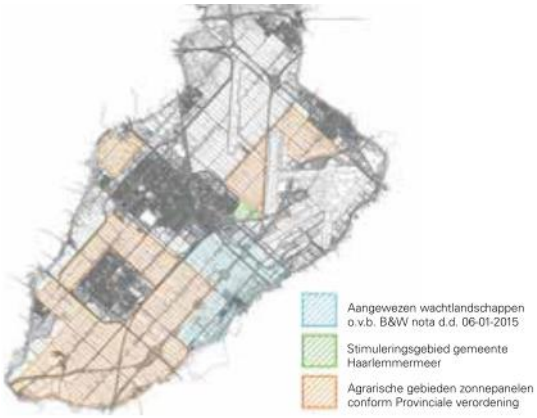

Figure 8 potential for solar within Haarlemmermeer where blue is intermediate use, green is actively stimulated by the municipality and orange is designated agricultural land by the province

Haarlemmermeer has 147.000 inhabitants as per 2017 (Gemeente Haarlemmermeer 2018a). Generally, the inhabitants of the Haarlemmermeer are more affluent than the national average, with a slightly higher average income and a higher municipal share of the 20% highest average incomes. It is also projected grow significantly in the next few decades, with an estimated population of nearly 175.000 in 2035 according to 2012 forecasts (Gemeente Haarlemmermeer 2013). However, this number is very likely outdated recent development in the housing market in and around Amsterdam have put serious pressure on surrounding municipalities to increase their housing stock. In the interview with municipal sustainability programme (interview 3) it was even said that up to 20.000 extra homes would have to be built in the near to mid future, which means between 35 and 50 thousand additional inhabitants for the municipality (interview 3).

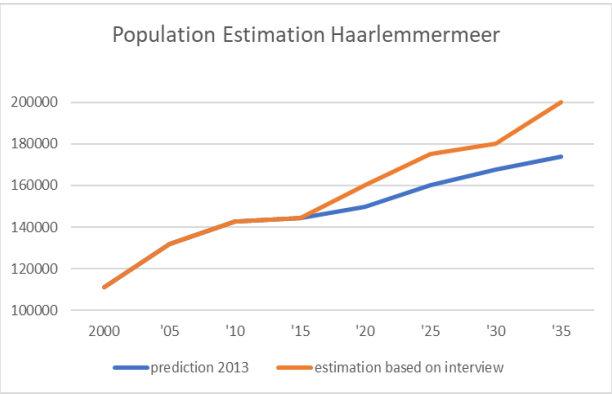

Figure 9 Population estimation of Haarlemmermeer

On average the municipality has a decently evenly distributed population of all ages with no real deviances form the national average (CBS 2018). The presence of

Schiphol also means that the municipality actually has more employment positions that in has inhabitants, which also means that several large highways cross the muncipality, and some of the busiest provincial roads in the country (interview 3)

Aside from the roads (6% of total surface area), land usage is primarily agriculture (65%), grown on the fertile clay of the bed of the former lake. Other intensive uses include residential (11%) and Business parks (6%). Surprisingly, Schiphol only takes up about 4% of the total land. Likely this figure only contains the airport itself and not all the secondairy activity surrounding it like business parks and hotels (Gemeente Haarlemmermeer 2018a).

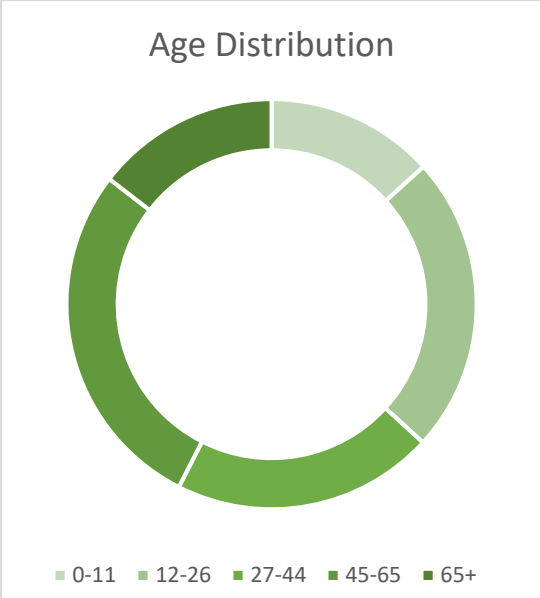

Figure 10 Average age distribution in the Haarlemmermeer

The Netherlands remains heavily dependent on its natural gas resources. Despite Tegenstroom also offering gas to customers we elect here to leave it out of the case study. This is based on the fact that Tegenstroom cannot offer true green gas as they offer green electricity, it is regular natural gas from Groningen (Tegenstroom 2018). Instead the thesis focusses on electricity and electrification. The Cabinet decision to bring the natural gas independent building decision forward 1,5 years from January 2020 to July 2018 only strengthened this choice. The dependency on national measures and the difficulty in decentralising gas production also contribute. That being said, the thesis will not deny the difficulty of the challenge of weening the Netherlands of its gas dependency by 2050, it's just too much of a different challenge to meaningfully include in this thesis.

As is usual in current electricity generation, the energy grid in the Haarlemmermeer is highly centralized. This means that there is no traditional powerplant within the Haarlemmermeer, instead the nearest are either in Amsterdam, Diemen or Velsen (energiegenie 2017). There are however several projects underway within the Haarlemmermeer that embody the municipal desire to become energy independent/ energy positive. The physically most prominent is the construction of the solar park "de Groene Hoek" of over 125.000 solar panels covering 26 hectares and providing 15.000 MWH per year (Gemeente Haarlemmermeer 2017b). It has been developed by SADC, Solar-Energy Works and F&S Solar and is currently looking into providing green energy to several of the data centres on Schiphol. However, that is not the end all be all with regards to sustainability in the municipality (4).

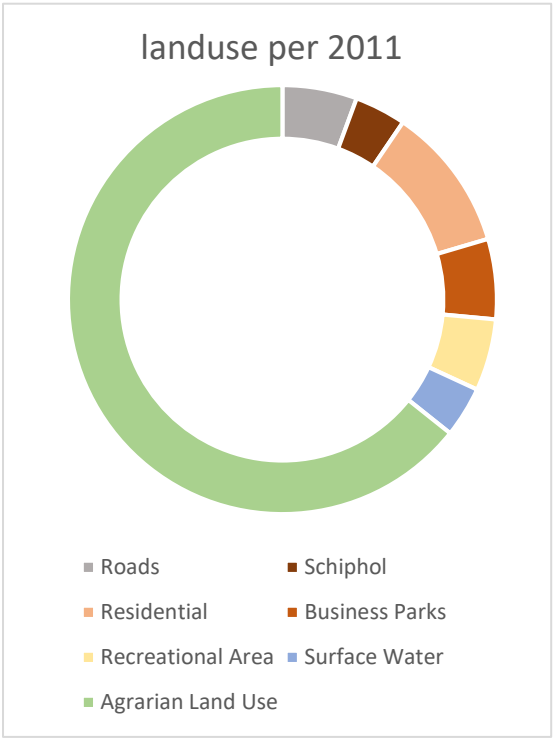

Figure 11 Land use in Haarlemmermeer per 2011

The real estate department is currently hard at work to develop energy neutral solutions for municipal and other social real estate, including combatting vacancy and increasing efficiency of use by placing new installations and smart meters, installing solar panels and increasing insulation, among other measures (Gemeente Haarlemmermeer 2015). New sport and recreational facilities have been fitted with

heat recovery systems and older facilities are being retrofitted and renovated up to new standards set by the municipality (Gemeente Haarlemmermeer 2017a). To close of the real estate, agreements have been made with the local social housing agency to increase energy performance of its housing stock in line with the same standards set by the municipality (Gemeente Haarlemmermeer 2015).

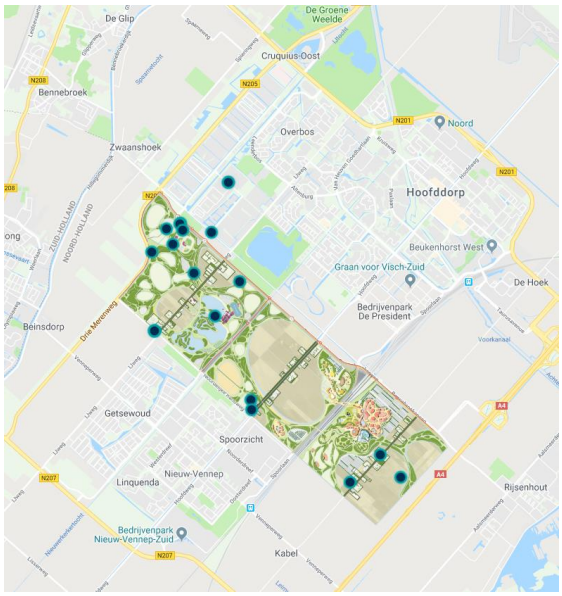

Figure 12 Park21 between the two largest residential cores of the municipality

For inhabitants of the municipality the Winst uit je Woning programme has been highly successful with over 6500 household within the municipality making use of the programme to increase their homes' energy efficiency (interview 3; Gemeente Haarlemmermeer 2015). By subsidizing the programme in its early stages, the municipality has helped it grow to over 17 other municipalities in the Netherlands (interview3). Winst uit je Woning prides itself in an ingenious grouping system to categorize houses and aggregate measures that they may require to buy sustainable measures like solar panels and insulation in bulk and provide tailor made solutions to similar homes (interview 3).

There have also been pilot studies for heating grids, the local street lighting is being rapidly replaced for LED lighting, all homes are being fitted with smart metering systems and there I rapid installation of recharging infrastructure for electric vehicles to stimulate and facilitate electric driving taking place (Gemeente Haarlemmermeer 2015).

Figure 13 National Map of the Netherlands, Haarlemmermeer highlighted. Source: google map

4.2.2 Tegenstroom

Tegenstroom was founded by the municipality of Haarlemmermeer in early 2014. This was something not unheard of in the Netherlands with municipal energy corporations providing most of the energy during the early twentieth century before scaling up into regional energy corporations. What is uncommon about Tegenstroom is the fact that for such a small player it seems relatively successful in a marketplace generally dominated by large market parties. The municipality founded the company with the explicit intent of "stimulating local investment and local energy generation and to improve local energy independence" (Tegenstroom 2014a) (6). In this sense, Tegenstroom profiles itself a "social enterprise" without a profit objective (Tegenstroom 2015a) (5). This means that the company strives to keep its overhead low and all profits are invested back into local projects or on reducing costs for customers. Tegenstroom is also uncommon in that it is incorporated and not an energy cooperative as is common among similar

initiatives, something all interviewees remarked upon (interview 1, 2 3). Finally, armed with the knowledge that similar companies have been attempted before, the municipality and the director went in search for several projects for Tegenstroom that it could use to profile itself and develop their business case (Energeia 2013; interview 1).

This lack of profit objective and the intense local commitment is essential to the company and fundamental in its formation, remaining a central goal four years after its founding. By not striving for profits and remaining small in geographical scale the two employees of the company also remain actively locally involved (6). Both live in the municipality, working out of a small office in an office pooling building. Both remain in active contact with their customers, leading to some surprised reactions of customers that they will have the person on the phone that is advertised on the website, when they experience issues or have questions (interview Tegenstroom 1). Other examples of this local commitment are for instance the active help when a customer could not qualify for solar panels due to a drain on the roof but could not afford for it to be removed. Tegenstroom arranged to be professionally removed for the price of one apple pie through cooperative with a local installation company and a social help organisation (Tegenstroom 2014b).

The two people running Tegenstroom are in charge of three municipal corporation in total. First is Tegenstroom, second is Tegenstroom voor Ymere (Tegenstroom for Ymere) and third is Meermaker. Tegenstroom and Tegenstroom voor Ymere are outwardly presented as a single company, but legally split for financial reasons. Meermaker is a sister corporation to tegenstroom and profiles itself as a sustainable investment company for local projects that champion sustainable developments. It is for instance actively involved in renewable projects as “neighbourhood battery” (Meermaker 2017) and the renovation of sport facility Vespohal to be near energy neutral (Meermaker 2016). Like Tegenstroom it was founded by the municipality with the explicit intent of driving sustainability within the municipality forward. It has done so successfully, turning a three million Euro grant in more than 30 million Euros of local investment by funding up to 40%, allowing those initiatives credence to secure further funding (interview 2; Energeia 2013) (6 7).

Tegenstroom is fundamentally an energy company, however it does not produce enough energy itself to be able to reliable supply its customers and meet the rigorous demands set to energy delivery. Instead it is attached to the energy collective of OM (interview 1). OM is a collective of 35 local energy cooperatives working together to produce local energy and deliver it to their customers (OM 2018).

Tegenstroom and Meermaker are, as may be expected, closely linked. Often, both are involved in the same projects. One as (co-)financier, the other as energy supplier, or energy customer when it concerns a positive energy projects, like the cooperative with the “stroom van Jos” project where a local entrepreneur filled the roof of his barn with solar panels in excess of what they needed themselves (Gemeente Haarlemmermeer 2018b) (6).

Other projects either or both have been involved are numerous and include the first project of Tegenstroom, the cooperative with Ymere to place 24.000 solar panels on 3000 social rent homes (Tegenstroom 2014c). Other projects entail raising awareness whilst working towards sustainability goals, such as “The Energy Battle” for sportsclubs (Tegenstroom 2017a). This entails how sports clubs can reduce their energy consumption through competing against each other to be as green as possible. The “schooldakrevolutie” bundles the large, flat surface area of school roofs with an educational aspect to teach children to the need for energy conservation and clean energy (Tegenstroom 2016).

There have also been several national and even a world’s first in the cooperative with Tegenstroom and Meermaker. Local battery storage in individual homes in the Haarlemmermeer, bundled with a smart energy monitoring system, to increase independence and allow for local storage (Meermaker

2017)(4). Similarly, in cooperative with the grid operator a neighbourhood battery system was set up in an area with a lot of homes with solar panels. It was meant to test if similar solutions could save on costs for having to run additional powerlines with the expected increases in peak demand and volatility of energy demand and supply by storing energy locally, avoiding "pumping the energy around" Meermaker 2017, Tegenstroom 2017b, interview 2). Unfortunately, the nature of the projects makes it so that the operation of the battery by the grid operator is seen as outside their jurisdiction of operator and therefore running into institutional issues (interview 3).

The reuse of old greenhouses to grow microplanktons gives old greenhouses a new renewable purpose and aids in moving towards a circular economy in the municipality and the micro planktons store much more CO2 than regular trees do and may be used for a variety of products (Meermaker 2015). A worlds' first has been the creation of a DC greenhouse, powered by local solar panels. By using the Direct Current, the solar panels produce directly and not transforming it into Alternating Current first, the Greenhouse increases energy efficiency by about 5%. By using its own solar panels, it is also able to reduce its total energy bill by up to 30% (Meermaker 2014b; PrimA4a 2017)(3 4).

Tegenstroom and Meermaker supplement each other well. Tegenstroom provides power and takes care of tendering installation projects, whilst the monetary power of an investment fund even a relatively small one like Meermaker, allows "a foot in the door" (interview 2) for a lot of projects to secure further funding. This synergistic relationship is crucial to the goals of Tegenstroom as many of the clients drawn by Meermaker' s "sack of money" eventually become clients of Tegenstroom as well, spreading word of mouth and increasing their reach (interview 2)

The incorporation of Tegenstroom (and Meermaker), by the municipality makes them a bit of an odd entity. It allows them a certain independence and the ability to choose their own projects to an extent, whilst they can still rely on the municipality for institutional support and (non-monetary) financial assistance/ advice. It also ties Tegenstroom much closer to the municipality than other energy initiatives/ cooperatives, something that is returned to in the section on governance. The close ties of Tegenstroom and the municipality have on several occasions led to projects that came to the municipality for assistance being redirected to either Tegenstroom or Meermaker(6). This has been done by both the municipal sustainability programme or the alderman for sustainability directly (interview 2). These redirects by the municipality and the Alderman also show the importance of personal networks for Tegenstroom. It was many personal connections that drove Tegenstroom's founding, and it is through the director's connections that many projects manage to get through (interview 2).

4.2.3 Active domains.

This final section of the contextual section explores the multi-level and multi domain aspects of the various actors, initiatives and projects that have been identified in the previous sections. To do this it lays out the various actors and projects that are involved with Tegenstroom in a tool to do research (figure 15; Appendix D).

From modelling the geographical and institutional scales the various projects and parties operate on, it becomes clear that most of the direct links Tegenstroom has are on the very local level, mostly single individuals, businesses or street level projects as befits the Dutch transition method and is in line with the findings from De Boer (2018a)(1 5 9). It also shows the preference for direct involvement by the director of Tegenstroom (5). On the meso-level the connections Tegenstroom has are mostly facilitating in nature, such as the connection to OM, the cooperative Tegenstroom is part of, or the connection to Ymere, the social housing agency Tegenstroom and Meermaker put 24.000 solar panels on top of. Aside from this most meso-level interactions relevant to Tegenstroom are mostly handled

by the municipality such as the initial loan by BNG for Tegenstroom's founding or difficulties surrounding solar farms on agrarian land (1 6).

Next, this section takes a look at which domains Tegenstroom is directly or indirectly involved in through their connections to initiatives or other parties. As De Boer et.al. (2018a) identified them relevant to the energy system, there are the community, governance, physical infrastructure, biophysical and economic systems that all relate to the energy system. By looking at these connections an overview of how embedded Tegenstroom is within the energy system can be constructed. The most obvious in this regard are Tegenstroom/OM and Eneco's role in the energy domain, as they are suppliers. Liander are responsible for the maintenance of the physical energy infrastructure and fall in that domain. Looking then at the neighbourhood battery that both are involved in there is a meeting point of domains, because the battery stores power (energy domain) may reduce the need for Liander to upgrade cable infrastructure (physical infrastructure) thereby cutting costs (economy) whilst saving the residents/ participants in the project money and making them aware of their energy habits (community) (7). The School-Roof-Revolution and Energie-Battle both touch on the energy system by reducing the footprint of these clubs, but also the community domain through education (4). The blocking of further solar panels and wind farms within the municipality by the provincial government is an example of the governance domain interacting with the energy domain and the founding of Tegenstroom and Meermaker shows the governance system combining economic domain (local energy as a business case) with the energy domain once again. Changing national goals and socio technical landscape allow local energy to become more affordable and for people to form cooperatives, combining economy, energy, community and governance domains (2 3 6). For Tegenstroom then this means that they operate mainly in the energy domain as a supplier, but through their projects and their people-oriented approach also interact with most of the other domains in some manner.

This concludes this section by answering the sub question that has been central in it. By describing several of the characteristics of the Haarlemmermeer an overview of the area Tegenstroom is operating in was created. By providing a description of Tegenstroom and its activities it was learned how Tegenstroom operates and provided the opportunity to develop a tool to do research with which the domains in which Tegenstroom manoeuvres were modelled. This model is explained in Appendix D) and can be seen on the next page. Based on this, in the next section an overview of how open the playing field is within the Haarlemmermeer and how projects impact Tegenstroom is provided. To conclude this conclusion, the answer to the essentially contextual sub question in this section ***"What local circumstances have shaped Tegenstroom and is Tegenstroom viable outside of these"*** must be found in how Tegenstroom operates, manoeuvres within different spheres. The answer is centred around the central quote by De Boer and Zuidema (2015) *Depending on local and regional circumstances, such as the characteristics of the landscape, weather and the economic activities taking place, certain renewables will be more favourable than others.* Essentially then, Tegenstroom would not have existed without its surroundings and continues to be shaped by it. Tegenstroom was formed due to the willingness from the municipal alderman and the director of Tegenstroom has driven it further since then. The foresight to include several projects has given Tegenstroom a foundation to build its business case on, whilst the regime limitations are being overcome by similar initiatives. This leads to an answer that, if there is strong political will, strong individual motivation as well as a powerful sustainable network and the ability to identify founding projects, Tegenstroom or a similar initiative might indeed be viable elsewhere as well.

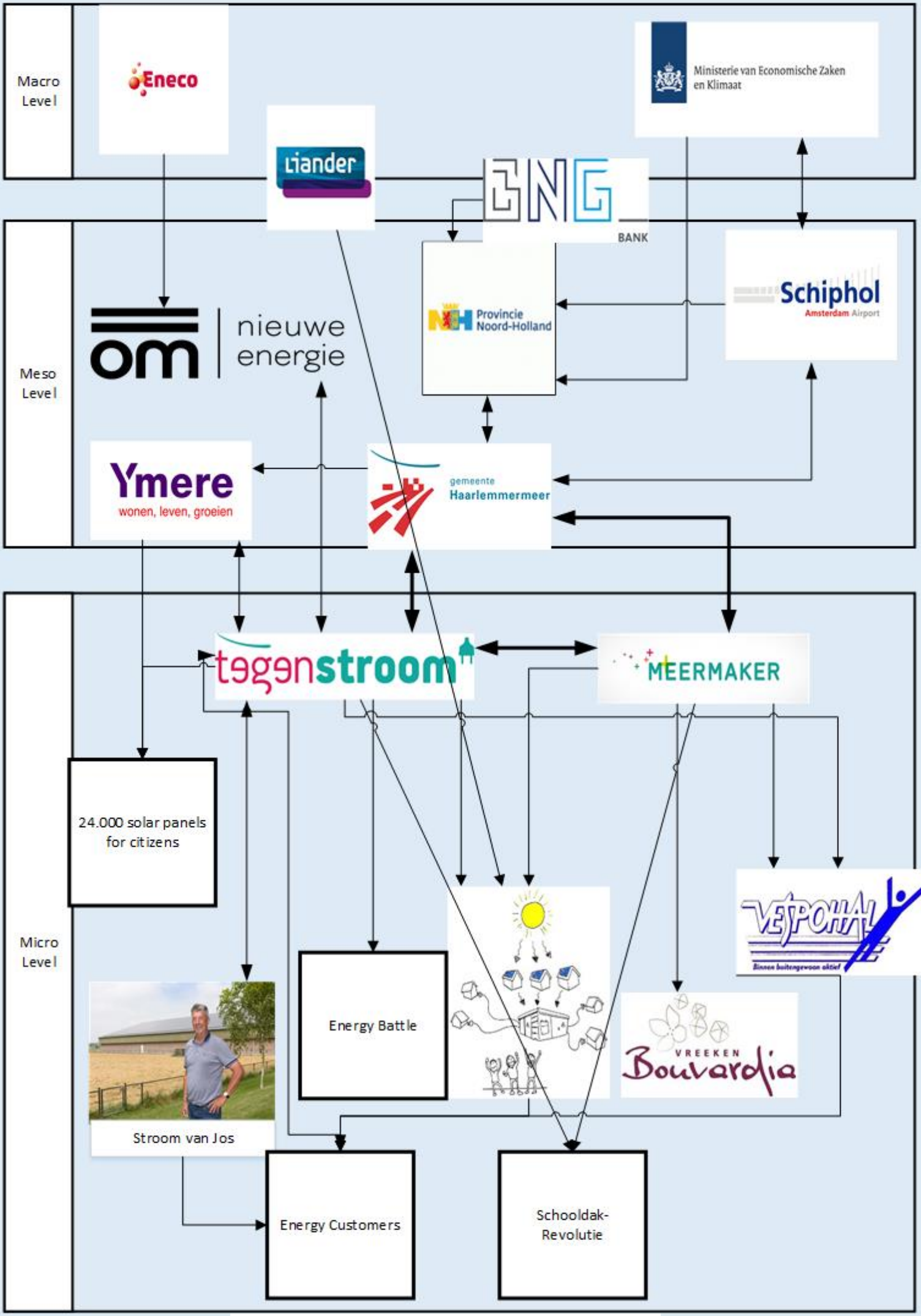

Figure 14: actors and initiatives in a multilevel framework

4.2 Sub question 2: Transitions and Innovations

*In this section a closer at the local level of the energy transition is taken. Therefore, this section follows the general structure of Loorbach (2010) by dividing the analysis into the strategic, tactical, operational and the reflexive spheres. Within these spheres the multi-domain, multi-actor and multi-level aspects are analysed. By looking into how the municipality aims to achieve their goals and how Tegenstroom features in their plans an overview is provide of what the energy transition in the Haarlemmermeer looks like. By looking into the management strategy of the municipality it can then be explained why Tegenstroom is a private energy corporation and not a cooperative as is more usually the case. This section starts with a summation of the visions and goals that guide the transition at different level and ends with answering the sub question: "**what is the role of Tegenstroom within the municipal energy transition?"**.*

This section starts out by taking a closer look at the visions or goals that guide the national government, municipality of Haarlemmermeer and Tegenstroom (1 9). On the very highest level, the Paris agreements have set goals of maintaining global warming under 2 degrees centigrade for this century (UNFCCC 2016). On the national level, this means that the Dutch national Government has recently reset its national transition aim to reduce CO2 (and equivalent) emissions by 49% in 2030 and by 95% compared to 1995 levels (Gerrits 2018). On the lowest institutional level, the municipality of Haarlemmermeer is striving to become energy positive or energy delivering to neighbouring municipalities by 2040 (Gemeente Haarlemmermeer 2017c). Tegenstroom, having been formed by the municipality, shares a similar aim in the form of promoting local solutions, local generation and greater equality between customers and energy providers(6).

The formulation of these visions on different levels make up much of the strategic sphere of the Dutch energy. This is also evident in the great importance for the lower institutional scales that the national formulation of a transition objective by 2011 in the form of a "Cabinet approach to climate policy on the road to 2020" (Rijksoverheid 2011) has been (1 9). This macro level policy allowed for more detailed creation off municipal level sub goals in the Haarlemmermeer or the overall meso level (1). It allowed for the Haarlemmermeer formulation of transition goals within the national vision and that of the then newly formulated energy neutral goals of the MRA (metropolitan Region Amsterdam) by 2040 (Gemeente Haarlemmermeer 2015) (6). Other important aspects of note that correspond with this level include changes in cultures and perceptions to the growing impact people have on the planet and the increase in local engagement in for instance the form of energy cooperatives (HIERopgewekt 2017b).

On the tactical sphere it seems there is much more activity within the municipality, with multiple actors, within multiple adjacent domains and among different levels (1). After the formulation of the climate policy documents in 2011, many municipalities started actively working towards integrating local level measures to work towards the energy transition (Rijkswaterstaat 2013) (9). In the Haarlemmermeer several big steps were taken within the municipal government, starting with the formulation of the energy positive by 2040 goals at the strategic level (interview 3; Gemeente Haarlemmermeer 2017b). The nature of the municipal goals are considered to be more individualistic and oriented towards realising the municipal goals much more than it concerns itself with the national goals, Haarlemmermeer's contribution or cooperating with other municipalities to achieve their goals (6).

In accordance with these goals, the municipality set up their sustainability programme(6 7), which works alongside the other departments of the municipality such as real estate, social care and land use planning. One of its main aims has been to champion the sustainability goals and integrate sustainability into the daily routine and way of thinking within the municipality, integrating

environmental policy into the municipal structure, whilst also actively pursuing sustainability goals in cooperation with other parties (interview 3; Gemeente Haarlemmermeer 2017c). Outwardly, the programmes main ambitions have been the promotion of a circular economy in the Haarlemmermeer and to stimulate the transition towards an energy positive municipality (interview 3; Gemeente Haarlemmermeer 2017c). The programme was tied to the tenure of the municipal college and is currently finishing up its second term (2015-2018) and is awaiting reabsorption back into the other municipal departments (interview 3; Gemeente Haarlemmermeer 2015). This programme, is what was decisive in classifying the municipal efforts as more tactical than strategic. This is mainly because the programme benefits from a cultural change bringing sustainability to the forefront of social discussion (1). At the same time the programme itself was aimed at changing the regime, structures and practises within the municipal apparatus to be more environmentally aware and include environmental practise into the workflow of other departments whilst stimulating niche level innovation.

Part of this has been the so called “thousand flowers blooming” frame of mind adoption within the municipality (interview 3). This entails the fostering of new ideas, or “sprinkling seeds in fertile soil” and nurturing ideas and initiatives that arise (interview 3), which has for instance resulted in the Winst uit je Woning initiative discussed earlier (9). To frame it more theoretically; this frame of mind has led to a tactical, meso-level approach that is aimed at breeding niche level innovation, it supports multi-actor, multi-domain initiatives and is able to nurture an open playing field within the municipality, also called a “miniature sustainable ecosystem” by the policy advisor (interview 3) (2 4). By providing subsidies and safe opportunities for growth and development, allowing for the “thousand flowers blooming” approach to encourage innovation and development, whilst simultaneously providing opportunities for interaction and cooperation in, for instance, the form of meeting chambers to connect entrepreneurs, this approach has allowed for the spread of knowledge between people and the linking of ideas in multiple sectors and on multiple levels (interview 3) (4 5).

Aiding this frame of mind has also been the municipal mindset that sustainable initiatives can and should be backed up by an economically sound business case (1). This means that initiatives have a decent chance of becoming self-sustaining entities, not dependent on constant subsidies to keep them afloat. Note that this does not discredit the use of subsidies, it merely moves away from maintaining them over long times in uneconomical business practises. This is driven by the idea that sustainability can be “earned back if done properly” and should not just be ecologically sustainable but also economically sustainable.

Finally, it is also within the tactical sphere that the founding of Tegenstroom and Meermaker is classified. They were founded specifically to further the municipal energy objectives, as is evident from their aims to stimulate local energy production growth and supply local energy to local people (Tegenstroom 2014a; Tegenstroom2015a) (6). The total outsourcing of energy generation and partial outsourcing of funding for new innovations and seeking out potential synergy bonuses into Tegenstroom and Meermaker has allowed the municipality to create two separate bodies that are actively involved in the shaping and driving of the transition without having to be actively involved in the day to day affairs of running these initiatives, instead focussing on its core business (interview 3). Still within the tactical sphere are also classified, the projects that were tied to Tegenstroom’s founding such as the “Tegenstroom voor Ymere” solar panels project. This project especially was directly tied to the retraction of municipal subsidies for solar panels, in line with the “business case” argument from earlier (interview 3). Whilst the execution of the projects is an operational level affair, their inclusion in the founding of a private, municipally owned energy company was, tactical in nature due to their longer time span and the knowledge that although “resources are often available, suitable projects are often hard to find” (Energeia 2013) for local similar initiatives. By including them in the foundation of

Tegenstroom, it was given greater purpose within the municipality than only local energy generation (Interview 3). Instead, it can also lay focus on local projects and networks building, which leads to the third sphere.

In this operational level focus is more on the niche level innovation projects that Tegenstroom and the municipality engage in as the level focuses more on the short term, innovation and individual action (Loorbach 2010). It is through this level and the projects that take place here that that the drive for system innovation and improvement is achieved. As both Rogers (2010) and Rotmans (2001) point out that innovation takes place primarily at the niche level. It is then at this level, that most innovations and potential system improvements are made. For Tegenstroom and Haarlemmermeer for instance, the neighbourhood battery is a testing ground for potential improvement by saving costs on upgrading powerlines and storing energy locally to prevent production or demand peaks from overloading the grid, improving robustness (Meermaker 2017, Tegenstroom 2017b, interview 2). Educational opportunities such as "dag voor de Duurzaamheid" and "de energiebattle" are intended to make citizens aware of opportunities and their own impacts (Tegenstroom 2016: Tegenstroom 2017a). Project to increase installed capacity and provide local power, such as "Tegenstroom voor Ymere" or the "stroom van Jos" project are direct additions to national, municipal and Tegenstroom's goals (Tegenstroom 2014c; Gemeente Haarlemmermeer 2018b).

It is through these and similar projects that Tegenstroom, Meermaker and the "thousand blooming flowers" mindset aid in keeping a wide-open playing which is essential in a transition (Loorbach 2010). By combining new information, spreading this information between actors, generating new ideas, initiatives and projects, many options are opened to the municipality in the energy transition (6 9). By providing backup to initiatives or setting up businesses such as Tegenstroom and Meermaker the municipality can provide safe places for experimentation that may then later come up and grow much bigger or more impactful, as happened with the Winst uit je Woning initiative (Beermann and Tews 2017; Interview 3).

Unfortunately, it has also become clear form the interviews (interview 2; interview 3) that Tegenstroom's small size may be hampering its further growth. Although the niche level that Tegenstroom currently occupies is well suited to the execution of local scale projects due to for instance the personal connections with clients that Tegenstroom prides itself in (interview 1) (4), it is not well suited to engage in the larger energy market or the development of new projects. This requires a more tactical level approach, with greater oversight and goals, something initially provided by the municipality at Tegenstroom's founding but is now relatively lacking (interview 2) (6). Despite Tegenstroom's connections with OM and the municipality, it is having trouble securing new projects and growing its customer base (something returned to in 4.4) (interview 1). As it is Tegenstroom appears to be running into the same issues similar initiatives encountered that are mentioned in Energeia (2013). They are having difficulty finding new suitable local projects and securing them in a highly competitive energy market (interview 2).

This then, leads into the fourth and final of Loorbach's (2010) spheres, the reflexive sphere. In this final sphere a look at the municipal process is taken, as well as whether a learning approach was adopted and if there was critically reflectivity within the municipality (6).

Let's start by looking at the municipality. The day-to-day operations and implementation of policy is managed by the municipal college and the alderman for sustainability. This alderman has championed many projects throughout his tenure, and was crucial the founding of Tegenstroom and Meermaker (interview 1)(6 7 9). The governing of the overall municipality and its overall policy directions is done by the municipal council. They are also responsible for checking the overall policy implementation as

done by mayor and aldermen. This then makes them the municipal governmental body ideally responsible for checking the implementation of the sustainability programme and the energy objective that the municipality has adopted. It was surprising then that on multiple occasions the council requested information regarding the progression towards these goals and overall sustainability within the municipality and received such a convoluted answer that they had to request additional clarification on multiple occasion (Boele 2017). Even more surprising however was that when they received clarification they deemed adequate, the council became so enthusiastic about the whole ordeal that they started offering further suggestions for initiatives (6 7). From this it seems that although enthusiastic about developments and the potential within the municipality, the council is lacking in its supervisory role. The wide transition objective of the municipality is leaving a lot of room for interpretation and it has resulted in the setup and development of many initiatives but no clear line of progression towards the energy goals. This seems to have resulted in an underperforming of the learning sphere within the Haarlemmermeer.

So, in conclusion for this section. There is a cultural change occurring that is leading to more vocal involvement and awareness of human impact on the planet and environment. This has led to pressures on the societal sub system of energy to change. This change is occurring slowly and currently that the energy system is adapting to these pressures and changes (De Haan and Rotmans 2011). In this transition the interplay between different levels is becoming more and more important as energy generation becomes more visible and thereby is interacting with more societal domains that before as well as affecting more actors that before (Rogers 2010: Rotmans 2001). These interactions are also leading to new innovations and ways of doing things. By taking a look at how the municipality of Haarlemmermeer and Tegenstroom are situated within Loorbach's (2010) spheres an overview of the management strategies employed can be provided. From this, it is evident that although there is a lot of enthusiasm for developing the transition goals, there is also a lack of oversight and use of learning opportunities. This has led to a general tendency to create more initiatives (horizontal expansion) rather than developing initiatives further to reach greater benefit (vertical growth). In this, it is also clear that Tegenstroom has been a part of this enthusiasm and was initially set up with several projects to guide its development and stimulate green energy and innovation. Unfortunately, these projects are now coming to an end and Tegenstroom is having trouble developing new projects due to competition. This seems to indicate a lack of tactical oversight or capability over or within Tegenstroom. To provide an answer to the sectional question: ***"what is the role of Tegenstroom within the municipal energy transition?"***, the role of Tegenstroom in the municipality has been one of relative success so far. It has been successful in creating/ developing the projects it set out to achieve having up to 1700 customers currently (interview 1). Unfortunately, its future is less certain, with difficulty in its new projects and severely limited funds to reach new customers or projects. Through these projects and the growth of their customer base Tegenstroom has aided in the developments of the "small sustainability ecosystem" as well as to spreading information and innovation in the Haarlemmermeer.

Despite their current issues, we have confidence that Tegenstroom will persevere, as its greatest assets, the two women guiding it, are full of confidence and new ideas.

4.3 Sub question 3: Decentral Energy and Area-Based Development

*In this section a discussion on decentral energy generation and area-based development in the Haarlemmermeer is central. The section starts off with the importance of personal connections and embedding initiatives in their local context. After discussing the importance of strategy for initiatives, the section moves on to discuss microgrids, and Tegenstroom's role in promoting projects innovation and cross sectoral links. Central in this section is the question: "**is Tegenstroom unique from local area-based perspective? ".***

The previous section already discussed the importance of macrolevel change and strategic goal setting as well as niche level innovation and how national policy changed to account for this (1). By moving to promote local generation and stimulating cooperative or individual local generation the bottom up importance of the transition is stimulated. Energy cooperatives are also vitally important because of their personal connection the energy transition (4). Whilst a more thorough definition is provided in the next section, it is important to know that a defining characteristic of (Dutch) energy cooperatives is that they are set up, operated and financed by their members, which implies a certain dedication to their cause. Their local knowledge and engagement, as well as their entrepreneurial form makes them intrinsically dependent on their members. This personal connection to the cause is indicative of the importance of the community sphere (De Boer et. al. 2018a) and is vital in a transition where the local effects will be so close to individual citizens and the public landscape. Similarly, the presence of people with the knowledge and ability to drive these initiatives forward is crucial to their success and drives the diffusion of innovation and increases participation by increasing opportunities for local people to identify with the project (Mcbride 2014; Hasanov and Zuidema 2018) (5).

In line with the local involvement is that profits for cooperatives are generally reinvested back into the local area to further the local low carbon practises (De Boer et. al. 2018a). From interviews (1 and 2) it has become clear that despite its different institutional nature, the two employees of Tegenstroom are highly committed to the goals that were formulated at the founding of Tegenstroom. Tegenstroom also practises many of the defining social characteristics that De Boer et. al. (2018a) identified cooperatives engage in. These include regional support groups, sharing experiences and mutual learning, networking and coalition building and the activation of knowledge and experience of volunteers (4 5). Most of this is achieved through Tegenstroom's participation of founding of projects as discussed in section 4.2 but also through their strong personal connections to the sustainability programme and the alderman for sustainability (interview 2 and 3).

It is then, through local specific knowledge, local engagement and the sharing of ideas that potential links and efficiency gains or missing links can be identified. The Haarlemmermeer is already facilitating this in their innovation chambers (recently made independent) (interview 3) (6). Through their strong local focus and their strong network as well as the already established referrals from the municipality and a growing reputation Tegenstroom may play a significant role in the creation of microgrids and local integration of renewable energy as they have been doing already in the established projects (7 8). This is also in line with De Boer et. al (2018) where local initiatives become small nodes of links where different aspects of the energy landscape come together through the initiative's activities. For Tegenstroom these activities are the projects they undertake or are associated with.

One example of these is the neighbourhood battery that has already been mentioned earlier. It is a pilot project in the east of the Haarlemmermeer among 32 energy clients with solar panels of Tegenstroom, funding from Meermaker, knowledge and funding from the network operator and smart home energy management system company (7). The interest here was whether or not the local storage can forestall the need for large investments into upgrading existing powerlines (Liander 2017). By connecting the homes to a battery system, the homes can store their excess electricity when it is not

needed and access it when it is needed (8). This is instead of the current measure of selling it to the grid and then buying it back later when needed also known as “salderen”. Currently, the homeowners all have a separate “space” within the battery bank, that is managed by a smart system. This may however change at a later date as it is intended that the energy will become pooled with automatic trading of generated energy taking place between residents, essentially sharing their solar panels capacity through the battery (Liander 2017).

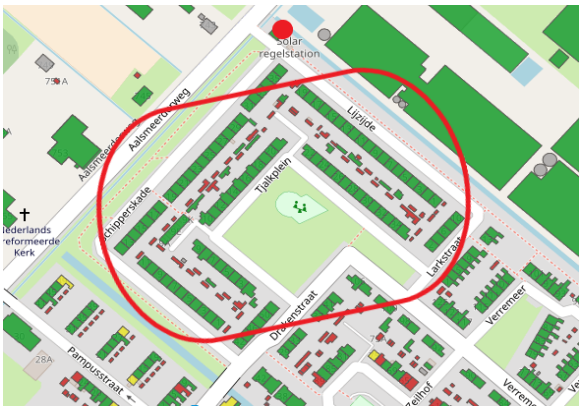

Figure 15: The location of the neighbourhood battery in RIjsenhout. the red dot representing the physical battery and the framework the location of the 35 social housing units with solar panels from Tegenstroom

Unfortunately, there are several difficulties. The ownership of the battery by the network operator and the intended trading between homeowners. This is seen as a breach of their mandate, where the operator cannot also operate the installation (interview 3) (2). Secondly is the smart operating system connecting houses to the battery. It is currently in an unfinished state and Tegenstroom is not hopeful it will be any time soon (interview 2). Finally, the presence of the “salderingsregeling” is essentially allowing for the energy grid as a whole to be used as a giant battery to store solar power into and buy back later. This is making local storage in the form of batteries currently unappealing due to their high cost (Didde 2018).

Microgrids, as has been established from theory earlier, are the locally integrated prosumer solutions that offer energy on a much smaller geographical scale than current energy plants. These microgrids promote a movement towards a more robust, distributed network (Tenti and Caldognetto 2018). However, the municipal scale seems too large still to effectively integrate locally. In fact, the municipality looks at residential cores, districts, neighbourhoods, street and even the individual housing level try and come to adequate solutions and local integration (interview 3). It is also why the scale of integration is often focused on the individual household and individual solutions (1). To truly become microgrids a more cohesive approach may be necessary. Energy cooperatives for instance can allow residents to work together to achieve energy goals they have set themselves. These may range from wind turbines to solar panels, small-scale bio-fermentation plants, local storage solutions for local generation and nearby use of local solar fields (De Boer and Zuidema 2015). As Tegenstroom is so similar to how a cooperative operates and is so closely tied to the municipality it may come to play a larger role in the realisation of microgrids in its function as both municipal scale energy company and local energy initiative. Unfortunately, no evidence of this is currently available as Tegenstroom is currently mostly focused on the short term as discussed previously and the municipality is currently mostly focused on stimulating new initiatives rather than further development of existing ones.

In conclusion, *is Tegenstroom unique from local area-based perspective?* The answer is mixed. It displays many of the characteristics and potential benefits of a small energy cooperative as described by De Boer et. al. (2018a) whilst operating at a higher-level scale yet is also involved at the small scale through local projects. It engages the same local social practises as local energy cooperatives and seems to have the same potential benefits for embeddedness. Potential for the realisation of new linkages and synergies between sectors comes from the larger scale Tegenstroom operates, its close ties to the municipality and its function as energy company but is hindered by their operational focus and difficulty securing new projects.

4.4 Sub question 4: Governance

*In this section, focus is on the governance aspect of the energy transition in the Haarlemmermeer. As is established from the literature, the transition is part of an incredibly complex system and a process of change and the governance movement of recent years is in response to the increasing complexity of governing. In this section, interested is in whether the municipal strategy of "one thousand flowers blooming" was unique, whether Tegenstroom as private corporation is unique, whether Tegenstroom and her connections to the municipality are unique and whether the notion of Tegenstroom as a collective point for decentral energy offered in one of the interviews is unique. As such, the broad, guiding sub question central in this section is: "**is Tegenstroom unique from a governance perspective**?".*

This section starts then, by looking into whether Tegenstroom status as an independent private energy corporation without profit objective, founded by the municipality is a unique situation. To do this, HIERopgewekt.nl is used, a website that collects and support data on local energy initiatives. Founded and run by Climate bureau HIER and nature and ODE Centraal, advocate for the sustainable energy sector (HIERopgewekt 2018a). Additionally, it is supported by the department of Rijkswaterstaat, the Dutch infrastructure department of the ministry of infrastructure and environment (Rijkswaterstaat 2013). HIERopgewekt styles itself as platform for everyone involved or interested in local sustainable energy (HIERopgewekt 2018a). it offers information about starting your own initiative, the sharing of knowledge and innovation, networking opportunities and visibility for initiatives (Rijkswaterstaat 2013). It also provides a comprehensive overview of energy cooperatives and other energy initiatives (HIERopgewekt 2017a) and an inventory of currently active cooperatives (HIERopgewekt 2018b).

From this it is known that there were 366 active energy initiatives in the Netherlands in 2016 and 389 in 2017 (HIERopgewekt 2018b). Of those, the vast majority (313 in 2016) come in the form of energy cooperatives of differing sizes, ranging from block and street level up to multi-province cooperatives. These cooperatives mainly exist as unions of citizens who share resources and knowledge or pool energy production. Of the remaining 53 (in 2016) 13 are village windmill foundations and 30 are collective actions like crowdfunding solar fields (HIERopgewekt 2017b). Three are cooperatives by private (non-energy) companies and there are two cooperatives by established energy suppliers (HIERopgewekt 2017a). This leaves four initiatives remaining. These are classified cooperatives between municipalities and local energy companies. Of these four, three are cooperatives between multiple municipalities or a municipality and a private energy cooperative or energy company (HIERopgewekt 2017a). Only a single municipality has its own energy company, which, perhaps unsurprisingly, is the Haarlemmermeer with Tegenstroom (HIERopgewekt 2017a).

This goes to show that although there are a few similar initiatives cooperating with a municipality (or multiple) and there are multiple local energy companies working together with their respective municipality. There is however, only a single entity that is both local, not for profit and owned by a municipality, which is Tegenstroom. The founding of Tegenstroom by the municipality was coupled with 9 founding projects for the money to be invested in, most of which was earmarked for the cooperative with Ymere, the social housing agency within the municipality (Energeia 2013). This approach was reported as highly uncommon in a time where the founding of municipal energy companies was seen as non-effective because no suitable projects could be identified (Energeia 2013).

Whilst municipalities offer opportunities for civil (energy) initiatives, most do this primarily through assisting in the set up or organization of existing cooperatives that come from civil society. The assisting document developed by Rijkswaterstaat to guide and assist civil servant in aiding initiatives offers various reasons for municipalities to assist initiatives. It states that initiatives aid municipalities in actively working towards their set energy goals. Energy initiatives allow municipalities to use the

motivational strength of its citizens to drive their local transition forward (Rijkswaterstaat 2013). Their local focus allows for optimal local integration and minimizes chances of local resistance (9).

This ties back directly to the increasing complexity of the energy market and the energy transition as a complex problem in its own right. With the transition to a largely decentralised or distributed energy network, energy solution will not only be more visible in the landscape, there is also a need to cooperate with local actors and citizens (4 5 8). Not only because of the physical access to roofs or private investment in energy solutions will be required from the community sphere however. It is also because local actors and citizens may be able to identify missing links or come up with unconventional solutions within local niches that government might not have considered (4 5). All in all, the energy transition is a move not only towards a decentral or distributed energy network. It is also a move along De Roo's holy spectrum of planning (2010) (figure 1). Coming from a highly centralized technical rational approach to energy generation, the discussion is moving to a more decentralized, inclusive, communicative approach, involving more actors due to increased complexity. It appears that "*no single actor, public or private, has the all-encompassing knowledge, overview, information or resources to solve complex and diversified problems"* (Sehested 2003; p. 89) is relevant in energy as well.

Currently, municipalities favour the incubation or encouragement of local initiatives developed by local citizens, often in the form of cooperatives (HIERopgewekt 2017b) (6 7). In this, cooperatives can be defined as micro-organizations, with fewer than 10 (often 0) employees (being community driven they often depend on volunteers). These cooperatives have no profit objective and an annual turnover of less than 2.5 million Euros (HIERopgewekt 2017b). The cooperatives are funded and guided by their members. The entrepreneurial form of cooperative arose in the Netherlands around the 1980's with windcooperatives and has evolved to include local cooperatives in 2007 and project cooperatives in 2013. Local cooperatives have a sustainability objective for their local living environment and concern themselves with production, economize or supply energy, whilst project cooperatives are similar but focused on a single objective or project (HIERopgewekt 2017b).

These cooperatives are generally favoured due to their independent nature, local connection and motivational drive of its members to achieve their goals and recoup their investment and attain their sustainability goals (5). For the municipality this generally means only having to provide guidance and knowledge of institutional set up (Rijkswaterstaat 2013). This guiding document also notes that partnerships between municipality and initiatives develop naturally over time and are dependent on the contextual factors much more than they are on active steering or goal-oriented development attempts. This leads them to classify several levels of cooperative between initiatives and municipalities. These levels are not really a development pathway as much as they are used to help guide municipalities in assisting initiatives depending on their level of involvement with the energy cooperative (Rijkswaterstaat 2013). These levels are, in ascending order of involvement:

- **Coaching** (support new initiatives in forming their goals and formulating their questions)
- **Facilitating** (aid in non-monetary form, like making available meeting space or referring the initiative to other sources of information)
- **Service providing** (more formal, the municipality uses its competencies to provide substantive assistance in for instance permitting processes or looking for project sites)
- **Participating** (more intensive yet, the municipality may decide to become a (paying) member, customer or financial benefactor)
- **Co-producing** (the most intensive form of cooperation, the municipality ties itself to the initiative to further municipal energy/ sustainability goals. it is defined by a clear division of tasks and both partners offer added benefit to the cooperation.)

The relationship between Tegenstroom and the municipality is classified as co-production based on the background the guide provides and the relationship that has emerged from the interviews and desk research (6). First and foremost, is the fact that the guide by Rijkswaterstaat (2013) defines co-production further as a municipal energy company. The fact that the municipality is founder and sole shareholder of Tegenstroom satisfies the criteria of municipal energy company. Secondly, the very close ties between the two (three counting Meermaker,) are indicative of the symbiotic relationship between them. It was on multiple occasion in all the interviews that the close ties between the initiatives and the municipality, meaning the sustainability programme, and specifically with the alderman has been crucial in Tegenstroom's success over the past few years (interview 1, 2, 3) (6).

Thirdly, the fact that Tegenstroom, despite being an independent corporation, uses the municipality as a financial back-office to offload the burden and bridge the knowledge ties it very closely to the municipality and uses a clear division of tasks (interview 1+2; Rijkswaterstaat 2013). This type of relationship is marked by the ability of the municipality to transfer municipal tasks to a separate institution or create greater public support for their investment and civil engagement by splitting the task off from traditional municipal institution into something closer to their citizen (Rijkswaterstaat 2013) (4 6). This was also remarked by the policy advisor for the sustainability programme, where the incorporation of initiatives allowed the municipality to focus on its "core-business" and not bother with the day to day affairs of, for instance, running an energy company (interview 3).

Tegenstroom was set up with the explicit goal of furthering the municipal transition goals. To do this it was initially set up with 9 projects attached to it (interview 1; Energeia 2013). These projects were identified as being able to further innovation and the make headway in the transition process (interview 1). Chief amongst these was the cooperation with Ymere and the 24.000 solar panels goal it set itself (Energeia 2013) (2 3 6 9).

Most of these founding projects were aimed at reducing the role of the municipality in the energy transition, "moving away from the director's seat" (Energeia 2013) and instead moving the transition to the market as early as possible (6). This is visible in for instance the neighbourhood battery where the municipality was only involved in the permitting process and all other activities were organized by Tegenstroom, Meermaker and other parties like the net operator (Liander 2017). Similarly, the newly formed cooperation with the "Stroom van Jos" project was not attached to the municipality and came about through networking relations between the entrepreneur laying solar panels and the director of Tegenstroom, once more indicating the importance of social capital in initiatives (interview 1). However, now that these 9 original projects are coming to an end, Tegenstroom is having difficulty engaging in new projects and setting a clear line for itself, mainly due to competition, as discussed earlier (interview 1).

In conclusion and in answer to the question: "***is Tegenstroom unique from a governance perspective****?"* Tegenstroom does occupy a highly unique and unusual position in their relationship with the municipality. Where most initiative come up from civil society and are supported by a municipality, Tegenstroom was set up and intrinsically linked to the municipality yet is a separate entity. Their co-productive relationship offers benefits to both parties whilst operating independently from each other and the close ties allow for the sharing of ideas and referring of other initiatives and projects between the two. However, whilst Tegenstroom so far has been relatively successful it remains uncertain if it will remain successful as it has little capital to expand. This is required to recruit further customers outside of its appeal as local initiative with local power or, to set up new projects when the original founding initiatives are fully wrapped up. Similarly, we wonder if the scale of Tegenstroom is help or hinderance as most initiatives are lower scale because it aids in local embedding and increases chance of success.

Chapter 5 Discussion/Conclusion

*In this chapter the data from chapter four is discussed and how the answers to the sub question relate to answering the main question is explained: "**does the seemingly unique set up of Tegenstroom allow it different options than other energy cooperatives and how might this impact the Dutch energy transition?**". These findings are discussed and used in the conclusion and answer of the main research question. Afterwards, the potential implications for planning are discussed and limitations of the research are considered*

In this thesis the focus throughout has been on Tegenstroom and its role in the municipal energy transition of the Haarlemmermeer. The central aim has been to find out if Tegenstroom has had a positive influence on the energy transition and if its unique local circumstances are something that may be duplicated elsewhere to aid in the bottom up energy generation that is essential in the move towards sustainable energy.

To do this, several important theories were identified. Complexity theory which underpins this entire theory thesis as a pair of goggles to view the world. Transition theory, transition management theory and diffusion of innovation theory showed how societies change through multi-level, multi-actor and multi-domain interactions. Management theory for instance showed how it is possible to guide a transition by examining it through different spheres. These theories also showed that people are essential, they are who theories are about and where innovation takes place. Governance theory explained a shift towards a more complex society and how to govern in an increasingly complex world. Decentral energy provided a glimpse into the future energy system and tools on how to get there, whilst area-based development showed the importance of local contextual influences and the embedding of initiatives in their environment.

These theories were interwoven into four sub questions that were meant to help answer the main research question: "***does the seemingly unique set up of Tegenstroom allow it different options than other energy cooperatives and how might this impact the Dutch energy transition?***". To do so, the context of Tegenstroom had to be described as it is one of the most important aspects, not only in area-based approaches and the transition to local energy generation, but also because context can provide clarity and meaning to observed phenomena. This is also explained extensively in the methods of case selection in Appendix A).

By using information from various websites, a sketch was made of the municipality of Haarlemmermeer and how it may relate to local energy generation in section 4.1. This sketch also included regime issues, social data infrastructure and a description of the municipal mindset based on interview 3. This was followed by a case description of the Tegenstroom initiative and multiple of its projects. This case description was based primarily based on interview data and publications by Tegenstroom, Meermakers, various news articles and municipal publications. Finally, both of these descriptions were combined into an overview of active domains that Tegenstroom and its affiliates operate on and their respective institutional levels. This led to the creation of figure 14, based on Geels and Kemp's multi-level model (Rotmans et. al. 2001). This model is further explained in appendix D). Ultimately all this information was concluded in answering the sectional question: "***What local circumstances have shaped Tegenstroom and is Tegenstroom viable outside of these?***". The answer to this question was that Tegenstroom would not have existed without the necessary political clout, a highly motivated director, both of which with extensive and powerful social networks, as well as the ability and foresight to identify suitable projects to set up Tegenstroom. Should these conditions be found or created somewhere else, then a Tegenstroom-like initiative might indeed be set up there as well.

Section 4.2 zoomed in on the levels that the local energy transition is taking place on. For this reason, it follows the general structure of Loorbach's (2010) four spheres of transition management and looks at them separately. At the strategic sphere, it is the the formulation of the of the international vision and national and local transition goals that guides the energy transition. On the tactical sphere, the formulation of the municipal sustainability programme was identified as an important measure within the municipal transition. Its formulation of a "thousand flowers blooming" mindset and the encouragement of sustainable thinking, resulted in what was called a small "sustainable ecosystem" in interview 3. This ecosystem encouraged sustainable initiatives and provided networking opportunities as well as the sharing of information between actors. Tactical also has been the formation of Meermaker and Tegenstroom and their founding projects. Unfortunately lacking was found the further implementation for Tegenstroom as the projects are coming to an end and Tegenstroom experiences great difficulty securing further projects. On the operational level, the execution of these projects and sharing of information takes place and innovation. On the fourth and final sphere, an unexpected lack of oversight was encountered from the municipal council and learning opportunities and further reflexivity seemed limited to certain projects rather than the entirety of both Tegenstroom and the municipal sustainability programme. This together led to the answer of the sectional question: "***what is the role of Tegenstroom within the municipal energy transition?***". Tegenstroom has had a relatively successful role in the municipal energy transition so far, growing to 1700 customers and spreading knowledge and innovation through their projects. They are however also hampered by strong competition and a lack of overall reflexivity which hampers the creation of a clear development path

Section 4.3 looks at Tegenstroom for an area-based perspective. Using the interviews with the policy advisor and the employee of Tegenstroom, as well as the websites of several of Tegenstroom's affiliates and projects to gain a better understanding of the local role and effects of Tegenstroom. By composing Tegenstroom with the general local characteristics of energy cooperatives it became clear that Tegenstroom's projects operate on the same level as energy cooperatives, providing the same potential for local integration yet benefiting from a municipal backer. In an answer to the sectional question: "***is Tegenstroom unique from local area-based perspective?***", a mixed answer was the only one possible. In certain regards, namely the projects, Tegenstroom in incredibly similar to local cooperatives. Yet through its connection to the municipality and the higher geographical scale of an energy company it is also intrinsically different. This allows for different, often larger opportunities such as the neighbourhood battery. These projects in turn embed Tegenstroom further into the local context.

Finally, section 4.4 focused on the governance aspect of Tegenstroom and their close ties to the municipality. Essential here were the Hieropgewekt website and the interviews with the director and municipal policy advisor. Also of great use, was the advisory document of Rijkswaterstaat which provided overview of how municipalities may deal with initiatives. In this section, the uniqueness of the bond between Tegenstroom and the municipality was established through Hieropgewekt.nl as well as the comment by all three interviewees. This bond was classified as the most intensive level described in the advisory document based on these interviews as well. Afterwards the benefits of this bond were discussed and the involvement of the municipality in the transition objective of Tegenstroom was elaborated on. This lead to the answer to the sectional question: "***is Tegenstroom unique from a governance perspective****?"*. Tegenstroom does indeed occupy a highly unique relationship with the municipality. Most cooperatives are social initiatives that come to a municipality for assistance, yet here the municipality went ahead and set up an initiative themselves. Their co-production relationship offers benefits to both parties while remaining independent. However, as with Tegenstroom's uncertain future, so is the municipal role in Tegenstroom in the future unclear.

This means that the main question can now be answered. "***does the seemingly unique set up of Tegenstroom allow it different options than other energy cooperatives and how might this impact the Dutch energy transition?***". Tegenstroom does indeed have a highly unique set up with its strong bonds to the municipality, the founding projects and its bond to Meermaker. It is also highly dependent in its contextual factors with highly dependent on its contextual factors with a motivated politician and director, both with very strong social networks. But these are not reasons that prevent the copying of Tegenstroom-like initiatives elsewhere. In fact, similar initiatives, of cooperatives formed by multiple municipalities exist in the Netherlands. Tegenstroom is active on a larger scale than most (highly similar) energy cooperatives but smaller than regular energy companies. The strong bonds with the municipality and their involvement in the original setup implies direct possibilities for municipal involvement in shaping the local energy transition in the Netherlands. For this to be successful though, a few lessons need to be learned from Tegenstroom. These lessons are that it requires a strong business case, viable initial projects and a concrete municipal vision at the tactical level, as well as a strong learning approach and reflexive oversight. Additionally, the small "sustainable ecosystem" that has been created in the Haarlemmermeer should not be discounted for influence. Finally, the competition in the energy sphere is strong and the creation of an initiative like Tegenstroom involves substantial public fund. This means that the formation of a Tegenstroom-like initiative should not be taken lightly, as there is substantial possibility for it to fail if certain factors are not accounted for.

All in all, this means that Tegenstroom is a highly interesting case that, given the right conditions may be spread as a concept to allow a more direct municipal involvement in the local energy transition. On its own however Tegenstroom's impact on the transition has been limited and with the difficulties it is currently experiencing and the need for the right conditions its impact on the overall transition is therefore also limited

Generalising these findings is only limitedly possible due to the highly specific nature of the case study and its rather unique institutional position. The knowledge that oversight and reflexivity are key in a transition is not new, as was shown by Loorbach's (2010) transition management theory. What is interesting is the role of municipal oversight and its overall impact on initiatives within its boundaries, as well as the importance of tactical level on for the development of these initiatives. Secondly, is the importance of context. Local area-based approaches theory (De Boer and Zuidema 2015) that the local conditions and embeddedness of an initiative greatly increase their viability. This was also found in the case of Tegenstroom, where local projects greatly increased Tegenstroom's local performance and customer base. At the same time this context is not an insurmountable obstacle for implementation of a Tegenstroom-like initiative elsewhere. Instead, the presence of powerful social or political actors with extensive networks is key in their development.

We believe that the most important finding in this case study has been the importance of identifying suitable starting projects to allow a strong start and development of a similar initiatives. These projects provide the municipality an opportunity develop and fill in missing links and actively encourage the development of local energy solutions, information sharing, innovation and education. For this to happen though, further research may be required into what are suitable projects. This might also benefit smaller initiatives such as cooperatives in identifying projects to undertake. Another point of further research would be the impact that the "sustainable ecosystem" and "thousand flowers blooming" have had and their viability for expansion should they prove as beneficial as claimed in the interview. Finally, the importance of this research to planners would be the development of initiatives that allow more direct steering of municipal energy goals and the guiding of the local transition whilst maintaining a certain distance at the same time. By nurturing several promising projects at the same time through a municipal energy company a knowledgeable entity is created with a desire to innovate.

Chapter 6

In this final chapter a reflection of the overall research process and the quality of research is provided. For this, three questions were used to provide some structure the first two: "what went well and what didn't" and "what would you have done differently in hindsight" reflect on the overall thesis process. The third question "do the outcomes appear convincing to you" discusses the end result. For this reason, this section is written in the first person, something that was avoided throughout most of the thesis.

What went well: Something I was rather proud of was the quality of the theoretical framework. I spent a lot of time working on it and considering what to write. Although it is very long and reads like a summary, I was proud of what I produced there. Another thing highlight to me was that despite only managing to perform three interviews, these interviews were extremely friendly and provided me with great insights, both for the thesis and for me personally. Finally, in a final sprint to the finish I put in more time into this thesis than I have ever spent effort on anything on during my university career. And although the end result is not as good as I would prefer it to be, I am proud at the effort I put in.

What didn't go so well: first of all, the tool to do research. Early on I developed the idea to use Geels and Kemp's(Rotmans et. al. 2001) model to give shape to the data and provide an overview of various levels, domains, actors, regime issues etc. this was unusable as chapter 4 developed, requiring a rethink of how to implement a conceptual. Because of this I find that my use of literature tied to data as been mediocre at best as no clear model was used, instead using links between various articles. Apart from this, poor time management has crippled this thesis. Due taking far too long with the theoretical chapter the data collection didn't start until late July, a time period most people go on holiday. This meant that no respondents were available from the province and the alderman for durability, one of the key players in Tegenstroom's foundation could not be interviewed. In all, this meant that the meagre number of 5 interviews had to be further downgraded to 3, which then had to be supplemented with further desk research. Finally, chapter four is not so much a presentation of data as it is a story dependent on some theories, leading to weak conclusions in chapter 5.

What I would have done differently for this thesis: this thesis would have benefited greatly from a comparative approach. By doing an intensive study of Tegenstroom and then comparing this to small cooperatives as well as the three cooperative municipal energy companies and for instance loose projects, Tegenstroom's actual performance could have been assessed rather than having to rely on secondary sources of how cooperatives usually operate. Additionally, much stronger time management would be needed, with deadlines having to be set much earlier to account for holidays and data collection. This would also have allowed for the comparative approach to be implemented and a wider view on Tegenstroom to be adopted.

Do the outcomes appear convincing to you?
Despite working on chapter 4 and 5 near nearly every day for the past 6 weeks they do actually not appear convincing to me. I find the little amount of primary data a severe hinderance, as is the highly specific nature of the case. The intent was to look at an energy initiative to see if it could benefit the overall energy transition in some form and what was delivered was a mediocre story about a small concept with 1700 customers. Despite pointing out the importance of multi-level approach the greatest focus was on the very local level with little info on the higher institutional level. Another weak point is chapter 4.3. At the outset of this thesis my aim was to use area-based approach theory inspired by De Boer and Zuidema (2015). Yet the chapter that should therefore be the strongest is in fact the weakest. No real info on just how embedded Tegenstroom is discovered or has been integrated into the context of 4.1. This corresponds with the overall data, which is mostly descriptive in nature and provides more of a broad overview rather than deep analysis. Finally, I feel I have failed to overcome my own preconceptions as Flyvbjerg argued is a strong point of case study research, I feel constructed an image of Tegenstroom for myself and have failed to refute this or tie it to reality.

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Appendices

A) Methods of case selection

Rice (2012) in his chapter on sampling in geography briefly mentions case studies. Primarily, he says, it should be the aim of geographers to make useful generalisations, to explain patterns and help better understand the world around us (Rice 2012). However, he says, we must maintain a primary focus on the general or generalisable rather than the specific or unique and that is why, even though they provide detailed information, case studies are generally less useful. Because, in case their generality is fundamentally unknown, they are less useful (Rice 2012). Because of this fundamental lack of generality, there is no basis for making funded inferences about a population and extrapolating findings remains a matter of "intuitive judgement" also known as guesswork (Rice 2012, p232).

Fortunately, nowadays there is also a substantial body of scientific literature that disagrees with Rice (2012) on the subject of a case study's benefits. Nowadays, this body of literature has argued for the use of context in scientific research and that the generally perceived weaknesses of case studies are not as great as they appear. The relevance of case studies today is argued by Flyvbjerg especially well in his 2006 article that lists five main misunderstandings about case study research (Flyvbjerg 2006).

Firstly, Flyvbjerg deals with the idea that context bound knowledge is not as valuable as is objective knowledge. This decidedly modernist way of thinking within social studies is put away as "regressive thinking" by Flyvbjerg, where he goes on to argue that context-based knowledge is the most valuable knowledge. He argues that case-based experience is the only way to make a qualitative leap in learning. It is how beginners move from a rule governed analytical rationality towards a fluid performance of tacit skills associated with true expertise (Flyvbjerg 2006). In this regard we have included a substantial first section of chapter four with regards to Tegenstroom and its context.

Secondly, Flyvbjerg discusses the problem of generalisation regarding case studies. He states here that the choice of case can be fundamental and provides several historical examples. The most famous of these examples is Galileo's disproval of Aristotelian gravity. By a single case of showing that a feather and a weight would fall just as quickly in a vacuum, 2000 years' worth of assumption was disproven. This shows that a well-chosen critical case, investigated in great detail, can lead to discoveries just as much if not more so than statistics applied to large numbers of cases. Finally, Flyvbjerg (2006) concludes with the remark that generalization itself is often overrated, whilst the force of example is very much underrated.

His fourth, and last point discussed here, considers the idea that case studies contain a confirmation bias and are therefore of doubtful scientific value. This comes forth from the perception that there is more room for the researchers own subjective views and arbitrary judgements to seep in. This too is dismissed by the use of examples. Flyvbjerg (2006) explains that a close zoom in, performed in a single case study leads to the most rigorous falsification of any (social) scientific method (quantitative or qualitative). More often than not, and certainly more often than other methods, are preconceived notions, that are essential in a case study (Yin 2014), adjusted or disproven after an in-depth scrutiny of a case (Flyvbjerg 2006).

Flyvbjerg's "5 misunderstandings in case study research" show us that case studies are in fact a valuable way of gaining knowledge and that they are not merely ways of exploring before "the real science can begin" (Rice 2012, p232).

Flyvbjerg's (2006) explanation that case studies are in fact a bona fide method of doing research now of course leads into why it was chosen as the way of analysing the research subject. For this a further

explanation of what a case study actually is follows, based on the questions; Why do we employ a case study design, and why is this the most relevant way of analysis for this research topic?

Yin (2014) dismisses the notion that research designs should be ordered hierarchically and that case studies are only primarily viable for exploratory phases of research. Instead he argues for a pluralistic view of research design where the main research question guides the research design and each method has its own way of collecting and analysing empirical evidence, following its own logic (Yin 2014). In this, he distinguishes between three types of research:

- Exploratory research:
- Descriptive research:
- Explanatory research:

Where the nature of the research design is indicated by the formulation of the main research question. Exploratory methods will for instance favour "what" questions, developing hypotheses and propositions for further research (Yin 2014). Descriptive research may favour, as the name suggests, descriptive methods. They are primarily centred around "what" "who" and "where" questions, where the goal is for instance to describe the prevalence of a phenomenon to predict a certain outcome (Yin 2014). Finally, explanatory research focusses mainly on "how" and "why" questions. This type of questions is mostly concerned with tracing links over time, instead of frequencies or incidence (Yin 2014). As such, the most important condition for choosing between different research designs, is to identify the type of question being asked, where "how" and "why", like our research question, are primarily concerned with explanatory methods and are closely related to a case study research design.

Given this preconception towards an explanatory research design that is embedded in the main research question, and the fact that case studies are in fact valid methods for conducting research and gaining context bound knowledge, the choice to conduct a case study seemed clear. This then leads to the question, what exactly is a case study? It is a word that is used a lot, in social research but often seems poorly defined. Flyvbjerg for instance does provide a definition of a case study that he deems "so oversimplified as to be misleading" (Flyvbjerg 2006 p2.). In this project, we follow the definition set out by Yin (2014) and briefly elaborated on below, to give structure to the thesis.

Yin's (2014) definition of a case study consists of two main parts, one of scope and one of content. The first part, concerning the scope of the case study deals with the purposeful inclusion of the context in your research design, as the subject cannot be separated from it. As such, part one of Yin's (2014) definition is:

1) A Case Study is an empirical inquiry that:
    - Investigates contemporary phenomena within its real-life context, especially when:
    - The boundaries between phenomenon and context are not clear.

Secondly, Yin (2014) include the data gathering and analysis strategies into his definition, as they are fundamental aspects that differentiate a case study research design from other methods of scientific inquiry:

2) The Case Study inquiry:
    - Copes with the technically distinctive situation in which there will be many more variables of interests than data points, and as a result:
    - Relies on multiple sources of evidence, with data needing to converge in a triangulating fashion and, as a result:

- Benefits from the prior development of theoretical propositions to guide data collection analysis.

This means that the researcher will go into the subject with multiple preconceived notions. However, as Flyvbjerg already showed, this need not be a problem per se, as often case studies provide greater sources of falsification than other scientific methods (Flyvbjerg 2006).

So, summing up. We have found out here that case-based research is in fact a valuable way of gaining knowledge. Secondly, using Yin (2014) a detailed picture of what a case study actually is was build. Based on this we elected to use the case method to research the Tegenstroom initiative in the Haarlemmermeer. This is among other things due to the explanatory nature of the research question, the social nature of the Tegenstroom initiative, the impossibility to separate the subject from its context and its complex and contemporary nature as well as the importance of time in complexity theory, transition theory and innovation theory. This together combines into a need for multiple sources of information to triangulate data, resulting in the choice to use a case-based approach to review the Tegenstroom initiative in the Haarlemmermeer.

B) Interview guide Tegenstroom:

- Hoe beschrijft u uw onderneming
- Wat zijn de doelen van de onderneming
    - Hoe groot is de nadruk op innovatie en hoe groot is die op het leveren van stroom
    - Heeft u productie doelen/ klanten targets, ondanks de afwezigheid van een winstoogmerk?
    - Waar komt uw energie vandaan?
    - Waar komt het gas vandaan?
    - Helpt u ook bij het afkoppelen van het gasnetwerk?
- Hoe bereikt u deze doelen
- Wat voor projecten heeft u nog meer in het vooruitzicht?
    - Gas
    - Elektriciteit
    - Buurtprojecten
- Hoe bereikt u lokale klanten? (zoekt u ze op, vinden ze u…?)
    - hoe groot is de rol van klanten, hoeveel initiatief kunnen klanten zelf tonen/ hoeveel inspraak is er om eigen projecten in samenwerking op te zetten?
    - Doet u ook aan " aansporing" (mensen/buurten actief maken)
    - Heeft u voornamelijk individuele klanten (bewoners) of probeert u juist meer bedrijven te bereiken (voorbeeld woningbouw vereniging, scholen (schaalvoordelen bij klanten met grotere oppervlakten))
- Met wie werkt u samen/ hoe ziet uw zakelijk netwerk er uit?
    - Hoe ziet uw netwerk er uit
    - Wat is de verdeling tussen publieke en private ondernemingen hierin?
    - Het belang van de gemeente?
- Hoe bent u opgezet
    - wat was de oorsprong? Uw initiatief? Gemeente? Meermaker? Lokale ondernemers?
    - Heeft u ook naar andere gemeenten gekeken?
    - Andere lokale energiebedrijven?
    - Wat denk u dat u anders doet? Wat doet u hetzelfde?
    -
- Wat is de rol van de gemeente
    - Hoe cruciaal waren ze in de opzet
    - Hoe groot is de vinger die zij in de pap houden
    - Hoeveel wordt er nog met de gemeente samen gewerkt
    - Hoeveel contact is er onderling
    - Hoeveel ruimte voor eigen initiatieven,
    - Wordt u ook betrokken bij initiatieven van de gemeente zelf?
- Heeft u nog verdere vragen of dingen die u denkt die belangrijk zijn om nog te vermelden of die u graag kwijt wilt
- (Waar zou ik nog verder moeten vragen denkt u, welke belangrijke spelers of factoren zou ik verder nog moeten opzoeken denkt u?)

C) Interview guide municipal sustainable policy advisor

Eerst een overview van de gemeente:

- Wie bent u
- Wat doet u
- Wat doet uw afdeling.

Case Haarlemmermeer:

- Wat voor projecten lopen er?
- Zijn er lokale specifieke projecten
- Zijn er beperkingen in wat u mag doen
- Hebben grote projecten zoals 380KV invloed?
- Wat voor invloed heeft het nieuwe klimaatakkoord
- Wat is de rol van Tegenstroom Meermaker
- Hoe intiem bent u met ze bekend.
- Wat voor rollen hebben de projecten van Tegenstroom Meermaker
- Hoe belangrijk is de rol voor burgers hierin

Transitie:

- Is er een transitie visie
- Komt deze van boven af? is deze zelf bepaald?
- Hoe ziet de gemeente zichzelf hier naartoe werken.
- Wat is de ruimte voor lokale initiatieven?
- Tegenstroom Meermaker
- Hoe stimuleert de gemeente innovatie?, gebeurd dat überhaupt?
- Heef tu zicht op wat voor spelers er zijn het veld zijn? Hoe houdt u ze bij? Hoe wordt met hen gecommuniceerd? Wat zijn de rollen die de gemeente voor hen ziet?

Local innovation/ local linkages

- Zijn er initiatieven waarvan u weet dat ze gefaald hebben/ niet successvol waren
- Wat zijn de lokale krachten van de Haarlemmermeer
- Wat ziet u momenteel als grootste struikelblokken
- Kunnen kleine partijen makkelijk inpassen dan groet? Zijn grote partijen daadkrachtiger?
- Wat is het beland van schaal voor REI? Groot bedrijf vs klein initiatief
- Microgirds en lokale processen zoals batterijen

Governance renewal

- Hoe beïnvloeden partijen het gemeentelijk beleid?
- Hoe kijkt de gemeente naar initiatieven zoals buurtbatterij, zonneweide A4 of DC-kas, brengen ze iets bij. Staat de gemeente er buiten?
- Kunnen partijen iets gedaan krijgen?

It is worth mentioning that these questions were meant as more of a reminder for myself much more than direct question to the policy advisor. The interview itself was well over an hour of densely packed talk and background information on municipal views and processes.

D) Tool to do research

This model was originally intended as a tool to do research throughout the thesis. We meant to use it to model and provide overview of various actors, domains and levels. Unfortunately, the model proved to be unsuited to the task and instead the theoretic overview of figure 4 was expanded to include important linkages that were then seeded throughout chapter 4. The overview was however still useful to use in section 4.1 as an overview of actors and therefore is included there. Below follows an explanation of the model.

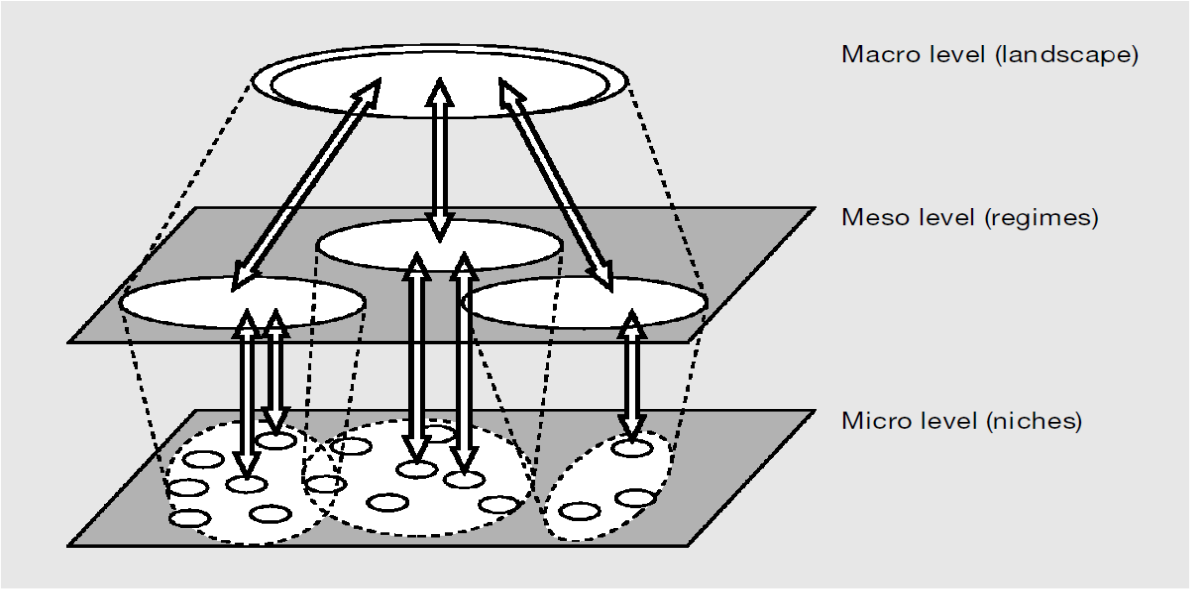

Figure 16 Multi-Level model by Geels and Kemp (2000)

In this appendix we develop our tool to do research based on Geels and Kemp (2000) multi-level perspective model as depicted above (Figure 16) In this model, we connect the different institutional levels of the transition model to spatial scales of institutions and regulations to provide an overview of their impacts and operational levels and where and how they are situated in relation to each other.

Rotmans et. al. (2001) do not just couple the levels of the model to society (i.e. macros, meso micro levels). They also associate their model to different types of actors. For instance, macro level actors represent global corporations or nations/ federations of states. Meso level actors may represent networks, communities or organisations. Micro level actors then, represent individual actors and small enterprises.

By translating these different typologies into practical examples, we can create for ourselves an overview of how Tegenstroom is situated within the Haarlemmermeer, its institutional framework and the energy transition. We do this by, for each of our sub questions, indicating where we would place the actors, processes, constraints or developments, based on data from interviews and desk research. This visualization helps us to gain further insight into how Tegenstroom is situated in its context and how depended the initiative is on its local context as well as. Additionally, it allows us to visualize whether the transition within the Haarlemmermeer and Tegenstroom is utilising the multi-domain, -actor and -level approach that Rotmans et. al. (2001) propose. By investigating this we can then answer the main question of the thesis of whether the situation of Tegenstroom really is unique, whether it allows it different options, whether it is benefitting from multi domain characteristics and if it is a viable option to transplant the initiative to other places to aid the overall Dutch energy transition.