Governance of Change in Sustainability Transitions

A case study on Texel's energy and water ambitions for 2020

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Governance of Change in sustainability transitions

A case study on Texel's energy and water ambitions for 2020

Submitted to Delft University of Technology

in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE

in Engineering & Policy Analysis

Faculty of Technology, Policy and Management

by

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To be defended in public on 08-29-2017

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Preface

As much as it pains me to admit it, procrastination is a habit that has plagued me since I started studying, and has plagued me still during the writing of this thesis. In fact, even during this foreword I have delved through the vast amount of web pages on the internet. I've never really had a solution for it, but it always consoled me that the majority of my study colleagues suffered the same faith, even though it's generally to a lesser extent than me.

As annoying as it can be, procrastination sometimes leads me to nice and interesting things that the internet has to offer. One of those things was as an article[1] about a book that was written by Ian Stewart called *"17 Equations That Changed The World"* (Steward, 2013). The book explains how these 17 fundamental mathematical equations have altered the course of history by showing examples of everyday applications that resulted from them. When I took a quick peek at the list, I felt mildly proud of myself. Because of my bachelor background in Molecular Science & Technology I am no stranger to mathematical equations. And indeed, most of these looked very familiar. This caused a small (and rare) moment of me feeling super smart, knowing that I (once) knew the theory behind these complex-looking equations such as Fourier Transformations and Schrodinger's equation and how to work with them, even though it has started to become a bit fuzzy nowadays.

The article cared to refresh my memory on these equations by accompanying each of them with a short explanation. Being as procrastinate as ever, I read through this explanatory text. One passage kind of stuck with me. It was the explanation of the 3rd equation in the list (see figure 1). The formula given here is the definition of the derivative in calculus. For example, we can think of velocity, or speed, as being the derivative of position — if you are walking at 3 miles per hour, then every hour, you have changed your position by 3 miles. Probably one of the more basic equations in the list, it's so fundamental that it is taught in math classes in high school. The article read as follows:

"Naturally, much of science is interested in understanding how things change, and the derivative and the integral — the other foundation of calculus — sits at the heart of how mathematicians and scientists understand change."

Change... that sounds familiar. Yes. My thesis is also about understanding change, even though it has very little to do with calculus. Where the mathematical derivative quantifiably measures the rate of change, change in my thesis is not so much about a quantifiable rate. My thesis is about how modern society changes in terms of sustainability, and how this change is governed. In other words, it's not so much about how *much* things have changed in quantitative terms, because that's relatively easy to measure. This thesis is about how we, as a society, make sure that we change for the better in the first place.

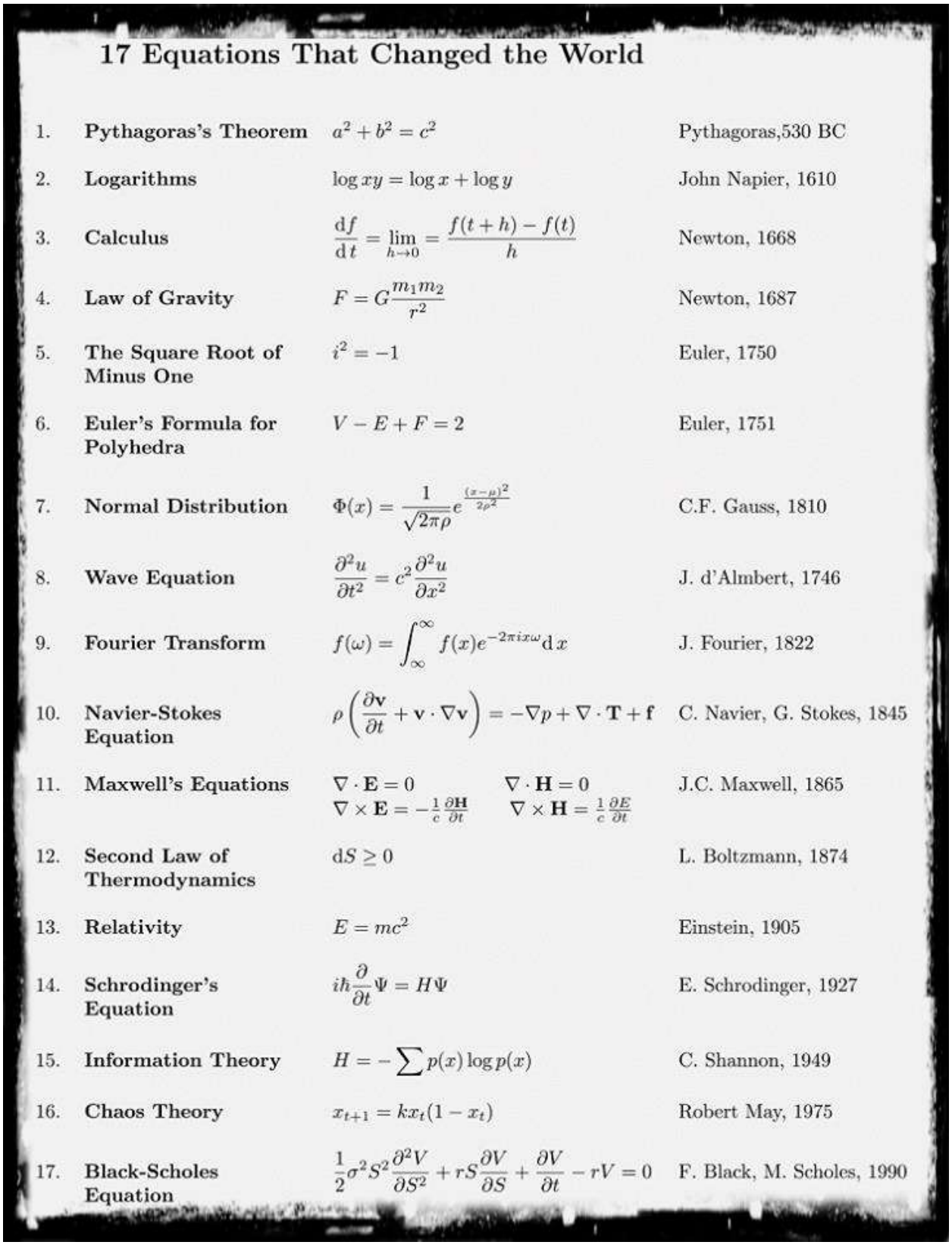
[1] The link to the article: http://www.businessinsider.com/17-equations-that-changed-the-world-2014-3?international=true&r=US&IR=T

For me personally, this thesis has made me learn a great deal about myself. With the risk of sounding cheesy, finalizing this thesis does mark a change in my life as I can finally start working and making a proper living. Although I can't say it really has changed me as a person, as writing a thesis may have done so for others. I've experienced quite a few things during this thesis, however. They were both fun and not so fun things. And especially during the not so fun times, I could always count on the support of the people around me. These include my parents but also definitely include my supervisors. I mention Bertien Broekhans in particular, who has had to deal with my many delayed deadlines and insecurity issues about the quality of my work. But every time she has been very understanding and helpful, and after meeting with her I always got my mind focused again and felt good about continuing towards the finish line. Thank you so much for that! Of course, I would also like to thank my other supervisors Kornelis Blok and Kas Hemmes for their support and insights. I would also like to thank Pieter de Vries from the Municipality of Texel for his time and effort. Sorry it took so long :)

Then I would like to thank Antoine, Dirk, Han, Herman, Stephan, Pepijn, Gijs, Paul and Mimi for giving me the opportunity to interview them. Your contributions are an important part of this thesis. Sorry it took so long, though. Last but not least, I want to thank my parents, friends and family and everyone who showed patience and understanding during my time working on this thesis.

Please enjoy reading my thesis!

Jeffrey Ros



17 Equations That Changed the World

1.	**Pythagoras's Theorem**	$a^2 + b^2 = c^2$	Pythagoras,530 BC
2.	**Logarithms**	$\log xy = \log x + \log y$	John Napier, 1610
3.	**Calculus**	$\frac{\mathrm{d}f}{\mathrm{d}t} = \lim_{h \to 0} = \frac{f(t+h) - f(t)}{h}$	Newton, 1668
4.	**Law of Gravity**	$F = G\frac{m_1 m_2}{r^2}$	Newton, 1687
5.	**The Square Root of Minus One**	$i^2 = -1$	Euler, 1750
6.	**Euler's Formula for Polyhedra**	$V - E + F = 2$	Euler, 1751
7.	**Normal Distribution**	$\Phi(x) = \frac{1}{\sqrt{2\pi\rho}} e^{\frac{(x-\mu)^2}{2\rho^2}}$	C.F. Gauss, 1810
8.	**Wave Equation**	$\frac{\partial^2 u}{\partial t^2} = c^2 \frac{\partial^2 u}{\partial x^2}$	J. d'Almbert, 1746
9.	**Fourier Transform**	$f(\omega) = \int_{\infty}^{\infty} f(x) e^{-2\pi i x \omega} \mathrm{d}\,x$	J. Fourier, 1822
10.	**Navier-Stokes Equation**	$\rho\left(\frac{\partial \mathbf{v}}{\partial t} + \mathbf{v} \cdot \nabla \mathbf{v}\right) = -\nabla p + \nabla \cdot \mathbf{T} + \mathbf{f}$	C. Navier, G. Stokes, 1845
11.	**Maxwell's Equations**	$\nabla \cdot \mathbf{E} = 0$ $\quad \nabla \cdot \mathbf{H} = 0$ $\nabla \times \mathbf{E} = -\frac{1}{c}\frac{\partial \mathbf{H}}{\partial t}$ $\quad \nabla \times \mathbf{H} = \frac{1}{c}\frac{\partial E}{\partial t}$	J.C. Maxwell, 1865
12.	**Second Law of Thermodynamics**	$\mathrm{d}S \geq 0$	L. Boltzmann, 1874
13.	**Relativity**	$E = mc^2$	Einstein, 1905
14.	**Schrodinger's Equation**	$i\hbar\frac{\partial}{\partial t}\Psi = H\Psi$	E. Schrodinger, 1927
15.	**Information Theory**	$H = -\sum p(x) \log p(x)$	C. Shannon, 1949
16.	**Chaos Theory**	$x_{t+1} = k x_t (1 - x_t)$	Robert May, 1975
17.	**Black-Scholes Equation**	$\frac{1}{2}\sigma^2 S^2 \frac{\partial^2 V}{\partial S^2} + rS\frac{\partial V}{\partial S} + \frac{\partial V}{\partial t} - rV = 0$	F. Black, M. Scholes, 1990

Figure 1: The 17 equations that changed the world (Steward, 2013)

Executive Summary

Problem: In 2007, the Island of Texel has signed an ambition manifesto together with the other five Wadden Islands which states that the islands aim to achieve a fully self-sufficient energy- and drinking water supply by 2020. Almost ten years have passed since the ambition manifesto was signed, and the "deadline" is rapidly closing in. Of all the wadden islands, with 3,8% in 2015 Texel has the lowest percentage of renewably generated energy on the island (though the other islands are ahead by much). The drinking water ambition has apparently been set aside now that the drinking water company PWN has installed a new water supply pipeline, committing Texel to supply from abroad for many years to come.

An early study by Ecofys shows that technically, it is possible to produce the complete energy demand on the island itself. ECN did a similar study in 2007 and concluded differently, but that was based on the exclusion of wind energy because large windmills could not count on much support at the time. With this in mind, it is clear that Texel's current lack of progression should not be sought solely in technical limitations. Rather, to find out why things happened as they did, it is important to look at the process of change from a *governance* perspective. These developments are the reason why the following research question for this thesis was formulated:

How did the governance of change contribute to the current state in the realization of Texel's ambitions for a self-sufficient renewable energy- and drinking water system?

Research goals: This research has two goals. The first goal is to create an analytical framework to analyze processes of governance of change in socio-technical systems. The second is to learn about how the governance of change has contributed to the current state of these two systems on Texel, and to see whether more general lessons about governance of change in socio-technical systems. This is done by applying this framework to two socio-technical systems on Texel (energy and water, based on the ambition manifesto).

While the ambitions are shared between the five Wadden Islands, Texel is chosen as a single case study for several reasons. First of all, Texel is often seen as "The Netherlands, but smaller." Extending that, the island can be viewed as a socio-technical system on its own, because of its clear geographical and technical boundaries. Secondly, these boundaries fit within the timeframe of this research, which is six months. The boundaries are both physical (in terms of proximity, in order to acquire the necessary data) as well as theoretical; the goal of the municipality of Texel to achieve a fully self-sustained renewable energy supply in 2020 is a clear goal and sets functional boundaries to the theoretical approach of this thesis.

Methods & Results:

Analytical framework

The first goal was achieved through literature research, where a good starting point was found in the work of Borrás and Edler (2014). They formulated a conceptual framework to *describe* governance of change in socio-technical systems. According to hem, the ways in which change in socio-technical systems is governed varies according to the extent to which actors are distributed in the system, the way in which new knowledge and technologies offer new opportunity structures, the way in which public, private and mixed forms of instrumentation re-define incentives, and the extent to which the change and its governance is legitimate. Looking at this framework, in order to be able to more closely *analyze* governance of change, the framework needs ways to operationalize its concepts (Actors, Instruments and Legitimacy).

Operationalization of the concepts was added to the framework as follows: Firstly, an analytical framework requires an emphasis on the interactions of actors. Since change processes are in large part a product of these interactions, this distinction is important; analyzing change on a local scale like on Texel requires a more detailed focus on success and failure in interaction between local actors. Network management theory provided a

base to find and explain these interactions by introducing the concept of *strategies* that could be, or are utilized by actors in order to create support for their goals. The role of *policy entrepreneurs* cannot be ignored here, as these initiators are much more proactive than others and are able to spot and utilize opportunity structures, or can create windows of opportunity by connecting certain policies to certain problems, while navigating the political situation. Furthermore, s*upport* is a key concept in the management of actor networks. Additionally, it is also a key concept to operationalize "legitimacy" pillar of the framework. Support for goals, actions or visions is needed for actors to initiate change, and gathering support of other actors by using strategies is how they achieve this. Hence, the addition of actor network strategies creates a clearer connection between the pillars "Actors" and "Legitimacy". *Culture* is identified as an important factor that drives support, especially in local communities such as is the case on Texel. The final analytical framework incorporates these new concepts, and is shown in figure 2.

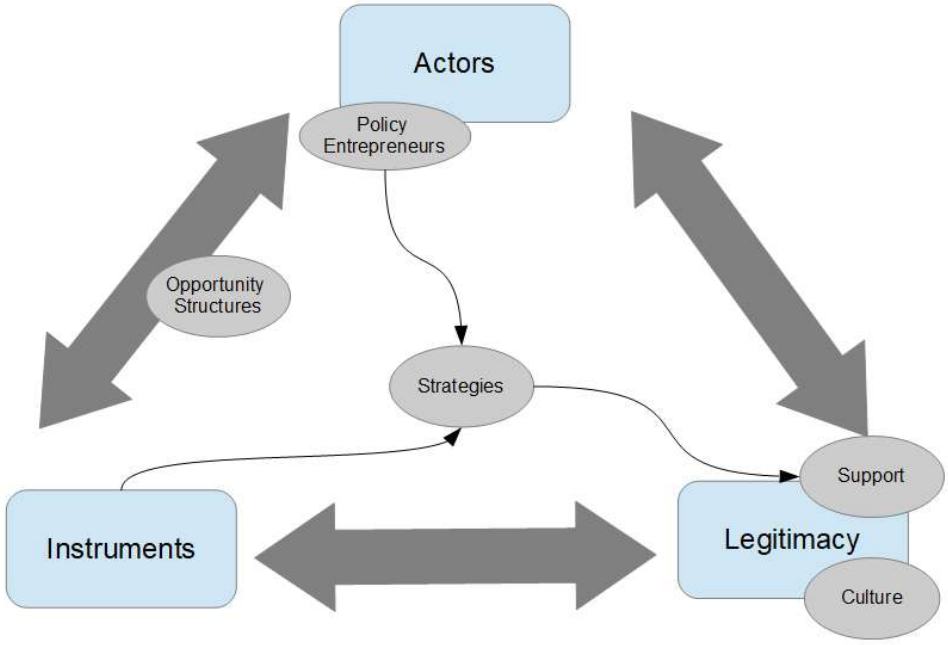


Figure 2: Framework to analyze governance of change in socio-technical systems.

A detailed description of the process of governance of change in the two systems was created through thorough desk research where (online) news articles, expert reports, information brochures and other (digital or analogue) sources of information were consulted. In addition, Interviews with relevant actors on Texel were conducted to find out about actions, interactions and motives between actors, where possible. I'd like to refer to Chapter 4 for this description.

Application of the framework: results

The analytical framework was applied to this description of the two socio-technical systems. The following results were found. Starting with Texel's socio-technical energy system, overall it can be concluded that the governance of change in this system revolved around legitimacy. That is, Legitimacy for change itself in the first place, but also legitimacy for the renewable energy technologies to be used on Texel. This could be observed through the strategies that were identified that actors used to gain support for their ideas and initiatives, or to block that support. The reason why legitimacy, and thus support for change was such an important aspect in the socio-technical energy system is because of its decentralized nature: The energy market is open for initiatives of social actors, and therefore Texel "dictates" what happens on Texel on its own terms. However, because a reliable energy infrastructure is already in place, change depends on the willingness of actors to 1) work towards a shared

renewable goal and 2) to actually take action is indispensible. Foundation for Sustainable Texel played a key role in the first department between 2000 and 2007, firstly by acting as a knowledge broker to educate the inhabitants of Texel about renewable energy technology and sustainability and secondly by using a commissioned report by Ecofys as an instrument to put a formal plan for energy neutrality in 2030 on the political agenda. Later on in 2007 several local individuals ("frontrunners") took the initiative for TexelEnergie by mobilizing people, in order to take matters in their own hands. Here we see that the strategy by the municipality to set an example starts to pay off, and the collective supportive strategies of "enabling" and "rewarding initiatives" by the municipality have contributed to the current amount of solar energy production on the island. Furthermore the municipality also focused on setting examples in energy saving and "enabled" the inhabitants of Texel to do the same through financial instruments (subsidy and opening an energy desk).

Probably the most influential factor that steered the direction of change in the governance through legitimacy was the "clash" between renewable energy technologies and the Texel Core Values. Despite the fact that these values were not yet "officially" embedded in policy until 2015, have already been instrumentally used in 2001 by the tourist industry, the forestry commission and local inhabitants in a strategy to frame windmills as an undesirable technology that infringe on the peace and quiet and the cultural open landscape of Texel and hence damage tourism. This initiated fierce debate about the use of windmills just before the municipal elections in March 2002, causing a loss for pro-windmill politicians and leading to a shift in the direction of change where windmill ambitions were almost non-existent on the political agenda for fear of losing credibility. The same strategy of framing was successfully reused by local inhabitants between 2005 and 2007 when a local farmer proposed to build a large bio-fermenting plant. Because these technologies did not get the needed support on Texel, the municipality, TexelEnergie and Urgenda governed change by focusing more on solar energy and energy saving in the built environment.

In the socio-technical energy system, the ambition manifesto – as an instrument - played an important role in the governance of change. Texel might not reach their ambitions in time. But perhaps the goal of the ambition manifesto was not explicitly to reach exactly what was stated inside of it. Maybe instead, one of the implicit goals was to set in motion a *process* of transition towards more sustainable systems. If that is the case, the ambitions have reached some level of success.

In the socio-technical water system, both parts (the sweet- and waste water management part and the drinking water part) were governed through the centralized power of governmental actors. The province, municipality and the water boards for the first part, and drinking water company PWN for the second part. Legitimacy for change was constituted through this centralized power, and hence played no role in the strategies that were used by these actors. There was limited involvement of social actors. In the governance of the first part of the system, in 2000 a Master Plan Water for Texel was in place. This was a mutual instrument to consolidate the organizational structure and the shared interest to improve the efficiency of fresh water and waste water management on the island. A strategy to cooperate was utilized by the municipality and the water boards, by acting on the available opportunity structures that were present. The waste water treatment facilities were in a poor state. The water board HHNK desired to centralize the waste water management. Furthermore, the sewers also were in need of renovation, which is the task of the municipality. HHNK wanted to reduce the amount of waste water to be processed by decoupling rainwater from waste water in the sewers. Furthermore, the law required that everyone is connected to the sewer system by 2005, meaning that a new sewer system was needed on the countryside. All these goals and problems were coupled in the cooperative strategy of the two governmental actors, leading to a reduction in costs for both actors, and to the situation that is the present.

In the drinking water part of the system, change is absent except for the fact that a new drinking water pipeline has been constructed by PWN. This was the result of the incident with the old pipelines in 2013. This incident was also the only opportunity structure that the municipality took, commissioning a feasibility study for

water production on the island. The ambition manifesto was used as an argument to do this. However, a study resulted in the conclusion that it is not economically feasible. Since PWN is obligated to provide a safe, reliable and affordable drinking water, they are not influenced by Texel Core Values or any desire of Texel to be autarchic, nor is there a sense of urgency that justifies change in this part of the water system. This sense of urgency is present in the energy system in terms of the effects of climate change and the accepted knowledge that renewable energy technologies are a solution to reduce this (whether this is actually accepted knowledge everywhere on the globe is perhaps debatable, but not a discussion that should be started here. One can assume that it is generally accepted in The Netherlands). The closed water market also does not provide any opportunity for social actors to take initiative on that regard. Hence in the water system, change cannot happen on the Texel terms. Therefore, this part of the ambition had no success.

Discussion of the results: In conclusion, what was learned from Texel is that the successfulness of strategies in the governance of change depends on the nature and context of the system. For example: mobilizing people to found energy cooperation TexelEnergie was successful because the energy market in place allowed an opportunity for such an initiative to work. Secondly, the Texel Core Values could be successfully utilized to shift the direction of change from windmills and bio-fermentation to solar energy and energy savings, because the decentralized nature of the system allowed social actors to guide change on their own terms, based on the cultural values of Texel. In contrast, in the water system these strategies would not work because the drinking water market is closed and regulated by governmental actors, meaning that there is no opportunity present for societal actors to mobilize and start producing their own drinking water. In that regard, legitimacy for change is absent since they depend on the support of drinking water company PWN, which is merely concerned with providing a reliable drinking water infrastructure and is legally bound to provide this in the most cost-effective and safe way possible. Hence, they are not interested in changing the existing centralized drinking water system towards a system where drinking water is produced on the island, simply because it is desired by Texel.

This thesis covered a dual case study where the governance of change in the socio-technical energy and water systems on Texel was analyzed. Generalization from single case studies is a controversial topic and requires extrapolation that can never be fully justified because findings are always embedded within a context. In this study, the findings from the previous section are embedded in a specific context that is unique to Texel. Because of this it would be premature to express any generalistic and legitimate conclusions about governance of change in socio-technical systems based on the findings of these case studies alone. Such claims warrant similar analysis of other socio-technical systems, preferably also water and energy systems but in different settings (settings here referring to different locations or communities).

Recommendations for future research: With the abovementioned in mind, the recommendations for future research are:

- Test the validity of this analytical framework by applying it on more cases of governance of change
- Apply the analytical framework on multiple *energy* and *water* cases for governance of change, so that the results can be compared. Only then might it be justified to express generalistic conclusions and lessons. This can be done for energy transitions, but perhaps application on other systems can lead to new insights
- Action-test the successful strategies described in section 6.1.1
- Investigate ways to further expand the framework by looking at new (yet undiscovered) concepts in other areas of literature
- Re-apply the framework on other sub-systems on Texel (food, waste, etc.)

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Chapter 1: Introduction

This chapter provides an introduction and background information regarding the research problem. In section 1.1 Texel and its energy- and water ambitions for 2020 are introduced and I will explain here what inspired me to choose this topic for this thesis. Section 1.2 explains why the research problem of this thesis is about governance of change. In section 1.3 the research questions are presented and finally, the research approach is explained in section 1.4.

1.1 Sustainable Texel?

Texel is The Netherlands' largest of five Wadden Islands, consisting of about 13.900 inhabitants in approximately 7600 households (CBS, 2016). Being a popular tourist location, the island houses averagely 800.000 tourists over the course of a year, providing roughly 70% of the island's yearly income.

In 2007 Texel signed an ambition manifesto together with the other Dutch Wadden islands, stating that all Wadden Islands intend to achieve a fully self-sustaining, renewable energy supply and a fully self-sufficient water supply by 2020 (Ambitiemanifest Waddeneilanden - De Energieke Toekomst, 2007). This ambition manifesto is a political agreement, proposing a (sustainability) transition that aims to achieve local and renewable energy- and water production and consumption. The municipal councils knew that it would take time to accomplish this ambition. Furthermore, they stated that it would also involve many actors from all kinds of fields and backgrounds, both from inside and outside the island community.

About a year ago, I went on a one week trip to Texel with a group of students for a project course from Delft University of Technology. Our goal was to study Texel as a sustainable island, by looking at several different socio-technical sub-systems in detail (i.e. food, inorganic and organic waste, lifestyle, tourism, agriculture, entrepreneurship, etc.) As soon as we arrived on the island with the TESO ferry, something immediately struck me: where are the windmills? It was my first time visiting Texel. I knew that Texel wanted to have 100% renewable energy by 2020 so I had more or less expected there to be more than just one windmill on the island. The fact that there were not therefore surprised me; how could Texel desire self-sufficiency in terms of energy without any windmills? But because our project did not cover the topic of energy I decided I'd look into it later. The fact that energy was not covered was in agreement with the "client" (The municipality of Texel) and the reason for this was because a lot of research had already been done and existing policy was already in place for 2020. The intention of the project was not to evaluate that policy and its implementation, but to look at sustainable Texel from a different point of view[2]. Interestingly enough, when our trip ended and I got back to Delft, the course manager for the project course forwarded me an email that originated from a resident of Texel. That person was surprised (and seemingly a little bit upset) about the fact that we had not covered the topic of energy during our project visit. In his email he reminded us about the ambition manifesto of 2007. This revitalized my aforementioned curiosity, and resulted in my decision to look into this topic, at that time not yet knowing that I'd write a thesis about it, of course.

[2] For more information on the project, please visit http://tudelft.gingerresearch.net/page/8066/2015-sustainable-texel

What I found seemed a bit disheartening to me. At first glance, there seem to have been plenty of initiatives especially regarding sustainable energy. For example, Texel has its own energy company: TexelEnergie. Founded under great enthusiasm by local Texelers, the local energy company desires to supply Texel with green energy that is produced on the island itself. TexelEnergie was involved in several projects, such as a smart grid experiment called "Cloud Power Texel[3]" and a sustainable wood burner for central heating in a residential area. Furthermore, Texel has an experimental tidal energy plant near the shore with a 200 kW turbine. Urgenda was also involved, for example by transforming homes into energy neutral homes. However, despite all these efforts, the total percentage of renewable energy versus total energy demand on Texel was only 3,5% in 2015 (this is the most recent data I could find) according to the Local Energy Window website ("Gemeente zoeken - Lokale Energie Etalage", 2017). Furthermore, I saw various signs that progress on Texel is dwindling. One example is that the iconic non-profit organization "Stichting Duurzaam Texel[4]" (Foundation for Sustainable Texel) has recently been shut down ("Stichting Duurzaam Texel stopt ermee", 2015). The NGO initially started many sustainable initiatives as early as 2000 and received a sustainability award from Urgenda in 2007. A collection of frontrunners on Texel founded TexelTeam 2020 to fill the gap that the NGO left behind, however this team also shut down soon after without notable success. Another example is the aforementioned TexelEnergie. The company is not performing as well as expected and seems to be dealing with financial issues ("Directeur TexelEnergie weggestuurd door RvC", 2015). Finally, perhaps the most striking evidence that Texel's energy system is not undergoing a whole lot of change reverts back to my initial surprise: the fact that currently only a single large windmill is in operation on the island since the ambition was formalized, even though the island is one of the windiest locations in The Netherlands.

Looking at these developments, one may observe that the island has not yet gained a lot of progress with regards to their energy and water ambitions. Almost ten years have passed since the ambition manifesto was signed, and the "deadline" is rapidly closing in. It seems that complete energy neutrality and especially self-sufficiency in (drinking) water is going to be unreachable in the remaining three years to come.

1.2 Problem description: A matter of governance

With the ambition manifesto, the municipal councils of the five Wadden Islands testified for a joint willingness to achieve goals that are highly ambitious: a transition process towards self-sufficiency and sustainability. Transitions are a process of change, and the ambitions of the Wadden islands regarding energy and water require change on both a social and a technical level, both involving many complex issues. Furthermore, the desired transition processes involve a variety of actors and cannot be achieved without their involvement. The councils of the five Wadden islands remarked that cooperation and support from local people, organizations and (external) businesses are the keys to success for the intended transition. They further indicated the importance of local, national and international support.

An early study by Ecofys in 2001 about Texel's energy system, requested by the Foundation for Sustainable Texel, shows that technically, it should be possible to produce the complete energy demand on the island itself (de Beer, Chang, & Folkerts, 2001). ECN did a similar study in 2007 (again on behalf of

[3] see: https://app.tki-urbanenergy.nl/storage/app/uploads/public/58c/d5b/849/58cd5b8499da8062421156.pdf
[4] The website, unfortunately, has recently been shut down as well.

the Foundation for Sustainable Texel) and concluded differently, based on the notion that wind energy is a necessary condition for local renewable energy production and realizing that large windmills could not count on local support at the time (ECN, 2007). With this in mind, it is clear that Texel's current lack of progression should not be sought (solely) in technical limitations. Instead, it is important to look at this process from a socio-technical perspective. To find out how the processes of change developed on Texel as they did, the way in which the socio-technical energy- and water systems were *governed* is relevant. But what exactly is governance? During my study, I came upon the following definition of governance by Borrás & Edler (2014, p. 14):

"The way in which societal and state actors intentionally interact in order to transform Socio-Technical & Innovation (ST&I) systems, by regulating issues of societal concern, defining the processes and direction of how technological artifacts and innovations are produced, and shaping how these are introduced, absorbed, diffused and used within society and economy."

There are many different actors on Texel with different backgrounds. It is important for the process of change that these actors support the ambitions and are willing to participate in achieving the goals described therein. This is a process that requires governance through political will, policy regulation and alignment, leadership and coordination, actor participation and local/external (business) support. However, such a process is difficult to govern or influence. So what role does this play in the realization of Texel's goals for 2020? The definition above mentions that governance covers *intentional* interaction in order to transform (socio-technical) systems. The ambitions that Texel has are, indeed, intentional. So to find out how Texel got to the situation where it is now in, the socio-technical systems of water and energy must be thoroughly examined and understood with regard to different types of actors fostering or preventing change, and how they governed this.

This research therefore has two goals. The first goal is to create an analytical framework to analyze processes of governance of change in socio-technical systems. The second is to apply this framework in a dual case study about to two socio-technical systems on Texel, namely energy and water. This is done in order to find out how the governance of change has contributed to the current state of these two systems, compared to the ambitions. While the ambitions are shared between the five Wadden Islands, Texel is chosen as a single case study for several reasons. First of all, Texel is often seen as "The Netherlands, but smaller." Extending that, the island can be viewed as a socio-technical system on its own, because of its clear geographical and technical boundaries. Secondly, these boundaries fit within the timeframe of this research, which is six months. The boundaries are both physical (in terms of proximity, in order to acquire the necessary data) as well as theoretical; the goal of the municipality of Texel to achieve a fully self-sustained renewable energy supply in 2020 is a clear goal and sets functional boundaries to the theoretical approach of this thesis.

1.3 Research Questions

The problem description results in the following research questions:

Main Research Question:

How did the governance of change contribute to the current state in the realization of Texel's ambitions for a self-sufficient renewable energy- and drinking water system?

Sub-questions:

1. *What analytical framework is needed to analyze processes of governance of change in socio-technical systems?*

2. *What change has occurred in the socio-technical water- and energy systems between 2000 and now?*
    a. *What did the energy- and water systems look like in 2000 and now?*
    b. *What are the differences between these two systems?*

3. *Who and what drives change on Texel?*
    a. *Who were the main actors of change?*
    b. *What instruments did they use?*
    c. *How were the actions of these actors legitimated?*

4. *What lessons can be learned about governance of change in socio-technical systems from the case of Texel?*

By answering these research questions, this thesis aims to contribute in two ways:

Scientific contribution of this thesis

The term "governance" has been mentioned and used a lot in literature about socio-technical systems and innovation. However, it is generally addressed in an implicit manner, often depicted as a social dimension within socio-technical systems that needs to be acknowledged (Borrás & Edler, 2014). Recognizing this conceptual gap in the social science literature, Borrás & Edler (2014) designed a conceptual framework with which processes of governance of change can be described in more detail. However, this framework falls short in ways to operationalize the concepts that it describes, which is necessary to more deeply analyze the intentional interactions between actors that result in change, the opportunity structures they utilize or act on and the role that legitimacy plays in governance of change. By expanding on the existing framework by introducing the concepts *culture*, *support* and *strategies*, this thesis improves the framework to analyze processes of governance of change in socio-technical systems. Chapter 2 will go into this in more detail.

Social contribution of this thesis

Texel has been the focus of many a study. However, a detailed analysis of the *governance* of change in Texel's energy- and water system (the two topics within the ambition manifesto) has not yet been performed. Doing so may provide useful insight to whomever are interested in Texel's ambitions for 2020 and thereafter. Whether those are people involved in the process on Texel itself, or people who take an interest from outside Texel. Furthermore, insights and lessons learned from this thesis about Texel can potentially be utilized in other, similar circumstances where (sustainable) transitions certain socio-technical systems are desired.

1.4 Case study approach

This research has two purposes. The first is to create an analytical framework in order to analyze processes of governance of change in the socio-technical systems. The second is to apply this framework in a dual case study on two socio-technical systems on Texel (energy and water) in light of their ambition manifesto. In order to answer the main research question, the corresponding sub questions need to be answered first. Every question will be studied by using a fitting research method as explained below.

1. *What analytical framework is needed to analyze processes of governance of change in socio-technical systems?*

This first sub-question will be answered in Chapter 2. This involved a literature study on governance in transition literature and literature on energy systems, including a discussion on the preliminary framework by Borrás & Edler (2014) where gaps in the applicability of this framework were found to originate in the lack of operationalization of its core concepts. This was complemented with an additional literature study in the field of network management, where the concept of actor *strategies* provides a means to operationalize interactions for change in socio-technical systems. The concept *support* was added to operationalize Legitimacy and the role of *culture* on support was also added to the framework. Lastly, the concept of *policy entrepreneurs* was added because they are actors who spot and utilize opportunity structures. The result of this part of the research is an analytical framework to analyze processes of governance of change in socio-technical systems. The framework is then applied on Texel's socio-technical energy- and water systems in two case studies. The case study format is chosen because a case study creates the depth that is necessary for this sort of qualitative research (Verschuren, Doorewaard, Poper, & Mellion, 2010). The reason to choose Texel as a subject is because first of all, their ambition for 2020 is an intentional desire for change in the socio-technical systems where governance plays an important role. Secondly, as was mentioned in the problem description, Texel can be viewed as a socio-technical system on its own, because of its clear geographical and technical boundaries. Lastly, a single case study fits best within the boundaries of a master thesis research, both in terms of time as well as manpower.

2. *What change has occurred in the socio-technical water- and energy systems between 2000 and now?*
    a. *What did the energy- and water systems look like in 2000 and now?*
    b. *What are the differences between these two systems?*

To answer these questions, Chapter 3 provides a description of the socio-technical energy- and water systems on Texel. Data used in this description comes from desk research, where sources such as statistical data centers (CBS), study reports about Texel from research companies, and (online) news papers were scanned and analyzed for data about the relevant actors, technology, rules and regulations and other relevant societal factors, both for the year 2000 and for today. "Today" in this case refers to the most recent data possible that can be found on topics such as energy and water demand, production, etc. This data ranges from 2015 to 2017 depending on the source.

3. *Who and what drives change on Texel?*
    a. *Who were the main actors of change?*
    b. *What instruments did they use?*
    c. *How were the actions of these actors legitimated?*

To find out how the changes described in chapter 3 have come to pass, these questions will be answered in chapter 4 by providing a description of the process of governance of change in the socio-technical water- and energy systems on Texel. Data for this description comes from desk research, where (online) news articles, expert reports, information brochures and other (digital or analogue) sources of information. Furthermore, a total of eleven semi-structured interviews were performed with several individuals. Some these act as spokesman for a company or institution; others are so-called "frontrunners" of Texel, people who drive change by themselves. The value of interviewing a certain individual is not 100% guaranteed on beforehand due to time constraints, but the selection is based on analyzing the actors that are relevant in the socio-technical system description in chapter 3. While the interviews should be focused on the research questions and accompanying relevant data, a semi-structured interviewing technique is chosen over other techniques. The reason for this is that the relatively flexible nature of semi-structured interviews allows for probing. This in turn potentially leads to more insights that could not beforehand be considered or noted. The required data encompasses perceptions, motivations for actions, and opinions about performed actions, identified instruments and behaviors of actors. An unstructured interview could result in this as well; however, leaving the initiative to the interviewee could result in me being unable to retrieve data on the topics relevant to this research.

4. *What lessons can be learned about governance of change in socio-technical systems from the case of Texel?*

Finally, the process description from chapter 4 is analyzed by applying the analytical framework that is proposed in chapter 2. The analysis of the governance of change in the two different socio-technical systems on Texel will be presented and discussed in Chapter 5.

From the data and analysis in the previous Chapters, the main research question will be answered in Chapter 6, after which the conclusions, data, and research methods will be reflected upon. For clarity, a flow diagram of the proposed research is presented in figure 3.

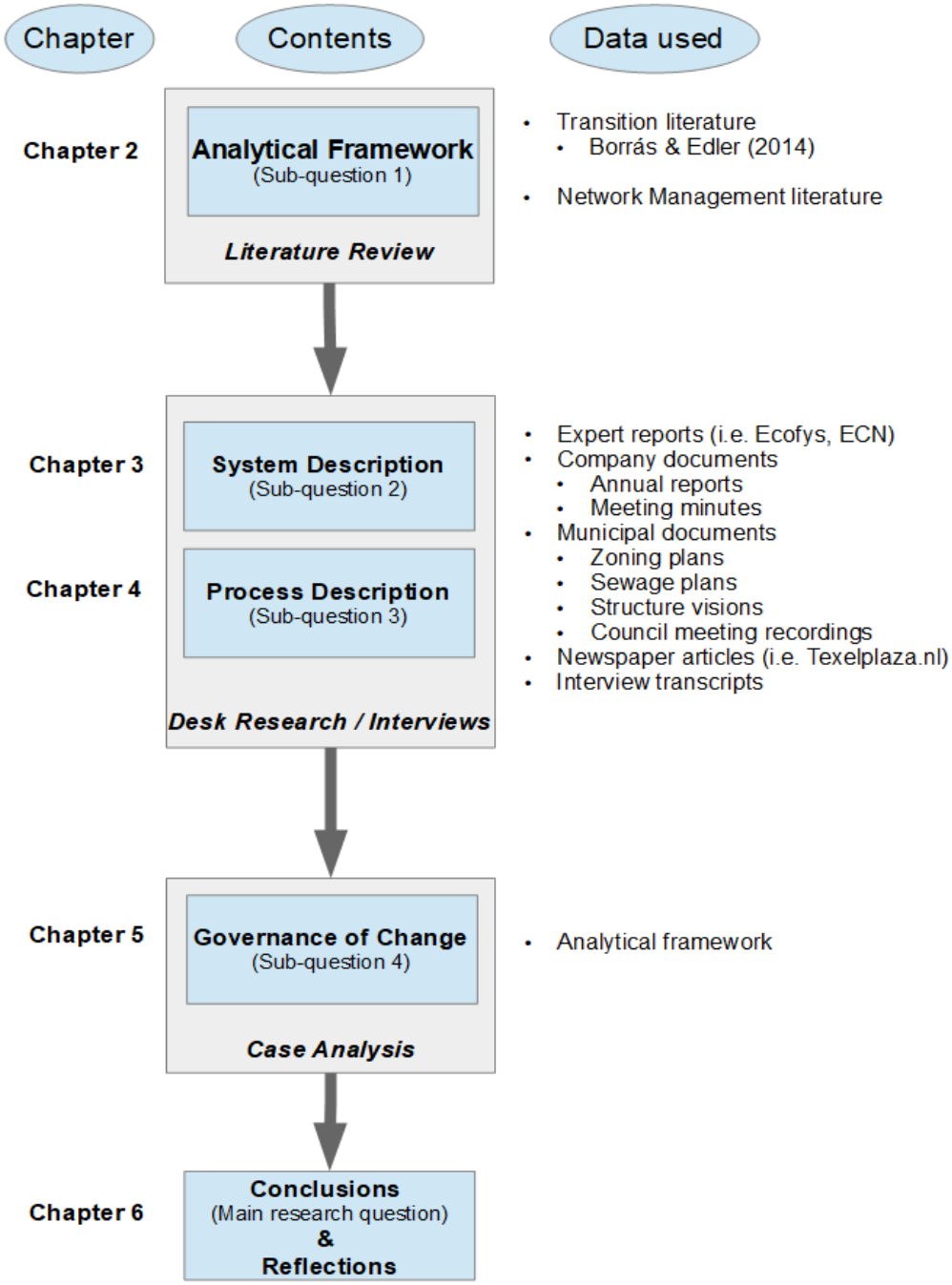

Figure 3: Research flow diagram

Chapter 2: Analyzing governance of change in socio-technical systems

Given the current situation on Texel, the ambitions that the island has set for it requires both technological change as well as social change in the way energy and water are produced, managed and consumed. Especially the wish for a self-sufficient and renewable energy supply requires that the socio-technical energy system undergoes what is called a sustainability transition. A transition is described as a radical, structural change of society that is the result of a co evolution of economic, cultural, technological, ecological and institutional developments (Jan Rotmans, Kemp, & van Asselt, 2001). As mentioned before, the aim of thesis is to analyze what kind of changes occurred on Texel and how these changes were governed between 2000 and now. Such an analysis requires an analytical framework with which the process of governance of change in socio-technical systems can be studied.

This chapter describes the development of such an analytical framework. For this, a literature review on transitions and governance was performed. Because Texel is a small island community on a municipal level, it makes sense to look at studies at equally local level. Therefore, section 2.1 introduces the concepts of transitions and socio-technical systems and looks at these concepts specifically from a local level viewpoint. Section 2.2 follows with a review on literature about governance of change in socio-technical systems, which includes a base structure for the analytical framework by Borrás & Edler (2014). This basic framework is then enriched with additional theory about actor interaction and strategies in section 2.3. The chapter concludes by bringing everything together in an analytical framework that can be utilized to analyze processes of governance of change in socio-technical systems (section 2.4).

2.1 Transitions in local socio-technical systems

As was mentioned earlier, Texel intends to become self-sustaining in both energy and water, and wants to achieve these goals in a sustainable way. This does not happen overnight and instead is likely to take place through a gradual sustainable transition. Sustainability transitions are long-term, multi-dimensional, and fundamental transformation processes through which established socio-technical systems shift to more sustainable modes of production and consumption (Markard, Raven, & Truffer, 2012). But what is a socio-technical system? Elzen, Geels, & Green (2004, p.3) refer to socio-technical systems as "a cluster of elements, including technology, regulations, user practices and markets, cultural meanings, infrastructure, maintenance networks and supply networks". Socio-technical systems can be divided into different categories such as energy, food, or water provisioning, among others. A common factor within socio-technical systems is that they are constituted around the acknowledgement that the use of technology and innovation is not a thing on its own. Technologies can in fact be seen as a means of shaping society, while in turn technology and innovation can be shaped by society as well (Frank W. Geels, 2002; Smith, Stirling, & Berkhout, 2005). Furthermore, technology and technology transitions are inextricably bound to social groups (or actors), social activities, and social rules. This is defined to include the social relations (e.g. the interests, values and behaviors of people and organizations) that link, use and make sense of technological artifacts (e.g. tools and machines) (Berkhout, Smith, & Stirling, 2003). In other words, technology and social factors can both complement and thwart each other, making socio-technical systems diverse and complex to understand and analyze.

Socio-technical systems are organized, transformed, and reproduced by multiple actors and institutions that operate within or outside a society and at different levels. The notion of "levels"

indicates the scope at which socio-technical systems are viewed. For example, the role, influence and power of a national government is different when analyzed at an international level, as opposed to when one analyzes these same factors in a system on a national or regional level. Texel is a municipality of the province of Noord-Holland in The Netherlands, which means that its energy- and water systems are analyzed at a municipal level. A level on that scale often referred to as "local" level, (compared to "national" and "international" levels when talking about The Netherlands as a whole, or Europe, respectively). The role of local communities in influencing energy and environmental issues has seen an increased attention in literature in recent years (i.e. Glad 2017; Parag et al. 2013). However, in traditional transition literature, the role and influence of local authorities in (sustainable energy) transitions have often been either underplayed or they have been viewed as a part of the 'dominant regime'; often counter-posed to the niche activities of community groups and organizations (Bolton & Foxon, 2013; Bulkeley, Castán Broto, & Maassen, 2011). As Pohlmann (2011, p.7) argues: "in order to gain a thorough understanding of global transformations, ethnographic and micro-focused case studies of local institutions and cultures are needed." And on the next page (Pohlmann, 2011, p. 8): "research on local climate governance offers insights into issues, and questions, that are of decisive importance with respect to global transformations of society." Hence, organizing action, influence and change from the local level has become a core focus for the encouragement of sustainability pathways and processes by a range of stakeholders and decision makers (Fudge, Peters, & Woodman, 2016). Evidently, looking at energy transitions on a local level from a governance perspective is considered a valid method to learn about sustainability pathways, and may provide handholds for those who seek to apply this knowledge on a meso- or macro scale.

2.2 The governance of change in sustainable transitions

The envisioned energy- and water transitions of Texel are a process of change, which are intertwined and connected to many developments, processes and actors. Furthermore, it is important to note that this transition is *intentional*; the ambition manifesto contains a clear goal for the near future that the municipality of Texel wants to reach. This intentionality fits the current climate around sustainability because overall, increased awareness about climate change and its implications makes the role of deliberate attempts to create incentives, rules and institutions that initiate and drive sustainable transitions more distinctive than ever (Schmitz, 2015). As a result of this intentionality, the role of guidance and governance becomes of increased importance (Smith et al., 2005). Governance relates to mechanisms directed toward the coordination of multiple forms of state and non-state action. Thus implying a recognition of the variety of actors who intervene in the purposive steering of society, toward low carbon, resilient or sustainable objectives (Newell, Pattberg, & Schroeder, 2012; Okereke, Bulkeley, & Schroeder, 2009). The concept of governance mechanisms is not explicitly explained anywhere in literature but comes down to how actors interact and why, and what effects these interactions have on system change (Newell et al., 2012). In any case, especially in case studies on governance of local socio-technical systems, finding and explaining governance mechanisms can be useful in exposing patterns or pathways that may provide helpful lessons in guiding transitions elsewhere (case study examples are i.e. Fudge et al. 2016; Holley and Lecavalier 2017; Shih, Latham, and Sarzynski 2016).

Transition theory has a focus on explaining and analyzing transition processes in hindsight. A problem with existing socio-technical transition (STT) literature is that despite it being riddled with

notions about governance, it is only being dealt with in an indirect and implicit way and hence lacks a clear understanding on the role of governance socio-technical system change (Borrás & Edler, 2014). This begs the question, how can governance of change be analyzed if there is no clear notion of what governance is? A good starting point can be found in the work of Borrás and Edler (2014) They formulated a conceptual framework for the analysis of governance of change in socio-technical systems, defining governance of change as "...the way in which societal and state actors intentionally interact in order to transform socio-technical and innovation systems, by regulating issues of societal concern, defining the processes and direction of how technological artifacts and innovations are produced, and shaping how these are introduced, absorbed, diffused and used within society and economy" (Borrás & Edler, 2014, p. 14). With this definition in mind, three areas of focus (the authors refer to them as "pillars") that were extracted from STT literature are central to this framework (figure 4). Borrás and Edler see this framework as a first step to overcome the implicity of governance in literature, instead putting governance at the core of analyzing change by looking at three main pillars both individually and together: purposeful actors and the opportunity structures they create or take advantage of, the instruments that are utilized in governing change, and the nature and conditions for the legitimacy of change and its governance.

Figure 4: Three pillars to understand governance of change in socio-technical systems, as proposed by Borras & Edler (2014: p.25)

While Borrás and Edler have proven the usefulness of their framework with several case studies, it is important to note that the framework is merely a starting point in attempting to conceptualize governance of change in socio-technical systems. With that in mind, there are several criticisms that require attention and demand additional concepts that are currently missing, that will complement the framework to further deepen the analysis of governance of change. The three pillars and their shortcomings will be presented below.

Pillar 1: Agents and opportunity structures

The first pillar of the aforementioned framework focuses on the *who* and *what* of system change. The *what* part concerns itself with "agents" within the socio-technical system that are capable to induce or

prevent change. The authors refer to agents as being any actor in the socio-technical system that have the willingness and the capacity to induce change, or to stop it from happening. Note that the term agent is an ambiguous term in this context of social science. The term *agent* in reference to the framework is based on the term *agency* that is often discussed in transition literature literature (e.g. Geels, 2004; Rotmans & Loorbach, 2008) and is said to deal with the contribution of actors to transitions. However, the term *agency* is also commonly used by policy analysts that use system (computer) models to analyze policies. In this regard, the term *agent* denotes the model representation of an actor (Jennings, 2000) The term *actor is therefore preferred, as it can* denote various relevant parties such as an individual person, but also a *composite actor* as defined by Scharpf (1997: p.52) as "an aggregate of individuals, having a capacity for intentional action at a level above the individuals involved", i.e., organizations. Scharpf furthermore defines a *collective actor* as a composite actor that is "dependent on and guided by the preferences of its members", and a *corporate actor* as a composite actor that has "a high degree of autonomy from the ultimate beneficiaries of their action and whose activities are carried out by staff members whose own private preferences are supposed to be neutralized by employment contracts" (p. 54). For some analytic purposes, an actor may even represent a group of individuals that share similar characteristics but are otherwise unorganized. Borras & Edler speak of "capable agents" or "agents of change" but their agents are basically actors. Thus, in order to prevent any conceptual misunderstanding between the two terms, I prefer to use the term "actors" and "actors of change". This thesis will adopt the working definition for *actor* as presented in Enserink et al., (2010, p. 79): "a social entity, that is, a person or organization, or a collective of persons and organizations, which is able to act"

The key dimension of this pillar is the interaction between actors and opportunity structures. The latter is explained as "co-evolution of technology and social institutions, which sequentially or simultaneously generate opportunities for change that agents might take" (Borrás & Edler, 2014, p. 26). A pitfall that I observed is that while the authors make it clear what opportunity structures are, operationalization of the concept of opportunity structures is lacking. How can opportunity structures be recognized and what influence do they have in the governance of change? Surely, many of these opportunities can be found and explained when cases are analyzed ex post, but are actors capable of spotting and utilizing opportunities when appearing? Opportunity structures do not generate change out of themselves. In fact, the role of actors is crucial in this regard because it is they who are capable of triggering, directing, inhibiting or otherwise influence change in systems by co-creating and/or utilizing new opportunities. "Opportunity" here refers not only to new technologies, but also new openings and venues that are offered to socio-technical systems and their actors by the interplay between social institutions and new forms of knowledge. In this regard, some actors can also be seen as *policy entrepreneurs* (Kingdon, 1985): governmental or non-governmental initiators that feel the need - and are able - to affect the turn of events. Such actors are much more proactive than others and are able to create so-called windows of opportunity by connecting certain policies to certain problems, while navigating the political situation (Arnouts & van der Zouwen, 2012). In terms of this thesis, policy entrepreneurs can for example introduce new actors, affect the power relations within a network, put an issue on the political agenda, or modify the rules of interaction. In addition, they can possibly make use of opportunities offered by developments that occur outside of the actor network. In light of this framework this also links to the recognition and utilization of opportunity structures.

Another shortcoming in the first pillar of Borras and Edler is that it seems to only revolve around which actors are capable to induce change. It offers little discussion on how these actors interact with each other. This may be deemed acceptable when dealing with the analysis of change in systems on a macro level, where more abstract terms like "regimes" (a concept known from Geels 2004, 2014) and aggregate actors are generally used. However, when analyzing governance processes of change on a smaller level (such as is the case on Texel) a more detailed insight in the interactions between (individual or aggregated) actors is of key importance, because the difference between success and failure could be lying in these details. Actors often find themselves in a network together with other actors and in today's modern society everyone depends on everyone else (de Bruijn & ten Heuvelhof, 2008). Looking back at the working definition of governance of change for this thesis (as adopted from Borras and Edler) it speaks of two types of actors: societal actors and state (or governmental) actors. In western society it is nowadays very uncommon that any single actor is powerful enough to impose strategies or policies unilaterally. Especially on the local scale such as is the case for Texel, not even state actors possess enough resources or power to uniformly impose their goals. Actors will have to cooperate and seek support for the achievement of their goals. In the political science literature, the interactions that happen to that effect are often referred to as actor *strategies* (de Bruijn & ten Heuvelhof, 2008; Huitema & Meijerink, 2010; Meijerink & Huitema, 2010). Huitema and Meijerink (2010) refer to strategies as ways for policy entrepreneurs to prepare, instigate, implement or otherwise influence policy change. However, strategies are not necessarily strictly the domain of policy entrepreneurs, as any actor can utilize strategies to find or create support for their goals. Strategies are used in the interaction between actors and involve how goals, perceptions, problems, solutions and information are utilized.

As a last remark, it is important to note that Texel is a small island community. Hence, actors on Texel are not necessarily collective entities as mentioned in the definition of Scharpf (1997). Actors in this system can, in fact, be individuals that have a lot of influence that can result in change. This means that there is a need to be able to analyze the behavior and impact of individuals, something that traditional transition science generally does not cover. Even individuals whom are not necessarily represented in dominant regimes, can play an important role in the development of socio-technical systems (Van De Poel, 2000). As such, they cannot be ignored as potential relevant actors. Important to note is the following remark by Pesch (2015, p. 382) who gives special emphasis to the importance of individual actors. He states that "individual actors are part of different societal and institutional realms. They are motivated by private ideals, by political conviction, culture, organizational goals, institutional domains, and so on. Hence, without addressing the question about what drives people at different societal levels, transition literature cannot really defend that agency is fully embedded in its theoretical backdrop". This addition to the role of actors in change processes is useful in the application to Texel, because many front running actors on Texel are individuals that try to instigate change, be it from personal motives or otherwise. Though some might also represent organizations or institutions, making them "wear different hats" as it were, as the goals and values of the individual can be different from that of the actor he or she represents. This notice is of importance because they can be reasons for successful or failing strategies as well.

Pillar 2: Instrumentation

The second pillar deals with the *how* question, aiming to expose the instruments that are used in the governance of change. These instruments are described as "the specific ways by which actors induce change in the socio-technical system and are able to design and give direction to that change" (Borrás & Edler, 2014, p. 31). Probably the most signature example of instruments are government policies. These policies are generally used to correct market failure or system failure by government intervention. Examples are financial instruments, such as feed-in tariffs for the promotion of renewable energy (i.e. Huijben et al. 2016; Nicolini and Tavoni 2017). However, instruments can also originate and be utilized by social actors. An example of these can be technology or impact assessments by expert NGO's, which can be used to gain support for ideas or solutions. Another example is agreeing on standards for electric vehicle charging (Forrest, Tarroja, Zhang, Shaffer, & Samuelsen, 2016) in order to reduce consumer barriers and development costs. Such instruments are aimed to "harness market, peer and community energies to influence behavior, and draw on the infrastructire of intermediaries such as industry associationsm standards organizations and non-government organizations for rule development and implementation" (Webb, 2004, p.4).

All in all, instruments can be many things. In fact, instruments created by one actor can potentially be opportunities for other actors. For example a government subsidy on solar panels can motivate people to invest in several, as an investment now to save energy/money later, or an independent environmental impact study report can be utilized by proponents or opponents to plead their case for or against the implementation of the subject under investigation. This indicates that instruments can also become part of strategies that actors use. In any case, "change in socio-technical systems is often driven by sets of instruments rather than individual instruments" (Borrás & Edler, 2014, p. 195) and the creation and utilization of instruments usually results in changes in governance mechanisms. Therefore, paying attention to the creation and use of instruments is a logical part for the analysis of governance of change.

Pillar 3: Legitimacy

The final pillar is concerned with whether and why socio-technical systems, and governance processes therein, are (or are not) accepted. Legitimacy can be divided into two types: input and output legitimacy (Easton, 1965). Input legitimacy refers to to support by the social community granted to political institutions and/or their decisions. Output legitimacy is the "success" that governance delivers, the achievement of (perceived) benefit for the common good from decisions that have been made in the past. Because success can only be seen after past decisions have already been made, input legitimacy has more impact on the process of governance of change. Input legitimacy is, first of all, key in decisions that shape change, especially when such change comes with many uncertainties that are inherent with novel scientific and technological applications. As one scholar states: "The great challenge of sustainable development is that we have to find approaches that are effective in the sense that they enhance the sustainability of society, while, at the same time, they are legitimate, not contributing to the worsening of second-order problems and affecting the autonomy of individuals." (Pesch, 2014 p.40) Secondly, change is inherently political, meaning that shaping the direction of science, technology and innovation affects the interests, benefits, and values of all stakeholders, whether they are directly involved in the process of change or not. Lastly, since new governance approaches lead to binding decisions and socially

shared direction, social legitimacy is crucial in order to safeguard voluntary compliance to these approaches.

That brings us straight to another pitfall that was observed in this pillar: Borras and Edler state that social legitimacy is needed in order to safeguard voluntary action to change a socio-technical system. But how is legitimacy measured? How can it be spotted and does it really lead to change? Borras and Edler do not take this question into consideration, instead simply noting that acceptance is a key indicator for change. However, whether people accept change or not does not say anything about their *willingness* to engage in initiatives or other types of action that result in system change.

Therefore, grasping back on the interdependency of actors, I'd like to state that *support* is a key term in the process of change, as actors find themselves in an ever changing network with other actors. Without support from other actors, policies or strategies might fail. This notion is also important for the case of Texel; the ambition for 2020 is one that is set by the municipality (together with the municipalities of the other Wadden Islands). Here too, the municipality cannot achieve this goal alone; it is dependent on other actors on (and even off) the island. The notion of support can be seen as the operating part of the pillar "legitimacy".

Another concept that is important in the discussion of legitimacy but that is only briefly touched upon in the framework discussion by Borras and Edler is the influence of *culture* in the governance of change. Cultural characteristics can be defined as socially constructed phenomena resulting in collective meanings in a shared social environment (Shortall & Kharrazi, 2017). Literature has covered culture as an important aspect for sustainable development on a national level (i.e. Shortall and Kharrazi 2017; Soini and Birkeland 2014) and, more interesting for this thesis, as an important factor in sustainable development on islands, where Vallega (2007) stresses the importance of local values such as protecting intangible culture, i.e. unique landscapes and cultural heritage and Canavan (2016) mentions that tourism potentially creates issues between protecting traditional cultural resources and utilizing them. These remarks make it clear that the influence of local culture on governance of change is not to be dismissed. Hence, culture is inexplicitly tied with support and thus also has an influence on how actors interact and make decisions, or behave strategically.

Summarized: applicability and pitfalls of Borras and Edlers' framework

The three pillars proposed by Borras and Edler provide a first foothold for a focused study of essential concepts that constitute the complex phenomenon of governing change in socio-technical systems. By formulating key questions about the nature and dynamics of change and governance of that change, a broad spectrum of "who", "how" and "why" can potentially be unveiled. Important to note is that intention and deliberation are central to this framework. The ambitions that have been set for Texel also emphasize intentionality towards a sustainable goal, which is an argument in favor of using this framework to analyze the case on Texel. The three pillars that are proposed by Borras & Edler together provide a good starting point by offering key governance related questions about how system change is coordinated in complex contexts.

In the discussion about the three pillars, a couple of pitfalls were observed. These pitfalls identify a lack of operationalization of the concepts that are used in the framework. As a result, identifying governance mechanisms (explained as how actors interact and why, and what effects these interactions have on system change) is difficult, while finding and explaining governance mechanisms is

useful in exposing patterns or pathways that may provide helpful lessons in guiding transitions elsewhere. Two important pitfalls were identified.

First of all, the pillar "actors" revolves around which actors are capable to induce change. However, it offers little in the way of gaining insight on how these actors interact with each other, which is an important aspect when analyzing governance of change. Secondly, in the discussion of the pillar "Legitimacy" it was noted that while Borras and Edler state that social legitimacy is needed in order to safeguard voluntary action to change a socio-technical system, the framework also lacks operationalization of this pillar. Acceptance is mentioned as a prerequisite for change, however people do not necessarily volunteer in action for change, whether they accept such change or not. Therefore, I introduced the concept of *support*. Support for goals, actions or visions is needed for actors to initiate change, and gathering support of other actors by using strategies is how they achieve this. I also introduced the importance of *culture* and its effect on strategic behavior of actors and in gaining support. Island communities often have local cultural values and value their heritage. These values can have a big influence on the way that actors interact with each other.

Concluding, in order to gain more knowledge and insight on the behavior of actors and its (lack of) effect on governance mechanisms and, in turn, on change, the framework needs additional concepts to deal with actor interaction and gaining legitimacy through support. Both pitfalls can be dealt with when looking at actor *strategies* which are deliberate (or sometimes even non-deliberate) actions to gain support and henceforth initiate change. Network management literature can provide insight on how a network of actors can be managed and what strategies actors in a network (can) use to achieve their goals (de Bruijn & ten Heuvelhof, 2008). The second pillar "instruments" could be perceived to partially cover this concept of strategies, as certain strategies can be seen as instruments to induce system change. Consequently, the concept of strategies can be considered as a bridging term between "instruments" and "legitimacy" which solidifies their interdependency as shown by the arrows between them in figure 4. Hence, insights from network governance and network management theory can shed more light on how actors interact and whether and why strategies (be they or be they not as instruments) can be of influence in the process of change.

2.3 On interaction and strategies

In the previous section, it was established that the framework by Borras and Edler lacks in dealing with interaction between actors, which is a necessary part in finding out how change is governed by actors and how legitimacy is gained through support. The concept of strategies was briefly introduced. Strategies can be used to explain why certain decisions and mechanisms on Texel were or were not successful, because such behavior can be a major influence on the outcome of policy decisions, and consequently on the process of change on Texel. This paragraph will discuss strategy types based on work by Huitema and Meijerink (2010) and de Bruijn and ten Heuvelhof (2008).

As was mentioned before, actors are not single entities that act on their own (de Bruijn & ten Heuvelhof, 2008). In a modern society, everyone depends on everyone else. Actors will have to deal with a network structure of other actors. Network management is far from easy. Since network management strategies are conducted in a situation of mutual dependency, it requires knowledge of the network and various skills including negotiation skills. A network manager is not a central actor or director, but rather a mediator and stimulator (Forester, 1989). This role is not necessarily intended for

only one actor. Even though public actors often assume the role of network manager, other actors can do so as well. Which actor has the authority and possibility to fulfill the role of network manager is most certainly influenced by the strategic position of actors and the (behavioral) rules in use in the network (Ostrom, 1986).

In a network, decisions are often made in a process of interaction. This means that an actor's attention shifts towards the question of how the process of interaction can be influenced. Who might contribute to serving the interests of a certain actor? How can other actors be committed to these interests? These questions give rise to certain *strategies* that actors in a network (can) utilize to reach their goals. De Bruijn & ten Heuvelhof (2008) have made an overview of potential strategies that cover three areas.

1. Strategies concerning problem perceptions and solutions

When an actor presents a (policy) problem, it should realize that it's a problem *perception*; the problem as perceived by the problem owning actor may not be a problem that is recognized as such by other actors. Strategies such as broadening a problem formulation or raising complexity can increase the chances of binding other actors to the problem of one, while coupling or decoupling solutions of one actor to another actor's problems can likewise unite the two towards a mutually beneficial goal. Sometimes it's best to wait for a window of opportunity to do so, so timing is important in that regard. Policy entrepreneurs (Kingdon, 1984) are especially apt at using strategies at the right time or place.

2. Strategies concerning actor goals

A goal gives an indication of what an actor wants. However, goals can change, because actors learn. If one actor sets a very clear goal, it makes it difficult for other actors to change their goals and maneuver, for example when new opportunities arise during a decision making process. Goal stretching, like broadening problem formulations, makes one actor's goal more recognizable to other actors. One can also choose to change the language in which a goal is expressed: naming and framing serves to express a goal in such a way that others perceive it as desirable as well.

3. Strategies concerning information

Information is a crucial resource in decision making. The nature of the problem definition and the chosen goal determine the information that an actor needs. Information gathering and information supply and sharing are strongly actor-related and is therefore also susceptible to strategies. One actor's information can be disputed by another, so negotiated knowledge can help actors agree on what is wrong or right. (Independent) experts can be utilized in that regard. Information can also be used strategically, for instance by only sharing partial information (selective communication) or by distorting information. Lastly, timing is also important here; the impact of information in a decision-making process not only depends on the content of the information, but also on the moment when it is introduced into the process and on the attention paid by the actors in the network.

The work of Huitema and Meijerink (2010) is involved with how policy entrepreneurs can utilize strategies in order to affect policy change. While this work is primarily focused on water policy, the nature of the content can be used in other types of systems as well. Furthermore, where these authors

specifically focus on policy entrepreneurs, the strategies that will be described can be used by any actor that is intent on system change, because in the end the purpose is to drive transitions.

Much of the strategies opted by these authors are relatively identical to those of de Bruijn and ten Heuvelhof (2008) such as the development of new ideas and selling them by building coalitions. Ideas shape interest from other actors, but in turn, (perceived) interests can be a motivating factor behind the development of (new) ideas. Policy change requires the formulation of new ideas for managing water or energy. A useful addition is their notion that while networks are often seen as spontaneous, self-organizing entities, in fact managing networks requires considerable effort, and policy entrepreneurs can choose for two strategies concerning network orchestration: management of the interactions within the current network settings, or creation or change of the current network setting.

The strategies described above are not a total picture of what kinds of strategies are available to actors. However, it does provide a handhold to explain the interaction between actors and their methods for gaining support (legitimacy), which is what the original framework lacked. Together with the original three pillars, a more comprehensive analysis of governance of change can be performed.

2.3 Concluding: An analytical framework to analyze governance of change

The goal of the literature overview and discussion thereof in the previous paragraph is to come to an answer to the first research sub-question for this thesis: How can governance of (sustainable) change in local socio-technical systems be analyzed? The answer to this question is the creation of an improved analytical framework. The ways in which change in socio-technical systems is governed varies according to the extent to which actors are distributed in the system, the way in which new knowledge and technologies offer new opportunity structures, the way in which public, private and mixed forms of instrumentation re-difine incentives, and the extent to which the change and its governance is legitimate. The essence of this analytical framework is to identify governance *mechanisms* that affect or hamper change in socio-technical systems. Transitioning the energy system on Texel requires that investments are done in renewable energy technology and systems. The construction of such renewable energy systems, such as photovoltaic solar power, bio fuels, and wind energy, necessitates the development of scientific and technological expertise, entrepreneurial activities, a right mixture of policy instruments, and acceptance by the public (Devine-Wright, 2011; Meadowcroft, 2011). These elements are all covered by the framework of Borras and Edler, thus providing a handhold to analyze the process of governance of change. However, their framework lacked an emphasis on the role of actors, specifically in the way they interact. As change processes are in large part a product of these interactions, this distinction is important; analyzing change on a local scale like on Texel requires a more detailed focus on success and failure in interaction between local actors. Actors reside in actor networks, so the addition of network theory provides a number of additional handles to improve the analysis of the governance of change in local socio-technical systems.

Network management theory provides a base to find and explain these interactions by shining light on the *strategies* that could be, or are be utilized by actors in order to create support for their goals. The role of *policy entrepreneurs* cannot be ignored, as these initiators are much more proactive

than others and are able to spot and utilize opportunity structures, or can create windows of opportunity by connecting certain policies to certain problems, while navigating the political situation.

Support is a key term in the management of actor networks. Additionally, it is also a key concept in the "legitimacy" pillar of the framework. Hence, the addition of actor network strategies creates a clearer connection between the pillar "actors" and "legitimacy". *Culture* is identified as an important factor that drives support, especially in local communities such as is the case on Texel.

With these concepts from network management strategies, the framework should now be adequately equipped to analyze the process of change in socio-technical systems on a local level. Figure 5 shows a schematic overview of the analytical framework.

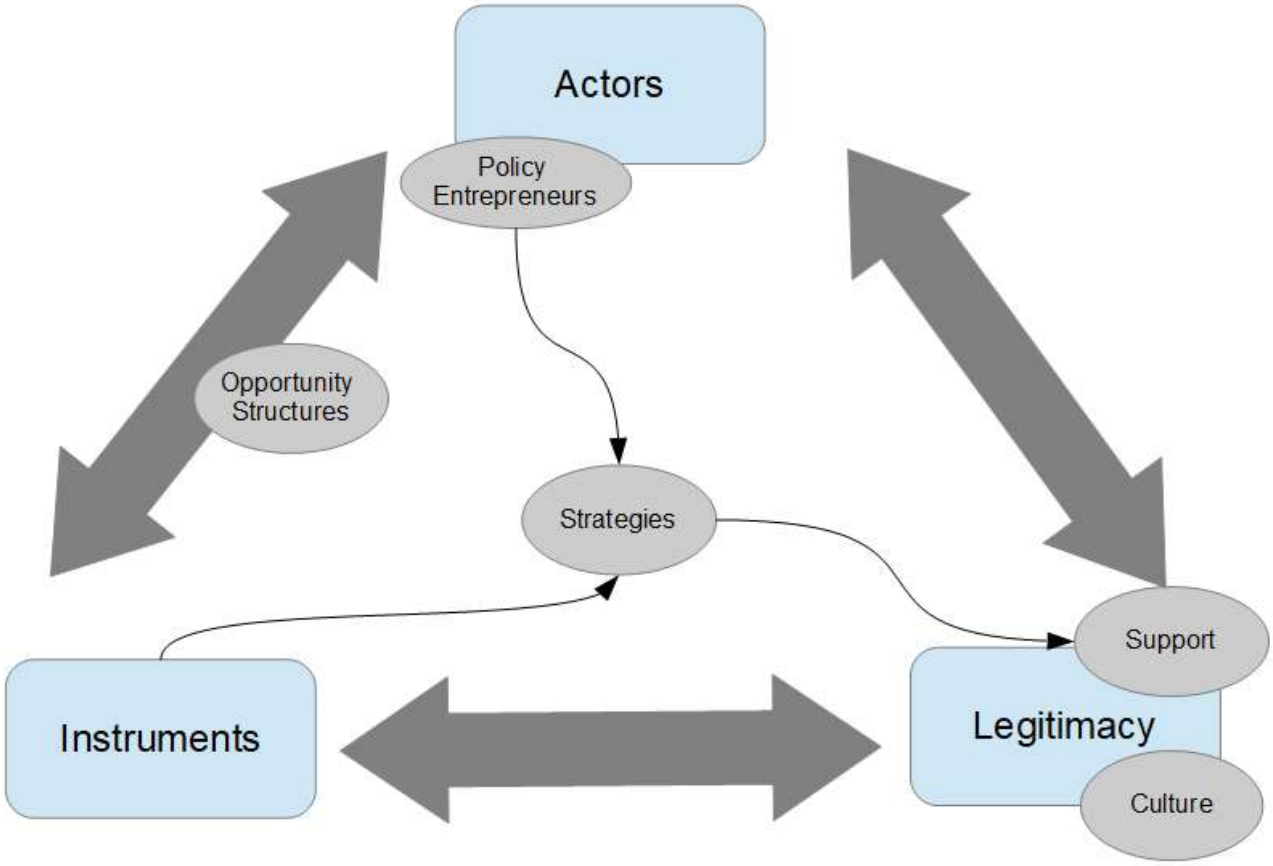

Figure 5: Analytical framework to analyze governance of change in socio-technical systems

Chapter 3: System descriptions

In order to analyze socio-technical systems, they first need to be described. Furthermore, in order to analyze and explain the processes of governance of change within said systems, the first step is to identify what has changed within the time period that is being investigated. The purpose of this chapter is to describe the social and technical situation of the socio-technical energy system (section 3.1) and the socio-technical water system (section 3.2) on Texel. For both systems, first the situation for the year 2000 and then the current situation (with the most recently available data where possible) will be portrayed. Finally, section 3.3 will remark on similarities and differences between the two systems.

3.1 Texel's socio-technical energy system

Modern society is thriving on various forms of energy, which is indispensable from daily life. Electricity is used to power appliances for daily chores and machines for production and manufacturing goods. Gas is mostly used to heat up households and, as is common in The Netherlands, to cook meals on gas stoves. This paragraph will describe the socio-technical energy system of Texel in 2000 (paragraph 1) and the current energy system (paragraph 2) and concludes with insight on the differences between the systems within these two timelines.

3.1.1 Texel's socio-technical energy system in 2000

The energy market

The energy market in 2000 was different from what we are used to today. Despite the Electricity Act of 1998 (Elektriciteitswet 1998, 1998) and the Gas Act from 2000 (Gaswet 2000, 2000) that both promote full liberalization of the energy markets, early 2000 there were no changes for consumers yet. Inhabitants of Texel were unable to choose where to take their electricity and gas from. Choosing to take green electricity was not possible until July 2001 and consumers didn't get to choose their energy supplier until January 2004 (Bakas & van Gastel, 2002). Instead, which of the six large energy companies delivered your electricity or gas was based solely on your postal code. For Texel, this company was NUON, meaning that everyone on Texel, including the municipality, received their energy from the then government-owned energy company.

Energy production and demand

The energy that NUON sold to consumers on Texel was mostly imported from the mainland. Only about 1% of the total energy demand of Texel (excluding transport fuels) was produced on the island (de Beer et al., 2001). More specific, 4% of electricity demand was produced renewably and 0.1% of gas demand was produced renewably on the island.

Five windmills generated a total of 1350 kW of energy in Oudeschild. Four of these were owned by NUON and were located at the harbor. One was (and still is) private property of the Schagen family, who were a prime example of a strong entrepreneur spirit on Texel. The energy that their windmill produced back then was directly sold to NUON under a 10-year contract, flowing directly into the electricity grid (Interview Texel resident, windmill owner). Other than wind energy, about 2400 m^2 of solar panels were present in 2000, mostly on the roofs of several companies (de Beer et al., 2001). They

provided an average total of 75.000 kWh per year. Finally, a total of 60 solar boilers (800 m^2) provided heat with the equivalent of 33.000 m^3 of natural gas per year (de Beer et al., 2001).

In total, Texel used 63.2 million kWh of electricity and 23.5 million m^3 of natural gas in 2000, amounting to around 1054 TJ of energy. Including transport fuel, the total energy use on Texel amounts to almost 1500 TJ, not accounting for the fuel used by the TESO ferry (de Beer et al., 2001). Table 3.1 gives an overview on how this was divided among different actor groups on Texel.

Table 3.1: Distribution of energy demand between different actor groups in 2000 (de Beer et al., 2001)[5]

Energy use	Natural Gas			Electricity			Fuel		Total
	10^6 m^3	TJ	%	10^6 kWh	TJ	%	mln L	TJ	TJ
Private Housing (5400)	12	422.0	51%	15.7	56.5	25%			
Holiday houses	5.6	197.0	24%	4.9	17.6	8%			
Tourism & Services	1.9	66.8	8%	23	82.8	36%			
Agriculture	1.0	35.2	4%	5	18	8%			
Industry	1.0	35.2	4%	5.1	18.4	8%			
Other	1.9	66.8	8%	9.5	34.2	15%			
Transport							8.5	442	
Total demand	**23.5**	**826.5**	**100%**	**63.2**	**227.5**	**100%**		**442**	**1496**
Renewable Energy Production	0.033	1		2.5	9	4%			10

Households (note that this includes 5400 private- and business houses) were responsible for 25% of the total electricity and about half of the gas demand. On average, Texel households used 2910 kWh and 2222 m^3 of gas. Compared with the average for The Netherlands, the average electricity demand was 11% lower (3280 kWh for NL) and the average natural gas demand was about 15% higher (1940 m^3 for NL). Possible reasons are: 1) on average it is colder on Texel than in the rest of The Netherlands. 2) Texel has on average more detached houses than anywhere else. 3) Many residents are not permanently inhabited.

Energy and society

While Texel did not yet have a long term energy vision early 2000, the province of Noord-Holland had a renewable energy goal, which was to have 2.5% of the energy demand covered by renewable energy by 2005 (de Beer et al., 2001). They planned to create a CO_2 service point to help municipalities in executing renewable energy plans. On Texel, a number of initiatives for energy saving were ongoing already. The municipality provided a small subsidy (250-350 Dutch guilders, the old Dutch currency) for the installation of solar boilers (de Beer et al., 2001).

2000 is also the year in which "Stichting Duurzaam Texel" (Foundation for Sustainable Texel) is founded. The foundation is a continuation of “Werkgroep Duurzaam Toerisme Texel” (Workgroup Sustainable Tourism Texel) which was founded earlier in 1996 because a gathering of renowned people from Texel had the desire to manage the impact of tourism on the island, so that it would stay desirable

[5] The units of conversion that were used are: 1 million m^3 natural gas = 35.2 TJ, 1 million liter fuel = 52 TeraJoule. Furthermore 1 million kWh = 3.6 TJ.

for tourists to keep visiting Texel in the future. Now the workgroup believers that tourism is strongly interwoven with many other activities on the island, greatly widening their terrain of work and so, ultimately, the working group renames itself “Stichting Duurzaam Texel” (Foundation for Sustainable Texel) and makes it their goal to initiate and promote activities that promote a sustainable development of the island. The board of Foundation for Sustainable Texel is formed with representatives from large organizations such as TESO, De Krim, VVV, entrepreneur platforms TVO, TVL (the two of whom later fused into TOP Texel) and LTO Texel.

3.1.2 Texel's socio-technical energy system now

Before heading into the current situation of the socio-technical energy system on Texel, it is important to note that it was not easy to get the most recent quantitative data for Texel, since there is no recent energy report available as there was for 2000 (de Beer et al., 2001). Therefore, data for the situation "now" differs from times between 2015 and 2017.

The energy market

As was mentioned, consumers got to choose whether or not to take green electricity from NUON since 2001. However, the Dutch energy market has only been fully liberalized for consumers since 2004. This has resulted in competition in the wholesale and retail electricity market and the unbundling of network activities and sequentially led to an increase in the amount of energy retail companies. Consumers now have free choice where to buy their electricity and gas. At this moment, there are more than thirty energy retail companies in The Netherlands ("Welke energieleveranciers zijn er? | EnergiePortal", 2017). Texel also has its own energy company: TexelEnergie, which is part of the cooperation Renewable Energy Union (Duurzame Energie Unie) that handles licenses to sell energy. TexelEnergie currently serves a total of around 4400 customers in (numbers are from the 1st of December 2015) (Texelenergie, 2015). The percentage of customers from Texel is unknown, but it is safe to assume that the majority of members and customers of TexelEnergie originate from Texel. While many inhabitants and companies on Texel buy their energy from TexelEnergie, the municipality of Texel does not receive its energy from the cooperation. They own stock in the waste burning facility HVC in Den Helder, where Texel's waste is transported and burned. In return they receive electricity at very low costs. Gas is supposedly still supplied by NUON (Interview Municipal Official).

While buying and selling gas and electricity has become a completely free market, distribution and management of the local gas- and electricity network on Texel are the responsibility of the government-owned network company Liander.

Energy production and demand

According to the "Energie in Beeld" website[6] in 2016 Texel used 71.5 million kWh (257.4 TJ) of electricity (an increase of 13.1%) and 21.2 million m^3 (746.2 TJ) of natural gas (a decrease of 9.8%), amounting to around 1004 TJ of energy excluding transport fuels (Figure 6). Unfortunately, data about current transport fuel use for 2015 or 2016 could not be found, nor is recent data about the division of energy

[6] See www.energieinbeeld.nl

use between the actor groups available.[7] Only the division between households and business is known (table 3.2)

Table 3.2: Gas and electricity consumption on Texel in 2016

Sector	Natural Gas		Electricity		Total
	10^6 m3	TJ	10^6 kWh	TJ	TJ
Households (6050)	9.3	327.3	17.8	64.1	
Business	11.9	418.9	53.7	193.3	
Total	21.2	746.2	71.5	257.4	**1003.6**

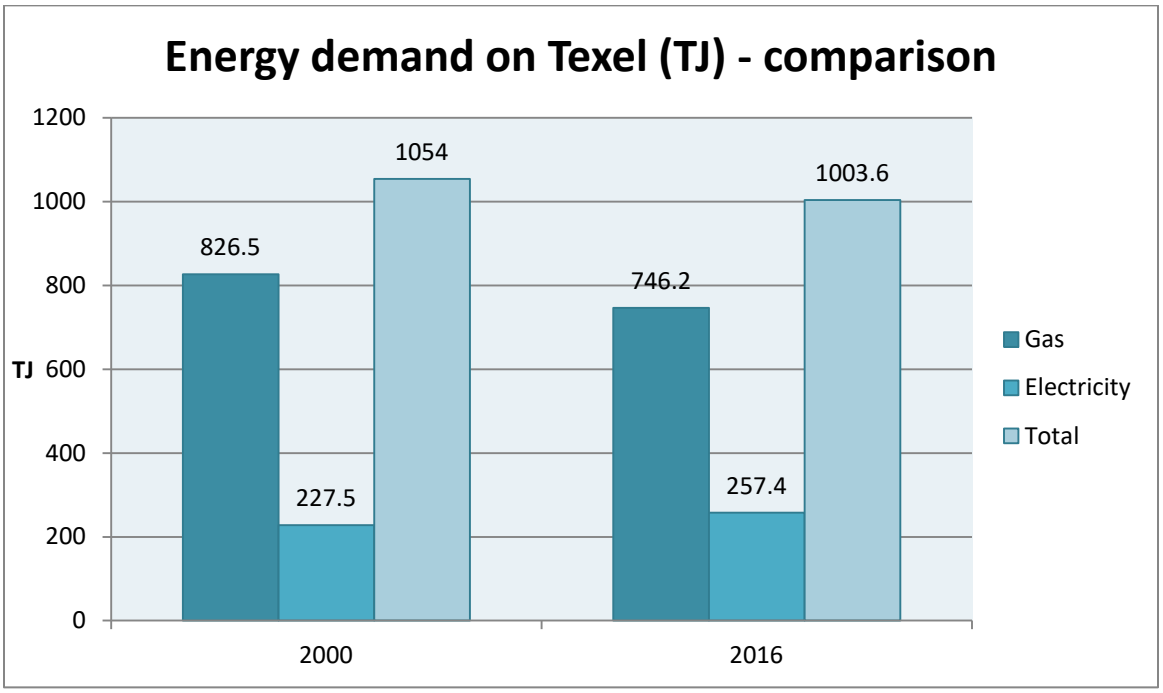

Figure 6: Energy demand on Texel in 2000 and 2016

In terms of renewable energy production, Texel has focused strongly on solar energy in the past years (Figure 7). Currently, solar panels are present on about 15% of the residential roofs (Zierse, 2016) and even the water board "Hoogheemraadschap Hollands Noorderkwartier (HHNK) is involved in producing solar power on Texel. Floating solar panels are installed in the water basin at their water treatment plant at Everstekoog. The produced electricity covers the electricity needed for Texel's public lighting, making Texel the first municipality with energy neutral public lighting ("Texel eerste Nederlandse gemeente met energieneutrale openbare verlichting", 2017). According to the "Energie in Beeld" website, a total of 2.2 million kWh (7.9 TJ) of solar PV electricity is produced on Texel in 2016 (Energie in Beeld, 2017).

[7] For reasons why this information is unknown, please refer to the reflection section in section 6.2.1.

Despite many intentions and plans from the municipality and residents of Texel throughout the years, there is only one single windmill left standing on Texel, which is the one that is owned by Dirk and Fanny Schagen. This windmill provides on average 750.000 kWh (2.7 TJ) per year (Interview Texel resident, windmill owner). Other than solar energy and a windmill, currently there is an experimental tidal energy plant near the TESO harbor that is producing 200 kW of electricity ("Getijdencentrale terug op plek", 2015). Lastly, the "climate monitor" website from Rijkswaterstaat[8] (part of the Dutch Ministry of Infrastructure and Environment) shows that in 2015 an amount of 33 TJ of heat on Texel originated from renewable sources (Figure 8). In total, 3.8% of the energy on Texel is produced renewably.

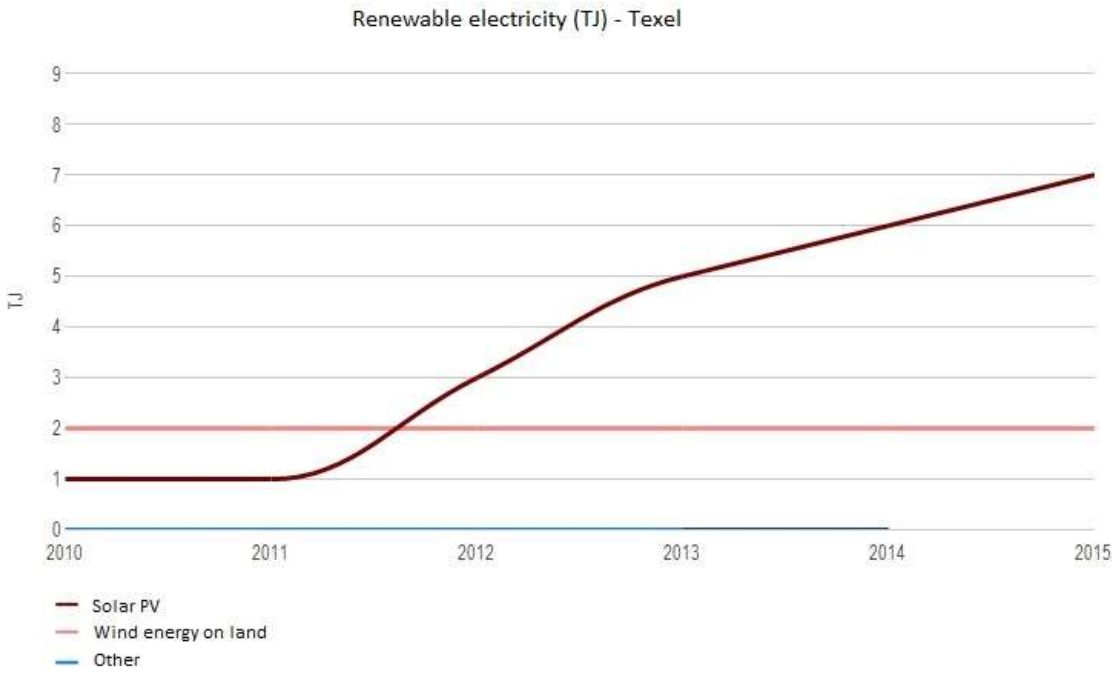

Figure 7: Renewable electricity 2010-2015 (source: https://www.lokaleenergieetalage.nl)

[8] See https://klimaatmonitor.databank.nl/dashboard/Hernieuwbare-Energie--Hernieuwbare_energie/

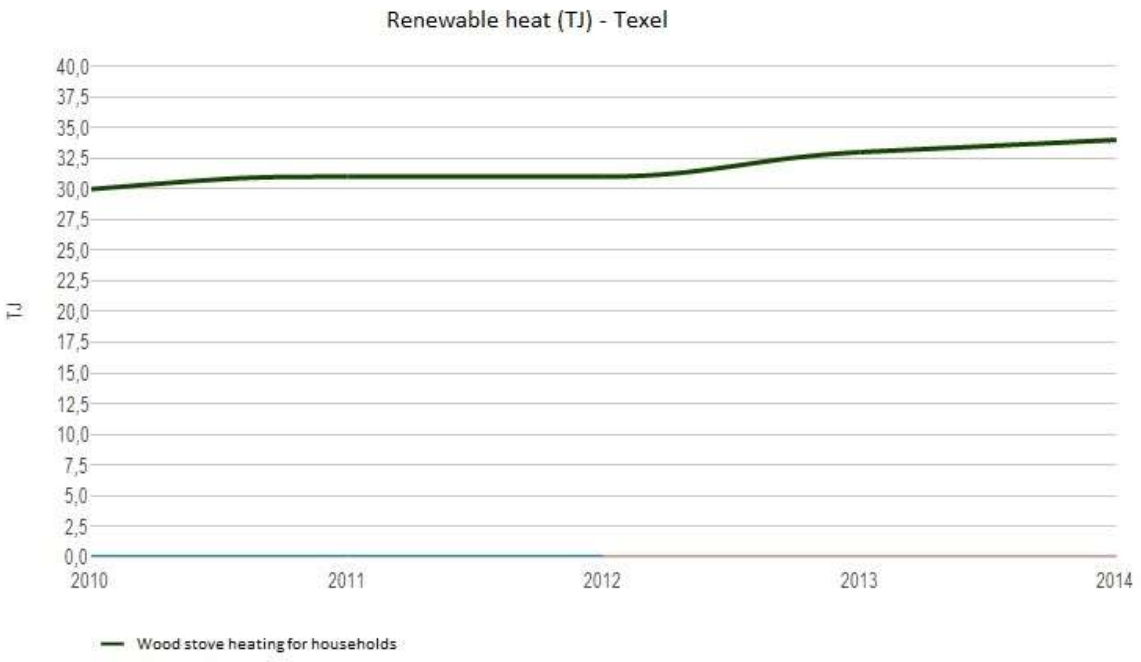

Figure 8: Renewabe heat on Texel (2010-2014) (source: https://www.lokaleenergieetalage.nl)

Energy and society

Currently, sustainability and renewable energy have a more prominent place on the political agenda, not only on Texel but worldwide. Climate change awareness in general is now common and more generally accepted, in part due to the latest climate convention in Paris ("The Paris Agreement", 2017). This means that there has been an increased governmental focus on topics such as renewable energy and corporate social responsibility. Texel, wishing to be seen as an innovative island of frontrunners in this area, has adopted a formal ambition since 2007 to achieve energy independence in 2020. Since then, the island has had its share of sustainable projects in the past 16 years, with and without the help of "outside" actors such as Urgenda. The energy footprint of households and holiday residences was reduced by promoting insulation methods. 14 houses have been refit into zero-energy houses through a project from Urgenda.

At this time there appears to be an almost even split between Texelers with regards to being pro or against windmills. Some argue that the favor has started to turn in favor of utilizing wind energy on Texel. A group of locals have therefore recently organized a "citizen initiative", formally asking the municipal council to organize a poll that will research the actual amount of support for wind energy on the island. However, the council has voted against this research[9]. This indicates that wind energy is still a very controversial topic on Texel.

The Texel culture has always been an important aspect on Texel. The Texel Core values ("Stichting Kernwaarden Texel", 2017) are held in high esteem. Recently these core values have been further reinforced through the large visionary project Planet Texel (Godefroy, van der Ploeg, &

[9] Gemeente Texel: Raadsbesluit #042: Draagvlakonderzoek windenergie. Vastgesteld in de openbare vergadering van 15-06-2016.

Timmermans, 2015) which has added the seven "Texel Principles" to the already existing core values. These core values and principles are nowadays strongly enforced in the daily politics on Texel and make for a unique political climate. At the moment, a "spatial quality" commission is in place that is advises the Municipal board of aldermen in any decision making process involving plans for spatial development and spatial quality of the municipality. The committee assesses these plans based the island's core principles (Gemeente Texel, 2015).

3.1.3 Conclusions for the socio-technical energy system

Comparing the socio-technical energy system of Texel in 2000 with the socio-technical energy system now, several things can be observed. First of all, let's look at the energy market. In 2000 the market was more or less closed for consumers, leaving little opportunity for change especially in the public sector. This changed when the energy market was completely liberated. Consumers get to choose for the cheapest or greenest energy retailer (or whichever characteristic they prefer) and the market is open for new energy companies or co operations, which Texel now has: TexelEnergie. However, the closed market was also a less complicated one, not necessarily completely inhibiting the area of opportunities. Dirk and Fanny Schagen are prime examples, as they chose to build a windmill and sell their energy directly to NUON. Possibly, the couple would not be as interested or willing to build such a windmill in the current energy climate; as they mentioned in an interview it is already a lot more difficult just to establish a suitable contract to sell energy to energy companies (Interview Dirk Schagen). And each time a contract ends, a new one is made for increasingly shorter periods due to the uncertainty on the markets.

The amount of actors in the system has increased throughout the years with TexelEnergie and Urgenda and even HHNK getting involved in the process of change. Therewith not only the actor network has become more complicated than in 2000, technical complexity has also increased due to the increased implementation of renewable energy and pilot projects.

In 2000 the politics on Texel did not yet possess a long term planning in terms of a renewable energy mix or structural visions regarding energy for the future. Instead, the island's focus on sustainability in these early years was mostly driven by Foundation for Sustainable Texel and originates from increasing awareness of the negative effects of tourism on the island. In short, the motivation for change lies mostly at an *inward* focus on the island and the protection of its natural treasures and community. However, while in 2016 the focus on sustainability is partly still motivated in the same way, the sustainable focus now extends outwards. This means that through increased national and global climate awareness, Texel is also more aware of the effect of their current lifestyles on the climate. And more importantly, what this means for the future of their island. This is one of the motivations of Texel to promote itself as the pioneers in sustainable initiatives.

According to the "Energie in Beeld" website[10] in 2016 Texel used 71.5 million kWh (257.4 TJ) of electricity (an increase of 13.1%) and 21.2 million m^3 (746.2 TJ) of natural gas (a decrease of 9.8%). In The Netherlands, between 2000 and 2016 the electricity demand has risen from 388 PJ to 434 PJ (in increase of 11.9%) and gas demand has lowered from 1469 PJ to 1265 PJ (a decrease of 13.9%)(CBS, 2017). This indicates that Texel is more or less following the trend of the rest of The Netherlands in terms of energy use.

Overall, Texel has seen a large increase in solar energy production. Still, the total amount of renewably generated energy only grew from 1% to 3.8% between 2000 and 2016. In comparison, in The Netherlands as a whole the amount of renewable energy in the total energy production grew from 1.64%[11] to 5.8% in the same time (Figure 9). It is clear that Texel still has a long way to go to reach its ambitions for 2020.

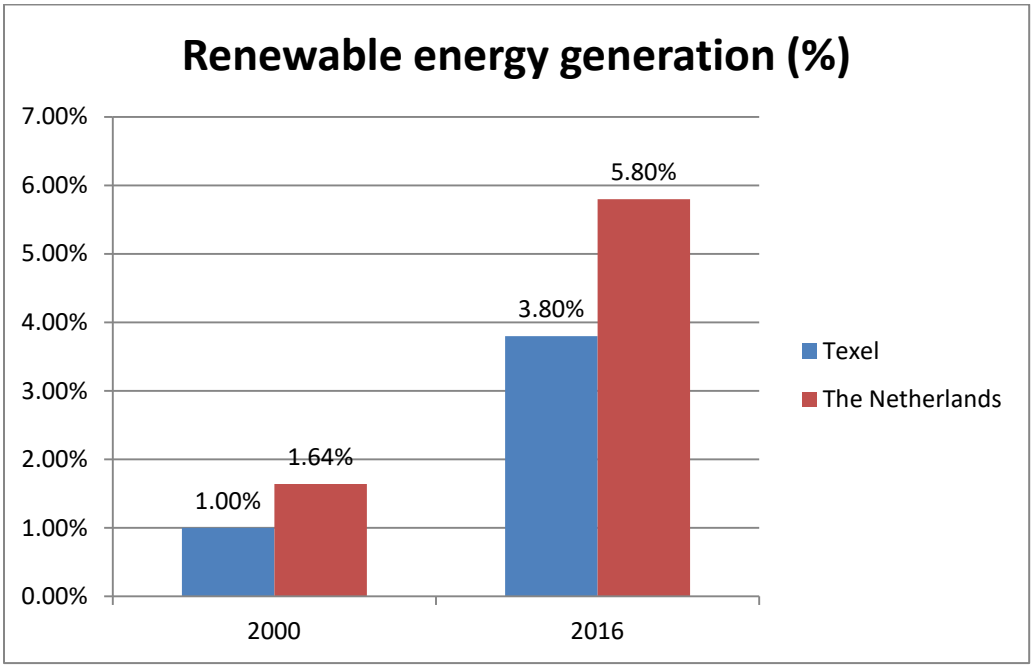

Figure 9: Percentage of renewable energy production

[10] See www.energieinbeeld.nl
[11] source: http://www.clo.nl/indicatoren/nl038532-verbruik-van-hernieuwbare-energie

3.2 Texel's socio-technical Water System

Water is one of the fundamental components of life; almost nothing can thrive without water. For Texel, water is especially an important topic. A large part of Texel is protected Natural Park because the Wadden area is considered a unique landscape. Texel is surrounded by salty sea water, so saline seepage into ground water is an important issue both for agriculture and nature. Furthermore, clean drinking water is a basic necessity for any household. This section will describe the socio-technical water system of Texel in 2000 (section 1) and now (section 2) and concludes with insights on the differences between these two points in time. Because this thesis is based on the ambition to be independent in terms of fresh water supply, the system description strictly focuses on this topic, meaning that related water topics (for example water safety concerns due to the rising sea level) are not part of the scope of the water system.

3.2.1 Texel's socio-technical water system in 2000

Managing water on Texel and maintaining its quality requires a lot of (technical) management in which different actors are involved. First of all, the roughly 13.500 residents of Texel need clean drinking water for their daily habits. Unlike in the past and as is the case on most of the other Wadden islands, Texel does not produce any drinking water on the island itself. Instead, since 1988 drinking water is supplied by the drinking water company PWN through two pipelines that transport drinking water from the main land to Texel. This water is stored in reservoirs in Den Burg and De Cocksdorp, which are filled during the night. From here, pumps make sure the drinking water is distributed to the users. The amount of water that enters the reservoirs during the night is predicted and depends on the day of the week, the weather and the season. The filled reservoirs should provide users with enough drinking water during the morning and evening peaks (Kersten, P., Sowka, J., Bekkering, J,. Colenbrander, B., 2016). Annually, Texel uses approximately 1.6 million m^3 of drinking water in total (Boot et al., 2015). 48% is used by households, using 143 liters per person per day on average[12]. 52% is business related, 45% of which is used for tourism, about 350.000 m^3 per year. Since Texel is heavily dependent on tourism, the drinking water demand rises strongly during the summer season. Figure 10 shows the monthly amount of drinking water that is supplied, compared to the amount of people that are transported towards the island by TESO.

[12] These numbers are from 2010 (Boonekamp et al., 2012). Exact data for 2000 could not be found. A report by Vewin (2013) indicates that on average, water use by households has dropped by about 10% between 2000 and 2013. This means that the actual numbers will likely be slightly higher.

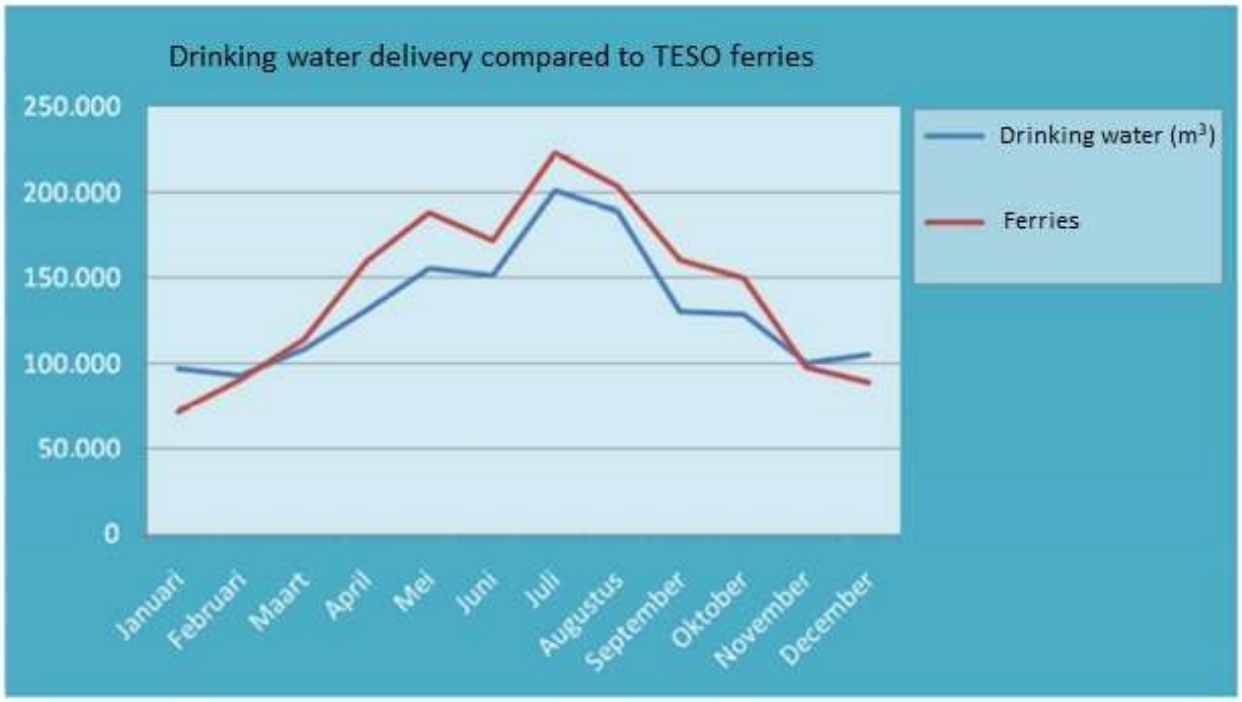

Figure 10: Drinking water delivery throughout the year (blue line) versus number of TESO ferries (red line).

After use, most of the resulting waste water ends up in the sewage system. Because the sewage system is for the most part a mixed system, rainwater that runs off from roofs and hard roads also ends up here. During periods of heavy rainfall this causes a problem with overflow of the sewers that lack the capacity to deal with the amount of water. Excess water is directly expelled into the surface water, which means that some of the sewage also ends up there (Schurink, 2000). The maintenance and repair of the sewage system is under the responsibility of the municipality of Texel. The sewers transfer waste water (and the rainwater that ends up in the sewage system) towards the island's five waste water treatment facilities (RWZI's), which are owned by "Hoogheemraadschap Uitwaterende Sluizen". This water board is also tasked with monitoring and maintaining the quality of surface water. The biggest RWZI is located at Everstekoog and handles approximately 60% of the waste water. Other RWZI's are located at De Cocksdorp, Oudeschild, Oosterend and 't Horntje. After the cleaning up process, the waste water from Everstekoog is released onto the surface water near the Waal en Burg polders, from where it naturally flows into the Wadden Sea at Krassekeet. Everstekoog is the only RWZI with a so-called heliophyte filter, which is a swamp-like area that turns "dead" treated wastewater into water that is less harmful to release onto the surface water. The other RWZI's release their water directly on the sea.

Not all households are connected to the sewage system. People in the outskirts are too remote and instead either use septic tanks or directly discharge their waste on the surface waters. It is legally required that every household or business is either connected to the sewage system, or owns an individual water treatment unit by 2005 (Schurink, 2000). Furthermore, both the municipality and Uitwaterende Sluizen wish to convert to a separated sewage system on the long term, so that only waste water ends up in the water treatment facilities and fresh rainwater ends up in the groundwater.

Next to drinking water, retaining natural sweet water is also an important topic on Texel. Texel's natural water system can be viewed as a relatively closed system due to the fact that Texel has to make do with a thin fresh water lens that is surrounded by salty sea water. This lens is a fresh water layer that resides in the upper layer of the saturated water zone underground, and results from precipitation that infiltrates in the upper soil.

Next to tourism, agriculture is one of the most important economic activities on Texel. Agricultural companies heavily depend on the sweet water lens in order to grow their crops. Fresh water is scarce on Texel, so watering (sprinkling) crops by extracting ground water is not permitted on Texel. The organization WLTO (Westerlijke Land- en Tuinbouworganisatie, or Western Horticulture and Agriculture Organization) protects the interests of this sector. Because the rest of the groundwater on the island is brackish to saline, when no rainfall lens is present, the possibility exists that this brackish groundwater enters the unsaturated zone which has an inhibitory effect on the growth of crops. The lens thickness increases when the ditch water level is lowered and / or the drainage level is increased (de Jongh, 2009). Especially in the summer periods the water level management is important. Farmers rather have drier land than wet and salty land. Other than the thin sweet water lens, two large fresh water bubbles are available on Texel: one under the dunes and one under "De Hoge Berg" (translation: The High Mountain) (see figure 11) at a depth of about 20-60 meters. These water sources are protected and only utilized in times of extreme scarcity. At this time there are still a lot of unknowns about underground waterflows and the depth of sweet/salt borders and on the island. A research project is being devoted towards that topic by the province, however.

Figure 11: Location of several areas on Texel

At this time, Texel finds itself at the start of a potential large organizational project regarding water management. The waterboard "Hollands Kroon" expresses a wish for a more integrated approach with regards to water management. This is picked up by the municipality of Texel. The municipality of Texel wishes to show itself to the outside world as "Sustainable Texel" and is aware that many stakeholders depend on a careful management of the water chain and system. And while different projects and activities are already being done, most of them lack joint alignment (Schurink, 2000). Therefore, a taskforce was initiated by the municipality in collaboration with the two water boards and the province. Their goal was to investigate whether there is a need for, and support for a "Masterplan Water for Texel. The exploratory phase was finished early this year and proved positive towards such a masterplan.

3.2.2 Texel's socio-technical water system now

Over the past years, Texel has fluctuated slightly in its amount of inhabitants. However, at the moment the total amount of inhabitants is still around 13500. The total yearly demand of 1.6 million cubic meters (Peters, 2013) of drinking water is still completely supplied by the drinking water company PWN, now through a new, recently constructed pipeline ("*Drinkwater op grote diepte van Den Helder naar Texel",* 2017).

The sewage system has been expanded, so every household, including the countryside (par few exceptions) is now connected to the sewage system. All of Texel's waste water is transported through this system but now ends up in the single remaining, centralized water purification plant "Everstekoog". From there, 90% of the effluent water is reused to support the groundwater on the Common (Gemeenschappelijke) polders. The remaining 10% is still pumped into the Wadden Sea (Kersten, Sowka & Colenbrander, 2016). The purification plant is property of the governmental water board "Hoogheemraadschap Hollands Noorderkwartier" (HHNK).

A new Water Act has been introduced by the national government in 2009. An important principle of the Water Act is that as many water related activities are covered by general rules. To that effect, the Water Act integrates the old laws about water management into one "umbrella" law. Water-related government institutions now have clearer tasks as well. The water boards are responsible for regional waters such as canals and polder waterways. They ensure that surface water is clean, so the fish population is maintained, among other things. Water boards also protect the land from flooding and ensure that farmers have enough water for their crops. They also provide wastewater treatment. For Texel, the water board is Hoogheemraadschap Hollands Noorderkwartier (HHNK). HHNK is now the single water board for the Texel region that has been aggregated from the old waterboards "Hoogheemraadschap Uitwaterende Sluizen", "Waterschap Hollands Kroon"HHNK and a couple of other smaller institutions back in 2003. Co-operation and goal alignment form the basis for the achievement of the objectives of the Water Act. That means that cooperation between governing actors is no longer optional. Art. 3.8 of the Water Act stipulate that water authorities and municipalities take care for coordination of tasks and responsibilities, leading to an effective and coherent water management. To control or adjust things proactively, several legislative instruments are put in place, such as a revised plan system. The Water Act has changed some of the responsibilities of the municipality of Texel as well, as municipalities are now the first contact for any actor who requires legal information or permits with regards to water. The municipality then passes along any request to the right institution. Furthermore, the municipality also takes care of groundwater management in urban areas.

Texel's dunes and other areas are now part of the Natura 2000 areas, sanctioned by the European Commission. This means that they are under strict protective laws for the preservation of endangered flora and fauna. A total of 4600 hectares falls under this law (Ministerie van Economische Zaken, 2016). The Natura 2000 areas are a source of worry for farmers. First of all, these areas contain plants that are registered as acidification sensitive, making it difficult to obtain an environmental permit for livestock farms nearby. Another problem is buffer zones around Natura 2000 areas which cross farmland. On these buffer zones it is now allowed to hunt wild geese, while both agriculture and nature suffer damage from these animals. Next to these problems, Texel's farmers still have to cope with wet weather during winter periods and drought during summer. There is no means yet for storing enough fresh water for the summer period. Some farmers experiment with planting crops in saline soil. Silt farming is becoming an increasingly "hot" topic not only on Texel, though through the "Texel Zilt Proefbedrijf" (Texel Experimental Salt-farm) and other projects Texel is definitely a frontrunner on this topic.

3.2.3 Conclusions for the socio-technical water system

Comparing the water system descriptions for 2000 and now, several changes are observed. First of all, the waste water management has been completely centralized around Everstekoog, where 90% of the waste water is transferred to the surface water on Texel. The impact is small, on average about 150.000 m^3 per month (Kersten, P., Sowka, J., Bekkering, J,. Colenbrander, B., 2016) compared to the yearly precipitation (58 million m^3. evaporation already substracted). However, it provides a little extra needed fresh water during the dry summer periods, which is highly needed as can be seen in figure 12.

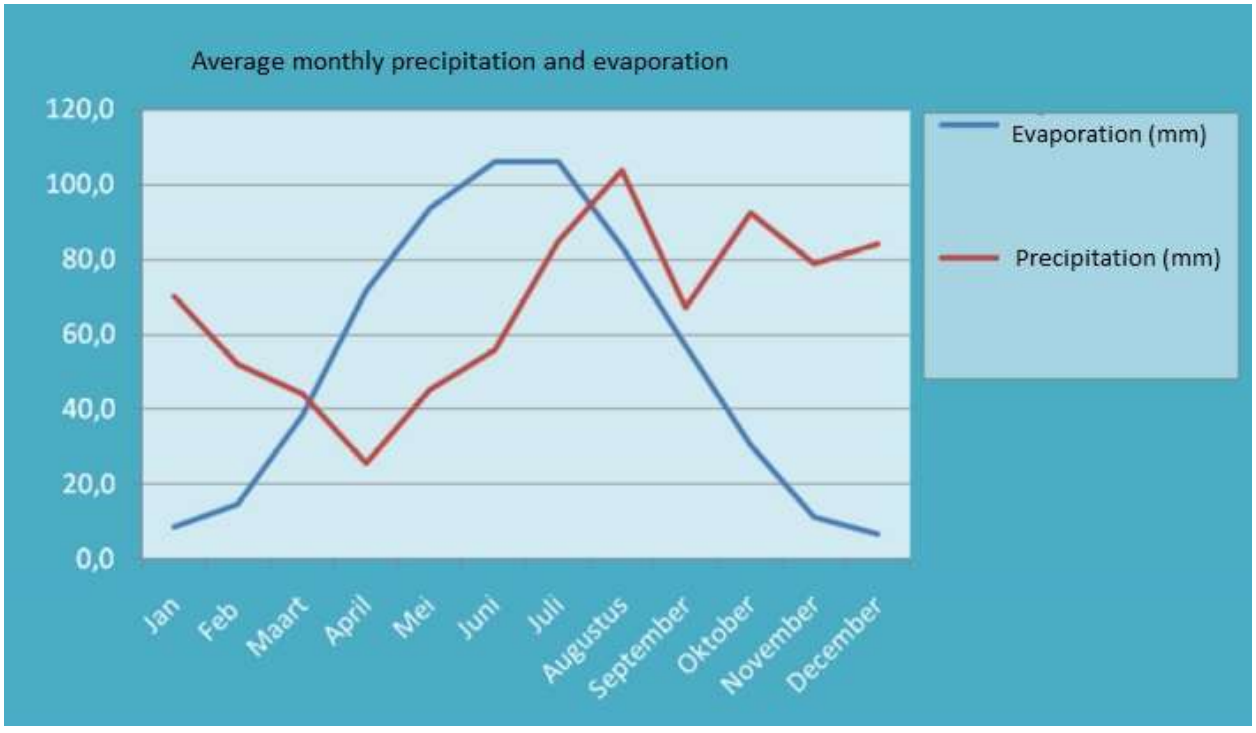

Figure 12: Average monthly precipitation and evaporation on Texel

Furthermore, most of the households and commercial structures have been connected to the main sewage system, decreasing the environmental impact of waste water in the countryside. However, the production and distribution of drinking water has not changed at all. PWN is still in charge of 100% of the drinking water supply on Texel. Lastly, several projects have been executed regarding water management and dealing with salinity in agriculture. However despite these projects, no permanent solution has yet been found to the drought during summer periods. Large projects for retaining excess (winter period) rain water have not been done, though small scale projects are present.

At the social level, the actor network has changed. The fusion of the water boards into "Hoogheemraadschap Hollands Noorderkwartier" (HHNK) has created a single (regional) entity that is now responsible for most of the regional water tasks. Because of this centralization, coordination between the water board, the province and the municipality has become less complex. An example of that can be found in the fact that the municipality and HHNK worked together to replacing the current mixed sewage systems with a separated sewage system. The new Water Act has also created more clarity concerning the legal framework around water management, simplifying the mechanisms for change surrounding the water system. It is now clearer for everyone which institution is responsible for which task. The task of the municipality to be the first contact person for water-related issues makes it easier for people and commercial businesses to ask for licenses and permits when needed.

Regarding the water ambitions as stated in the ambition manifest, this has not yet been reached and given the fact that PWN (in consultation with the municipality of Texel) has constructed a new pipeline for the delivery of drinking water, this ambition seems to have been put on hold.

3.3 Conclusions: Similarities and differences between the two ST-systems

This chapter described the socio-technical energy- and water systems for Texel at two different points in time (2000 and now). Texel has stated clear ambitions for 2020: a self-sufficient (renewable) energy system and a self-sufficient fresh water supply. The ambitions for these two systems are very similar, yet when we look at the change that has appeared in the two systems in the past 16 years several observations can be made.

First of all, while in the energy system the actor network seems to have become more complex with the involvement of more actors, in the water system it is the other way around. Because of the privatization of the energy market, the socio-technical energy system saw an increase in actors of change over the progression of time. Important to note is that this involves an increase of non-governmental actors that are involved in this system. This increase means that very likely more interaction and task interference between these actors is involved in the governance of change, leading to increased complexity. In contrast, in the socio-technical water system the amount of actors involved has reduced, in part because the water boards were centralized. Furthermore, this system is still primarily under the management of governmental actors. This means that even though interaction takes place, it is likely less complex and involves less task interference. Centralization was also observed in technical aspects of the water system.

Secondly, a difference in opportunities for change between the two socio-technical systems in 2000 is observed. In the socio-technical energy system, the network of actors in 2000 was mainly comprised of governmental actors (considering the fact that NUON was then a state-owned company). The energy market was still relatively closed with limited to no choice for consumers, limiting their

influence. In 2000 there was no shared goal between these actors towards a renewable energy system on Texel. Hence, governance of change relied strongly on whether legitimacy could be found for system change. In contrast, in the water system incentives for change can be seen in two things. Firstly, in the technical and legal opportunities that were present (the water treatment facilities that were in need of renovation and the governmental law that forces every household to be connected to a sewage system by 2004). Secondly, in the already present intentions for collaboration between the (governmental) actors of change in the socio-technical water system through the Master Plan Water for Texel.

Lastly, from the two systems in their present state the following is observed. In the socio-technical energy system, an absence of wind energy and large scale biomass is observed. However, a lot of investments in solar energy technology and insulation for energy saving can also be observed, which means that while certain technologies were blocked, room for alternatives is present in order to attempt to reach the ambitions for 2020. In the socio-technical water system, however, drinking water is still supplied by PWN through a newly constructed pipeline. This is a long term commitment. Hence it seems that alternatives towards this ambition have been closed down.

In conclusion, there are a lot of differences between the two socio-technical systems on Texel. The energy system starts out with little common ground for change while in the water system many opportunity structures for change are present, and the intention to change is already present as well. In both cases the end results show that the ambitions for both systems will likely not be reached by 2020. For energy, the total amount of renewably generated energy on Texel is around 3.8% while for The Netherlands as a whole, the total amount has surpassed Texel with 5.9% ("Aandeel hernieuwbare energie 5,9 procent in 2016", 2017). In the water system, as was already mentioned, a new pipeline by PWN has seemingly ended the ambition for an autonomous drinking water supply on the island. The next question that arises is: how did the process of governance of change unfold, or in other words what has happened in the years between 2000 and now that the systems have developed in the way that they have? This leads us to the next chapter, where the process of change in both systems are described and analyzed.

Chapter 4: Description of the governance of change processes on Texel

In the previous chapter, the socio-technical energy- and water systems on Texel were described and from the description between the situations in 2000 versus the current situation, several differences within the socio-technical systems were observed in the available opportunities for change in 2000 and in the situation that the socio-technical systems are currently. The next step is to find out what happened between 2000 and now that resulted in the current state of both socio-technical systems. Therefore this chapter describes the process of governance of change in these two systems. Section 4.1 will describe this process for the socio-technical energy system and section 4.2 will do the same for the socio-technical water system. The chapter will conclude by discussing what happened by shortly describing them in light of the three basic pillars in the framework (Section 4.3).

4.1 Description of the process of governance of change in the Energy System

With regards to energy, in 2000 there was not yet a common goal for sustainability among the actors on Texel. Instead, incentive for change depended strongly on economic factors; tourism is one of the main economic activities on the island and much of the employment opportunities are directly or indirectly connected to tourism. It is no surprise then, that the first sign of "sustainability awareness" (in a broad sense) came from the common realization that the impact and size of this industry should not surpass the carrying capacity of the island. This realization is where *Stichting Duurzaam Texel (*In english: Foundation for Sustainable Texel) originated from. The foundation was a continuation of “Werkgroep Duurzaam Toerisme Texel” (Working group Sustainable Tourism Texel) which was founded earlier in 1996. However, the working group found that tourism interweaves with many other activities on the island, thus greatly widening their terrain of work. Ultimately, the working group renamed itself Foundation for Sustainable Texel in June 2000 and created a new goal for the foundation: Initiating and stimulating activities that promote the sustainable development of the island of Texel, with a good balance between Texel's economic developments on the one hand and the conservation of natural and cultural values on the other hand (Andringa, Fonk, & van Sandick, 2008). The rest of this section will describe the process of governance from that point in time.

4.1.1 2000 - 2007: Awareness raising and agenda setting

The early actions of Foundation for Sustainable Texel: Awareness raising

Since the foundation of Foundation for Sustainable Texel (the starting point of this case study) this actor played a substantial role in the governance of change in the energy system, gradually steering the island towards a path of sustainability.

"Part of the thinking power on Texel originates strongly from Foundation for Sustainable Texel especially during their early days, when all large parties were involved."

- Professor at TU Delft, also Co-founder of Foundation for Sustainable Texel and resident of Texel, interview

Foundation for Sustainable Texel in 2000 was founded by renowned individuals that represented a diverse amount of powerful actors on Texel, including TESO (the ferry company), Staatsbosbeheer

(National Forestry Association), (W)LTO (Western Horticulture and Agriculture organization), TVL (Texel Association for Accommodation Providers), TVO (Texel Union of Entrepreneurs), VVV (local tourist office) and Recron (association for recreational entrepreneurs in The Netherlands). This amount of representatives made that the foundation enjoyed a broad representation and acceptance from the population on Texel (Kelp, 2013). Between 2000 and 2007 Foundation for Sustainable Texel managed to fulfill two important roles.

The first role that Foundation for Sustainable Texel fulfilled was to put sustainability on the political agenda of Texel. In 2001 Foundation for Sustainable Texel commissioned a feasibility report for the use and application of renewable energy on Texel. The research was performed by the external, energy-related consultancy company Ecofys and the results appeared in July 2001 (de Beer et al., 2001). The result of the report stated that it should be technically feasible to meet heat- and electricity demand with renewable production methods by 2030. The demand for transport fuels could however not be fully met in a sustainable way, unless electric transport is used. Texel has great potential to realize a large part of their energy demand with renewable energy in the short term. Wind energy has the most potential, but when only a limited use of wind energy is allowed, large energy savings will be necessary. (de Beer et al., 2001). The total predicted investment costs would range between 125- and 140 million euro's, including investments in test pilots. An advice that Ecofys proposed was to establish an independent energy company on Texel that collectively buys in green energy, using the company earnings to invest in renewable energy technology on the island. A cooperative business approach was proposed in order to help generate desired support for renewable initiatives on the island. This approach was chosen because it is similar to how the successful Texel' company TESO was once founded; of which most Texelers are shareholder of and as such are familiar with.

Foundation for Sustainable Texel presented the report and their resulting recommendations to the province and the municipality of Texel ("Hoopvol rapport: Texel in 2030 op duurzame energie", 2001). The municipality considered Foundation for Sustainable Texel's ambition for a fully independent energy supply on Texel in 2030 to be ambitious, but the energy plan was nonetheless met with enthusiasm especially by the then active alderman for sustainability from the left-wing political party GroenLinks (Green Left). Important to note is that this Alderman was also involved in (the foundation of) Foundation for Sustainable Texel (Kelp, 2013). The municipality agreed to support Foundation for Sustainable Texel in its endeavor to follow the plans in the report (Provinciale Staten, 2001) and made the goal to reach a sustainable island by 2030 an official policy target in their structure vision (Gemeente Texel, 2002).

The second role that Foundation for Sustainable Texel fulfilled was to gradually raise awareness about sustainability among Texel. This was done by organizing information nights and events, inviting external experts and guest speakers to make people of Texel familiar with developments around topics such as domestic energy savings and renewable energy technologies. An example is a symposium about sustainable building and renovations in 2001 where both local and non-local building companies, installation companies and architects were invited to exchange information about sustainable techniques, and financial advisors shared information about available subsidies ("Beurs en symposium over duurzaam bouwen", 2001). This initiative was so successful that it was repeated in 2005 ("Beurs presenteert mogelijkheden duurzaam bouwen", 2005). Furthermore, Nienke Bloksma from Foundation for Sustainable Texel introduced the "milieubarometer" tool (a method created by Recron) on the island

together with TVL and VVV. This tool was designed to help tourist companies find profitable opportunities related to sustainable business management (Bloksma, 2003). Foundation for Sustainable Texel promoted this method by subsidizing companies that were willing to achieve a milieubarometer medal. This led to initiatives like local produce and "nature month" on Texel, and soon various businesses owned such a medal ("Texel kan zich met Milieubarometer onderscheiden", 2005). Foundation for Sustainable Texel further organized a series of lectures and information nights about renewable energy, where spokesmen from ECN (Dutch Energy Research Center) informed those who were interested about various forms of renewable energy such as the production of hydrogen as an energy source ("Deskundigen spreken over waterstof als energiebron", 2005) or about solar energy. It turned out that Texelers at the time were hesitant about solar energy because of the costs; however the presenting experts tried to convince people that it could be a lucrative form of energy production even in The Netherlands ("Duurzaam Texel houdt bijeenkomst zonne-energie", 2006). Most notably, in 2005 Foundation for Sustainable Texel invited Søren Hermansen, coordinator of the Danish (and now fully sustainable) island Samsø, to discuss that island's goal to achieve a completely renewable energy system by 2008 ("Discussie met Denen over gebruik duurzame energie", 2005). In short, Foundation for Sustainable Texel managed to create support and awareness around sustainable topics in all parts of the Texel society with their projects and lectures, turning out to be a source of inspiration for many Texelers.

Lack of support for windmills leads to a change of direction

Going back to 2001, the energy report by Ecofys (de Beer et al., 2001) incited a vivid debate about wind energy. Inspired by the newly formed goal for 2030, the municipal council wanted to make room for wind turbines in the eastern parts of Texel. At that time unopposed to utilize wind energy, they also wanted to get rid of the existing height restrictions for windmills in order to keep up with recent developments. They saw a need for further study in order to come up with a suitable location ("College wil meer ruimte bieden aan windmolens", 2001) they also wanted the province to support in this regard (Provinciale Staten, 2001). Foundation for Sustainable Texel saw an opportunity there and came up with its own plan to construct wind turbines on Texel.

"*Sustainable Texel launched a unanimous plan to construct a (small) wind turbine park on Texel in September 2001. In November 2001, The Forestry Commission and Recron, both members of the board of the organization, turned against this plan. Subsequently it became a large item for the municipal council elections in March 2002, as the theme controlled the elections and all political parties who were in favor of wind turbines (CDA, GroenLinks and PvdA) suffered big losses. The alderman of GroenLinks even had to leave his position in 2002 because of the results of the elections*"
- Founder of Texelenergy, as cited in Kelp (2013)

By then wind energy was already a highly controversial topic among the Texelers. The technology's image was already damaged due to an incident during a storm in august 2001, where one of the four windmills at the harbor in Oudeschild was hit by lightning and broke down. The harbor owner as well as the village commission did not like the windmills, claiming that visitors were not fond of them either ("Bliksem treft windturbine bij passantenhaven", 2001). Furthermore, the Forestry Commission

(Staatsbosbeheer) and Nature Reserves (Natuurmonumenten) were opposed to using windmills on the island as well. They claimed to be worried that windmills have a negative impact on nature (the wings would hit birds) and that they would create landscape pollution ("Landschapszorg Texel vreest komst windmolens", 2001). The tourism industry was worried that this landscape pollution would have a negative impact on tourism on the island ("Horeca keert zich tegen grote windmolens op Texel", 2001). Negativity about windmills is also expressed from the community on Texel. Landscape pollution is seen as an "attack" on the Texel Core Values ("Dick Drijver: Geen concessies aan kernwaarden", 2002). The tourism industry and forestry commission are quick to pick up on this statement as well. By now, political parties in the municipal council were also strongly divided on the matter. Eventually the proposed plan did not survive the elections and the active Alderman from GroenLinks, who was at the political forefront to promote sustainable initiatives, stepped down.

Ultimately, after performing a study on support for wind energy on Texel (commissioned by the municipality) consultancy firm Arcadis advised the municipal council to remain reserved with the placement of windmills on Texel, an advice that was also incorporated into the 2002 structure vision for Texel ("Structuurvisie: Geen draagvlak voor windmolens", 2002).

"There is a lot of emotion surrounding windmills. Of course, one of the charms of Texel is that it's sort of a step back into time. This nostalgia is important; Texel is like The Netherlands in the 50's or 60's, a time monument. And the politics on Texel is very conservative as well. Parties like GroenLinks and CDA are splintered. The local agenda prevails. No one is willing to throw themselves to the lions to commit political suicide by promoting wind turbines"
- Municipal official, interview

Another large project that Foundation for Sustainable Texel wanted to initiate came a few years later in 2005 and involved hydrogen production. The idea was to set up a transport system and use the hydrogen in a small (50-100 kW) thermal power plant, ultimately leading to a small scale hydrogen economy. Together with the Dutch Energy Research Institute (ECN), the municipality of Texel and Air Products Netherlands (supported by Senternovem and Shell Research) a study on the feasibility of such a hydrogen demonstration project was first conducted in March of 2005 (Smit & Duijves, 2005). The resulting report concluded that a demonstration project would technically be possible, preferably at the EcoMare site. There it would potentially become an attractive demonstration for EcoMare's large amount of yearly visitors. The project would cost €4.9 million but would result in €21.000 of energy savings and 340 tonnes of negated CO2 each year (Smit & Duijves, 2005). Both the municipality and Foundation for Sustainable Texel were willing to continue with the project ("Bouw aardgasreformer op Texel begin volgend jaar gepland", 2005) though subsidy requirements stated that a private investor needed to be found before such a project could apply for government subsidy. In august, the project was slowed because Shell stepped out, claiming that they never intended to contribute to the project itself, but just the feasibility study. ECN was under the impression that Shell would finance the project as well ("Shell betaalt niet mee: waterstofproject vertraagd", 2005). ECN tried to find a new financer but the project was never realized.

Energy from biomass was also one of the spearheads for the energy plan by Ecofys. In 2005 a local farmer wanted to install a bio-fermentation installation at his site in order to produce natural gas

from the local and imported manure on Texel. Manure is used to fertilize farming lands, but goes paired with quite some odor nuisance; fermenting the manure would not only reduce this stench, but also produce energy without losing its fertilizing effect. Both the province as well as the municipal executive board approved of the plan ("Texelse noviteit: groene stroom uit mest en mais", 2005). However, the plan was met with local opposition from nearby citizens who disliked the impact of such an installation on the authentic landscape of Texel and who feared an increase in feedstock transport from outside of the island. According to them this stroked against the Texel Core Values ("Veel protest tegen biovergistingsinstallatie", 2005). The plan first threatened to strand when the minister of economic affairs canceled subsidy for renewable energy (van Uffelen, 2006). When this decision was later reverted, the plan for a bio-fermenting installation was renewed and again approved by both the municipal council and the province. A building permit was granted and the destination plan for the area would be revised to make room for the bio-fermenting plant. However, the local opposition, backed by local political parties, fought the decision at the Council of State. The Council of State decided against the decisions of the municipal council to grant a building permit ("Rechter haalt streep door biovergistingsinstallatie", 2007). The reason for this is that the installation would produce power, and only 3% of that power would be used by the firm itself. The remaining 97% would be sold. The Council of State claimed that selling electricity did not fit into the extracurricular activities of an agrarian company. So ultimately in 2007, the Texel Core Values won against the plans for energy from biomass.

Solar energy achieved more success on Texel. From 2001 the municipality already focused on initiatives surrounding solar PV by subsidizing solar panels ("Veel aanmeldingen voor subsidie zonnepanelen", 2001) and by collaborating with NUON to put solar panels on local institutions ("Actie levert zonnepanelen op voor 30 verenigingen", 2001). Likely this was the initiative of NUON, however, because in 2001 the market for Green Energy opened up in the Netherlands, forcing energy suppliers to produce renewable electricity (Scheepers et al., 2002). With wind energy lacking support and thus being out of the picture for a while, the direction of change increasingly focused on solar power. In 2003 the successful collaboration with NUON was repeated ("Groenestroomactie: 180 m2 zonnepanelen voor EcoMare", 2003) and the municipality also organized information sharing initiatives ("Actie in gemeentehuis voor gebruik zonnepanelen", 2003) alongside Foundation for Sustainable Texel to encourage people to buy solar panels. Additionally, after the success of the second sustainable building fair in 2005, sustainable renovations for private house owners and recreational houses were also subsidized by the municipality ("Energiesubsidie voor gewone en recreatiewoningen", 2006).

The period between 2000 and 2007 showed several insights in the process of governance of change. First of all, Foundation for Sustainable Texel was an important actor of change that managed to set the wish for energy neutrality in 2030 on the political agenda while at the mean time raising general awareness and support for the (at that time) not yet very popular topic of sustainability. Furthermore, the Texel Core Values proved to be a limiting factor during discussions and initiatives for wind energy and energy from biomass. The resulting lack of support for these (large scale) technologies resulted in a direction of change where solar energy and sustainable building became the main focus. However, with limited resources available at that time, both Foundation for Sustainable Texel and the municipality were as of yet unable to make big steps towards that goal for 2030.

4.1.2 2007 - 2014: Uptake in renewable energy projects

In the year 2007 several developments happened on Texel that had significant influence on the governance of change in the energy system on Texel. First of all, the efforts by Foundation for Sustainable Texel were noticed by Urgenda, an NGO that promotes sustainable development. They awarded Foundation for Sustainable Texel with a prize and publicly made Texel one of their icon projects for sustainability. Furthermore, inspired by the Danish island Samso, the municipality created and signed an ambition manifesto with the other four Wadden Islands, establishing a new goal for energy neutrality in 2020. And last but not least, several initiators on Texel decided to take matters in their own hand by establishing a cooperative energy company. This section describes what happened around these three developments.

Texel locals take initiative: Texel's own energy cooperation emerges

As was mentioned earlier, one of the recommendations from the Ecofys report (de Beer et al., 2001) was to establish an independent energy cooperation on Texel. Back then, the municipality expressed enthusiasm for that advice and promised to look into it (van Lanen, 2001). Early 2002 some energy companies also showed interest in the realization of what is then called "*Texel's own Energy Company*" (TEM). Foundation for Sustainable Texel picked this up, starting conversations with these energy companies. The municipality wanted to wait until after the upcoming municipal elections in March 2002 (van Lanen, 2002). Ultimately, the boundary conditions proved unfit, preventing this idea to take root at the time. As was already mentioned in Chapter 3, despite the Electricity Act of 1998 that promotes an open energy market, actual liberalization of the energy market took more time and did not fully come to fruition until 2004. Hence the execution of this idea depended on the willingness to cooperate of established energy companies. While at first it seemed that there was some interest here and there, the energy market climate proved unripe and the initiative by Foundation for Sustainable Texel stranded.

However, during the spring of 2007 a lecture about renewable energy took place at Ecomare. Here the discussion about establishing a Texel Energy Cooperation resurfaced ("Oprichting | TexelEnergie", 2017). A local politician from the political party PvdA (Labour Party) reminded the other participants of the fact that Texel once used to have its own energy company, before the island was coupled to the mainland in 1993. His idea to found a new energy company was met with great enthusiasm by several of the people attending the lecture, including a spokesman from Ecomare and the former Alderman from the political party GroenLinks (Green Left). Together they decided to gather a group of Texelers from their own personal networks to collectively brainstorm about the idea. Shortly thereafter, this group took an excursion to Samsø together with a delegation of local politicians and several entrepreneurs who were involved in Foundation for Sustainable Texel. This trip proved very insightful for all people involved, inspiring them for the idea to incite an "energy democracy" on Texel, a symbol for how a population can independently choose how to deal with its own energy supply ("Samso vorige reis | TexelEnergie", 2017).

"We wanted to be an instrument that is independent of the municipality of Texel, without any interference from government entities or their funds. We wanted to be free in our actions."
- (One of the initiative takers ("Oprichting | TexelEnergie", 2017))

Not long after the brainstorming sessions and excursion, TexelEnergie was founded in November 2007. TexelEnergie was set up as a cooperation. 13.500 shares (an amount that symbolizes the amount of residents on Texel) were made available for €50 per share. In theory this made it possible for anyone on Texel to become shareholder and therewith having a say in the company's future. This setup was not by chance. TexelEnergie was organized in the in the same fashion as the highly regarded Texel ferry company TESO was founded back in 1907. And that paid off: TexelEnergie instantly enjoyed much local enthusiasm and support. By December 2007, TexelEnergie reached around 1500 members and a total of 4500 shares were sold ("Texelaars doen het zelf", 2008).

"We have our own ferry company that brings us to and from the mainland. TESO was founded in 1907, and all the Texelers back then could buy a share for 5 guilders. Now they are worth 7000 to 8000 euros each. Stock buyers for TexelEnergie include grandparents who like to give a share to their children and grandchildren."
- (One of the initiative takers of TexelEnergie, as cited in Dekker, (2012)

TexelEnergie's similarity to TESO shows that TexelEnergie fits into Texel's Core Value of cultural history. With a lot of support from the local people and politics, TexelEnergie shows that these values are held in high esteem. Texelers supported the cooperation not only because it boosted the self-esteem of the whole community, but also because they saw certain market value; Texel is known culturally for its self-reliant nature and TexelEnergie is a testament to that.

Resetting the ambitions

The founding of TexelEnergie was not the only result from the trip that the initiative takers for TexelEnergie took to Samsø in 2007. It also turned out to have a ripple effect on the political agenda.

"It has really come from Samsø that this ambition manifesto has arisen. Due to this journey, people realized that it would really help if the municipality would set such an ambition in order to give parties such as Foundation for Sustainable Texel and TexelEnergie more space and a playing field to pursue a certain horizon, but also in order to prepare and adjust policy frameworks and spatial policy for the things that were to come. What I would like to say is that the ambition manifesto has really been set up from the initiative of Texel, and much of that credit should go to [name of local frontrunner that was also involved with TexelEnergie]*, who has been deeply involved. He also communicated with the other islands and that is how this was set up."*
- (Local entrepreneur/frontrunner and resident on Texel, interview)

The ambition manifesto that is mentioned in this citation is the agreement between the five Wadden Islands to reach a fully self-sustaining, renewable energy- and water supply by 2020 (Ambitiemanifesto Waddeneilanden - De Energieke Toekomst, 2007) The literal text of the core of the ambition is as follows: "It is our ambition to make all of the Wadden Islands fully self-sufficient in 2020 in the field of renewable energy and water supply" (p.6). The motivation behind this dual ambition was to preserve the vulnerable and unique natural areas on the Wadden islands, while at the same time continuing the facilitation of tourism in a sustainable way (Ambitimanifesto Waddeneilanden - De Energieke Toekomst,

2007). The manifesto did not formulate any concrete projects or plans, though every island formed its own "energy team" with people from local companies, tourism, nature organizations, housing corporations, and more. On Texel, Foundation for Sustainable Texel took on this task. Or rather the foundation was the inspiration for other islands to have their own energy team ("Duurzame Waddeneilanden", 2017). The manifesto further mentioned that an execution plan should be made and that it would require collaboration not only from the islands themselves, but also from external parties such as the national government, provinces and energy companies, among many others. When and how execution plans would be formalized was not yet clear from this manifesto, but the Wadden Fund (Waddenfonds) was mentioned as an important source of investment for the execution of projects. The "Wadden Fund" was established in 2007 by The Dutch government and was planned for a period of twenty years. During this period, a budget of over 600 million euro's in total is made available for the ecological and economic strengthening of the Wadden Sea area ("Over ons | Waddenfonds", 2016).

With the ambition manifesto, Texel's original ambition for 2030 was set for 2020 instead (none of the interviewees could tell me exactly *why* the ambition was set 10 years earlier, though). In any case, signing the ambition manifesto put that ambition even more firmly on the political agenda. A direction was chosen, and both the Municipality of Texel as well as TexelEnergie was intent to reach that objective. Shortly after signing the ambition manifesto, the municipality of Texel created an energy vision in 2008, along with an execution plan for the upcoming years that showed how the municipality intended to achieve its ambitions (Energievisie Texel en uitvoeringsplan 2008 - 2011, 2008). Their program primarily focused on the "Trias Energetica" strategy which starts with energy savings by reducing heat and electricity demand, after which the remaining demand is filled up with renewable sources. The Municipality presented their own role in reaching the ambitions as follows: a) creating the right boundary conditions, b) set an example and c) try to influence the behavior of people and entrepreneurs by means of communication and information sharing (Energievisie Texel en uitvoeringsplan 2008 - 2011, 2008).

To set an example didn't take long, as the municipality utilized the idea of a TU Delft student who studied the possibilities for sustainable public lighting on Texel as part of his graduation research for the study “Strategic Product Design”. His supervisor (a Texel frontrunner) gave him the idea to do this for the municipality (Interview TU Delft Professor; interview former TU Delft graduate).

"I started this project as a graduation project from TU Delft in 2008. This was in the time that LED was still new and expensive. [...] The initial goal was to see whether LED would be a good replacement for conventional public lighting. Back then, the conclusion was that most gain could be gotten at the ferry port. After my graduation I looked into the whole island, and wrote a business plan that stated that half of the energy use for public lighting could be saved by using LED."
- (Former TU Delft graduate, now resident on Texel, interview)

Public lighting became a popular topic after the graduation research. With the ambition for 2020 in mind, the municipality started several pilot projects throughout Texel involving the installation of LED lights ("Gemeente Texel heeft led- verlichting primeur", 2008) and experimenting with partial dimming ("Proef: uitschakelen van verlichting bij Akenbuurt", 2009). The municipality was also intent on making more room for "darkness during the night" which was even adopted as a new Texel Core Value

("Kernwaarde: meer duisternis in dorp en buitengebied", 2010). In 2012 the municipality realized that a structural lighting plan was missing, and recognized the fact that a lot of the public lighting was reaching the end of their lifetimes. The former TU Delft graduate, by then having moved to Texel, wrote a business plan for the replacement of all public lighting with LED lights in 2012 (Vigor Novus, 2012) aiming to decrease energy use in public lighting from 600 to 200 MWh per year. This plan was adopted by the municipal council ("3,5 miljoen voor duurzame openbare verlichting", 2012). The municipality applied for a subsidy from the Wadden Fund for the project, which accepted to cover 40% of the investment cost of €3.6 million ("Duurzame openbare verlichting stap dichterbij", 2013). Another 8% was funded by the province through the TWIN-H subsidy (Interview former TU Delft student). The tendering of the project took some time. The project was innovative and one-of-a-kind, so expertise was required. In 2015 the tendering was won by Imtech Traffic & Infra who finalized the project in 2016 ("Texel slim verlicht", 2016).

Collaborative efforts from "the other side"

In the mean time in 2007, Urgenda joined the network of actors on Texel. During a festival about sustainability on June 21, 2007 Foundation for Sustainable Texel received an "Icon Award" from Urgenda. The reward was handed out to put Texel on the map as one of Urgenda's five iconic projects for sustainability in The Netherlands. Urgenda is a Dutch NGO that was launched by ten sustainable innovation programs during the same festival. The initiative takers behind this NGO wish to accelerate sustainability initiatives throughout The Netherlands. Following up on the award, Urgenda started a so-called "sustainability arena" on Texel in collaboration with members from Foundation for Sustainable Texel and a group of local frontrunners from Texel. Through six interactive sessions that were organized over a period of 1.5 years, the group of participants worked on formulizing a vision for a sustainable island in 2040 (Texel Geeft Energie, 2009).

Meanwhile, Foundation for Sustainable Texel kept focusing on information sharing with people on Texel, such as through educating children at school in a playful way ("Duurzame legokist voor alle Texelse basisscholen", 2007; "Duurzame excursie voor Texels basisonderwijs", 2008) and took the role as a subsidy information point for both citizens and entrepreneurs. They also approached ECN to perform a study on enhancing societal acceptance with regards to sustainable energy projects (Mourik, Feenstra, & Raven, 2007). Shortly after the ambition manifesto was signed, the municipality created an energy vision document and execution plan (Gemeente Texel, 2008) to put action with their ambitions. These documents acted as communication instruments towards the citizens, who were deemed as a crucial group that needed to be actively involved in order to realize the energy vision.

With Urgenda rounding off their energy vision in 2009 (Texel Geeft Energie, 2009) the foundation almost immediately started taking action on Texel, both individually as well as together with the municipality and TexelEnergie. An example is a project that involved partially funding an electric vehicle for the pest control service of the municipality ("Elektrische auto voor plaagdierbestrijding gemeente", 2010). Urgenda and the municipality also organized "TexelElectricDay" to introduce people and tourists to electric driving ("Gratis met de elektrische taxi op TexelElectric Day", 2011) and eventually even installed twenty charging poles on the island ("Twintig openbare oplaadpalen voor elektrische autos", 2012). *Urgenda* also attempted to persuade people to collectively buy electric vehicles, but that failed because the people did not appreciate the lack of choice in the available type of

cars (Interview project manager Urgenda). One of Urgenda's action methods was to involve local people and entrepreneurs as much as possible. But that didn't always work. In 2013 *Urgenda* worked on making existing homes energy neutral, based on their vision that households spend on average around 35.000 euro's on energy in 15 years.

"That money is enough to get everything one needs to make any home gas-free and energy neutral. So why not invest that now, when it pays back anyway?"
- (Project manager Urgenda, interview)

Urgenda initiated this project on Texel because of the large amount of funds that were available from the energy desk. The energy desk - which was available between 2011 and 2014 - was a municipal instrument that utilized part of a 2.5 million investment which was provided by the province. This investment was used to promote energy saving projects on the island ("Energieloket Texel Succesvol | Duurzaam Bouwloket", 2016). Every house owner could apply for a subsidy, provided that they would improve the energy efficiency of their house in some way.

Early in 2013 people could apply voluntarily to let their homes be refitted into energy neutral homes by Urgenda. To take away concerns about financial risks, *Urgenda* guaranteed energy neutrality. In other words: the participants would not pay any energy bills after the refitting. If there would still be excess energy costs for the household, *Urgenda* would cover them. *Urgenda* also tried to involve Texel building and installation companies in the project, which they thought would be a positive boost for the local economy. However, this turned out difficult.

"We tried to build these homes with local parties. However this was a huge struggle! We tried to excite them into learning new, innovative methods. But they weren't really enthusiastic about it because they lacked knowledge and expertise, and did not want to learn new things especially since they had no incentive to do so. Business wasn't going bad; there was plenty of work available. This was a shame because our idea was that stimulating local businesses would kickstart a movement."
- (Project manager Urgenda, interview)

"If I have problems with some of the systems in my house, I need to call a business in Den Bosch (Klimax), who installed everything. This usually takes a lot of effort and time because they don't exactly work around the corner. Texel companies have helped around a little, but their involvement was minimal. I won't go blaming anyone for anything, but those companies on the island have plenty work and little competition. And it seems that they are not so keen on learning new things."
- (Participant in the project, interview)

Despite this, the project was deemed a success by both Urgenda and the municipality, with five houses completed at the beginning of 2015. Urgenda often showcase these example projects to attempt to convince more people to do the same.

Urgenda also did projects together with TexelEnergie. Firstly, the two actors together organized a collective solar panel action for consumers ("Texel, eiland in de zon: enthousiasme en aanvragen", 2012) which was quite a success due to the fact that people could also apply for subsidy at the energy

desk. TexelEnergie also received 2.5 million, partially for their solar panel project and to invest in other renewable options. TexelEnergie used part of this subsidy to promote the campaign by organizing information fares together with local entrepreneurs ("Zonne-energie campagne: Texel, eiland in de zon! | TexelEnergie", 2017). Secondly, Urgenda and TexelEnergie founded an umbrella cooperation "Duurzame Energie Unie" (DE Unie, in English: Renewable Energy Union) in 2014 together with WindUnie (Wind Union). TexelEnergie was one of the first energy co operations in The Netherlands, and had to deal with a lot of startup problems, such as licensing to be an energy supplier and managing administration. DE Unie is therefore set up as a Shared Service Center to support and accelerate the sustainable ambitions of local sustainable (civil) initiatives, by sharing the knowledge from TexelEnergie. Currently DE Unie has several dozens of members ("De Duurzame Energie Unie | Wat we doen", 2017).

The primary source of renewable energy that TexelEnergie exploits is solar PV; in fact, the cooperation's first focus on producing energy was by placing solar panels on the roofs of companies and institutes, for example on "De Potvis," a residential campus for employees of NIOZ (Knowledge Institute for Sea Research) and other institutions close to the ferry terminal. The biggest partner for this was Agrifirm, where 740m^2 of panels were placed on the roof of the company's seed potato storage. TexelEnergie rents these roofs and keep ownership of the panels, and in turn sells back the power to the owner of the roof at a lower price rate than regular retail prices (EenVandaag, 2011). The surplus is sold to regular customers of TexelEnergie. These first solar panels were financed through a loan of from ASN Bank. ("Zonne-energie | TexelEnergie", 2016) Further income for TexelEnergie is received through the SDE regulation (Subsidie Duurzame Energie or Renewable Energy Subsidy) which is a small subsidy per renewably generated kWh, and that is regulated by the Netherlands Enterprise Agency (In Dutch: RVO).

Other than that, TexelEnergie invested in a wood burning installation to provide block heating in the residential area "De 99" on Texel, which was planned in 2011 ("TexelEnergie mag De 99 met houtkachel verwarmen", 2011) but was delayed because local residents protested because they feared stench discomfort and landscape pollution, which was contested in court and turned in favor of TexelEnergie. The construction commenced in 2014 ("Aanleg houtkachel De 99 gestart, ondanks bezwaren", 2014). The municipality took up a supportive role towards Urgenda and TexelEnergie. The earlier mentioned energy desk was an extra financial stimulus for people to engage in the collective solar panel action by Urgenda and TexelEnergie. Furthermore, the municipality helped changing zoning plans for the wood burning central heating system in "De 99" residential area.

Publicity and more influence of external actors

As was mentioned, many of the projects, such as the energy neutral houses, were used by *Urgenda, TexelEnergie* and the municipality to communicate to the outside world that Texel was well on its way with their ambitions ("Texelse energie-ambities in landelijke media belicht", 2011). This attracted actors from abroad. An example is the project "Cloud Texel", a project by Capgemini and Liander that ran between 2012 and 2015. The companies worked together with TexelEnergie. Texel was already the first municipality to receive smart meters from network operator Liander in October 2011 ("Texel als eerste gemeente slimme meters", 2011). The project was commissioned by RVO (the entrepreneurship department under the Ministry of Economic Affairs)(RVO, 2015) who aim to accelerate the introduction of smart grids in the Netherlands. This project was therefore part of the Innovation Program for Intelligent Networks (IPIN) which started in 2011 and featured twelve pilot projects in total everywhere

in The Netherlands. Texel was chosen as one of these pilots because of its wish to become independent in their energy needs. The purpose of the Cloud Texel project was to study how a small community could function and how the energy flows could be monitored and charged for. The question that the collaborating parties wanted to answer with this pilot was whether motivated people were willing to adapt their energy using behavior by using energy when it is available and avoid usage when the community has a shortage of energy. The pilot involved 300 households on Texel, where it was examined whether it was possible to control the behavior in household energy consumption by using smart thermostats. The participants (about 10% of TE members) received a free smart thermostat and participated in a user survey.

"In this project TexelEnergie did a really good job! They took a lot of local communication upon themselves, including organizing user meetings. And during information evenings, both Liander and Capgemini fed back a lot of information from the data to the community. Furthermore, through interviews, flyers, videos, websites, etc., much has been done to create awareness, which actually made it sort of fun for users to save energy. The project has had an impact on local, national and even at some level, on international level. The local aspect succeeded because TexelEnergie managed to bridge a gap between local people and large companies from the other side. Even now there are users who continue to ask when the next pilot finally comes.
- (Resident on Texel / local frontrunner / former municipal official, interview)

During the test period, an average of 5.1% of electricity and 10.3% of gas was saved. People became more aware of their energy use. An interesting note is that this was hardly the case for tourists, however ("Cloud Power Texel, demonstratie van het Cloud Power concept", 2017).

Another example where Texel's publicity led to a large project with expertise from the other side was Planet TEXEL, an initiative that arose from a meeting between Texel's alderman and IABR's project director while discussing a smaller project to reinstate the center of Den Burg ("Het succes van Texel", 2015).

"The disadvantage of an island is of course that, despite the fact that the people here are very innovative and can find out many things, a lot of expert knowledge is still missing. So that has to be taken from the abroad. It is important to organize that well. Then there must be people who want to pick up and learn. That's happening, but on a very small scale. This is also one of the reasons for setting up Planet Texel.
- (Municipal official, interview)

The main question of Planet TEXEL was: how can the various Texel ambitions (the wish for energy neutrality and self-sufficiency, nature protection preservation, coastal protection and optimization of streams of water, housing, waste, traffic, and the tourism-based economy) be spatially optimized to integrate with the natural, scenic and cultural and historical values of the island? Design bureaus LA4SALE and FARO were tasked with designing future scenario's for Texel. The goal of the project workshop, which ran from 2013 to 2014, was to arrive at futuristic sight of Texel through design-oriented research, from which both directors and inhabitants can distill practical and concrete ideas to subsequently act upon ("Planet Texel geeft vernieuwende kijk op het eiland", 2014). The Municipal

Council of Texel agreed on 17 December 2014 to integrate and use the results of Planet Texel as a guide to the development of the island.

In the period between 2007 and 2014 the new ambition for 2020 set a clear goal to work towards. Furthermore, local people took matters in their own hands with the establishment of TexelEnergie. This shows the self-reliance that Texelers are said to possess when they set their minds to it. Urgenda took notice and saw opportunities to initiate various sustainable projects on Texel. Meanwhile, the municipality supported initiatives by these two actors where possible, meanwhile using financial instruments through the energy desk to encourage people on Texel to participate in the process of change. At the same time the municipality set an example themselves as well, most notably with their public lighting project. In this time period, many projects were initiated that were mainly focused on energy saving in buildings and solar energy production. These initiatives could count on support, where wind energy and biomass so far could not. Support seems strongly intertwined with the Texel Core Values, since plans that (perceivably) conflicted with these values were met with local resistance, while initiatives that were framed around strengthening these values (like the public lighting project) were more successful.

4.1.3 2014 - Now: A period of struggles

The pace in initiatives on Texel started slowing down around 2014 for several reasons. First of all, it turned out that TexelEnergie was starting to have internal struggles. This came to light when in 2014 TexelEnergie went looking for a location for a solar panel park. Initially, a suitable location was found on a piece of grassland next to the Everstekoog water treatment plant, which is owned by the water board HHNK. HHNK had no plans to use that field in the next 20 years. Urgenda's project manager facilitated talks between HHNK and TexelEnergie to use the site and in addition, after the project manager visited the site, he proposed to also put floating solar panels inside the water treatment basin.

"*We wanted to do something with that idea, but we did not have any policies in this area, there was no vision that involved such ideas. Internally, therefore the question was whether it is a task of water boards to generate solar energy? What would be our gain? Initially, we decided that we would help facilitate those solar panels, provided that we would supply the energy to the grid. Our reason for this is the fact that we have signed an energy agreement with the government, which states that 40% of the energy generated by water boards must be green. In practice, though, supplying the net was not possible because that would make us an energy supplier and that is not possible without permission. That raised the question: if we are going to facilitate our land for the municipality of Texel, who will be accounted for the energy? The municipality or HHNK? These kind of internal questions obviously took some time. But in the end we decided to give the go ahead, arguing that we as a government institute should not be blocking a process of sustainability by willing people, even though internally we're not on the same page on everything yet. We looked at the big picture".*
- (Manager Innovation for HHNK, interview)

HHNK agreed to facilitate the desired space, but they had no desire to use the produced energy for themselves because as a governmental institution, they already have cheap energy agreements that were impossible to beat by TexelEnergie. An agreement was set up between the municipality,

TexelEnergie and HHNK that TexelEnergie would rent the space and sell the generated energy to their customers (Interview with Manager Innovation for HHNK).

"We wanted to sign the agreement by the end of 2014. The councilor of the municipality was present, our portfolio holder was present, but TexelEnergie did not come with anyone. After a bit of pressure on my part, it turned out that TexelEnergie was having financial issues; the executive board was even sent away. At that moment we temporarily cancelled the project as we talked to TexelEnergie because our trust in them was slightly harmed. The municipality did seem to want to go further with TexelEnergie but a lot of conversing hence and forth was needed to regain our confidence. In the end, we decided to give the new board of TexelEnergie a chance. The municipality started getting a bit nervous, though. They really started to feel the need to produce volume on Texel in light of their energy ambitions. They therefore proposed to finance some of the solar panels themselves. Finally, it was decided that the municipality would then finance the floating part so that TexelEnergie could focus on existing field-based technology".
- (Manager Innovation for HHNK, interview)

The municipality started tendering for the floating panels project in 2015. The municipality took over this part of the project because it was more expensive and experimental. This way, TexelEnergie could still focus on less risky existing technology on the field next to the basin. Despite the fact that the tendering for the project was open to any interested company, local company Texel4Trading won that tender because they were familiar with the Texel climate ("Texel4Trading plaatst zonnepanelen Everstekoog", 2016). They realized the project in 2016. Meanwhile, because of the delay in the project, the initial application of TexelEnergie for SDE subsidy was revoked and TexelEnergie needed to apply for a new round in 2016. Without SDE subsidy, TexelEnergie would not be able to afford constructing the solar field because the Wadden Fund would not cover all the costs. The most recent data reveals that this application was again rejected in 2016 (TexelEnergie, 2017). It is currently unknown whether the project will still be executed.

Not only TexelEnergie had to take a step back to recover from their internal issues:

"Foundation for Sustainable Texel eventually started bleeding to death the past couple of years, so to speak. The office was getting smaller, people started working just part-time. Everything was becoming diminished. Eventually, it became more or less a volunteer organization, a network organization that organized meetings once a year. Then Urgenda came to Texel and a well-known vision (referring to the Vision Energy for Texel by Urgenda) was formed with a group of people. The people actually found that they had to take over the board of Foundation for Sustainable Texel because they were the "new leaders". The sitting board did not like that at all. That status quo has actually lasted for a while and then it was finally decided to set up TexelTeam2020."
- (Municipal official who was initially involved in TT2020, interview)

"That network turned out to be no longer powerful enough. New things have taken its place, such as Urgenda and Planet Texel."
- (TU Delft professor / one of the founders of Foundation for Sustainable Texel / Texel resident, interview)

Throughout the years the initiatives of Urgenda and TexelEnergie resulted in Foundation for Sustainable Texel taking a step back as the prime initiative taking actor, focusing more on being a small-scale information desk for people and entrepreneurs. Foundation for Sustainable Texel was eventually disbanded in 2015 ("Duurzaam Texel wordt opgeheven", 2015). However even before that, in 2013 a group of local initiative takers organized a new team "TexelTeam 2020" together with Marjan Minnesma, the director of Urgenda. Feeling the pressure of the ambition, they attempted refocus on the task at hand (Interview municipal official). TexelTeam2020 did not last long, however, since the people involved were eventually too busy with their own daily tasks. Marjan Missesma was involved in many other projects for Urgenda, severely limiting her time for TT2020. Two municipal officials who were also involved, had to step out because they felt that they were "wearing too many hats" (Interview municipal official). Being a government official would be a conflict of interest. Other people involved were too busy running their companies to really commit to the team.

"Eventually, the mix of people that were involved just didn't work out. As a result, TT2020 did not achieve much, which I personally find a shame"
- (Municipal official who was initially involved in TT2020, interview)

Meanwhile, Urgenda has also notched down their motivation for initiatives on Texel. They find that Texel started to shift their focus more on water management and safety, and that the councils on the other wadden islands were more willing to cooperate and are more action oriented regarding energy. So Urgenda started focusing more of their attention there[13]. An example where the interaction between Urgenda and the municipality went less smoothly than initially hoped for, is "Project Nesland". The project is a housing project for which a group of senior citizens took the initiative to realize a new housing complex with caring facilities. The project would be executed under collective commissioning. In April 2014 during the second part of the project, Urgenda saw an opportunity to make the complex energy neutral. The project manager of Urgenda sat together with the municipality, local construction companies, Woontij (A housing corporation on Texel) and the collective commission in order to discuss the creation of a zero-gas heating network for the district of 35 houses. The necessary heat demand would be produced by burning wood pellets in a central burner. 15 new houses would be connected in the first instance, the rest in the second instance. Because the other actors were initially reluctant, Urgenda decided to cover the investments, using a loan from the ASN bank. The agreement was that this upfront payment would be paid back by the municipality after completion of the project. This would be financed through the subsidy provided by the energy desk (*energieloket*). The execution of this

[13] This information comes from a presentation that was held by Antoine Maartens, project manager at Urgenda, during a lecture about engineering for sustainable development, in December 2015 at Delft University of Technology

agreement is somewhat debated. According to Urgenda, payback rules were changed halfway through, leaving them still with a gap between what they invested upfront and what they got back from the municipality (interview project manager Urgenda). On the other hand, the municipality claims this was due to the fact that a certain amount of subsidy is based on the energy level result of the houses (interview municipal official, involded in Nesland).

"The agreement was to make the houses completely energy neutral. In reality, the houses that were built just barely reach the EPC 0.4 mark. This means that the amount of subsidy we provided had to be reduced. The reason for the EPC 0.4 result is that not everything that was agreed on advance was ultimately built. The permit included a central heating system that uses wood pellets, which helps significantly in lowering the total EPC value. However, on top of that the use of solar panels would have made sure that the houses would actually reach EPC 0.0. Those solar panels were never built."
- (Municipal official, involved in project Nesland)

Meanwhile, the new residents of Nesland were complaining that the gas system wasn't working properly. The commotion also led to internal arguments between the collective commission members, some of them wanting to just be connected to the regular gas network (Interview project manager Urgenda). In February 2015 the Alderman signed an agreement where Liander (the local energy distribution network manager) was allowed to build a gas net in this area, much to the surprise of urgenda, whose whole point it was to keep the area gas-free (Interview project manager Urgenda).

Not only the previously mentioned actors of change on Texel had their share of struggles. From many of the interviews a mildly pessimistic air could be detected about the current stance with regards to the energy ambitions on Texel. While the large amount of publicity surrounding Texel has led to several large projects that involved actors from abroad, and the municipality is enthusiastic about this attention and their results, not everyone on Texel is positive about these developments.

"In my opinion one mistake that has been made, but that is everyone's fault basically, is that projects were called "successful" way too fast. People kept boasting "we are doing well and we are going to make it" (to 2020). A good example is the fact that Queen Maxima visited Texel to initiate the wood pellet burner from TexelEnergie. This was covered heavily in the local and national media, but I had serious doubts about whether it was so wise to put a pilot, where the end results are so uncertain, in the public spotlights. You end up putting a lot of pressure on everything and at some point it will work against you. I am actually convinced that it has led to a reduction in support for TexelEnergie because the results of the burner disappointed. Boasting success, Texel does not like that."
- (External project coordinator for TexelEnergie, interview)

The pellet burner that this interviewee refers to the central heater that runs on wood pellets. which was built by TexelEnergie in 2014. This installation supplied 94 homes with heat ("Biomassakachel verwarmt 94 Texelse woningen", 2016). However, during that same year the national "Heat Law" was enforced. This law protects consumers against the potential high cost of heat loss in central heating through a set maximum price per warmth unit. Because of this law the heater has resulted in net loss for the energy corporation. Hence, the installation has been discarded in 2017 (TexelEnergie, 2017)

"It's really an island thing I suppose; Texelers do not really like other people telling them how to run their lives, especially when those other people originate from abroad, even though their intentions are really good. For example I know that in De Koog, a lot of support for Planet Texel is missing (I know people in the village commission). What you need to know about that village is that it is THE tourist village on Texel, and that most of its property is owned by the biggest entrepreneurs on the island. And if those guys don't like something, you have a problem. And in fact it is them who feel a bit left out in the whole process. I often heard them say "there we have LA4SALE again". In my opinion the municipality just does not notice or recognize this well enough. The intention and ambition of the municipality is good though. This makes it hard to criticize the initiative."
- (Former TU Delft student, now living on Texel)

And that last remark might be true, since Planet Texel did lead to a revival of the wind debate. Some local frontrunners started to feel that support for wind energy might have taken a turn during the years, so a civilian initiative request was presented to the municipality to ask for a new poll on Texeler's stance on wind energy (Interview with local frontrunner). Unfortunately, this again failed when the majority of the municipal council voted against this initiative ("Geen draagvlakonderzoek windturbines", 2016). This is another block for the contribution of wind energy in the process of change in the energy system while the ambitions cannot be met without the use of windmills (van Weerdhof, 2011). Meanwhile, 2020 is coming fast.

The period after 2014 marks a period of setbacks for the pace of initiatives on Texel. With Foundation for Sustainable Texel having been closed down, the follow up TexelTeam2020 failing to take over their spirit, TexelEnergie needing to take a step back due to financial problems and Urgenda focusing most of their attention to the other Wadden islands, it seems that the period is surrounded by a lot of negativity. However, there are still plans ongoing, such as the much debated bio-fermenting installation, which the municipality still plans to build ("Biovergister: Geen belemmeringen door milieuaspecten", 2017) and TexelEnergie is still intent on installing their solar park at Everstekoog. However, it remains to be seen whether the ambitions for 2020 will be reached in time.

4.2 Description of the governance of change in the Water System

From Chapter 3 we learned that the nature of the water system is quite different from the energy system. Almost everything related to water on Texel is primarily driven by governmental actors, whose tasks are to provide commodities (drinking water) and services (waste water treatment, rainwater drainage, etc.) that benefit the public good. Because of this, the governance of change in this system happened differently as well, as we will see in this chapter.

It is important to note here that the ambition manifest, the initial base for writing this thesis, the part that describes the ambition for water expatiates strongly on *drinking* water. This is only a small part of the whole socio-technical water system. However, the ambition manifest speaks in general about "complete self-sufficiency", meaning that all the energy- and water needs will need to be found or produced on the island itself. Therefore, this chapter on the governance of change in the socio-technical water system focuses on all aspects of water: drinking water production, waste water management and fresh water (rainwater) management.

Again, the starting point is 2000, where the water boards, province and municipality just agreed to improve cooperation to increase the efficiency of water management by formalizing a Masterplan.

Governmental actors collaborate through a shared Masterplan

As mentioned, the municipality of Texel, the water boards "Hollands Kroon" and "Hoogheemraadschap Uitwaterende Sluizen" and the province Noord-Holland were already in the process of collaborating with the intent to jointly improve management of the water system. In 2000 they just finished an exploratory phase for the "Masterplan Water for Texel" where an inventory of ongoing and planned projects and the needs of the actors were mapped (Schurink, 2000) Table 4.1 shows an overview of their main interests.. As a result, the four involved governmental actors signed an intentional agreement in February 2000, officially kicking off the project "Masterplan Water for Texel" ("Masterplan Water voor Texel is gereed", 2001).

Table 4.1: Actors cooperating in the master plan and their interests

Governmental actor	Interests
Municipality of Texel	Sustainable island
	Lowering cost for sewage system in countryside
	Preventing sewage spills
	Separated sewage systems
	Better infiltration of rainwater into the ground water
Waterboard "Hollands Kroon"	Using effluent of the wastewater treatment facilities on Texel
	Helping agriculture with their drought problem in the summer
	More concrete plans for nature/water management
Waterboard "Hoogheemraadschap Uitwaterende Sluizen"	Optimizing the waste water chain at lowest possible public costs
	Using effluent of the wastewater treatment facilities on Texel
	Water quality befitting the natural surroundings, enough water in the ditches
Province	Sustainable development of buildings, agriculture, nature, tourism
	Wants to coordinate area-focused governance
PWN	Wants to keep supplying drinking water through the dual pipeline

The actors involved in the Masterplan were not just these governmental institutions; a number of social organizations and citizens were also involved within the Master Plan and formed a sounding board for the project. Actors involved in this board were representatives for agriculture (Western Agriculture- and Horticultural Organization (Westelijke Landbouw- en Tuinbouworganisatie, WLTO)) for natural areas (Forestry Commission (Staatsbosbeheer), Association for Agricultural Nature, Association of Nature Monuments) and tourism (VVV/Recron and the Texels Association for Accommodation Providers (Texelse Vereniging voor Logiesverstrekkers, TVL)). The agricultural sector's main concerns were the water levels, preferring too dry over too wet, and wishes extra fresh water to be available during the summers. Nature associations are also concerned with the water levels, and its impact on nature. Low water levels in the polders damage nature according to them. Maintaining the cultural landscape is also high on their agenda. The tourism industry underlines the importance of nature being important for tourism attraction (Schurink, 2000).

With a large geohydrological study finished in July 2000 (Groot Geohydrologisch Onderzoek Texel, 2000) a lot of knowledge was gained about the natural water flows on Texel. This was necessary for the next phase: a period of planning started in the "program phase" of the Masterplan, which was initialized by the four initiative takes of the Masterplan during the first formal meeting in May 2000. A short-term project plan was formalized for 2001-2003 (“Masterplan Water voor Texel - Projectenprogramma 2003 - 2006,” 2003). This involved, firstly, the preparation of duinrells to improve retention of sweet (rain) water that seeps from the dunes to the polder areas. The people on Texel were involved in the creation of these projects through discussion sessions. All of the projects were planned to start in 2001 and most of the funding was covered by the province under the SGB subsidy (SGB =

Subsidie Gebiedsgericht Beleid, in English: Subsidy for Area-focused Policy) ("Texelse waterprojecten goed bedeeld met subsidie", 2001) The rest of the costs were divided between the initiative takers and depended on the project. Some were divided evenly but others were paid fully by the actor that is responsible for a certain project. The Masterplan was celebrated and "officially" opened after the first duinrell project was successfully completed ("Opening Ploegelanden en start Masterplan Water", 2001).

Shortly thereafter other projects started, such as a water level measuring program at selected farmer's sites. The province initiated this in order to gain knowledge on how to improve local sweet water storage on Texel for the purpose of improving farming conditions for agriculture on the island (Bos, van Wee, & Steenis, 2003). On a larger scale, the governmental actors realized that important information about the workings of the water chain and systems were still unknown. Research was needed to find out where bottlenecks could be found and improvements could be made. Two research projects were therefore initiated. Firstly, a water system analysis and secondly, an optimization study for the water chain would be done by a waste water chain company together with the municipality ("Masterplan Water voor Texel - Projectenprogramma 2003 - 2006," 2003).

In 2003, the master plan entered its execution phase for long-term projects. The optimization study of the water chain by HHNK and the municipality resulted in a plan to centralize the waste water treatment and to dismantle the smallest, oldest water treatment plants located at Oudeschild and 't Horntje ("Masterplan Water voor Texel - Projectenprogramma 2003 - 2006," 2003). The results of the water system study was also available and provided a basis for the waterboards and the municipality to further shape their desired developments in water (chain) management on Texel. Some of the aforementioned short-term projects were finished or still ongoing. The "Boer en Water" project showed promising results at the farmer sites, showing that fine-tuning water level management on a company-level has a positive effect on their production. So HHNK expanded the project at four more farmer sites, expanding the measuring network in order to follow the flow between salt/sweet water lenses. (Bos et al., 2003). A complete project plan for 2003-2006 was established, for which Texel was divided into four polder areas of interest (See the information box on page 20).

Information Box: The project plan 2003-2006

Most of the project plans from the program are listed below ("Masterplan Water voor Texel - Projectenprogramma 2003 - 2006," 2003)).

Eierland area

The whole polder is planned to be revised in order to better facilitate agrarian ground use. In the winter there are problems with excess water, while during the summer period there is a shortage of fresh water for crops. The natural area "Roggesloot" needs a better separation of sweet and salt water in order to flourish, meaning that sweet water drainage routes need to be changed. Another project involves the water treatment facility De Cocksdorp. The installation cannot cope with the increased inflow of waste water during the summer, which negatively impacts the quality of the processed water. Furthermore, near this installation is an important breeding ground for "Lepelaar" birds (a protected species). In order to create a good climate for them, stickleback fish are lured by a freshwater stream that is pumped out from the polders towards the Wadden Sea. 400 m^3 of water is used per day. During scarce water periods in the summer, this stream sometimes has to be stopped. Therefore, a study is performed to see whether addition of a helofyte filter can improve the waste water enough to use the effluent for this purpose (Jak, Kampf, Foekema, & van Dokkum, 2003).

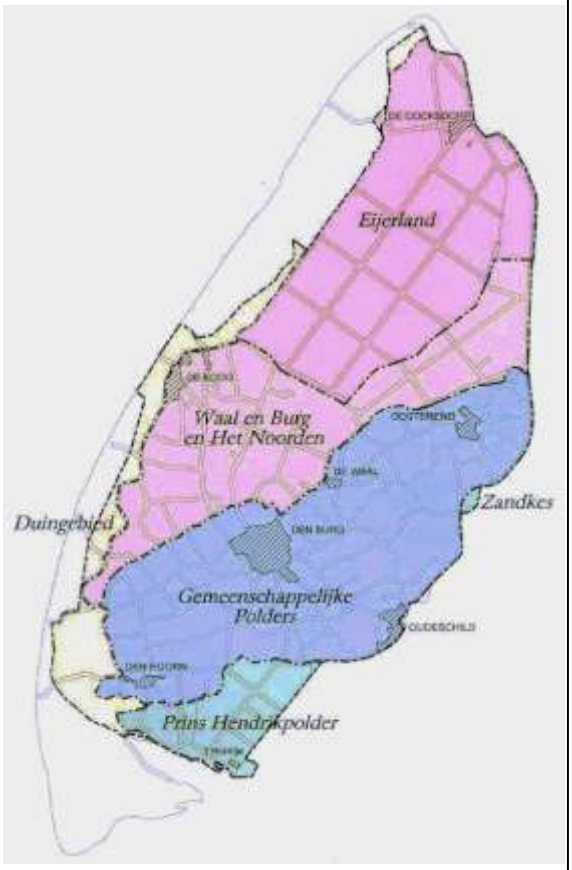

Figure 13: Polder areas on Texel

Waal & Burg en Het Noorden area

Next to "nature friendly" riverbanks and the still ongoing drought prevention in "De Bol" area, the earlier studies from the "Boer en Water" projects results into the wish to further study variable water level management through "smart stows" (slimme stuwen) in order to improve agricultural ground for farming.

In this polder lies RWZI Everstekoog. This plant will be extended in order to cope with the additional waste water that results from closing Oudeschild and 't Horntje. The helophyte filter will also be expanded. In the water analysis it was pointed out that the resulting water is best exploited by sending it through the southern route in order to battle the water shortage in Waal and Burg and Gemeenschappelijke Polders. Furthermore, the current outflow of Everstekoog is negatively impacting the natural areas in the polder, which require a brackish environment, making the reroute a win-win situation.

Gemeenschappelijke Polders and *Prins Hendrik Polder*

These polders will also get nature friendly riverbanks and since the Gemeenschappelijke Polders contains the most overflows from combined sewage, this will be dealt with. The main issue in Prins Hendrik Polder is the salinity level of the surface water which damages the parcels around it. A proposal will be made to solve this.

Masterplan becomes central part of daily policy

What is clear is that the master plan was executed quite project-like, organized by the governmental bodies that dealt with water management. Projects were done in collaboration with social actors, and this process went rather smoothly as no signs of opposition could be traced during this research, except for two major projects. The first is the construction of a new sewage system in the countryside by the municipality, and the second is the centralization of the waste water treatment systems by HHNK. These governance processes are discussed in more detail in the following sub-sections.

In September 2002 the province installed the Texel Area Committee (Gebiedscommissie Texel) in which the Masterplan project group became one of three sub-committees ("Gedeputeerde installeert Gebiedscommissie Texel", 2002). The Area Committee would be supervised by the province and the two water boards. One of the goals of the installment of the region board was to make projects and subsidies more transparent and easier to manage. A lot of projects qualified for SGB subsidy (Subsidieregeling Gebiedsgericht Beleid), a provincial subsidy for the environmental development of local areas in terms of economy, tourism and sustainability. This subsidy ran from 2001-2004 ("wetten.nl - Regeling - Subsidieregeling gebiedsgericht milieubeleid 2001 - BWBR0012594", 2017). Figure 14 shows an overview of the management of the Masterplan from this point. The support group contains the actors that were formerly in the sounding board.

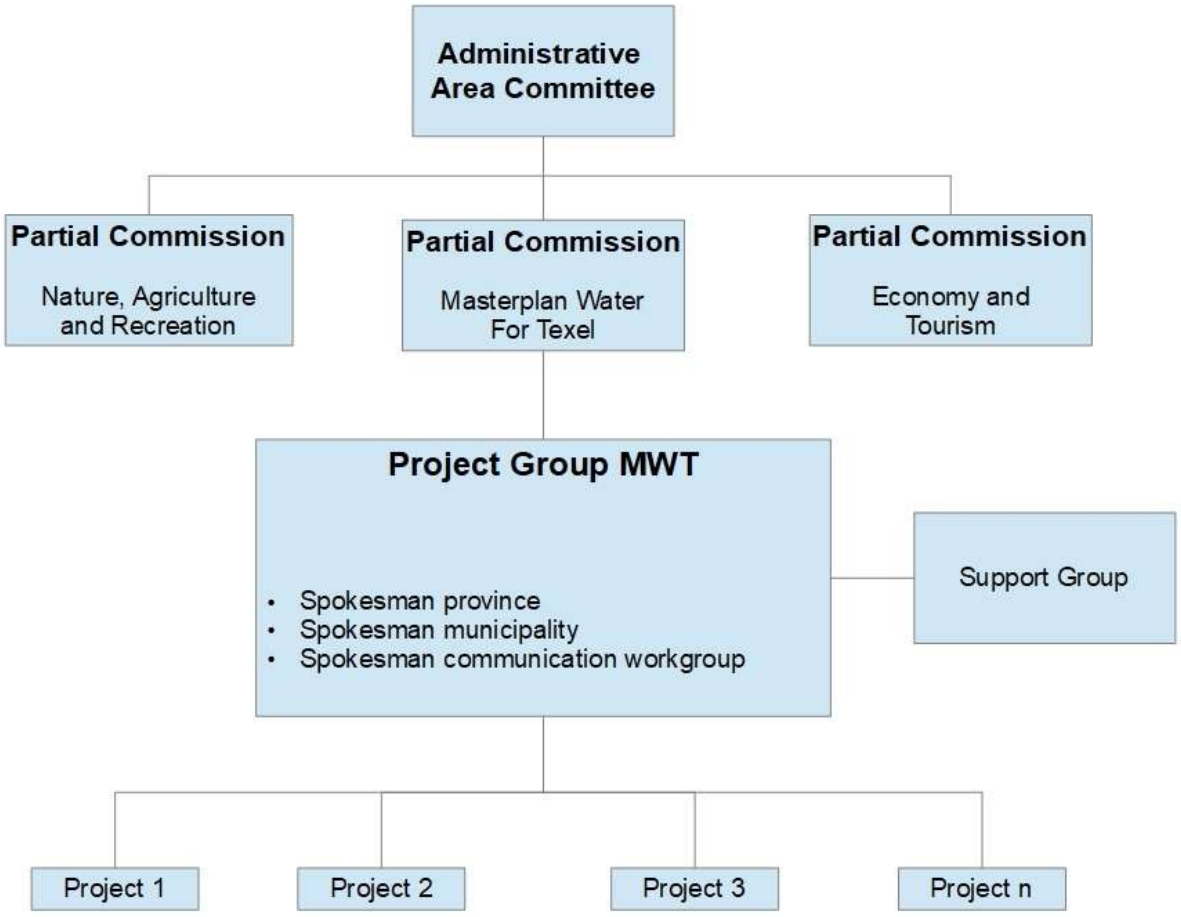

Figure 14: Organizational structure of the Texel Area Committee and project group MWT

Meanwhile, there were two changes in the organization of the master plan project group. First of all, as of the 1st of January of 2003, all the water boards in the province Noord-Holland are fused into "Hoogheemraadschap Hollands Noorderkwartier" (HHNK). The initiative for this lies with the province, who wanted a single, all-in water board with clearer tasks, partially to reduce overhead costs ("Fusie waterschappen in staten", 2002) Furthermore, the water boards themselves were also on page with the province, agreeing that a single water board would create large administrative power to be able to better serve the interests of the water system through governance. The merger also offered more possibilities for specialization and quality improvement of the water board ("Voordracht 25: Fusie Waterschappen in Hollands Noorderkwartier", 2012). Secondly, the fusion required some new agreements about the way the water board would handle the program coordination, process guidance and management of the various projects. The province handed over the full coordination of the Masterplan to the newly formed HHNK ("Masterplan Water voor Texel - Projectenprogramma 2003 - 2006," 2003).

Because of this, HHNK became the largest actor with regards to the projects for Texel. The project program contained a total of 45 projects of which 36 were to be executed by HHNK, 4 by the municipality, 1 by the province and 4 by external parties. The province only handled the creation of "natural banks" in secondary waterways. External parties were concerned with renovating water elements that were part of cultural history and with developing small natural areas on Texel. HHNK managed the brunt of the work, including closing down several RWZI's and expanding/improving others.

The process around installing sewage systems in the countryside

During the Masterplan, for the water system the municipality was primarily concerned with projects to reduce sewage water overflows by connecting the countryside to the main sewage system ("Aanleg riolering buitengebied start bij duinrand", 2001). This was planned to commence in 2001 because waste discharge on surface water would be nationally prohibited by 2005. However, the project was delayed because a lot of questions were raised by house owners and companies in the countryside about the costs of connecting to the planned sewage system. Some house owners were concerned that they might have to pay different amounts depending on the time that it would be their turn to get connected ("Bewoners buitengebied ongerust op betaling riolering", 2001), while TVL (Texel's Association for Accommodation Providers) protested against the fact that some entrepreneurs had to pay more, depending on how many holiday houses one owned. The costs for every holiday house would be stacked, leading to exorbitant costs for some entrepreneurs. The municipality planned to charge €3000 per household and €6000 for a commercial building for their connection to the sewage system, which would be mandatory. The €3000 fee would also be charged for every holiday house, creating potential huge costs for several of the lodging businesses. TVL proposed to increase the sewage taxes for everyone instead, in order to ease this burden. They claimed that only a couple of cents increase could be enough to pay for the project ("TVL: Aansluitingskosten riolering buitensporig", 2002). Politics were also divided on the matter, D66 finding the prospected cost of 23 million for just 1100 connections way too high ("Jan Hennink wil alternatief voor duur rioleringssysteem", 2001). Waterboard "Uitwaterende Sluizen" therefore proposed a plan where the municipality would buy individual water treatment

systems for every resident in the countryside. The municipality would then own them and the water board would manage and perform their maintenance. The municipality rejected that plan, disputing the quality of these individual treatment systems ("Texel zet vraagtekens bij alternatief rioleringsplan", 2001). Both TVL as well as the municipality sought legal counsel about the project ("TVL inventariseert landelijk beleid rioleringskosten", 2003).

Uncertainty about the costs for house owners and entrepreneurs remained ("Kosten van rioolaansluiting opnieuw op de agenda", 2004) but the municipality, convinced that there were no juridical problems, finally started the project in September 2005 ("Megaproject aanleg riolering buitengebied gestart", 2005). The project decided to connect 350 of the total 700 lots to the main sewage system, because the rest of the lots were too far away from the main system, which would make connecting them too expensive to make it mandatory. They would have to use septic tanks or private wastewater treatment units. However, the municipality still wanted to minimize the use of septic tanks, so in an attempt to encourage the owners of those lots to connect voluntarily, they offered to compensate 25% of the costs to connect to the new sewer system ("Vrijwillig op het riool: gemeente betaalt een kwart", 2006).

During the project, in 2005 the municipality and HHNK also signed a "waste water treaty". HHNK planned to do this with every municipality in its working area, though Texel was the first because of their ongoing successful cooperation in the master plan, of which this is also a part ("Texel en Hoogheemraadschap gaan samenwerken", 2005). Cooperation would drastically lower construction and maintenance costs for both partoes, because while the municipality worked on constructing new sewer pipes, HHNK simultaneously worked on constructing pressure pipes from these areas in order to connect them to the waste treatment facilities ("Wethouder geeft startsein riolering buitengebied", 2005).

HHNK and the municipality also worked together in other parts of Texel, where the municipality would install separated sewage systems there where maintenance was required anyway. This would not only reduce water nuisance during heavy rainfall, it would also decrease the load on HHNK's water treatment facilities (Basis Rioleringsplan Texel, 2008).

By 2008 the installation of the sewers in the countryside was nearly completed. The municipality hadn't yet concluded an agreement for the payment of all the households and entrepreneurs; about half of them had paid off their part. For the rest, the municipality had installed a regulation for increased betterment levy (baatbelasting) ("Baatbelasting voor riolering in het buitengebied", 2008). The maintenance of the sewers in other parts of Texel, and the installation of seperated systems, also led to a large increase in sewer taxes (from 159 euros per year per connection to 269 euros per year)**.** The municipality claimed it was more or less forced to do this, since the fund for sewer investments is more than 1.5 million short, and stricter accountancy regulations force the municipality to deal with this immediately ("Rioolbelasting vanaf volgend jaar fors omhoog", 2008). HHNK covered its costs for the pressure pipes in the area by increasing their sewer taxes.

The ambition manifesto, the end of the masterplan and the post-masterplan period

Next to an energy ambition, the ambition manifesto als expressed an ambition about water. It stated that the Wadden islands strive for a sustainable and self-sufficient (drinking) water supply, arguing that being dependent on the mainland for drinking water "is full of cons and risky" (although it doesn't

mention why) and therefore maximum effort needs to be put into reducing this dependency. The manifesto did not mention any plans on how to do so, however, and even states that both the energy as well as the water ambitions are huge, and "surpasses the capacity of the island municipal organizations, yet we are convinced that we need to do this" (De vijf Waddeneilanden, 2007, p.7).

"We strive for sustainable development on our islands. A development in which the care of the special nature and the environment is paramount, with the uniqueness of each island is maintained and fully exploited and which decreases the dependence on supply from the mainland. As a region, where the natural values are so strong and economically dependent on tourism, we consider such sustainable development strongly desirable for our future, if not necessary. With sustainable development we also explicitly strive for a healthy, thriving island economy." (De vijf Waddeneilanden, 2007, p.6)

However, most of the initiatives concerning water after 2007 were still based on the Masterplan, the content of which was not concerned with new methods for drinking water on the island. HHNK was the actor that was mostly involved in initiatives concerning water, both during the masterplan and after. Their biggest influence on the water system was the centralization of the waste water management. After the optimization study which was part of the Masterplan, HHNK systematically worked from having five different waste water treatments plant on Texel towards a single waste water facility at Everstekoog in 2012. 't Horntje and Oudeschild were closed down in 2007 and 2009. In July, the municipal council edited the destination plan for the RWZI Everstekoog in order to make it possible for HHNK to expand the installation and centralize water treatment in that facility. Before that, the area fell under the destination plan of the countryside (buitengebied) which did not allow the construction of water treatment facilities. This was initially not uncontested, since a local farmer and the political party "GroenLinks" were concerned about the influence of medicine leftovers and hormones in the effluent, which are near the former's farming lands. Ultimately the Council of State looked into it and gave clearance in favor of expanding the treatment plant, convinced by HHNK that medicine and hormones only become a concern with hospitals nearby, which isn't the case (Texelse Courant, 2012). The construction started in 2011 ("Nieuwe zuivering: efficientere afvalwaterverwerking", 2011) and finished in 2012, after which the old and obsolete treatment facilities were deconstructed in 2013 ("Overbodige oude rioolwaterzuiveringen ontmanteld", 2013). The effluent of the waste water plant was (and is still) used to alleviate some of the drought in the polders during the summer.

"Drinking water is a bit of a separate track within the ambitions of the municipality. I must admit that much less attention is paid to this on Texel."
- (Municipal official, interview)

Other than the masterplan, little other initiatives concerning water could be traced. With the official closing of the Masterplan Water for Texel in 2010 ("Van Masterplan Water Texel naar Klimaatplan Texel?", 2010) it seems that the governmental bodies continued business as usual, HHNK still being busy with renovating Everstekoog and the municipality getting adjusted to the new tasks that came with the introduction of the "Water Act" in 2009. Through this new law, the municipality became responsible for ground- and rainwater management in urban areas. Furthermore, they became the first

contact for any individual or company that required a permit for water-related activities. In the old situation, different permits were often necessary for a single activity. This changed to a single permit with the addition of "Wabo" ("Wet algemene bepalingen omgevingsrecht) for which the municipality was also now the first point of contact. The municipality would have to make sure that any request is forwarded to the necessary parties.

Salinization and drought was still reality on Texel, however. A local farmer therefore took the initiative to set up a research company in 2008, studying the salt tolerance of existing common agricultural crops. Right now this company is known worldwide for its knowledge on farming on salty ground, and research projects have developed all over the world. Other than that, Foundation for Sustainable Texel tried to attract attention to water saving, handing out free water saving plugs to all 6000 households on Texel. They estimate to save 18.000 m^3 water and 54.000 m^3 of gas on Texel with these plugs ("Duurzaam Texel deelt waterbespaarders uit", 2010). Furthermore, the province starts a 3-year pilot on Texel about self-sufficient freshwater storage. The province wants to contribute to possible solutions for expected freshwater shortages in the future. The purpose of the experiment was to elaborate a way that farmers can provide for their freshwater needs and thus be able to bridge a dry period. The pilot was in collaboration with a local farmer and ended in 2015. The province uses the results to provide a calculation tool for farmers to see whether investing in local water storage is useful for them.

A first effort since 2007 to give substance to the ambition manifesto is done by the municipality, who issued a study for the water footprint of Texel (Boonekamp, Van Dalen, & Prinsen, 2012). The goal of this study was to map the water streams on Texel and find out where potential bottlenecks or improvements could be made to make it more efficient. Striking is the fact that on the very first page, the report mentions that the municipality, despite the manifesto, does not necessarily aspire to have a fully self-sufficient water system and instead primarily focuses on the energy ambitions. However, discussion about the need for self-sufficiency started up again In June 2013, when one of PWN's two drinking water pipelines to Texel ruptured. While the second pipeline should be able to provide enough drinking water for the inhabitants and the additional 45.000 tourists (they use around 4500 m^3 of water on a daily basis) though due to the expected continuing heat wave in late July, PWN decided to send ten tankers with 30.000 liters of drinking water each, twice per day. Additionally, a temporary mobile Reverse Osmosis water plant was placed in Den Burg.

In response to the incident, the D66 fraction of the municipal council wished to find out whether it is possible to produce drinking water on the island in order to prevent another such problem in the future, putting the ambition back on the political agenda. The council agrees that a feasibility study is desired ("Texel moet voorzien in eigen drinkwater", 2013). TNO was commissioned to do this. The resulting report (Feenstra, Medevoort, & Kuipers, 2014) concludes that producing drinking water on the island is not economically feasible at the moment. Therefore, after consulting with the municipality, PWN decided to replace the current water pipes with new ones that will be deeper under the seafloor, making them more fool-proof.

"From there the municipality indicated that they still had an ambition in the field of water. So it was a good time to look at it. The quantities and physical resources to buffer short-term water and to use the

precipitation surplus have been looked at. That was not a possible on the short term, however. Then TNO did research into the feasibility of desalination plants. It appeared that that, for now, is also no option because of the fact that there are no residual heat streams available on Texel. If there were, then it might have been feasible. In short, an alternative was not there and so now a new water pipeline is coming. That's a long term commitment that we have now undergone, so we're stuck with it for the moment."
- Municipal official, interview

The pipelines have been completed just recently ("Drinkwater op grote diepte van Den Helder naar Texel", 2017).

Initiatives with regards to water are still ongoing. Early 2014, representatives from the agrarian sector, nature conservationists, recreation, the municipality of Texel, the province and HHNK came together for a field trial regarding water management on Texel. The rising concern about the effects of climate change on the island was the main incentive to start this up (TexelWater, 2015). A number of parties that are in any way involved with water on Texel joined together to form a collaborative platform called "TexelWater". Together they signed a manifesto that stated two goals: 1) to keep optimizing the sweet water system on Texel and 2) to make texel more resistant to the rising sea level. To this day, the platform is busy with initiatives like guest lessons on schools to raise awareness (HHNK), setting up a voluntary salt concentration measuring network (agrarian sector and HHNK) and developing salt-separating dams (agrarian sector)("Lopende initiatieven - Texel Water", 2017).

4.3: The governance of change at Texel

In this section, the sub question "*Who and what drives change on Texel*?" will be answered based on the description of the process of governance of change in the energy- and water systems from section 4.1 and 4.2. To explain the answer to this question, the governance processes of both systems will be interpreted by using the concepts Actors, Instruments and Legitimacy.

4.3.1: The governance of change in the socio-technical energy system

The system description in Chapter 3 showed several observations. First of all, the actor network started out less complex than it is now, because the energy market was closed and a single large energy company (NUON) supplied all of Texel's energy. Secondly, while sustainability seemed to be present on the political and societal agenda, in 2000 there was yet a lack of a shared vision and intention for change towards a sustainable energy system. Lastly, the system now shows that solar power is the dominant renewable energy technology on Texel, and that a lot of investments have been done in energy saving methods.

Looking at the described governance process of the socio-technical energy system, signs are observed that indicate that change was governed through legitimacy for technology. Between 2000 and 2004 incentives for sustainable initiatives were economically motivated and were initially also approached that way by Foundation for Sustainable Texel. The sustainable building fair and the introduction of the "milieubarometer" are examples of that.

In other cases legitimacy claims about technology were instrumentally used to change the direction of governance of change. Two cases substantiate this observation, the first of which was when the tourist industry, forestry commission and local inhabitants used the core values to present windmills in a negative daylight. The second case was when local inhabitants did the same thing with the plans for a bio-fermenting installation that a local farmer proposed and the municipality initially supported. For these reasons, wind energy and biomass remained controversial on Texel. Therefore, the municipality, Foundation for Sustainable Texel or the local farmer could not gather enough support for these technologies even while expert reports clearly stated that the ambitions cannot be reached without them.

Support for change plays a clear role in the socio-technical energy system because of the system's decentralized nature; the liberalization of the energy market provided an opportunity for social actors to take initiative for change in terms of renewable energy production in this system. And there where sustainable initiatives and technology promoted an added value to the core principles, support could be observed. Exemplary are the public lighting project by the municipality and the foundation of TexelEnergie. The latter example especially could not (and evidently did not) happen when the market was still closed and shows how the initiative of one policy entrepreneur (the local Labour Party (PvdA) politician who revitalized the idea for Texel's own energy company) led to a shared initiative for change.

Change thus accepted as long as it fit within the boundaries of the Texel Core Values. As a result, there was no support for measures that were meant to contribute to the sustainability ambition, but that were seen as harmful to tourism, the cultural landscape or the peace and quiet on the island. Ultimately, these Texel Core Principles seem to be a knife that cut on two sides. One the one side, they provide a clear set of rules to follow on the island which has a unifying effect when they are maintained.

On the other side, they strongly inhibited the use of proven policy and technology as a means to reach the ambition for 2020.

Because of the lack of support for wind energy and biomass, from 2007 onward change was governed by TexelEnergie and Urgenda through small scale projects that mainly focused on saving energy in the building sector and through utilizing and promoting solar panels. The wadden fund was instrumental in that regard, providing an opportunity to receive investments for these initiatives. The municipality took on a supportive role by utilizing other financial instruments (i.e. provincial subsidy through the energy desk) to encourage people to follow these examples, and through legal support (i.e. altering zoning plans and providing licenses) and ultimately by taking over a solar project from TexelEnergie. A mixture of the initial success of TexelEnergie, the projects from Urgenda (both of which are heavily promoted), the abundance of financial instruments (Waddenfonds, SDE subsidy, Twin-H grand, the government innovation funds) and Texel's image as a sustainable testing garden ultimately attracted larger actors. Through their success strongly depended on the support and enthusiasm of the local inhabitants. For example, "Cloud Texel" was a big success but Planet Texel incited mixed reactions.

It can be concluded that even though there is still a long way to go to reach the ambition for 2020, most of the already achieved renewable energy production capacity is the merit of TexelEnergie. This makes it ironic that while the creation of more production volume is increasingly pressing, initiatives actually have reached a slower pace when it turned out that TexelEnergie was not doing too well, together with Urgenda slowly backing out because they see more opportunities to reach their goals elsewhere. This has lead to the municipality taking more initiative themselves (taking over the solar panel project with HHNK). Whether the ambitions will be met remains to be seen, though Planet Texel does provide future prospects to look forward to. However, striking a balance between the Texel Core Values and the energy ambition remains a complex matter.

4.3.2: The governance of change in the socio-technical water system

Where change in the energy system was primarily governed by societal actors, in the socio-technical water system of Texel it were governmental actors (water board HHNK and its predecessors, the municipality and the province) that governed change. The centralized power structure of these governmental actors resulted in change happening through existing conventions and institutions. In 2000 the Master Plan Water for Texel was just taking shape. This master plan was established by these three actors because they shared a goal to find ways for a more integrated and cooperative approach to the management of fresh water and waste water on Texel.

Change was not governed through legitimacy like in the energy system, because issues concerning fresh water were shared concerns among the majority of (societal and governmental) actors on Texel. Fresh water is a basic necessity for the second largest sector on Texel: agriculture. So their involvement in plot projects by the province was to be expected. Initiatives that appeared later, such as the "Zilte Teelt" project, originated from an urgency to adjust to the landscape of Texel. This was not the case for energy, since energy supply is basically a common good on Texel and whether it's green energy or not, it's always there.

Therefore, support for change did not play as profound a role as it did in the energy system, although legitimacy for change naturally was also a prerequisite for the collaboration between the different governmental actors. Instead, change initiated around available technical and legal

opportunity structures. The first of which was the fact that the smaller water treatment plants were in need of renovation. The second opportunity structure was the existing national law that all households should be connected to a sewer system by 2005. The governance of change in the water system proved to be a less complex process than that of energy, first of all because water management was primarily the task of governmental institutions. The role of every actor within the system was clear, especially after the Water Act in 2009. Change in the water system was therefore characterized as project-like and went relatively smooth and straightforward. Only the municipality had some trouble adjusting to their new tasks, and ran into difficulties with local inhabitants during the installation of a sewage system in the countryside. However, this difficulty was merely related to uncertainty around the costs for the inhabitants and businesses residing there. The Texel Core Values did not play a role in this case; installing a sewer system was legally required and because it is the responsibility of governmental institutions, support for this did not play a role.

Secondly, Texel already has a long history with water and everyone on the island knows how important sweet water is for Texel, especially during summer periods. This made support for initiatives in this regard a lot easier to gain, because the "need" for change in the energy system was not as profoundly accepted as is for water. The founding of the "Texelwater" platform backs this statement.

A more diffuse approach to change appeared when the Masterplan closed down and the focus of actors changed from just making sweet water and waste water management more efficient, towards keeping the island safe from the impacts of climate change.

The actors involved in the master plan were mostly focused on fresh water (rainwater) and waste water management. A surprising observation, then, is that the ambition manifesto mainly focuses on achieving a self-sufficient *drinking* water system on Texel. However, as far as was observed, minimal effort was put in the realization of this goal. Only when one of PWN's water pipelines broke in 2013, an opportunity was taken by the municipality to look at the feasibility of this ambition. In the end, however, producing water on the island was entirely dismissed and instead PWN installed a completely new pipeline to deliver drinking water to Texel. Apparently, the drinking water ambition was and/or is not considered as urgent as the energy ambition; from the social community, no policy entrepreneurs or front runners were identified that would lobby for this ambition, contrary to what happened in the energy system with the foundation of TexelEnergie, for example. An explanation for this is that this part of the socio-technical system did (and does) not provide an opportunity for anyone to start their own drinking water company in the first place; the market for drinking water is closed and strictly regulated by the government. Furthermore, it makes sense that initiative should not be expected from the actor responsible for drinking water (PWN) either, since their interest is to serve the public good in the most efficient and economically feasible way possible. The maximum price of drinking water is also regulated by the Dutch government.

Chapter 5: Applying the framework: Strategies in the governance of change in Texel

Introduction

From chapter 4 it became clear that the processes of governance of change in the socio-technical energy- and water systems developed in different ways. In the energy system, change initiated through three societal actors (Foundation for Sustainable Texel, Urgenda and TexelEnergie) where the success of incentives was largely dependent on societal support and acceptance (legitimacy) and the Texel Core Values played a prominent role (culture).

In contrast to the energy system, the process of governance of change in the water system was based on the centralized power of few governmental institutions. Societal actors were not completely out of the picture, though change occurred through existing conventions and institutions and was driven by governmental actors who had a mutual wish to improve efficiency in water management. A master plan originated from 2000 and the ambition manifesto came later. It was only after the finalization of the master plan that a more diffuse approach appeared through the foundation of the TexelWater platform. However, this platform still includes the same actors among societal actors.

In chapter 2 it was explained that the framework to analyze these processes of governance of change centralizes around three concepts "Actors", "Instruments" and "Legitimacy". This was further expanded with the concept of *strategies* that explain interaction between actors and the way they utilize instruments and opportunity structures, and gain support, leading to system change. In this chapter, the analytical framework will be applied to the process of governance of change that was described in chapter 4, focusing on these strategies in order to learn which ones were successful or not, and why. From this, we may gain new insights about the governance of change (sub-question 4). The socio-technical energy- and water systems will be analyzed through this framework in section 5.1 and 5.2 respectively. After that, section 5.3 discusses the impact of strategies on the governance of change.

5.1 Analysis of the governance of change in the energy system

5.1.1 How Foundation for Sustainable Texel steered legitimacy

As mentioned earlier, Foundation for Sustainable Texel has played an important role in the process of governance of change during the first years of this case study. Furthermore, legitimacy was a fundamental part of this process, because sustainability was still generally considered a "niche" idea or activity during these days. In that regard, several strategies were successfully utilized by Foundation for Sustainable Texel which resulted in increased awareness and acceptance about sustainability in general and the creation of a vision that was ultimately adopted by the municipality.

The first strategy revolves around knowledge sharing. Foundation for Sustainable Texel managed to build up awareness around sustainability by acting as a knowledge broker for sustainable ideas and initiatives. This was done by attracting knowledge from overseas knowledge institutes like ECN, bringing that to Texel to share with the inhabitants and entrepreneurs of Texel. Knowledge sharing was an effective strategy to gradually increase acceptance for the work of the foundation, and was strengthened by introducing sustainable projects as (financial) opportunities. Hence, part of the early success by Foundation for Sustainable Texel that induced change in the energy system was due to the

fact that Foundation for Sustainable Texel framed sustainable initiatives in a way that made people and entrepreneurs believe that they had something to gain from it (mostly financially, for example the "milieubarometer").

Second, Foundation for Sustainable Texel successfully managed to gain support for their sustainable ideas by organizing credibility. The foundation was initially represented by spokesmen from the large companies on Texel, providing a large base of support for its initiatives. Vice versa, the positive attention that Foundation for Sustainable Texel enjoyed through its sustainable projects (such as rewards for social corporate responsibility) had a positive effect on the "green" image of the entrepreneurs that were involved. Hence, Foundation for Sustainable Texel managed to "hitchhike" on the reputation of a few influential entrepreneurs, ultimately leading to a reinforcing causal loop of positive influence that led to a mutual beneficial relationship between Foundation for Sustainable Texel and the firms that it represented.

Third, Foundation for Sustainable Texel partially depended on financial support from the municipality. So in order to maintain this internal mutually beneficial relation, it was important that the foundation captured and held the support of the municipality. The report by Ecofys in 2001 provided an instrument for Foundation for Sustainable Texel to align their goal with the municipality. Foundation for Sustainable Texel therefore played an important role in putting sustainability more firmly on the political (municipal) agenda, by lobbying for the adaptation of this vision for 2030. Timing of the act of lobbying was important here as well, because at the time the alderman was a proactive member of left-wing political party GroenLinks (Green Left). This political party desires sustainable growth. This alderman was also involved in the working group before it became Foundation for Sustainable Texel, possibly providing Foundation for Sustainable Texel with an opportunity structure: a short communication line between the foundation and the municipality, and perhaps even a spokesman for sustainability on behalf of the foundation. Through the adaptation of the energy vision by the municipality, Foundation for Sustainable Texel was more or less safe in assuming that they could continue their work.

Concluding, the first years if this case study revolved around Foundation for Sustainable Texel building up legitimacy to "break the energy system open" for change. This happened through three interdependent strategies that targeted the awareness and the support of different groups of actors. First of all, knowledge sharing influenced the awareness of people on Texel. Secondly, Foundation for Sustainable Texel "hitchhiking" along with the influence of the few respected spokesmen that represented both the foundation as well as big firms on Texel, created support among entrepreneurs. However, awareness and support alone do not lead to change. So lastly, the lobby by Foundation for Sustainable Texel using Ecofys' expertise resulted in a shared vision and actual plans to reach energy neutrality in 2030.

5.1.2 How the tourism industry influenced the direction of change

Throughout the whole period of time, legitimacy remained important for the process of change in the energy system. While support was present for the energy vision and the process of change, the *direction* of change was not set in stone. In fact the direction of change was influenced strongly by the tourism industry. The primary interest of this actor group is to keep Texel attractive for tourism. The municipality's direction for change involved following up on the expert knowledge of Ecofys, meaning

that windmills and bio-fermentation were supported and initially part of their intended policy. The tourism industry (backed up by the forestry commission and local inhabitants) managed to change the direction of change, blocking this pathway by appealing to the Texel Core Values. These values are held in high regard throughout Texel, which is why the strategy of framing the attractiveness of these technologies (by displaying them as an infringement on the values of peace and quiet, space, and open landscapes) worked to their advantage.

Meanwhile, the energy demand of the tourism industry grows because tourists demand more luxury. This energy is easily available in the existing energy infrastructure, which means that sustainable change, while supported by the industry, is not intrinsically needed. However, the tourism industry invested in energy savings and solar panels, though in small measures. Their motivation to do so was not the energy ambition, but reducing operation costs and the resulting improvement of their own "green image" (also known as a strategy of green-washing). Over the years, a green status has become more or less a mainstream requirement for entrepreneurs (Berkers & van Loon, 2008). The tourism industry was certainly aware that sustainability has become a new form of quality standard. Other than that, keeping the status quo in terms of landscape preservation aligned with their interests due to fear that change would damage the island's image and its unique landscape, and in turn would damage the tourism industry.

Concluding, existing support for system change does not mean that the *direction* of change cannot be contested. The tourism industry's protectionist appeal to honor the Texel Core Values in favor of using existing renewable technology for the production of renewable energy influenced the direction of change from wind and biomass to energy saving measures in the building environment and to the use of solar energy technology. This direction could count on the support of the tourism industry, which were perfectly aware of the rising awareness for sustainability. Their involvement in small-scale energy saving initiatives and buying solar panels did not lead to much change in a quantitative sense and can be seen as a strategy of green-washing. The involvement of the Texel Core Values as leverage for steering the direction of change indicates that cultural motives had a strong influence in legitimacy on Texel.

5.1.3 Why TexelEnergie and Urgenda had mixed success

That culture is a strong influence on legitimacy is again observed in 2007 when TexelEnergie was founded. Self-reliance is an attribute that the people from Texel proudly identify themselves with. And in that sense, TexelEnergie became a bridge between the Texel Core Values and the energy ambition by offering a desired, independent vehicle for the realization of renewable energy projects on Texel. This originated from the mobilization of pioneering individuals, set in motion by a policy entrepreneur (a local politician from the political party PvdA (labour party)). This example shows that the influence of an individual policy entrepreneur at the right time can have a big impact in the governance of change. The policy entrepreneur showed to possess good networking skills by seizing an opportunity, voicing the idea at just the right time and place. This was enforced by mobilizing a small group of individuals that shared a common willingness to invest their resources (time, reputation, and/or knowledge) into realizing TexelEnergie.

Where this strategy of mobilizing people worked well for TexelEnergie, in some cases Urgenda had a more difficult time when they tried to use this same strategy. Noticeable is the observation that

the initiatives that Urgenda tried independently on Texel were less successful than initiatives that were executed in association with TexelEnergie. The examples of Nesland, the failed collective purchase of EV's and the non-cooperativeness of the building sector on Texel during the energy neutral housing project attest to that. In contrast, the collective purchase of solar panels, the foundation of "Duurzame Energie Unie" and the collaboration with regards to the solar panels at Everstekoog (which would have been a successful project, were it not for the financial problems TexelEnergie suffered during that project) did turn out positive. In both cases an appeal was made to the cultural attitude of Texelers, but the success varied, indicating that the successfulness of certain strategies are not only actor dependent, but also culturally dependent; TexelEnergie could more easily utilize existing relationships while Urgenda was considered an outsider, making it harder for them to utilize these (and new) relationships.

Despite that, however, Urgenda's publicity campaign, aiming to promote Texel as a successful testing garden for sustainable initiatives (which was one of their initial visions that was also embraced by the municipality) did not go unnoticed by actors from abroad, nor by the government. The promotion of success stories about projects and about TexelEnergie resulted in the attraction of new, mostly public-private combinations of actors from abroad to Texel. Supported by different governmental financial instruments, several of these projects were successful, such as the tidal energy project and the Cloud Texel project. Though the success of the latter can yet again be attributed to the fact that TexelEnergie was heavily involved in the information sharing between the people on Texel that participated in this project, and Capgemini and Alliander. In other words, Urgenda utilized a strategy of "branding" Texel as a testing garden in order to attract new economic and experimental opportunities on the island.

Concluding, both TexelEnergie and Urgenda tried to utilize the same strategy of *mobilizing* people to take action but with different instruments and resources. TexelEnergie was more succesful in that regard than Urgenda. Why was that the case? Two reasons where identified that are relevant in the discussion about the role of strategies in governance of change on Texel. Furthermore, both of them are linked to the Texel culture. The successfulness of certain strategies for change depends on this local culture, as first of all the Texel Core Values need to be considered "real" which means that they need to come from Texel, by people from Texel. TexelEnergie was an initiative that developed on Texel, by the people from Texel. This fact is why it enjoyed a lot of support. The connected strategy is that the people involved could make use of existing relations in the network on Texel. In contrast, Urgenda had a much more difficult time in exploiting the same strategy, simply because Urgenda was seen as an "outsider", telling people on Texel what to do and how to do it. This role of outsider made it much harder for them to exploit these existing relations individually, and to make new ones. However, Urgenda did contribute to change on Texel by their branding strategy, attracting new actors to Texel who are interested in testing out new technology on the island.

5.1.4 The supportive strategies of the municipality

Chapter 4 described that the municipality stated in their 2008 report "Energy Vision Texel" that they cannot reach their ambition alone, but need other actors to achieve it. For themselves, they dictated a supportive role. But even before that was explicitly mentioned, the municipality used supportive strategies that affected change in the energy system. These supportive strategies happened throughout the whole case study and can be divided into three categories.

The first strategy is exemplary behavior. Examples were the purchase of EV's for municipal tasks, the heavily publicized public LED lighting project and ultimately making that energy neutral through constructing floating solar panels in the water basin at Everstekoog. These initiatives in example setting were meant to inspire and encourage people to copy what the municipality did. This encouragement was further stimulated by a second strategy, which is taking away the most obvious barrier that people have when they decide whether or not to adopt sustainable initiatives: money. By using financial instruments in the form of subsidies, the municipality tried to influence these decisions. I'd like to call this strategy "enabling". They started this by subsidizing the purchase of solar panels and later, funds from the province were used to open up an energy desk where people could apply for subsidies related to energy saving (insulation) in their houses, solar panels, and for other sustainable initiatives. These two strategies (setting an example and "enabling") were used simultaneously and would not have worked independently. If the municipality would not show exemplary behavior, the uptake of solar panels would likely have stuck with just frontrunners that already have an intrinsic personal interest in sustainability. Others would likely not be motivated to follow suit. Vice versa, without financial instruments the payback time of solar panels would not yet be interesting enough for this same group of people to commit to using solar panels.

The third supportive strategy of the municipality was rewarding the initiatives of other actors. This applied to TexelEnergie, who ran into trouble with the experimental floating solar panel project in the Everstekoog waste water treatment facility. By taking over this project, the municipality sent a message that the initiatives by TexelEnergie were appreciated, and that they were willing to help in times of need.

These three complementary strategies were mainly focused on solar PV and energy saving, which was the direction that Texel took when it became clear that wind energy and energy from biomass could not count on enough support. However, the municipality attempted to redirect the direction of change again through another strategy that involved Planet Texel. With this large project, the municipality attracted independent actors from overseas to talk with the people and come up with innovative concepts for the future direction of Texel, keeping the energy ambition in mind. By approaching this in an open fashion where anything was possible, the project bureaus could incorporate wind energy in their concepts. Through the interaction with the people on Texel, a strong focus lied on combining these concepts with the Texel Core Values. I would like to call this strategy "coupling", as a solution to the "ambition problem" (windmills) is coupled with a spatial planning project. Through this project, the municipality could eventually reopen the discussion about wind energy, which is something that could not have been possible would it have been a plan that solely originated from the municipality, because it would not have been taken seriously and would not receive support. By outsourcing the project, having it presented by a renowned project bureau (IABR) and supporting the plans, the municipality managed to break open the status quo around wind energy without losing legitimacy in the process. Possibly this might have been the seed that inspired some pioneers to come up with the citizen initiative for a new poll on the support for windmills on Texel (which, unfortunately, was turned down by the municipal council). In any case, this strategy can also be categorized as supportive, because it managed to reignite the discussion about wind energy on Texel, attempting to redirect change towards the technology that Ecofys advised in the first place.

Concluding, an important observation is the first three supportive strategies were depending on each other for success. By setting a good example, support for change increased but again, support for change does not mean that change will happen. By subsequently providing financial support, people were encouraged to copy that behavior. Furthermore, the municipality showed support by praising the initiatives that were done, even when it turned out that it proved to be difficult.

5.1.5 Conclusion: Influence of strategies on change

As mentioned earlier, legitimacy played an important role in the process of governance of change in the socio-technical energy system of Texel. Since support is the key driver for legitimacy, it follows naturally that the strategies that actors on Texel used were centered on *gaining* support for ideas (in the case of Foundation for Sustainable Texel, TexelEnergie and Urgenda) or to *create* support to facilitate change (in the case of the municipality).

Furthermore, in some cases strategies only resulted in change because they worked jointly or sequentially, or both. This dependency between different strategies was present because awareness and support for sustainable ideas alone was not enough to drive change on Texel. Instead, sequential strategies were required to simultaneously drive *action*, which was needed to achieve change. For Foundation for Sustainable Texel organizing credibility was vital for the successfulness of their strategy of knowledge brokering. Without credibility, this knowledge would have gone to waste because no one would take the ideas and initiatives seriously without it. This is a reason why Urgenda had less success than both Foundation for Sustainable Texel and TexelEnergie in their initiatives because of their "outsider" status. The supportive strategies of the municipality (example setting, financial support and rewarding sustainable initiatives) were also successful because they were jointly used. Much like the game of rock, paper, scissor would not work with one of the elements missing, single strategies become useless with one component missing. None of the strategies would have worked without the other.

Lastly, in the socio-technical energy system the Texel Core Values and the general Texel culture (i.e. self-reliance and an intrinsic distrust of people or actors from abroad) had a large influence on legitimacy. As a result, it also influenced the strategies that were used and the successfulness of said strategies, depending on which actor used them. This especially presented itself through the uncertainty surrounding the effects of large scale wind- and biomass energy production projects on the tourism industry. Here, adhering to the Texel Core Principles prevailed over the scientific affirmation by experts on how to reach energy self-sufficiency on Texel. Ideas, plans and initiatives that conflicted with these principles stood no chance to gain public or political support. Because this lack of support, the direction of change that intended to utilize large scale renewable energy projects like wind and bio-fermenting was redirected towards change on a smaller scale and in a diffuse way, mainly focusing on solar PV and energy saving in the existing building environment. The municipality later attempted to reignite the discussion about windmills by coupling this technology with new spatial planning projects; however whether this leads to any results remains to be seen.

Ultimately, while volume-wise the amount of renewably produced energy may seem to be small, especially with 2020 around the corner, it is safe to say that change has occurred in the energy system. Technologically, change has been quite small but change in acceptance and support for a sustainable transition on Texel is observed. The Texel Core Values have had a large impact on the

direction of change, but despite that, a general direction has been chosen that could count on the support of the majority of actors on Texel. In that sense, transition is still ongoing in the energy system.

5.2 Analysis of the governance of change in the water system

In contrast to the energy system, the process of governance of change in the water system of Texel unfolded quite differently. Instead of a diffuse process through societal actors that formed coalitions and sought ways to gain support for their ideas and initiatives, change in the water system was steered by the centralized power of governmental actors and happened largely through existing conventions and institutions. Even so, by analyzing the system using the framework from chapter 2, strategies can be spotted in this system as well. How that influenced change in the water system will be explained in this section.

5.2.1 How opportunity structures led to strategies for change

In 2000 the Master Plan was just taking shape. This Master Plan was an instrument initiated by governmental water institutions (the province and the two waterboards "Hoogheemraadschap Uitwaterende Sluizen" and "Hollands Kroon") and the municipality to secure a mutual commitment and agree on an organizational structure (referring back to figure 14), in order to improve the efficiency of fresh water and waste water management on the island. Issues concerning the retaining of fresh water during the summer and dealing with excess water during the winter were (and still are) a concern that is commonly shared on Texel, meaning that support for change to improve on these matters was not an issue. Hence in contrast to the socio-technical energy system, support (and thus legitimacy) was not fundamental to governance of change in the socio-technical water system. Instead, change was initiated by recognizing and acting upon available technical and legal opportunity structures that were present. The notion that support was not an issue is a reason why change took shape in a project-like way. The involvement of public actors in the preliminary phase of the Master Plan ensured that information was shared about what problems needed to be solved. Uncertainties surrounding the workings of the water system were largely taken away through focused studies by expert research institutions, the generated knowledge of which were accepted and undisputed because legitimacy was not an issue. This strategy of negotiated knowledge between the municipality, the province and the water boards resulted in a situation where this knowledge was shared and used in order to plan and execute projects in the water systems and water chain on Texel.

Change in the fresh water and waste water parts of the socio-technical water system can be attributed to the existence of a combination of two types of opportunity structures. The first type of opportunity structure was formal: the law requiring that every household and company should be connected to a main sewage system by 2005. The second type of opportunity structures were technical: several waste water treatment facilities and large parts of the sewage systems were in need of renovation, and HHNK desired to reuse treated waste water to battle drought in parts of Texel. These different opportunities were seized and coupled by the municipality and HHNK. Social actors had no play in this because these opportunity structures were not open for private initiatives; hence the direction of change was steered through the governmental institutions.

This strategy of coupling was motivated by mutual economic benefits and by the shared desire to improve the public good and led to two directions of change. The first is HHNK centralizing the waste

water treatment in a single, large facility at Everstekoog, where all the treated waste water is now pumped into the surrounding surface waters to help fighting drought. The second example is that HHNK and the municipality worked together during the renovation of the sewers, installing separated sewage pipes to lower the amount of grey water to be processed in Everstekoog, and more efficiently transport water excesses due to rainfall. Doing so simultaneously lowered the cost significantly. It is important to note that this direction of change was not *necessary.* For example, HHNK could have chosen to renovate the existing water treatment plants and keep it at that. And both the municipality and HHNK could have chosen to do their projects independently. However, the actors chose to couple their solutions.

Where opportunity structures led to change in the fresh water and waste water parts of the socio-technical water system, one part of this socio-technical system did not undergo change. Ironically, this is the one part where change was specifically desired by the municipality through the ambition manifesto. In the manifesto, a specific desire for a self-sufficient drinking water supply on Texel was expressed. However, it took a lot of time before initiative towards that goal was taken. It took an incident (the breakage of the water pipeline in 2013) that endangered the existing drinking water supply chain before the particular ambition resurfaced for debate again. The municipality acted as a policy entrepreneur in this case, by coupling the incident with ambition (producing drinking water on the island) and framing it as a solution to prevent such incidents to happen in the future. However, this strategy failed. The feasibility report by research institute TNO that the municipality commissioned concluded that at the time, producing drinking water from sea water was economically unfeasible. Since PWN is bound by price regulations, it makes sense that they will not advocate for production on the island, as it does nothing to improve security of supply or the quality of drinking water because these things are more or less optimized in the status quo. The other water actors (HHNK or the province) have no desire to change anything about the drinking water system either, as it is not their legal task. Therefore, this direction for change was blocked.

5.2.2 The shift from opportunities for efficiency to battling climate change

While the Master Plan finished in 2010, cooperation around water management continued through the established relationship between HHNK and the municipality. This collaboration between the two actors proceeds naturally and even extends to other fields (referring here to the energy project at Everstekoog).

With the finalization of the master plan, the involvement of public actors has increased in the governance of change in the socio-technical water system. A new opportunity structure formed through the increasing realization that Texel needs to protect itself, and its water system, from the effects that climate change has on the rising sea levels. This so-called "common enemy" created a new incentive for collaboration between actors (both the aforementioned governmental actors, as well as social actors who are involved in water use and management). A strategy of goal stretching from just water management to the inclusion of safety and drinking water led to the formation of the TexelWater platform. "Making Texel climate-change-resistant" is the new catch phrase, for which the platform is now a new network for cooperation for water management on Texel. It is, however, unclear which of the actors started this initiative.

5.2.3 Conclusion: Influence of strategies on change

Where change in the energy system started through awareness-raising en seeking (public) support for change, change in the water system was initiated through a combination of formal and technical opportunity structures that existed around different parts in the system. These opportunity structures were both technical and legal in nature. Change in the sweet water- and waste water systems were steered through existing conventions and institutions, where the municipality and the water boards used a strategy of cooperation. They coupled these opportunities with the desire to improve the public good. Meanwhile, this coupling of opportunities also led to economic cost savings. Economic drivers were also the main inhibitor for change regarding the drinking water ambition. Because the socio-technical water system lacked frontrunners or policy entrepreneurs who committed to the drinking water ambition, the decision for a new drinking water pipeline remained uncontested.

Much like the success of change depended on the joint use of different strategies in the energy system in order to create and receive support for initiatives, change in the water system also depended on the *combination* of different factors. In this case the combination of existing opportunity structures combined with strategies to collaborate for action.

5.3 Governance of change in the two systems, a comparison.

From the analysis of the two socio-technical systems, it is clear that there are several differences in the governance of change between them. Change in the socio-technical energy system was largely based on legitimacy for energy technology, where support played a key driver for legitimacy. The strategies that actors on Texel used were therefore centered on *gaining* support for initiatives (in the case of Foundation for Sustainable Texel, TexelEnergie and Urgenda), *blocking* initiatives concerning wind and biomass (in the case of the tourist sector and local inhabitants) or to *provide* support in order to facilitate change (in the case of the municipality). For these actors, ample financial instruments were available, either through the Wadden fund or through government and provincial subsidy, providing opportunity structures to start (experimental) initiatives as long as they fell under the label "sustainable development".

On the other hand, in the socio-technical water system support was already present for the initiatives of the actors that were involved (the municipality, the water boards and the province) because the "fresh water problem" is a well-known issue on Texel, and anything that helps battling this issue is met with approval of those it benefits (agriculture). Furthermore, change was legitimate from the established position of these actors. Therefore legitimacy did not play as important a role here as it did in the energy system. The technology that was used was also not contested, as they were not new, experimental or innovative and were necessary for the system to work (meaning here that sewers are a common technology to transfer waste water and waste water facilities are common technological facilities to treat waste water. They are inherently basic necessities for the socio-technical water system).

Change in the energy system was governed in a decentralized way, with different actors taking initiatives and looking for support and instruments to do so. In this "quest" to find, block or provide support, the Texel Core Values played an important role. They were first instrumentally used by the tourist sector in a time where these values were intrinsically known among Texel, but not yet neccesarily

laid down in stone or in policy. However, the forestry commission and local inhabitants (relatively implicitly) used them as arguments to negatively frame the attractiveness of the most viable options for renewable technology: wind and biomass, and steering the direction of governance of change from these technologies towards solar energy and energy savings in the building sector. Through time, the Texel Core Values kept being referred to and eventually they played a pivotal role in Planet Texel, where the Texel Core Values were used as instruments to integrate in spatial plans, leading to the new Texel Principles. In Planet Texel, the Texel Core Values were used as a binding factor to initiate new (discussions for) the direction of change. The Texel Core Values are nowadays firmly embedded in the Texel policies and used as official instruments to evaluate new (spatial) plans.

In the socio-technical water system, change instead was governed through the centralized power of the four (from 2003 on three) governmental actors (The two water boards (which later merged into HHNK), the municipality and the province). The Master Plan was an instrument created by these actors to secure a mutual commitment and agree on an organizational structure. Technical opportunity structures (the waste water treatment facilities and the existing sewers needing repair) and legal opportunity structures (The law that everyone needs to be connected to the sewers) were seized and coupled by these actors, using a strategy of collaboration to complete their tasks efficiently and cost-effectively. The Texel Core Values were not found to play a significant role in the governance of change, if at all. Projects were governed in a project-like way, with little resistance from the social community. The only delay was found in the expansion of the sewers in the countryside and they were related to costs. However, the municipality and HHNK possessed legal power to go through with the plans, and the financial instruments (water taxes and sewer taxes) to cover the costs.

Lastly, the socio-technical energy system showed a larger commitment of social actors and individual policy entrepreneurs that committed to change with the ambitions for 2020 in mind, in which the foundation of TexelEnergie is exemplary. This commitment was lacking in the socio-technical water system, especially in the drinking water part of the system. However, there was little in terms of opportunity structures to commit to private initiatives in the first place, because the drinking water sector is under the responsibility of governmental institutions, and therefore regulated.

In conclusion, governance of change in socio-technical systems remains a complex phenomenon. The governance process and the directions of change largely depend on the nature of the system. With "nature" in this case meaning that there are differences in circumstances in every socio-technical system, such as opportunities for change, available instruments and whether change is legitimate among the relevant actors or not (in the case of Texel: support for initiatives and cultural values in the energy system, and a desire for efficiency and economical drivers in the water system). These circumstances have an implication for the sort of strategies that actors use in the governance of change, and in how effective these strategies are. Despite these conclusions, there are lessons to be learned from this case study. These will be presented in the next Chapter.

Chapter 6: Reflection and Final Conclusions

In this chapter, the final conclusions of the thesis results will be presented, along with a reflection of several aspects of this research thesis. In chapter 5 it became clear that of change in socio-technical system is a complex phenomenon, and that governance process and the directions of change largely depend on the nature of the system. In this chapter, these conclusions will be reflected on and discussed in order to answer the main research question in Section 6.1. This section also covers the general lessons that were learned from this case study, both for Texel (6.1.1.) as in general (6.1.2). Section 6.2 provides a reflection on the research methods and how they affected the results, and the overall scientific contribution of the analytical framework. Finally, section 6.3 concludes with recommendations for further research.

6.1 Conclusions

6.1.1 Conclusions about the governance of change on Texel

Let's look back at the main research question, which is stated as follows:

How did the governance of change contribute to the current state in the realization of Texel's ambitions for a self-sufficient renewable energy- and drinking water system?

The current state

So let's start with the first part of that question. As we know, the ambition manifesto states that Texel wishes to be fully self-sufficient in terms of energy and (drinking) water. It also states that this means that all energy and water will need to be produced or found on or around the island itself. From the introduction and the data from chapter 3 it is clear that, comparing the current state of the two socio-technical systems with the goals described in the manifesto, it can be concluded that there is little chance that Texel will reach its energy- and water ambitions in time for 2020. Looking at energy, Texel has seen a large increase in solar electricity production (see figure 7). In terms of renewable heat, there has been a slow increase between 2010 and 2014 (see figure 8). Note that right now this may have decreased again because TexelEnergie recently terminated the central heating by the wood pellet burner in district "De 99" because it was running a loss for the energy company. The electricity demand has increased and the gas demand has decreased, more or less following the general trend of The Netherlands. In terms of renewable energy generation, however, Texel lacks behind the rest of The Netherlands, showing an increase from 1% to 3.8% between 2000 and 2015 while The Netherlands has increased from 1.6% to 5.8% (Figure 9). If Texel were to install a couple of large wind turbines, at least the electricity demand could still be met in time. However, wind energy is still much debated. While it is unclear what the current overall stance on windmills is across Texel, the local politics are still in majority against utilizing windmills on Texel. This is proven by the fact that a formal civil initiative to investigate this issue was recently rejected by the municipal council. Therefore, with less than three years to go until the self-imposed "deadline", it becomes highly unlikely that the ambition for 2020 will be fulfilled.

In the case of water the conclusion about whether the ambition will be reached in time is more straightforward: No, self-sufficiency in terms of (drinking) water will not be achieved by 2020. From Chapter 4 we know that the feasibility of local production of drinking water was looked into shortly after the incident where one of the water pipelines from PWN broke down. However, production of drinking water on the island was considered economically unfeasible. Meanwhile PWN has recently installed a new pipeline to provide Texel with clean drinking water. With this commitment the island is bound by that decision and will remain dependent on the mainland for their drinking water for years to come.

With the data about the past and current situation of the two systems speaking for themselves, let's look at how the governance of change in the period between 2000 and now has contributed to this current state of affairs. This is done by following the concepts of the analytical framework.

The contribution of governance of change to the current state of the socio-technical systems

Again, let's start with Texel's socio-technical energy system. Overall it can be concluded that the governance of change in this system revolved around legitimacy. That is, Legitimacy for change itself in the first place, but also legitimacy for the technologies to be used on Texel. This could be observed through the strategies that were identified, which actors used to gain support for their ideas and initiatives, or to block that support. The reason why support (which was identified as the operationalizing part of legitimacy in Chapter 2) was such an important aspect in the socio-technical energy system is because of its decentralized nature: The energy market is open for initiatives of social actors, and therefore Texel "dictates" what happens on Texel on its own terms. For change to happen the involvement of both governmental and social actors was needed but because a reliable energy infrastructure is already present, willingness to 1) work towards a renewable goal and 2) to actually take action is indispensible. Let's go into more detail on how this happened on Texel.

In 2000 the ambition manifesto did not yet exist. From chapter 3 it was clear that a shared vision about (renewable) energy was not yet present on Texel. Foundation for Sustainable Texel played an important part to legitimize the willingness to change in this period. Partially originating from self-interest, the actions of Foundation for Sustainable Texel resulted in a gradual increase in awareness and acceptance for sustainability on Texel. The foundation's strategies to gain support for its sustainable initiatives was not just for the purpose of intrinsically being sustainable, but it was also a way for the involved entrepreneurs to promote their own companies as "supporters for sustainable Texel" in order to gain goodwill. Foundation for Sustainable Texel organized credibility through being represented by Texel's most influential entrepreneurs, but also had a short line of communication into the political carousel through the Alderman from GroenLinks, who was involved in the foundation of its predecessor. These were reasons why they were successful in using the Ecofys report as an instrument to put a formal plan for energy neutrality in 2030 on the political agenda.

We also know from Chapter 3 that currently, there is only one large windmill left on Texel, and despite several attempts by a local farmer, there is no bio-fermenting plant to produce biogas on Texel. Instead, the main source of renewable energy on Texel comes from solar power technology, currently an amount of roughly 2.2 million kWh per year. In 2001 Ecofys concluded that wind energy and energy from biomass should play a significant role in the energy mix of Texel if the ambitions are to be achieved. So why did that not happen? Probably the most influential factor that plays a role in this is the "clash" between these technologies and the Texel Core Values. While these values were not yet

"officially" embedded in policy until 2015, they have always been seen as "common sense" for people of Texel. In this case, they have been instrumentally used in 2001 by the tourist industry, the forestry commission and local inhabitants to frame windmills as an undesirable technology that infringe on the peace and quiet and the cultural open landscape of Texel and hence damage tourism. This initiated fierce debate about the use of windmills just before the municipal elections in March 2002, causing a loss for pro-windmill politicians and leading to a political period where windmill ambitions were almost non-existent for fear of losing credibility. The same strategy of framing was successfully reused by local inhabitants between 2005 and 2007 when a local farmer proposed to build a large bio-fermenting plant.

Around 2007 Foundation for Sustainable Texel was still involved when the trip to Samso was organized by the founders of TexelEnergie. This turned out to be the inspiration for the shared ambition manifesto, resetting the ambitions to 2020 (although it is unclear why) and being brought to the spotlights. From this point on, the governance of change in the socio-technical energy system got more focused in light of these ambitions, as the amount of sustainable initiatives increased and several local individuals (policy entrepreneurs) took the initiative for TexelEnergie by mobilizing inhabitants of Texel, in order to take matters in their own hands. Here we see that the strategy by the municipality to set an example starts to pay off, and the collective supportive strategies of "enabling" and "rewarding initiatives" by the municipality have contributed to the current amount of solar energy production on the island. The latter strategy might even be one of the reasons why TexelEnergie still exists.

Furthermore the municipality also focused on setting examples in energy saving and "enabled" the inhabitants of Texel to do the same through financial instruments (subsidy and opening an energy desk).

It can be said that for the socio-technical energy system, the ambition manifesto – as an instrument - played an important role in the governance of change. Texel might not reach their ambitions in time. But perhaps the goal of the ambition manifesto was not explicitly to reach exactly what was stated inside of it. Maybe instead, one of the implicit goals was to set in motion a *process* of transition towards more sustainable systems. If that is the case, the ambitions have reached some level of success. One can agree that setting such an ambitious goal has created a movement, fueled by the increasing awareness about climate change and its consequences for Texel. And whether or not the goals are met exactly in 2020 does not really matter because in the end, do transitions really have and ending point in the first place? In the case of the socio-technical energy system, the ambition put a goal on the horizon for everyone on Texel to look forward to and as such, increased engagement of local inhabitants and initiated change by their initiatives.

This "movement" provided an opportunity for Urgenda to get involved in the governance process of change. However from Chapter 4 and 5 it was observed that their strategies had mixed success. Initiatives that Urgenda tried independently on Texel were less successful than initiatives that were executed in association with TexelEnergie because of Urgenda's status on Texel as an outsider from abroad. The examples of Nesland, the failed collective purchase of EV's and the non-cooperativeness of the building sector on Texel during the energy neutral housing project attest to that. In contrast, the collective purchase of solar panels, the foundation of "Duurzame Energie Unie" and the collaboration with regards to the solar panels at Everstekoog (which would have been a successful project, were it not for the financial problems TexelEnergie suffered during that project) did turn out

positive. In other words, the Texel culture hampered Urgenda's strategies for mobilizing people, substantiating the notion that the Texel culture plays an important role in the quest for support.

The description above explains how the governance of change in the socio-technical energy system on Texel led to an aversion for wind energy and bio-fermentation, leading to a diffuse approach of different actors that were mostly focused on solar technology and energy savings in the built environment. Currently however, Foundation for Sustainable Texel has closed down because their initial core tasks have been taken over by Urgenda and TexelEnergie. Ironically, Urgenda has substantially notched down their initiatives on Texel, and TexelEnergie is reinventing itself after a period of financial struggle. Meanwhile yet another initiative for windmills has been turned down in the municipal council. These developments suggest that the "movement" that the ambition manifesto has initiated is grinding to a halt. It remains to be seen whether this can be reignited again.

Now let's look at the socio-technical water system. This system can actually be viewed in different parts: that of fresh water (rainwater) and waste water management and the drinking water management. From chapter 3 we learned that the current situation is as follows:

- The majority of households and businesses are connected to the main sewage system.
- The waste water management has been centralized around Everstekoog.
- The effluent from Everstekoog is discharged on Texel to battle periods of drought.
- PWN has recently installed a new pipeline to supply drinking water to Texel and is still solely responsible for all drinking water entering Texel.

Both parts of the socio-technical water system were governed through the centralized power of governmental actors. The province, municipality and the water boards for the first part, and drinking water company PWN for the second, consecutively. Legitimacy for change was constituted through this centralized power, and therefore played no role in the strategies that were used by these actors. There was limited involvement of social actors. In the governance of the first part of the system, in 2000 a Master Plan Water for Texel was in place. This was a mutual instrument to consolidate the organizational structure and the shared interest to improve the efficiency of fresh water and waste water management on the island. A strategy to cooperate was utilized by the municipality and the water boards, by acting on the available opportunity structures that were present. The waste water treatment facilities were in a poor state. The water board HHNK desired to centralize the waste water management. Furthermore, the sewers also were in need of renovation, which is the task of the municipality. HHNK wanted to reduce the amount of waste water to be processed by decoupling rainwater from waste water in the sewers. Furthermore, the law required that everyone is connected to the sewer system by 2005, meaning that a new sewer system was needed on the countryside. All these goals and problems were coupled in the cooperative strategy of the two governmental actors, leading to a reduction in costs for both actors, and to the situation that is the present.

In the drinking water part of the system, change is absent except for the fact that a new drinking water pipeline has been constructed by PWN. This was the result of the incident with the old pipelines in 2013. This incident was also the only opportunity structure that the municipality seized by

commissioning a feasibility study for water production on the island. The ambition manifesto was used as an argument to do this. However, a study resulted in the conclusion that it is not economically feasible. Since PWN is obligated to provide a safe, reliable and affordable drinking water, they are not influenced by Texel Core Values or any desire of Texel to be autarchic, nor is there a sense of urgency that justifies change in this part of the water system. This sense of urgency is present in the energy system in terms of the effects of climate change and the accepted knowledge that renewable energy technologies are a solution to reduce this (whether this is actually accepted knowledge everywhere on the globe is perhaps debatable, but not a discussion that should be started here. One can assume that it is generally accepted in The Netherlands). The closed water market also does not provide any opportunity for social actors to take initiative on that regard. Therefore, this ambition remains unreachable for the time being.

6.1.2 General lessons from the case study

As we know, this thesis covered a dual case study where the governance of change in the socio-technical energy and water systems on Texel was analyzed. In quantitative research, generalizability is considered a major criterion for evaluating the quality of a study (Kerlinger and Lee, 2000; Polit and Beck, 2008). However, generalization from single case studies is a controversial topic. According to Polit & Beck (2010), generalization from single case studies requires extrapolation that can never be fully justified because findings are always embedded within a context (Polit & Beck, 2010). Therefore, one should be careful when expressing generalizations from single (or in this case, dual) case studies. In this study, the findings from the previous section are embedded in a specific context that is unique to Texel. While the two systems were both present in the same setting (the setting being Texel) there are still too many differences between the two to legitimately express any generalistic conclusions about governance of change in socio-technical systems based on the findings of these case studies alone. Such claims warrant similar analysis of other socio-technical systems, preferably also water and energy systems, but in different settings (settings here referring to different locations or communities).

However, this does not mean that nothing can be be learned from this case study. As noted by Thorne et al. (2009), "When articulated in a manner that is authentic and credible to the reader, (findings) can reflect valid descriptions of sufficient richness and depth that their products warrant a degree of generalizability in relation to a field of understanding" (p. 1385). So for this case, if we take into account that the field of understanding is socio-technical energy and water systems, there are some lessons that can be learned from this case.

6.1.3 Lessons learned about the (un)successfulness of strategies in the governance of change

These lessons have to do with the question why certain strategies worked or did not work, and what that had to do with the nature of the system on Texel in question. In the energy system, why were the tourist sector, forestry commission and local inhabitants successful with their strategy to instrumentally use the Texel Core Values in an argument against windmills and bio-fermentation, thereby redirecting change towards the initiatives around solar power technology and energy savings? How come that the local Labour Party (PvdA) politician managed to successfully mobilize people, resulting into the foundation of TexelEnergie? Why was Urgenda not as successful in using the same strategy of mobilizing

people as TexelEnergie was? As was previously mentioned, this has to do with the nature and context of the socio-technical energy system. The energy system has a decentralized and privatized context, which was predominantly governed by the initiatives of societal actors and in which legitimacy for technology was contested through the uncertainty about their effects on tourism and the Texel Core Values. Therefore, change depended on whether support for initiatives could be found between actors that had the power to incite change. It so happens that the Texel Culture plays a significant role in the motivations for strategies of these societal actors; the Texel Core Values could be successfully utilized to shift the direction of change from windmills and bio-fermentation to solar energy and energy savings, because the decentralized nature of the system allowed social actors to guide change on their own terms, based on the cultural values of Texel.

That the successfulness of strategies lies in this nature of systems can be substantiated if we look at the contrast of context between Texel's socio-technical energy and water systems. In the ambition manifesto, a self-sufficient drinking water system is desired. In the energy system, mobilizing people to found energy cooperation TexelEnergie was successful because the energy market in place allowed an opportunity for such an initiative to work. Why would this same strategy of mobilizing people to take initiative for a Texel drinking water company not work? Because there was no opportunity structure present that made it possible in the first place. Drinking water company PWN is responsible for a reliable drinking water infrastructure and is legally bound to provide this in the most cost-effective and safe way possible. People cannot start their own drinking water company because it's simply legally not allowed; the drinking water market is closed and regulated by governmental actor PWN. Hence, if change was to happen there, it should be legitimated through PWN. However, even if initiative takers from Texel would use the Texel Core Values to plead for water producing stations on Texel, PWN can and will ignore that, simply because it's not its task to indulge in this and it has the power to do so. Hence, they are not interested in changing the existing centralized drinking water system towards a system where drinking water is produced on the island, simply because it is desired by Texel.

The ambition manifesto was an initiative by the municipality of Texel. So to conclude, let's look at the governance of change from the point of view of the municipality. The fact that the energy system is decentralized and the energy market is an open market, the system was governed through mostly societal actors. This is the reason why the municipality had the chance to facilitate change in the energy system through the combined strategies of example setting, enabling and rewarding initiatives. They did not have any power to do the same in the water system, because the closed water market and predominantly governmentally steered governance does not allow these same strategies to work. The municipality should have known that. What can be learned from this is that one should be careful with expressing ambitions that are so easily dismissed by those who govern the system in which the ambition is applicable.

6.2 Reflection

6.2.1 Reflection on methodology

Data collection

Several remarks can be made about the data collection for this research. First of all, a large part of the data collection came from desk research. Expert reports, Municipal and governmental documents and other "official" documents were found aplenty, but skimming through them to find the information I needed was very time consuming. While I made limited use of coding in documents, in early stages I was still unsure what exactly to look for, partially because the operationalizing part of my framework at the time was not fully complete yet. Adding to that, I did not really have an effective coding system figured out because I was inexperienced with the method. Because of this I found myself reverting back to finding information in these documents, making the whole process even more time consuming and quite ineffective. Perhaps better preparation, for example by looking into data analysis tools, would have made this part of the research more efficient.

Furthermore, official documents often lack to mention the motivations behind certain policy decisions, instead (logically) focusing on the content. To get access to these motivations, interviews were done (see next section). Of course, useful information could be extracted from interviews. But even in cases where an interviewee was personally involved in the matter that was discussed, not every detail about initiatives, projects and motives could always be remembered in full by an interviewee.

Therefore, apart from interviews, a lot of information on actor interaction and opinions came from news articles and information articles and brochures. The biggest source for information on Texel was www.TexelPlaza.nl. One of the reasons is the fact that because Foundation for Sustainable Texel has closed shop, their website has been put down as well. A lot of information went along and got lost with that as well. TexelPlaza has been a very convenient website to find out about topics during the prime time of Foundation for Sustainable Texel (early 2000's) and one of few that gave me a lot of insight on local matters. The danger of strongly relying on a single source is that it can affect the credibility of the information. Preferably, multiple sources are used. However, the website did not seem to be biased or dependent on anything that would indicate a lack of credibility. Therefore I do not think it is an issue that this source was utilized to this extent.

A final thing that was a problem for me was that it was hard, and in some cases even not possible to come by quantitative data. For example, I was unable to find or extract the trend in energy use throughout the year on Texel, which would have been very useful to map the influence of tourism on energy use. Other than that, data on 2016 that could be compared to 2000 was surprisingly also hard to find, leading to a slightly limited (to my likings) system description in chapter 3.

Semi-structured interviews

Semi-structured interviews were conducted in order to find out about initiatives that actors took and the motivations and opinions behind them. For that purpose, the semi-structured approach was chosen in order to make sure that there was room for respondents to elaborate on the subjects that they were

well informed or well-opinionated about. However, providing this freedom during the interviews sometimes made it hard to stay ‘on-topic’ to make sure all the desired topics were covered. This was partially because I find myself to be "too polite" to interrupt while the interviewee is talking. Steering the conversation in the right direction and asking the right questions proves to be quite difficult as well when one is not very experienced in conducting interviews. This turned the interviews into quite cognitively challenging and physically exhausting endeavors, and transcribing them and filtering relevant data proved quite difficult. It did not help that due to time restraints, interviews had to be done quite early in the research process, leaving little time to prepare myself. Because I still experienced some issues with narrowing down the scope of the systems during the process of interviewing, sometimes I wasn't exactly sure what I was looking for. This made it difficult to steer the questions in the interviews as well.

Furthermore, many interviews contained personal opinions that may be sensitive to them or others, limiting the use if said comments for fear of damaging reputations or relations. Because of this, combined with time constrains and my inherent personal reluctance to approach people who may have more knowledge on certain subjects than myself, has limited the amount of interviews to a less than (personally) desirable amount. I acknowledge that more interviews would have provided more useful insight into the subject. Especially about topics further back in time that aren't well documented in textual sources, suchs as projects done by Foundation for Sustainable Texel in early 2000 and more insight on the dealings behind the Master Plan Water for Texel. Finally, due to said time constraint, some actors who would have had useful data were approached, but were too busy or unwilling to partake at that time. These included certain people from de Krim, TESO and TexelEnergie.

6.2.2 Reflection on the results and contribution of the framework

Looking back at Chapter 2, the goal there was to an analytical framework to analyze governance of change in socio-technical systems. Taking the framework by Borrás & Edler (2014) as a starting point, one of the main critiques was that while their three pillars Actors, Instruments and Legitimacy provided a basic handhold for the analysis of governance of change, their framework lacked an emphasis on how top operationalize these pillars when looking at governance at a local level. First of all, the role of the interaction between actors was underlighted in the work of the original authors. As change processes are in large part a product of these interactions, this distinction is important; analyzing change on a local scale like on Texel requires a more detailed focus on success and failure in interaction between local actors. Secondly, acceptance was brought forth as a factor to measure legitimacy, however a critique is that acceptance alone does not lead to change. Therefore, I introduced the concept of *support*. Support for goals, actions or visions is needed for actors to initiate change, and gathering support of other actors by using strategies is how they achieve this. I also introduced the importance of *culture* and its effect on strategic behavior of actors and in gaining support. By introducing the concept of *strategies* the interaction between actors and more importantly, how this interaction leads to system change, is operationalized,.

With the addition of these concepts (support, strategies and culture) to the framework, a new layer of depth has been added to the analysis of governance of change in socio-technical systems. The introduction of strategies in particular operationalized the way in which legitimacy for change is gained because especially in the energy system of Texel, many of the strategies used had the purpose to

receive, provide or block support for new initiatives and the choice for certain renewable energy technologies. With this new layer of depth, new lessons have been learned about what strategies are successful, based on the nature or context of the system under view. Having said that, I think that the work in this thesis has positively contributed in improving the framework, thereby taking a new step into analyzing and making sense of governance of change.

6.3 Recommendations for further research

For further research on this subject, a number of ideas were identified.

First and foremost, it is worthwhile to apply the analytical framework that was created in this research on other cases where governance of change in socio-technical systems is the core focus. This has multiple purposes. The first purpose is to test the validity of the framework, providing insight into the strengths and weaknesses of the framework and identify potential areas in which the analytic value of the framework might be improved. For the second reason, I refer back to section 6.1.2 where I mentioned that the current work is too specifically embedded in the context of the location Texel, that it is premature to extract any general conclusions about the governance of change in socio-technical systems from this case study. Therefore, this analytical framework should be applied on multiple cases, preferably also on socio-technical *energy* and *water* systems, so that the results can be compared. Only then will it be justified to express such generalistic conclusions and lessons. In the case of energy, I propose that it would be interesting to apply this framework to the case of Samsø in Denmark. This island (though smaller than Texel) had similar energy ambitions and currently produces more energy than it consumes. Perhaps it could still provide valuable lessons for Texel on how to approach their ambition in the upcoming years. But it can also be useful for other communities or regions that desire an energy transition. Perhaps this way, new combinations of strategies and how they work based on the context of the system can be identified.

Another possible approach is to action-test the successful strategies described in section 6.1.1. in actual systems with a similar context as on Texel and see whether they show similar results. However, this might be difficult because one would have to find a suitable location and actors willing to participate in such an action test.

Other research can be found in looking for more ways to operationalize the three pillars (Actors, Instruments, Legitimacy) that the analysis is based on. In this thesis, strategies were seen as a way to operationalize actor interactions, and support for ideas and initiatives as a way to operationalize legitimacy. Perhaps another scholar can think of ways to expand these concepts by looking into other areas of literature.

The analytical framework of chapter 2 provides a good starting point to analyze governance of change in socio-technical systems. However, perhaps there are concepts that are missing because they played no role and/or were not found in the Texel case study, because they were based on socio-technical systems concerned with water and energy. Looking into other socio-technical systems might provide more concepts to strengthen this framework.

Finally, where this thesis was focused on Texel as a whole, the transition of Texel can also be looked at from the point of view of other socio-technical sub-systems such as tourism or agriculture, for

those who are more specifically interested in sustainability related to those topics. This may provide more insight into drivers and barriers for support of change.

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Appendix I: Interview guide

Naam - Functie

Profiel:
[invullen]

Motivatie:
[invullen]

Inleiding:
Allereerst bedankt dat u wilt meewerken met dit interview.

Het doel van mijn onderzoek is om in detail te achterhalen wat er allemaal is gebeurd vanuit verschillende instanties op Texel in het kader van de ambitie om Texel in 2020 volledig zelfvoorzienend te laten zijn in energie en water. Ik wil graag zo veel mogelijk in kaart brengen wat er is gedaan, hoe en waarom dat is gedaan en wat voor veranderingen dit heeft bewerkstelligd in het energie- en watersysteem op Texel. Deze gegevens wil ik analyseren om te kijken of er lering uit te trekken valt voor Texel, maar eventueel ook voor Nederland in zijn geheel.

Het doel van dit interview is om de kant van een initiatiefnemer te horen. Waarom bent u begonnen aan het project [invullen]? Hoe verliep dit project en wat waren de resultaten? Hiervoor wil ik u een aantal vragen stellen.

De eerste stel vragen zal gaan over wat gedaan is, waarom en de resultaten. Deze worden aan iedere geïnterviewde gesteld. Daarna volgen nog wat meer gedetailleerde vragen gebaseerd op vooronderzoek.

Het interview wordt opgenomen (mits geen bezwaar). Het interview zal worden uitgewerkt in een verslag. Deze worden als bijlagen toegevoegd aan mijn thesis rapport. Uit dit verslag kunnen opmerkingen en zinnen gebruikt worden voor mijn thesis, deze worden dan in het rapport verwerkt. Heeft u daar bezwaar tegen of wilt u specifieke dingen liever niet terug zien (met uw naam er bij) in het rapport, dan mag u dit aangeven. Het uitgewerkte interview wordt eerst opgestuurd ter controle door de geïnterviewde en pas gebruikt na goedkeuring.

Stukken in cursief zijn toelichtingen of informatie waar ik naar op zoek ben, maar moet niet altijd direct hardop genoemd worden i.v.m. de "suggestive nature" ervan en de mogelijke subjectiviteit die dan vormt.

Vragenlijst

De vragen zijn vrij algemeen toepasbaar bij elke geïnterviewde. In cursief staat wat voor specifieke data ik zoek en eventuele extra vragen, deze verschillen per interview en hangen af van de plek in het systeem van de geïnterviewde.

NIET VERGETEN: *Vertel eerst dat je uiteindelijk een soort tijdlijn wilt verkrijgen, dus pak een A4 en begin vraag om bij het begin te beginnen, voordat het project überhaupt begon.*

- **Wat is er gedaan? / wat is er gebeurd?**

  - ✓ Wat is er precies gebeurd? Hoe werkt het initiatief/project?

- **Waarom is dit gedaan?**

  - ✓ Wat is de reden dat je met dit project/initiatief bent begonnen? Wat of wie heeft het geïnitieerd?
    Mogelijkheden: (Financieel, persoonlijke interesse, duurzaamheidsbewust, voorbeeldfunctie)

  - ✓ Wanneer kwam je op het idee / wanneer gebeurde het?

- **Hoe ging het precies in zijn werk?**

  - ✓ Welke partijen/bedrijven/mensen waren betrokken bij:
    - De voorbereiding?
    - Het project?
    - De bouw? / Installaties? Wanneer is er begonnen met bouwen?
    - Waarom is gekozen voor deze partijen?

  - ✓ Was er specifieke (specialistische) kennis of materiaal nodig voor het project, en waar kwam dit vandaan?

  - ✓ Hoe is het project gefinancieerd? *(Zelf? Lening? subsidie? Van wie?)*
    - Regelde je dit zelf of deed iemand anders dat?

- **Wat heeft het opgeleverd?**

  - ✓ Wat is het resultaat?
    - Voor de gemeente (ondervind je bepaalde voor- en nadelen?)
    - Voor de andere partijen

  - ✓ Ben je tevreden met het resultaat van het project?

  - ✓ Heb je veel reacties gekregen op je project van de bewoners op Texel?

  - ✓ Is er na de realisatie nog gemeten of de resultaten kloppen met wat beoogd is?

Andere relevante vragen (o.a. m.b.t. data verzameling, persoonlijke ideeën) indien tijd over. Volgorde in relevantie.

- ✓ Wat is jouw mening over de ambitie van Texel en hoe het er op dit moment voor staat?

- ✓ Ben je met nog meer duurzame initiatieven bezig?

Contactgegevens van relevante personen

- ✓ Bouwbedrijven
- ✓ Projectmedewerkers
- ✓ Beleidspersonen

Afsluiting

- Bedanken voor tijd en enthousiasme.
- Vragen of ik, indien nodig, nog contact op mag nemen als ik vragen heb of nog dingen wil nakijken.

Appendix II - List of interviewed people

Interviewee name	Organisation	Role / situation	Date and time
Antoine Maartens	Urgenda	(Former) Project Manager on Texel	Mo 18 April 2016 11:30
Dirk Schagen	[local resident]	Texel resident. Owner of the (only) windmill on Texel since 2000.	We 20 April 2016
Han Brezet	Foundation for Sustainable Texel	TU Delft Professor. Co-founder of Foundation for Sustainable Texel	Mo 2 May 2016 12:00
Herman Ridderinkhof	TexelTeam 2020	Texel resident. Participated in energy neutral housing project by Urgenda.	Tu 26 April 2016 10:00
Pieter de Vries	Municipality of Texel / TexelTeam 2020	Employee Sustainable Development	Tu 26 April 2016 14:00
Stephan Langeweg	Water Board HHNK	Manager Innovation at HHNK	Fr 20 May 2016 13:00
Pepijn Lijklema	Vigor Novus	Former TU Delft student. Current Texel resident	Tu 26 April 2016 16:00
Gijs Berger	TexelEnergie	(Freelance) Project manager for TexelEnergie	Tu 7 June 2016 12:00
Paul Fransen	Municipality of Texel	Project Manager for Nesland	Tu 7 June 2016 16:00
Mini Eelman	[local resident]	Local Frontrunner. Former municipal employee	We 15 June 2016 13:00