Factors influencing the implementation of ground based solar parks.

A case study research on the implementation of ground based solar parks in Fryslân and Groningen.

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Summary

Climate change is increasingly visible and felt by humans and nature. One of the measures we can take to limit the impact of climate change is to stop using fossil fuels and to start using sustainable energy. However, our society is equipped for fossil fuels and not for sustainable energy. Spatial planners all over the world are trying to integrate the sustainable energy sources in the landscape the best they can. One of the renewable energy sources is solar energy. Solar energy at a large scale is increasingly realized on the ground, so-called ground based solar parks. These solar parks are visible in the landscape, and this change sometimes leads to resistance at the level of citizens, but also at the level of the municipalities and provinces.

In the research, I focus on socio-technical transition theory, more specifically on the multi-level perspective, combined with the TPSN framework at the spatial scale. Based on this theory, different factors influencing the implementation of ground based solar parks have been researched.

Three different cases have been researched. All three cases received in 2014 the SDE+ subsidy and are located in the provinces of Fryslân or Groningen. The cases are EK Garyp in Garyp, Sunport Delfzijl in Delfzijl and Vierverlaten in Hoogkerk.

The results of this research show that the three cases have been realized at fairly easy locations. All three locations are locations that cannot be seen from the surrounding houses. Two of the locations were already intended as industrial area. The third location is situated at a former dumpsite, at which the municipality already was looking for a new usage. It appears that the concepts industry, culture, and areal differentiation mainly played a role in the implementation of these three ground based solar parks. However, as the land in the Netherlands becomes more scarce, other factors can become more important. The importance of a good financing system and awareness of the public has become clear through other countries.

Ground based solar parks could be implemented in the time given by the SDE subsidies (3-4 years) if they are structurally integrated into the regime. The window of opportunity is opened, now it needs to be integrated into the regime. However, it is important to continuously research the development of the planning of usage of land in relation to the realization of sustainable energy projects in the Netherlands.

List of abbreviations and frequently used units and values

In this thesis, several technical units and values are used. To get a good understanding of these units and values, I will explain their meaning and relation to each other in this chapter.

FREQUENTLY USED ABBREVIATIONS

A	Ampere
BMWA	Federal Ministry of Economics and Labour
BMU	Federal Ministry for the Environment, nature conservation and nuclear safety
EK Garyp	Enerzjy Kooperaasje Garyp
FiT	Feed in Tariffs
FSFE	Fûns Skjinne Fryske Enerzjy (foundation which financially supports sustainable energy projects in Fryslân)
FUMO	Fryske Utfieringstsjinst Miljeu en Omjouing (Regional Enforcement Service)
GHG	Greenhouse Gasses
GSP	Groningen Seaports
MPC	Multi-phase concept
MLP	Multi-level perspective
NEV	Nationale Energie Verkenning (National Energy Outlook)
NREAP	National Renewable Energy Action Plan
PBL	Planbureau voor de leefomgeving (Netherlands Environmental Assessment Agency)
PV panels	Photovoltaic panels, or solar panels
RES	Renewable energy sources
RES-E	Electricity from renewable energy sources
RETs	Renewable energy techniques
SNM	Strategic niche management
SDE+ subsidy	Stimulering Duurzame Energie (stimulation of sustainable energy production subsidy)
TM	Transition management
TPSN framework	Territory, place, scale, and network framework

UNITS AND VALUES

To prevent using too many zeroes, prefixes are used. Prefixes can be used in front of every unit, in this report I will mainly use it for Watts. In the table below, these prefixes are explained.

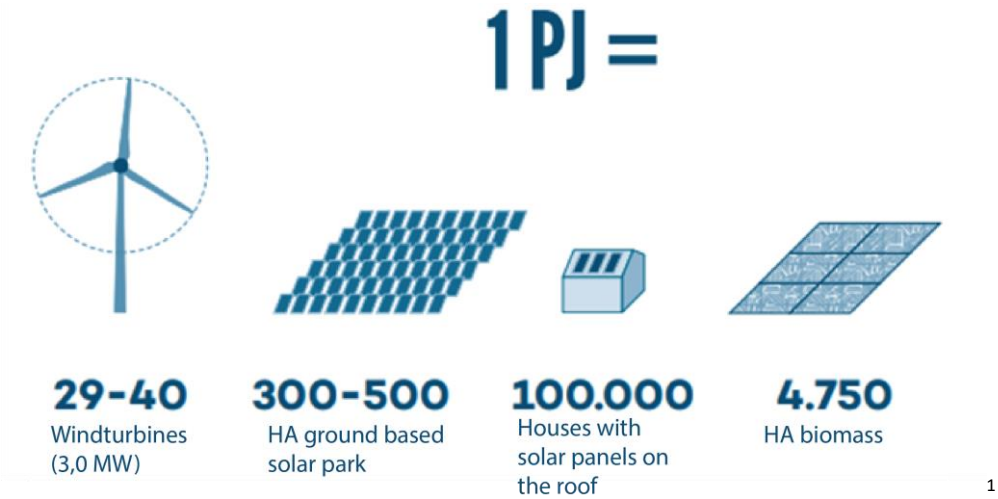
Prefix	Short prefix	Value
Kilo	K	1.000
Mega	M	1.000.000
Giga	G	1.000.000.000
Tera	T	1.000.000.000.000
Peta	P	1.000.000.000.000.000

FULL LOAD HOURS AND PRODUCTION FACTORS

A kWh is the actual power produced by the solar panels. The amount depends on the intensity of the light and the hours of sunlight is called the full load hours and is calculated by kWh/kWp. A kWp (kilowatt peak) is the power of the PV installation, the power that solar panels generate under standard conditions, corresponding to the power that a panel generates during the best days of the year.

SOLAR PARKS AND SPACE

As Posad et al. (2017) mention, not only the size of the object is important. The impact on the spatial planning, how much energy it will generate, and how the object can be spatially embedded into its planned location have to be taken into account as well. The Dutch government therefore often uses PJ (petajoule) as the main unit. To understand the size and scale of this energy unit and to get a clear image of the units used in this thesis, figure 1 includes an illustration of one petajoule. One petajoule is about 277 MWh.



[1]

Figure 1. One Petajoule. Source: (Posad spatial strategies/ Generation.Energy; FABRICations; H+N+S lanschapsarchitecten; Dirk Sijmons; Studio marco Vermeulen; NRGlab/Wageningen Universiteit; Ruimtevolk, 2017)

A solar park of 1 ha, produces roughly 1 MWp of solar power (GID, 2017). A solar park of one megawatt, therefore, is about the size of a farmyard, as is shown in Figure 2.

1 ha, size of a farmyard | 10 ha, size of a few parcels | 100 ha, size of a village

Figure 2. Visualization of different sizes of solar parks. Source: RVO (2016).

[1] Wind turbine: At 2240-3200 full load hours and a wind turbine of 3 MW.
Solar park: With panels of a peak load of 270-420 Wp and 850 kWh/kWp, 2 rows of panels in a 35° angle, and 9 meters distance between two rows.

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1. Introduction

1.1 Greenhouse gas emission

We are the first generation to feel the impact of climate change and the last generation that can do something about it"

– Barack Obama, September, 23th 2014

Former President Barack Obama used this quote of an American governor in his speech on Climate Change at the UN. He held this speech during the COP21 (conference of the parties 21), or the 2015 Paris Climate Conference. The UNFCCC's (United Nations Framework Convention on Climate Change) are held to start an international political response to climate change. The Netherlands take part in this Climate Conference as well. An international political initiative has been started, but the effectiveness on the ground is questionable. In Figure 1 the greenhouse gas emissions (GHG) of the Netherlands are shown as an example. In 2015 the GHG emissions totaled 196 billion kg of CO_2 equivalents[2]. This is a 5% increase compared to 2014, and a 12% decrease from 1990.

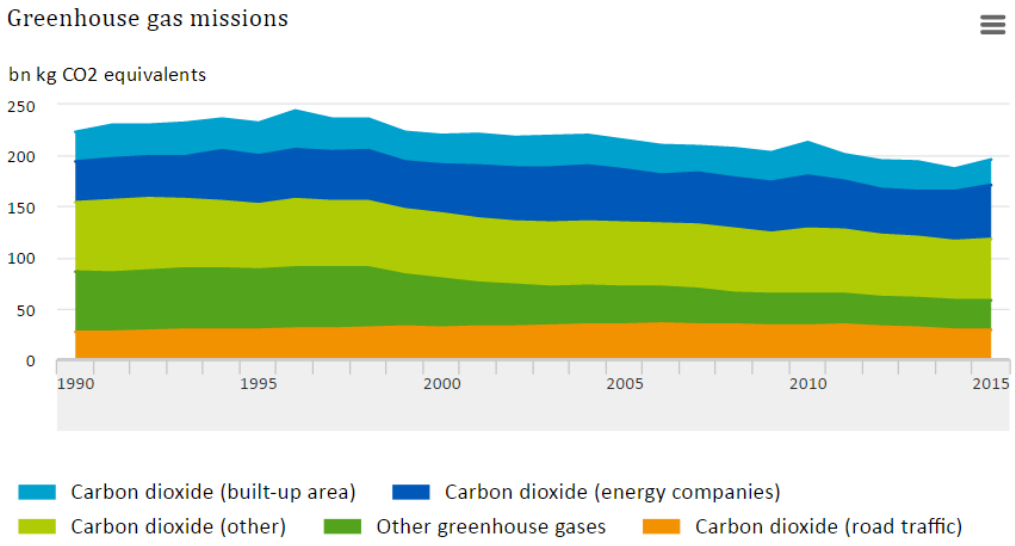

Figure 1 Greenhouse gas emission of the Netherlands. Source: (CBS, 2016).

[2] Because emission figures are converted to CO_2 equivalents, the aggregate effect of the various types of greenhouse gasses can be calculated. The conversion is based on the 'Global Warming Potential' (GWP) – defined as the degree to which a gas contributes to the global greenhouse effect. One kg of CO_2 equivalents is equal to the effect of 1 kg of CO_2 emission. 1 kg of laughing gas (N_2O; nitrous oxide) emission equals 298 kg of CO_2 equivalents and 1 kg of methane (CH_4) emission equals 25 kg of CO_2 equivalents. The GWPs of fluorinated gases range from rather small to huge, e.g. 1 kg of Sulphur hexafluoride (SF_6) equals 22,800 kg of CO_2 equivalents (CBS, nd).

During the UNFCCC conferences, the developed countries[3] have agreed upon a reduction of their GHG emissions, aiming to be under the 1990 levels through domestic and complementary efforts by 25-40% by 2020 and 80-95% by 2050 (UNFCCC, 2011). Developing countries should achieve a 15-30% reduction by 2020. The Dutch government, government of a developed country, is now aiming for a reduction of 14-17% by 2020 (ECLI:NL:RBDHA:2015:7145, 2015).

Appendix I shows the targets of other developed countries. It shows that the EU (28 countries) together already achieved 80% of its targets for 2020. According to this table, the Netherlands are doing worst, with only 39% accomplished. Compared to the neighboring countries, Belgium (62%), Germany (77%), and the United Kingdom (47%), the Netherlands are doing significantly worse. Not only are the Netherlands doing worst, the 14-17% target is also at least 8% lower than the 25-40% target for the European developed countries. In 2015 a group of Dutch citizens organized themselves in the foundation 'Urgenda' and sued the Dutch state (Urgenda, 2015). In the lawsuit, Urgenda demanded the state to ensure the reduction of GHG emission of at least 25% by 2020 compared to 1990. The result of the lawsuit was that the court ordered that the state is obliged to cut its emission by at least 25% compared to the emissions in 1990.

These emissions have become a point of discussion. In October 2017, the Nationale Energieverkenning (NEV) (Eng.: National energy outlook) of 2017 was published. This NEV yearly overviews the developments of Dutch energy management. It shows that the developments in the Dutch energy sector are inseparable from our surrounding countries. Figure 2 shows that until 1996 the GHG emissions initially rose, but from then on, the GHG emissions can be seen to go down. In 2015 the GHG emissions were 195 Mt (Megaton) CO_2-equivalents, which is a reduction of 12% compared to 1990. This reduction is mainly caused by a decline of the use of non-CO_2-GHG, and partly by CO_2-reduction in the industrial and construction sectors. CO_2-emissions from the energy and transport sector have, compared to 1990, increased in 2015, agricultural emissions have remained equal. Compared to 2014, the GHG emissions rose in 2015 and 2016. This is probably mainly due to increased use of the Dutch coal and gas plants. There were also more industrial activities and more use of gas because of a lower average temperature compared to 2014.

The provisional numbers of 2016 are 9 Mt higher than estimated (ECN, 2017). This difference can be explained by the extraordinary situation in the electricity sector. The temporal shut down of nuclear power plants in France, combined with a low gas price, led to an unexpected peak in the net export of energy. ECN sees this as an extraordinary situation and expects that this will not have permanent consequences for the reduction of GHG.

Calculations show that the policies will lead to a reduction of GHG to 170 Mt CO_2-equivalents in 2020 (ECN, 2017). This is a reduction of 25 Mt CO_2-equivalents. This will be reached by different developments in the energy- and industry sector, such as the growth of the production of renewable energy. These developments will lead to a GHG reduction of 23%, which is still not the required reduction by 25%. As there are many factors of uncertainty, for instance in the energy and CO_2-prices, economic, demographic, and technological developments and other factors like the weather, a differential has been calculated of 19-27% (ECN, 2017). The reduction in 2020 could turn out 5 Mt higher, or 13 Mt lower. The most important uncertainties lay in the reduction of conventional energy production and the developments in

[3] Developed/Annex I countries: Australia, Austria, Belarus, Belgium, Bulgaria, Canada, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Latvia, Liechtenstein, Lithuania, Luxembourg, Malta, Monaco, Netherlands, New Zealand, Norway, Poland, Portugal, Romania, Russian Federation, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey, Ukraine, United Kingdom, USA. (UNCC, 2017)

other countries, such as exemplified by the higher GHG emissions in 2016. The reduction of conventional production will occur thanks to a growth in renewable energy and the transport capacity of this energy between countries. The possibilities of exchanging renewable energy between countries will allow the receiving countries to use less conventional energy as well. Taken these factors into account the expectation is that in 2025 more than half of the produced energy will be from renewable energy sources.

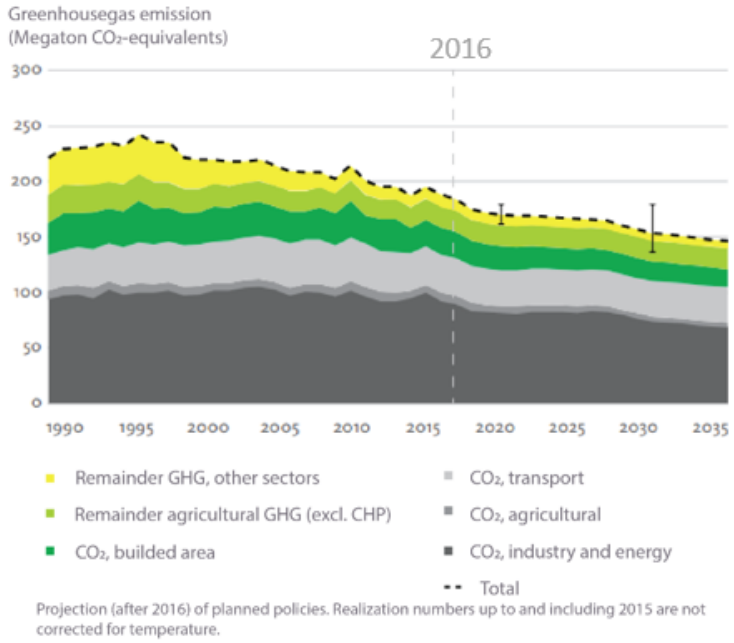

Figure 2 Development GHG emission in 1990-2035. Source: (ECN, 2017).

Because the Netherlands is behind on the goals of the GHG emission reduction, the Netherlands face a large challenge: to reduce the GHG emission. One of the possibilities is to change the use of fossil fuels into the use of renewable energy. In this thesis I will look at the challenges the Dutch spatial planning faces, specifically considering solar farms. I will use the next sections to explain the background of the thesis and conclude with the preliminary research question.

1.2 The renewable energy transition

1.2.1 The transition in the Netherlands

These GHG-emission reduction goals are set during the climate conventions, in which the Netherlands is taking part, as noted previously. The active promotion and implementation of renewable energy sources (renewables) started years ago and Appendix II shows the results of the efforts up until 2015. The Appendix notes the specific forms of renewable energy per EU country and the share of renewables in the gross inland energy consumption of 2015. It also shows which renewable energy source is being used by the countries and the percentage of each renewable energy source (biomass & renewable waste, hydropower, geothermal, wind, and solar). The statistics show a general pattern of which renewable energy source is favored. Overall, biofuels & renewable wastes are being used most, accounting for 8,4% of the final energy consumption in the EU-28 countries in 2015. In this report, I will use the most commonly used definition of Intergovernmental Panel on Climate Change (IPCC) of renewable energy:

> "*any form of energy from solar, geophysical or biological sources that is replenished by natural processes at a rate that equals or exceeds its rate of use. Renewable energy is obtained from the continuing or repetitive flows of energy occurring in the natural environment and includes low-carbon technologies such as solar energy, hydropower, wind, tide and waves and ocean thermal energy, as well as renewable fuels such as biomass."* (IPCC, 2011, p. 166).

In 2015, these five renewable energy sources produced only 5,84% of the total energy consumption in the Netherlands, as shown in Appendix III. Biofuels & renewable wastes (biomass) are also the biggest renewable energy source in the Netherlands, accounting for 3,95% of the total energy consumption. Even though it is a relatively "easy" source, as solar panels are quite easy to buy, solar energy accounts for only 0,25% of the total energy consumption. This includes both building integrated and ground-based solar panels. Looking at the percentages of Appendix II and III, we can state that there are different proven and working techniques to reduce the GHG emissions. Nonetheless, the Netherlands still fails to succeed in applying these techniques, and reduce their GHG emissions.

This failure is also highlighted by Raven, et al. (2012). They researched literature on socio-technical transition documents and conducted case studies and concluded that the Netherlands is widely credited for "*failing in the development of renewable energy technologies*" (Raven, Schot, & Berkhout, 2012). Moreover, they state that the Netherlands are being credited for applying a transition management approach in energy (cf. Geels & Raven, 2006) and Negro, et al., 2008)). However, this transition management approach has not led to a bigger reduction of GHG emissions in the Netherlands.

In the Netherlands, the Trias Energetic is often used as a starting point for the energy transition. The Trias Energetica is based on an idea of Johansson & Turkenburg (2004). They have described three major pillars of energy for sustainable development. These three pillars are more efficient use of energy, increased utilization of renewable energy, and, last, the accelerated development of new renewable energy techniques (RETs). The latest model of the Trias Energetica includes these pillars in the following steps:

1. Reduce the energy demand
2. A. Use energy from residual flows
   B. Use energy from renewable sources
3. Use the fossil fuels as efficient as possible

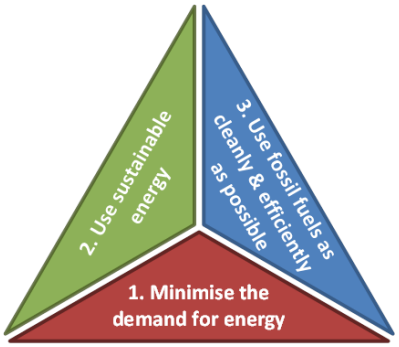

Figure 3 Trias energetica. Source: www.energy-watch.nl.

All three steps are important, but the biggest gain is in the second step, to use as much renewable energy as possible. This is also an important point mentioned in section 1.1, as the percentages of renewable energy aimed for in Europe have been set. Therefore, this second step, use sustainable energy, will be the focus of my thesis.

1.2.2 Ground-based solar parks

One of the commonly known sustainable energy sources is solar energy. Solar energy should have a large share in the amount of renewable energy production, as also described in the Dutch policies and ambitions (Ministerie van Economische Zaken, 2016). Appendix III shows that the Netherlands is behind in the use of solar energy. However, improvement is visible. Photovoltaic (PV) modules, or solar panels, can be placed on the ground. These are called ground mounted or ground-based solar panels. A larger amount of ground-based PV-panels in a group is called a ground-based solar park. In this thesis, I will look at ground-based solar parks of a minimum size of 1 MWp, which represents around 1 ha (RVO, 2016). This minimum size of 1 MWp is about the size of a farmyard (RVO, 2016). Furthermore, the municipality of Groningen wants to be included actively as authority from this scale, and from 1 MW the solar panels needed to put on the ground as the roofs are not that big. The spatial impact is more relevant for parks from 1 MWp than for smaller parks. The ground-based solar park is an upcoming renewable energy form in the Netherlands. As Figure 4 and Table 1 show, the amount of ground-based solar parks, here represented in MWp, implemented in recent years have grown in 2015 and 2016 and are expected to grow more in the coming years.

Year	MWp
2012	3
2013	1
2014	0
2015	4
2016	78

Table 1 Implemented MWp solar park per year. Source: www.zonopkaart.nl.

This is an interesting development in the renewable energy techniques because it allows for more renewable energy generation in a relatively small area. Figure 5 shows the implemented and planned MWp per province. It shows that there are many plans to implement ground-based solar parks.

The ground-based solar parks are part of the second step of the Trias Energetica. And since, in this thesis, I will look into the second step, to use as much renewable energy as possible in the Netherlands, the increase of solar parks in the Netherlands is of prime importance. For, to use as much renewable energy as possible, there needs to be renewable energy produced, to begin with. Therefore, the future of energy lays within renewable energy sources. This brings challenges to our use of space and thus to the spatial planning. These challenges will be discussed in the next section.

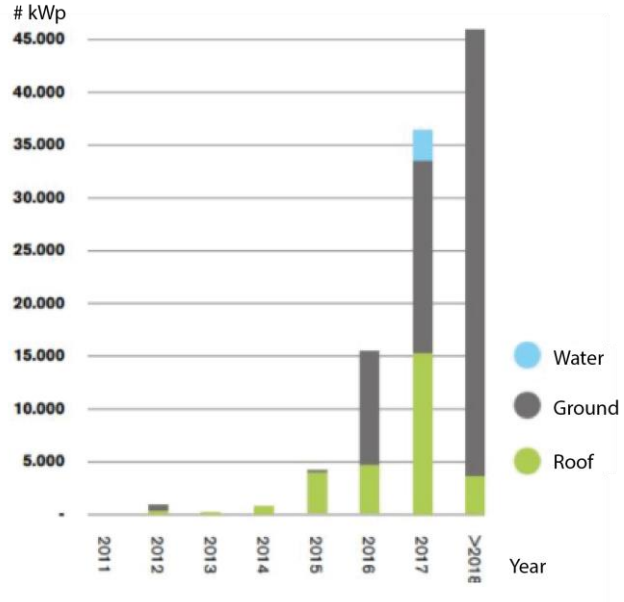

Figure 4 Expected new production capacity of solar energy in kWp in the Netherlands. Source: www.hieropgewekt.nl.

Table 2 PV installations in 13 European countries. Source: IEA PVPS (2016).

	PV cumulative installed capacity 2015	PV installations in 2015	PV penetration	Average size PV installations
	MW	MW	%	MW
Austria	937	152	1,6	6,2
Belgium	3250	91	3,9	35,7
Denmark	787	181	2,4	4,3
Finland	13	5	0	2,6
France	6589	887	1,6	7,4
Germany	39710	1461	8	27,2
Italy	18906	300	8,4	63,0
Netherlands	1560	437	1,3	3,6
Norway	15	2	0	7,5
Portugal	465	49	1,6	9,5
Spain	5430	54	3,1	100,6
Sweden	127	47	0,1	2,7
Switzerland	1394	333	2,4	4,2

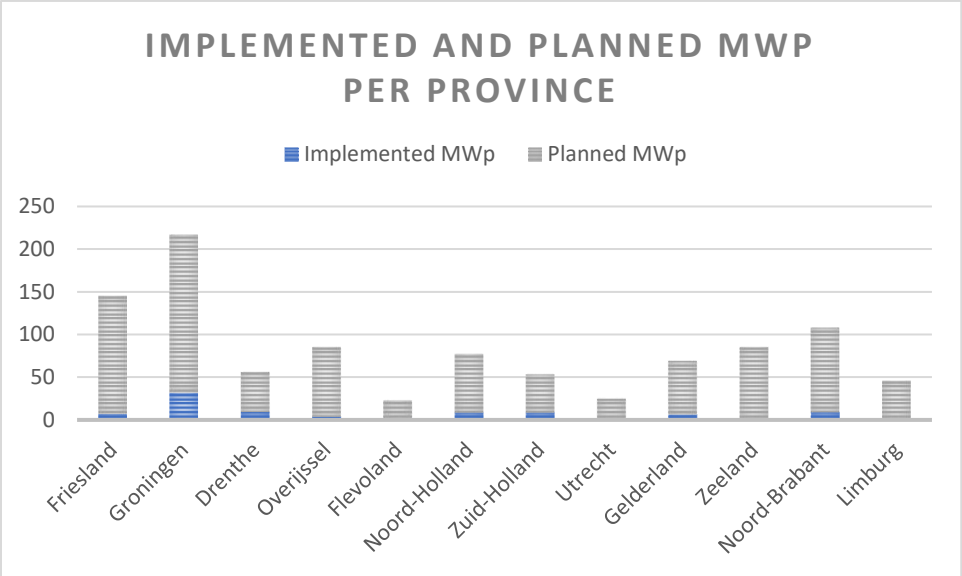

Figure 5 Implemented and planned MWp per province. Source: (RVO, 2017).

1.3 Spatial planning and energy

The first question that needs to be answered when researching energy and space, is whether there is a relation between these two concepts. Looking at the literature, the answer is clear and simple: yes, there is a relation. The controversies surrounding new wind farms are researched and debated, and lately, researchers also look into the controversies surrounding ground-based solar parks. These controversies mainly include and are part of the localized public opposition (Stewart & Aitken, 2015). The attention from the academic world for this subject, has its roots in everyday life (see for example Frolova, et al. (2015); Johnsen Rygg (2012); Stoeglehner et al. (2016); Vandevyvere & Stremke (2012); Wolsink (2007); Wolsink (2012), all studies that research the spatial implications of renewable energy or the struggles of civilians on renewable energy.

As long as we depend on energy and the energy infrastructure, the relationship will always be there. With the introduction of renewable energy sources, this relation is actually changing. We are already used to power structures like high voltage power lines, gas pipes, oil refineries, and power plants, these structures also need (spatial) buffer zones to prevent hinder from noise and shadow flicker, as well as safety zones (see e.g. Braam, et al., 2005; Gordijn, et al., 2003). The use of energy itself is spatially limited and differs between the energy types (Stremke, 2010). For example, heat, in the form of warm water, should not be transported over a distance larger than 10 km, but electricity can be transported over more than hundreds of kilometers. I will discuss the geographical implications of the renewable energy transition more in chapter two.

So, there is a mutual relation or interaction between the spatial characteristics and the production and possible use of energy. As the energy supply is changing, this has different spatial consequences and therefore is an interesting subject to look into as a spatial planner. The report of ECN (2017) also highlights that governments need to deal with the spatial impact of the energy transition and even claims that there is a growing necessity of cooperation between sub-national governments.

1.4 Focus of the research

1.4.1 Relevance of the research

These spatial consequences and changing governance is an interesting topic to research as a spatial planner. Especially, as seen in Figure 4, the amount of ground-based solar parks is growing fast in the Netherlands in 2015, 2016, and 2017. Figure 5 shows that there are a lot of plans to realize ground-based solar parks in the different provinces, but only a small percentage of these plans have actually been realized. In the Dutch newspapers as well, a lot has been written about ground-based solar parks, for instance, the plans for a ground-based solar park in Sappemeer[4], the struggles around the ground-based solar park in Vlagtwedde[5], and the most recent plans for a ground-based solar park in Wirdum[6]. The literature on renewable energy sources in the Netherlands is now mainly focusing on windmills, for example, Wolsink (2007); Boon & Dieperink (2014). Little has been written on the process of the implementation of ground-based solar parks in the Netherlands and which factors are influencing this process. Literature from other countries and on other renewable energy sources might be useful. Different case studies on the implementation of ground-based solar parks and the challenges and strategies in countries have been done in, for instance, Germany, Italy, and Greece (eg. Mangani & Osti, 2016; Eleftheriadis & Anagnostopoulou, 2015).

This thesis will give more insight into which factors related to spatial planning influence the implementation of ground-based solar parks, for instance, the direct and indirect space claims. In this thesis, I will focus on the implementation process of ground-based solar parks. Having insight into the factors which will be formulated in the theoretical framework, can help implementing ground-based solar parks more effectively and therefore help to achieve the climate goals as formulated in or by Europe. Also, the experience of the stakeholders of the cases that I will discuss in this thesis will gain insight in how to influence the implementation of ground-based solar parks.

[4] http://www.fluxenergie.nl/sappemeer-omwonenden-houden-grootste-zonnepark-van-west-europa-tegen/
[5] https://fd.nl/ondernemen/1206047/kolossaal-zonnepark-vlagtwedde-is-een-klucht-tussen-boer-gemeente-en-powerfield
[6] http://www.lc.nl/friesland/Plannen-voor-zonnepark-van-41-hectare-bij-Wirdum-22055520.html

1.4.2 The aim of the research

In the Netherlands, the production of sustainable energy (renewable gas, renewable electricity, and renewable heat or a combination of renewable heat and electricity), is implemented with the help of subsidies. Large-scale ground-based solar parks are being supported by the SDE+ subsidy. For instance, a solar park with at least 15 kWp and a large consumers' connection (NL: grootverbruikersaansluiting) (≥15 kWp and connection, > 3*80 A), can subscribe for this subsidy. This subsidy is a reversed auctioning system; producers receive a financial compensation for the renewable energy they generate. If you subscribe to the subsidy, you need to have the permits and licenses from the government to build the park. So, the entire governance process is already done. This system attracted 48 MW in 2013, 137 MW in 2014, but only 1 MW in 2015 (IEA PVPS, 2016). In 2015, the cumulative installed capacity of these solar parks was 186 MW. Table 2 shows the total amount of installed PV-capacity (solar panel capacity) in 13 countries in Europe. Comparing the average size of the PV-installation, on average the Netherlands has one of the smallest PV-installations.

In this research, I want to find out why such a small number of ground-based solar parks have actually been implemented, while all these ground-based solar parks (shown in Figure 5) with SDE+ subsidy already have the needed permits and licenses. More ground-based solar parks are implemented in other countries as shown in Table 2. Looking at this, I can conclude that the concept of solar parks itself and the techniques related to it are not the problem. So, there are factors or constraints to ground-based solar parks, leading to this small amount of realized ground-based solar parks in the Netherlands. I want to determine if spatial planning plays a role in these constraints.

As Figure 5 shows, 86 MWp has been implemented, and 901 MWp is planned and Table 2 shows that the Netherlands is behind on the realization of the energy goals compared to other countries. In this thesis, I want to focus on the reasons for this small number of realized or implemented ground-based solar parks. To research the process of the implementation, I will first have to describe what this process contains. Then I can determine what spatial planning factors are influencing this process. As spatial planning is a broad concept, I will research this through studying the socio-technical transition, which will be explained in the next chapter. Therefore, my preliminary research question can be formulated as: Which factors related to spatial planning influence the process of the implementation of ground-based solar parks?

1.5 Readers guide

In this chapter, I have drawn the outline for my research, the energy transition in the Netherlands. The focus of my thesis will be on factors that influence the implementation of ground based solar parks. In the next chapter, I will elaborate on the theory I have used to determine these factors. The chapter ends with a schematic overview of the theoretical framework. After the theoretical framework, I will explain my research objective and purpose, including my research questions in chapter 3. In this chapter, the methods I used to research these research questions, and how and which cases are selected for this research are also explained. Chapter 4 describes the cases I have selected after which in chapter 5 the results of the case studies are described. In chapter 6 I will discuss my conclusions and the answers on the research questions. In chapter 7 I will discuss the limitations of the research and recommendations for further research will be made.

2. Theoretical Framework

In the previous chapter, I have drawn an outline of the energy transition in the Netherlands, which led to the focus of my thesis, factors that influence the implementation of ground based solar parks. In this chapter, I will discuss the existing scientific literature on energy transitions. I will explain a few frameworks that exist to study socio-technical transitions and make a well-founded choice for one framework. I will end this chapter by explaining how I will use the chosen framework in my research.

2.1 Sustainable development

Processes like the implementation of ground-based solar parks are part of the sustainable development that governments are trying to support and facilitate. One of the responses to sustainable development is the methodology of green economists, which mainly dominates the policy discussions on sustainability (Geels F.W, 2012). Green economists define a green economy as *"one that supports a peaceful interaction between humans and the environment while trying to meet the needs of both at the same time."* (Sousa, 2017 p.1) Green economists believe that natural resources and the ecology also should have an economic value. Their approach is at the same time extensively debated, as the price mechanism, advocated by green economists, is not adequate for promoting radical sustainability innovations (Markard, Raven, & Truffer, 2012).

The challenges of sustainable developments like the development from the green economists are "*coupled with and aggravated by the strong path-dependencies and lock-ins we observe in the existing sectors*." (Markard, Raven, & Truffer, 2012, p. 955). The established technologies are highly intertwined with user practices and lifestyles, businesses, institutions, organizations, and even politics. As a result, these changes will not be radical, but incremental, and such incremental changes will not be sufficient enough to deal with sustainability challenges (Markard, Raven, & Truffer, 2012). Therefore, the question how to promote and govern a transition towards stability has gotten increased attention, both in politics and in social-science research. This has led to the research of socio-technical systems.

A socio-technical system can be defined as follows:

"*conceptualizes sectors like energy supply, water supply, or transportation which consist of (networks of) actors (individuals, firms, and other organizations, collective actors), and institutions (societal and technical norms, regulations, standards of good practice), as well as material artifacts and knowledge"* (Geels, 2004; Markard, 2011; Weber, 2003 in: Markard, et al., 2012 p. 956).

Different elements interact in the socio-technical system which provides a specific service for society. These elements have a broad variety, are tightly interrelated, and depend on each other. This has crucial implications for the dynamics the systems exhibit, and especially for system transformation. When a set of processes leads to a fundamental shift in this system, we call it a socio-technical transition (e.g. Geels and Schot, 2010; Kemp, 1994, Markard et al., 2012). It involves far-reaching changes along different dimensions, such as technical, organizational, material, institutional, political, socio-cultural, and economic dimensions. Ter Horst (2017) states the financial and physical dimension should be added to these dimensions as well. In the course of such a socio-technical transition, new products, services, business models, and organizations emerge, partly complementing and partly substituting existing ones. Not only the technological and institutional structures change, the perceptions of consumers of what constitutes a particular service (or technology) change as well. Examples of a socio-technical change are the introduction of pipe-based water supply, shift to the sewer system, and the shift to automobiles, as

described in Geels (2005a; 2005b; 2006). The difference to a technical transition is that socio-technical changes include a change in user practices and institutional structures, on top of the technical changes. For example, the change towards renewable energy sources requires also a change in the energy network and people using energy more conscious.

These socio-technical transitions are responses to the weaknesses of the green economy approach. The socio-technical researchers are trying to respond to this, by digging into previous transitions. Geels (2012) emphasizes that this way of researching highlights the multi-dimensional interactions. It represents the complexity of systematic changes towards sustainability. The definition of sociotechnical transition I will use is that a socio-technical transition is "*a gradual, continuous process of change where the basic character of society (or a complex sub-system of society) transforms*" (Rotmans, et al., 2001, p. 16). A sustainable socio-technical transition is taking place, when "*a long-term, multi-dimensional, and fundamental transformation processes [is taking place] through which established socio-technical systems shift to more sustainable alternatives*" (Markard et al., 2012, p.956). A socio-technical transition involves extensive changes along different dimensions (e.g. technological, political, socio-cultural, etc.)

Chang, et al. (2017) have distinguished the four most common approaches in sustainability-transition-related studies: multi-phase concept (MPC), multi-level perspective (MLP), strategic niche management (SNM), and transition management (TM). Chang, et al. (2017) conclude that the difference between these approaches is that they examine sustainability transitions from different perspectives. The MPC and MLP concept mainly describe and analyze various historical and contemporary transitions. MPC claims that successful transitions contain four phases and MLP uses three levels to explain why socio-technical transitions take place. SNM and TM are mainly used as policy instruments to proactively manage socio-technical transitions. More specifically, SNM identified three key processes of successful niche experiments. Lastly, TM provides a framework to govern socio-technical transitions. Figure 6 shows the comparison of the four methods by Chang et al. (2017).

Another key issue concerns the emphasis of each approach on the three levels; landscape, regime, and niche (see Figure 6). These three levels are relevant as they all represent a level of capacity to act. At niche level, the actor develops something new, which often requires new rules. At regime level rulesets are known in which the actor can act, and at landscape level, the actor cannot influence the surroundings, but the actor is influenced by it. The MLP focuses on the interplay between all three levels as this interplay determines the transition process. MPC included these three levels in its transition phases and focusses on how the levels relate to the transition phases. TM includes also all three levels, as the TM approach tries to influence the broad transition process. However, it mainly focuses on new sustainability coalitions and networks, which are actually situated at the niche level. SNM only focuses on the niche level.

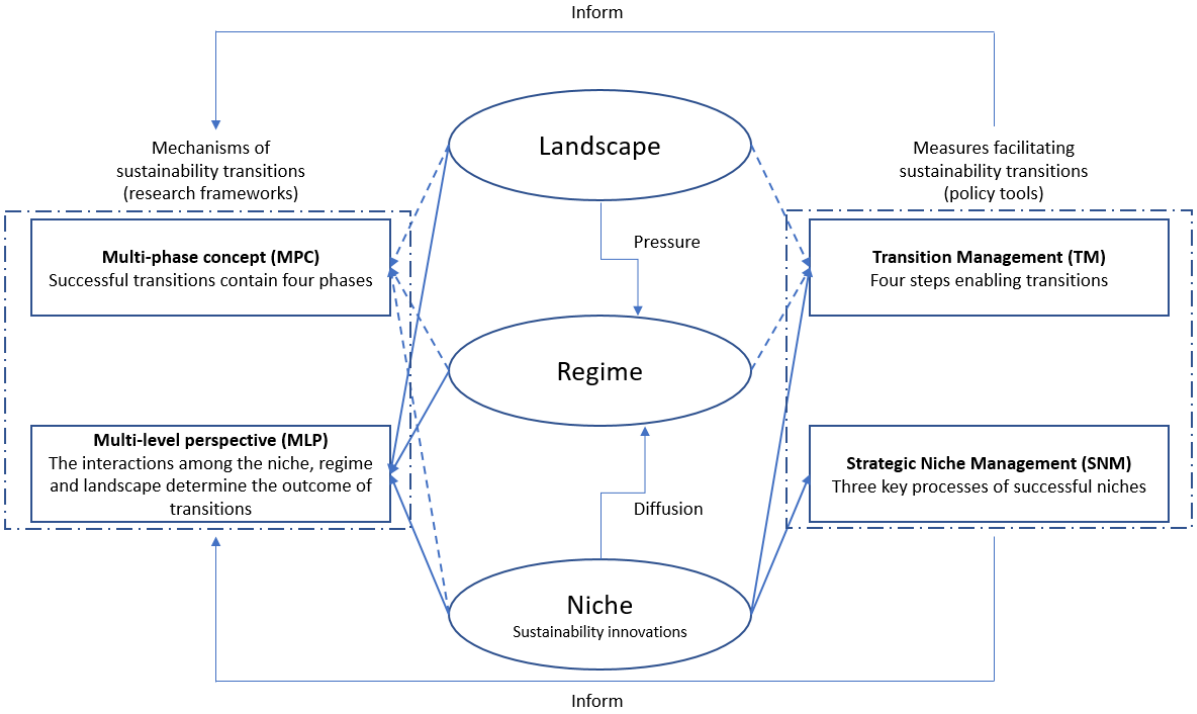

Figure 6 Comparison of the different approaches. Source: (Chang, et al., 2017).

2.2 Socio-technical transitions

In the previous section, four main approaches for current socio-technical transitions have been discussed: MPC, MLP, TM, and SNM. The MPC is mainly systematically illustrated by Rotmans, et al. (2001). According to the MPC framework, an ideal transition process can be represented by an S-shaped curve. This curve contains four different phases: predevelopment, take-off, breakthrough, and stabilization. These four phases all represent a different stage of the socio-technical transition. The MLP level focuses on the interactions among niche, regime, and landscape level to determine the outcome of a transition. The TM focuses on four steps enabling the transition and the SNM focuses on three key processes of successful niches.

The MPC describes certain generic patterns of transition through the framework of these four phases. To influence these patterns, it is important to first understand them. While the MPC is able to distinguish four phases of transition, it does not explain why transitions occur. The multi-level perspective (MLP) on transitions gives us a useful approach to explain why transitions occur, as described by Chang, et al. (2017). Rip and Kemp (1998) started the initial idea of MLP. Figure 7 shows this initial idea. The alignment of developments determines if a change or regime shift will occur. Developments in here are successful processes within the niche by changes at regime and landscape level. The drawback of this approach, described by Geels (2002), is that the approach has a bias towards the novelty and 'innovation journey'.

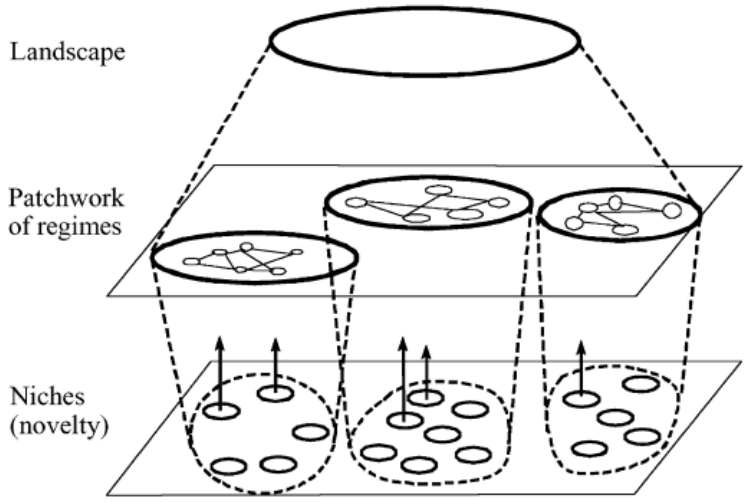

Figure 7 Multiple levels as a nested hierarchy. Source: Geels (2002).

To counter this bias, Geels (2002) has tried to pay more attention towards the ongoing processes at the regime and landscape level. The MLP defined by Geels (2002), describes a transition as a nonlinear process that results from interactions among developments at three levels: niche, regime, and landscape. The key mechanisms of MLP can be described as follows:

"(a) niche-innovations build up internal momentum, through learning processes, price/performance improvements, and support from powerful groups, (b) changes at the landscape level create pressure on the regime and (c) destabilization of the regime creates windows of opportunity for niche-innovations" (Geels & Schot, 2007, p. 400)

So, depending on timing and qualitatively different niche-regime-landscape interactions, transitions can evolve along these three different types of transition pathways. The MLP tool explains why sociotechnical transitions happen but does not allow for investigation on how to influence or even manage transitions. These issues are addressed by SNM and TM.

The Strategic Niche Management (SNM) aims to identify the features of successful niches. SNM has primarily been used to do retrospective analysis. It is proposed by Kemp, et al. (1998), and they defined SNM as follows:

"[T]he creation, development and controlled phase-out of protected spaces for the development and use of promising technologies by means of experimentation, with the aim of (1) learning about the desirability of the new technologies and (2) enhancing the further development and the rate of application of the new technology" (Kemp, et al., 1998, p. 186).

The SNM has been developed to understand the situations of niche innovations in real life. However, some scholars argue that the SNM mainly focuses on technological innovation, thereby neglecting a broad visioning process for sustainability. Others, such as Loorbach and Rotmans (2010), have responded to this deficiency of SNM by transition management (TM) approach. In this, they emphasize the importance of creating visions prior to niche experiments.

TM tries to manage transitions towards sustainable development (Lachman, 2013). It has an interdisciplinary approach to address sustainable development (Lam, Walker, & Hills, 2014) and "*combines studies of socio-technical transitions with insights from complex systems theory and the governance approach*" (Markard, Raven, & Truffer, 2012). The TM approach tries to create a social movement on sustainability through new alliances and networks (Loorbach & Rotmans, 2010).

Figure 6 shows the main differences between the aforementioned approaches. First, the MPC and MLP are research frameworks, while SNM and TM are closer to being policy tools to proactively manage socio-technical transitions. These two also focus more on the niche level, while the other two approaches include three or four levels. The four approaches inform each other, but as Chang, et al. (2017) state, it remains highly unclear in the literature whether these four dominant approaches are largely complementary to each other and thus could be used together, or if they have significant differences and therefore should be used separately. Some studies have used these approaches jointly. For instance, Raven et al. (2010) combined SNM and TM, both contributing to experiments. Other scholars indicate substantive differences between these methods.

In chapter 1.4, the aim of this research has been explained. The aim is to find and to describe factors influencing the implementation of ground-based solar parks by researching successful implementations of ground-based solar parks in the Netherlands. Various scholars, such as Arranz (2017), show that not only the niche level but also the regime and landscape level have a significant influence on the technological transitions in energy. The TM and SNM, moreover, mainly focus on the governance part, while the energy transition and the implementation of ground-based solar parks are about more than only governance. The other two approaches, MLP and MPC both focus on multiple levels, but as described in the first part of this chapter, MPC does not explain why socio-technical transitions appear. MPC focuses more on the phase of a transition. Therefore, I will be using the MLP approach to describe the socio-technical transition as the prime focus of this research, and why it appears or why it does not appear by explaining the interactions among the niche, regime, and landscape dimension. As Smith, et al. (2005) describe, one aspect of sustainability transitions is that guidance and governance often play a particular role. Important here is that what is being called 'sustainable' is subject to interpretation and might change over time (Garud, Gehman, & Karnoe, 2010). In the next section, the MLP and its relation to this thesis will be more extensively discussed.

2.3 Multi-level perspective (MLP)

The main idea of MLP has been described in the first part of this chapter. The most important point of MLP is that the further success of a new technology is not only governed by processes within the niche, but also by developments at the level of the existing regime and the socio-technical landscape. The initial idea of the MLP was proposed by Rip and Kemp (1998), the MLP as it is being used now, was developed by Geels (2002).

The three different levels, landscape, regime, and niche, are often associated with specific territorial boundaries, landscape with international features, regime with national features and niche with (sub-) national or local features. However, there is no need for doing so since, the levels only represent a different dimension and mode of structuring that could have a variety of spatial positioning and reach (Raven, Schot, & Berkhout, 2012). Niches, for instance, have less extensive and stable social networks, expectations are more fragile, and learning processes are less institutionalized than in regimes. These networks do not necessarily have to be local. Socio-technical landscape factors are able to put pressure on regimes. Also, they open windows of opportunities for niches to break through and to contribute to

fundamental changes in socio-technical regimes (Markard, Raven, & Truffer, 2012). For sustainability, national territories are certainly not the only significant space. Figure 8 shows the time and structure of each MLP level.

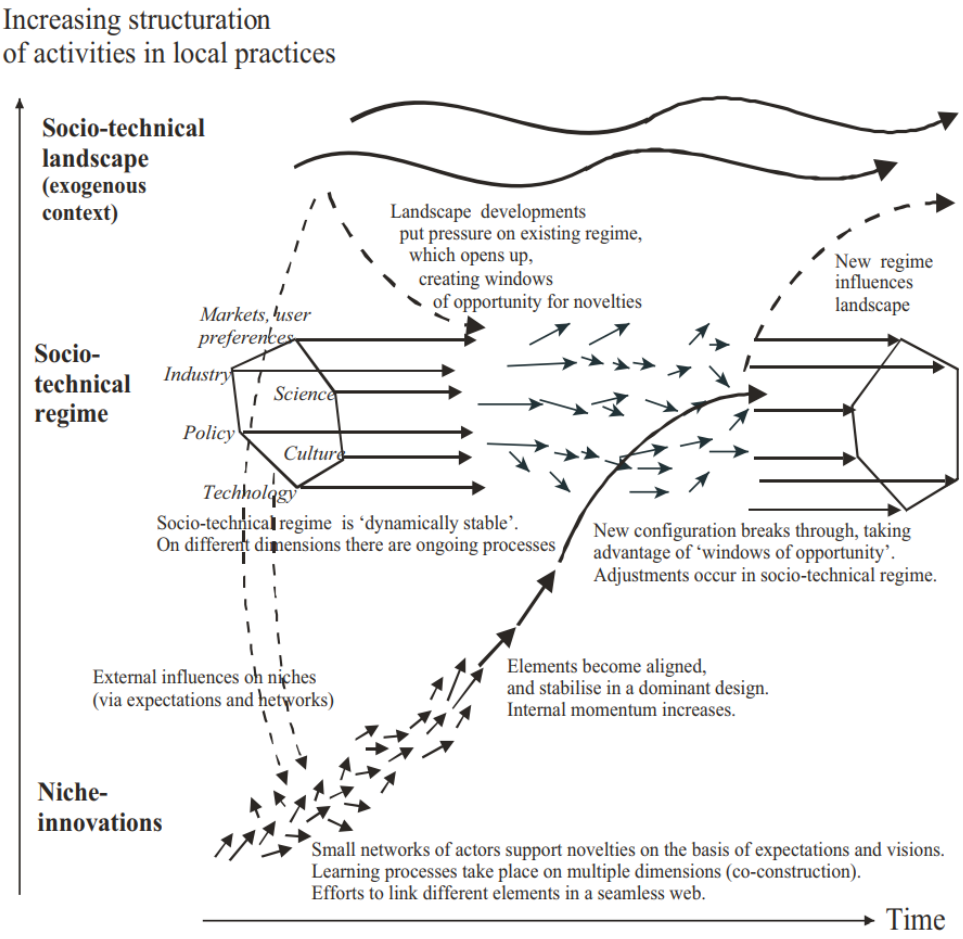

Figure 8 The dynamics of sociotechnical change. Source: Geels F. W. (2011).

Socio-technical landscape

The socio-technical landscape is the wider context and influences the niche and regime dynamics (Rip & Kemp, 1998). The concept not only highlights the technical and material backdrop that sustains society, but it also includes demographical trends, political ideologies, societal values, and micro-economic patterns, as described by Geels (2011). It is a slow changing structure, but can rapidly change by disruptive events like wars, or (climate)disasters.

Socio-technical regime

Socio-technical regimes form the 'deep structure' that makes an existing socio-technical system stable (Geels F. W., 2011). The concept refers to an endogenous structure or semi-coherent set of rules that coordinate and orient activities of others. Giddens (1984) explained that these regimes are both the medium and the outcome of action. On the one hand, actors act and draw upon rules, on the other hand, rules also configure actions.

Niches

Niches are 'protected spaces' in which users are willing to start or support emerging innovations. They enable the development of alternative structures (Raven, Schot, & Berkhout, 2012). Niche actors are, for example, entrepreneurs, start-ups, spin-offs. They work on radical innovations which deviate from existing regimes. Niches are crucial for transitions (Geels F. W., 2011). They provide the base for systemic change.

Figure 8 shows the ideal situation of how these three levels interact dynamically in an ongoing socio-technical transition. Each transition is unique, however, the general dynamic pattern is characterized by transitions resulting from the interaction between the processes at different levels. At niche level, actors in dedicated networks develop radical innovations (Geels F. W., 2010). These are represented by the small arrows at the niche level, going in different directions. If a radical innovation stabilizes and becomes a dominant design, it will also be integrated into the regime and landscape level, represented by the longer and fatter arrows, through the earlier mentioned windows of opportunities. Changes at the landscape level can create pressure on the regime. This destabilization of the regime by the socio-technical landscape and the niche creates windows of opportunities (Geels F. W., Technological transitions as evolutionary reconfiguration processes: a multi-level perspective and a case-study, 2002) for niche-innovations to be integrated at the regime level.

Kingdon (1984) created the policy window theory. In his theory, there are three main streams: the problem stream, policies stream, and the political stream. The problem stream is about problem registration, the policies stream is about the people that focus on the development of policies and the third stream, political stream, is about the public opinion, political support and other aspects (Kingdon, 1984). If these three streams intersect or cross, a 'policy window' or 'window of opportunity' is opened.

The windows of opportunity are created at landscape and regime level. Still, it remains unclear how radical innovations can break out from niche to regime level. Geels (2002) calls this process of breaking out 'niche-cumulation'. This means that new technologies do not directly compete with each other, but form some sort of symbiosis, the new techniques are created with the help of insights from old techniques. Next to that, regimes and the landscape do not change within a short period of time. They change step by step, new regimes grow out of old ones (Van de Ende & Kemp, 1999). Raven, et al. (2012) describes two different scales which both unfold on different levels of time. These different levels match with the above-mentioned landscape developments, socio-technical regimes, and technological niches. The two levels are the temporal and the structural scale. The temporal scale is distinguished by Braudel (1982), the structural scale was distinguished by Giddens (1984).

A third scale, the spatial scale, is added by Raven, et al. (2012). Ter Horst (2017) mentions this as an important dimension, as well. Raven, et al. (2012, p. 65) contend that "*any transition to sustainable development will require interaction between spatially distributed actors, institutions, and economic structures that exercise power within and across heterogeneous and uneven spaces of innovation"*. This means that a sustainable transition needs different actors, institutions, and structures at different locations and levels. These actors, institutions, and structures all exercise power onto the transition. The MLP including this spatial dynamic is called MLP 2.0. The spatial scale added to the MLP method, is a good starting point for the spatial scale in this discussion on sustainable transitions, as shortly mentioned in chapter 1.3. The other concepts (structural and temporal scale) are dealing with climate change adaptation at a more governmental level. This discussion on the need for government or governance is only part of a broader discussion, as described by Bridge, et al. (2013) and also shown by the introduction of the spatial scale. The adaptation to climate change, related to the energy transition, needs to be

triggered. Bridge, et al. (2013) describe that this transition is fundamentally a geographical process that involves reconfiguring current spatial patterns of economic and social activity. These three scales (spatial, structural, and temporal) are elaborated in the next three sections.

2.3.1 Temporal scale

The temporal scale describes at which time scale the intervention or action can be seen and what the impact is on each time scale and how each timescale impacts the intervention or action needed. The temporal scale is divided into the three dimensions mentioned before; socio-technical landscape, socio-technical regime, and niche. The socio-technical landscape is about the slow changing structures related to time, as described in Raven, et al. (2012). They are deep-seated trends that do not change quickly at all. Raven et al. have distinguished three different concepts; the economic growth or decline, demographic change, and social processes which can be punctuated by major events. These major events can be wars or natural disasters. Hence, the landscape level is about things you cannot change immediatelyy and hardly even influence. Table 3 shows the code and the definition used in the research that I have used for the concepts in the interviews for this thesis, these are also shown in Appendix IV.

Table 3 Temporal landscape concepts.

Concept	Definition used in research	Code
Economic growth or decline	The economic trend during the implementation of the case.	TL1
Demographic change	The demographical trend during the implementation of the case.	TL2
Social processes	The social processes which are punctuated by major events during the implementation of the case.	TL3

The regime dimension is more about institutions we have 'made up' ourselves, like cultural repertoires and market structures. So, it is about structures we have come up with to organize our lives and humanity. These institutions or structures are hard to influence. They are influenced by the landscape and niche level as is shown in Figure 8. Table 4 shows the code and the definition used in the research that I have used for the concepts in this thesis, based on Figure 8.

Table 4 Temporal regime concepts.

Concept	Definition used in research	Code
Industry	The outcome of mutual positioning and strategies of supply and demand. (based on Geels, 2002)	TR1
Science	Knowledge, technique, and skills (based on Geels, 2002) regarding ground-based solar parks.	TR2
Policy	Policies regarding ground-based solar parks.	TR3
Markets	The working of the market, the demands, needs, and behavior of the market and the stakeholders involved and the market involving ground-based solar parks. (based on Geels, 2002)	TR4
Technology	The technology used	TR5
Culture	The symbolic meaning of things, perception, habits, beliefs, values, and interests of actors. (based on Geels, 2002; Franzeskaki & De Haan, 2009)	TR6

The niche dimension is about new developments, for instance, events. These are short time span developments, such as new developments in projects. It concerns reshaping the alliances and the change of expectations, things discussed in the corridors of professional conferences and the politics. I have distinguished three different concepts based on Geels, and Schot (2007), which are shown in Table 5.

Table 5 Temporal niche concepts.

Concept	Definition used in research	Code
Innovations	Revolutionary new techniques within a technique	TN1
New technologies	New techniques that did not exist before.	TN2
New developments	Developments based on an older technique.	TN3

With the temporal scale, the timing, or the temporal context, of the innovation is explained. Sovacool (2016) calls this a vital element of consideration. He concludes that transitions are path dependent, as is also included in the MLP.

2.3.2 Structural scale

The structural scale is about the interplay between actors and systems, how they both influence each other. Table 6 shows the definition made by Raven et al. (2012).

Table 6 Structural scale in MLP. Source: Raven, et al. (2012).

Scale	Dimension	Explanation	Code
Structural	The way which actors' values, capabilities, and actions come to be ordered by the structures in which they are embedded, and which in turn reproduce and transform those structures	Landscape – conceptualized as an exogenous environment that actors cannot influence in the short term, but only adapt to. In the long-term, due to regime-changes that emerge as an outcome of changing actor practices, landscapes will also move. The structuring relates to a landscape that makes certain directions more risky, costly and difficult than others. Actors can choose to fight an uphill battle by working against dominant long-term structures, but they often will decide to go with the flow.	STL
		Regimes – balance shifts towards stability, routines are stabilized and embedded in broader organizational systems, networks, and infrastructures, which makes it less likely that actors can escape their structuring impact. At the same time, such ordering provides regimes with their durability and regime actors with systemic, predictable and effective influence. Regimes provide rule sets, which orient actor behavior.	STR

		Niche – protective spaces in which actors have relatively more agency and freedom (but limited power) to develop new routines and enact alternative structures such as new codes of conduct, routines, visions, standards, norms that deviate from the mainstream	STN

2.3.3 Spatial scale

2.3.3.1 Spatial scale in MLP

As said, a third scale is added by Raven et al. (2012). The energy transition has strong geographical components, first of all, because energy systems are constituted spatially. The system is embedded in particular settings and the networked nature of the system itself produces geographies of connection, dependency, and control. We depend on the deliverance of oil, gas, and electricity. Secondly, the high dependence on energy gave rise to distinctive spatial patterns of economic activity. Since the 19th century, this has underpinned the increasing separation of production and consumption, as described by Chisholm (1990) in Bridge et al. (2013). So, the globalization of economic activity rests, in part, on falling relative costs for energy in transportation (Dicken, 2011). This is, partly, due to the higher quality energy sources from coal to oil, or from steam to electricity, the increased economies of scale in the production and transport of goods and the ability to displace many of the social and environmental costs of increased energy abundance (Bridge, et al., 2013). Moreover, on a regional and urban scale, the price and the availability of energy have influenced patterns of urban development and building design. The strong relationship between economic development and the national rates of energy consumption "*powerfully illustrates how contemporary patterns of economic activity rest on geographies of energy capture and conversion and the ability to displace the environmental costs of energy use over time and space*" (Bridge, et al., 2013, p. 333). To conclude, the sustainable energy transition is a geographical project to meet the challenges of climate change and energy security. It not only requires to make choices from a range of possible solutions and scales of governance, but also for societies to commit massive investment to redesign infrastructure, buildings, and equipment. Next to that, a core discussion of the struggle of the energy transition should be held, about how small-scale and close to demand the future generation capacities should be (Späth & Rohracher, 2014).

Space is here perceived mainly as constructed space, constructed through physical, economic, and social networks. These interactions and representations are multilayered, in which boundaries are contingent and continually negotiated and revised. Space, as Raven et al. (2012) claim, only has meaning in relation to the perception of actors, and to their interests and strategies. Therefore, research should also include "*the imagined spaces, the struggles and conflicts in establishing specific spatial relationships and the resulting regimes and institutions, and implied reorganizations of spatial relationships."* (Raven, Schot, & Berkhout, 2012). In the MLP2.0, the spatial dynamic is defined by distance/proximity, differentiation, and reach, as shown in Table 7.

Table 7 Spatial scale in MLP. Source: Raven, et al. (2012).

Scale	Dimension	Explanation
Spatial	Distance/proximity	The relative proximity reduces the importance of absolute proximity as a necessary precondition for learning and innovation. Different forms: *cognitive* proximity: the shared knowledge base between actors; *organizational*: a similar organizational background of actors; *social*: levels of trust, friendship, kinship, and experiences between actors; *institutional*: the extent at which actors have similar broader cultural backgrounds such as societal norms and values.
	Differentiation	From the observation that different places, however defined, exhibit niches, regimes, and landscapes with different characteristics. E.g. electricity regimes have national, international and regional features and specificities (vertically nested) as well as exhibiting horizontal differentiation between regimes for households, large industries and so on (horizontally nested).
	Reach	The observation that 'action at a distance' operates in social systems across scales and levels. The spatial reach of the three levels is not given, space is always negotiated and constructed by networks of actors.

These terms have been distinguished by social scientists over the last 30 years (Jessop, et al., 2008). They are associated with specific spatial terms and theoretically and empirically closely intertwined, despite dealing with different issues. These issues have been linked to efforts to decipher large-scale transformations of socio-spatial organizations, particularly to the intensification of 'globalization', and the parallel development of restructuring of inherited geographies of capital accumulation, state regulation, urbanization, social reproduction, and sociopolitical struggle (Jessop, et al., 2008).

Even though these concepts are about the perception of actors, the ownership, and the physical place is not included as such. Meanwhile, other literature highlight the importance of ownership and in- and exclusion (Fournis & Fortin, 2017; Bridge, et al., 2013). Ter Horst (2017) also shows the importance of the physical space. To define this spatial factor more clearly, I researched how places are seen and used in the literature and sought a framework that could be included in the MLP to also included the physical place.

2.3.3.2 Spatial scale and the Territory, Place, Space, and Network (TPSN) framework

First, places were seen as fixed, areal, self-contained, more or less unique units of socio-spatial organizations. In the 1980s, places were increasingly seen as "*relationally constituted, polyvalent processes embedded in broader sets of social relations*" (Cresswell, 2004; Hudson, 2002; Massey, 1984; 1994, in: Jessop, et al., 2008). From the late 1980s, the assumption of territorialization of political power established around national boundaries by national states and societies as nationally bound was reflected upon. Territorialities and statehood changed as a result of contentious, but productive discussions on this theme. In the 1990s, relations on global, national, regional, and local scale were contested through capitalist restructuring and state retrenchment. The (potentially tangled and non-convergent) processes

of scale-making and scale-jumping were addressed with a focus on their impact on the hierarchical (re)differentiation among various intertwined forms of socio-spatial organizations.

Most recently, socio-spatial organizations are increasingly seen as networks, with transversal, 'rhizomatic' forms of inter-spatial connectivity. This led to broader theoretical debates on the conceptualization of emergent network geographies and their relation to inherited territorial, place-based, and scalar formations (Amin, 2004 and Marston et al., 2005). Späth & Rohrarcher (2014) have emphasized the importance of all four dimensions of the TPSN framework, as a heuristic of socio-spatial relations. This means that even though the four dimensions need to be researched separately in order to be able to research the dimensions, the interconnectivity and iterative processes between these dimensions also need to be kept in mind. Jessop, et al (2008), as a result have developed this framework, which consists of territories (T), places (P), scales (S), and networks (N). Table 8 explains the principles of each dimension and specifies their consequences for patterning those relations.

Table 8 Four key dimensions of socio-spatial relations. Source: Jessop, et al. (2008).

Dimension of socio-spatial relations	Principle of socio-spatial structuring	Associated patterning of socio-spatial relations
Territory	Bordering, bounding, parcellation, enclosure	Construction of inside/outside divides; constitutive role of the 'outside'
Place	Proximity, spatial embedding, areal differentiation	Construction of spatial division of labor; differentiation of social relations horizontally among 'core' vs. 'peripheral' places
Scale	Hierarchization, vertical differentiation	Construction of scalar divisions of labor; differentiation of social relations vertically among 'dominant', 'nodal', and 'marginal' scales
Networks/ reticulation	Interconnectivity, interdependence, transversal or 'rhizomatic' differentiation	Building networks of nodal connectivity; differentiation of social relations among nodal points within topological networks

Jessop, et al. (2008) emphasize that these four strands (networks, territories, places, and scales) have been recognized and distinguished as the four most relevant dimensions, but mostly are used as one-dimensional and separate aspects, rather than exploring the mutually constitutive relations among those categories and their respective empirical objects. Focusing on one strand may be justified as an entry point, but it requires reflexive attention to combine various dimensions of socio-spatial analysis. As one strand is being explained and gives a spatially sensitive explanation, Jessop et al. (2008) state that at least two other strands should be involved and explained. Their dynamic articulation should be included, as this shows the heuristics.

Important at this point is that the TPSN-framework can be used to inform the field of 'contentious politics', which examines various forms of contestation, resistance, mobilization, and struggle 'from below' regardless of their social bases, identities, interests, or objectives (Leitner et al, 2008; Miller, 2000; Routledge, 2003; Sewell, 2001; Tilly, 2000). The TPSN framework can be used to "*decipher the strategies and tactics of individual and collective agents, organizations, and institutions that are engaged in contentious politics, as they perceive them as participants."* (Jessop, et al., 2008 p. 398).

In this thesis, I will use the TPSN framework to decipher if these factors did have an influence on the cases. No spatial dimension should be accorded a priori as a preference, equally, not every dimension will be relevant to a particular phenomenon. Therefore, I will also include the influence of a concept on another concept. This implies that for instance, a territory on different scales has other governments, so a multilevel government. Table 9 shows these relationships. For example, in a territory different places can exist next to each other (territory influences place). Next to that, networks do not stop at the borders of a territory, a border does not automatically stop communication or collaboration (network influences territory).

Table 9 Relationships between the dimensions of socio-spatial relations. After Jessop, Brenner, Jones (2008).

Dimensions of socio-spatial relations	Fields of operation			
	Territory	Place	Scale	Networks
Territory	-	Distinct places in a given territory	Multilevel government	Interstate system, state-alliances, multi-area government
Place	Core-periphery, borderlands, empires, neomedievalism	-	Division of labor linked to differently scaled places	Local/urban governance, partnerships
Scale	Scalar division of political power (unitary state, federal state, etc.)	Scale as area rather than level (local through to global) spatial division of labor (Russian doll)	-	Parallel power networks, nongovernmental international regimes
Networks	Origin – edge, ripple effects, stretching and folding, cross-border region, interstate system	Global city networks, polynucleated cities, intermeshed, sites	Flat ontology with multiple ascalar entry points.	-

In this thesis I am interested in the influencing factors on the realization of ground based solar parks, therefore, I will distinguish the concepts as defined in Table 8. To include the concepts more as a heuristic, I will also include the concepts as structuring principles, as explained by Table 9. In the following section, I will explain the concepts and how I use them and I will use the definitions in Table 9 to include the concepts as structuring principles.

The definitions of the aforementioned four dimensions of socio-spatial relations in relation to ground based solar parks are:

- **Territory –** Involves the process of authority in ground-based solar parks. Questions can be raised as follows: who is the formal owner of the park; who gets what profits from this park; who is the authority on the ground-based solar park? It concerns bordering, bounding, and enclosure. In other words, who is included and who is excluded.
  Keywords: Bordering and enclosure.

Table 10 Dimensions of the spatial territories.

Dimension	Definition used in research	Code
Bordering	What are the borders of the park, where are the physical borders, how are these borders constituted.	SPT1
Enclosure	Who is included and who is excluded in the park, at the level of politics but also at the social level.	SPT2

- **Place –** involves the interventions that contribute to the place-making. The interest of places is the distance/proximity, differentiation, and reach as described in the MLP. The spatial embedding is also included here.
  Keywords: proximity/distance, reach, spatial embedding, and areal differentiation.

Table 11 Dimensions of the spatial places.

Dimension	Definition used in research	Code
Proximity/ distance	What is the distance to 'sensitive objects' like houses, civilians	SPP1
Reach	How visible is the site from a distance, from what distance experience (mentally or physically) people the solar park?	SPP2
Spatial embedding	How is the site integrated into the area.	SPP3
Areal differentiation	What kind of area is it and how does a solar park fit in the area.	SPP4

- **Scales –** in the TPSN framework the scale is mostly focusing on the governance side. Since I already included governance in the structural scale of MLP, I will include the rescaling by defining it as the differentiation from the MLP framework. This means the rescaling is the fact that different places exhibit niches, regimes, and landscapes with different characteristics. So, each solar park fits differently in different spaces.

Table 12 Dimensions of the spatial scales.

Dimension	Definition used in research	Code
Sizes	What is the size of the solar park	SPS1
Scales	What is the scale of the solar park in relation to the surrounding landscape	SPS2

- **Network –** involves the creation of social networks around the ground-based solar park. In other words, which networks have been established, what is their function, and what is their interdependency.
  Keywords: interconnectivity, interdependence, and networks and their function.

Table 13 Dimensions of the spatial Networks.

Dimension	Definition used in research	Code
Interconnectivity	Which different networks are used to realize the ground-based solar park.	SPN1
Interdependence	What is the interdependence these different networks	SPN2
Networks and their function	What is the use of the used networks	SPN3

2.4 Schematic overview

As explained, I will be using the MLP to describe the interactions on the niche, regime, and landscape level to determine how the transition towards renewable energy is going. Moreover, I will be using TPSN to bring an extra layer of conceptualization of the spatial scale, by bringing topological depth through a stronger sense of socio-spatial politics along the four TPSN dimensions. While the MLP uses the transition as a starting point, TPSN adds the spectrum of socio-spatial relations and examines their multidimensionality. Through combining these methods, I will gain insight into the socio-spatial dimension of the intervention of ground-based solar parks. A schematic overview of this theoretical framework is shown in Figure 9.

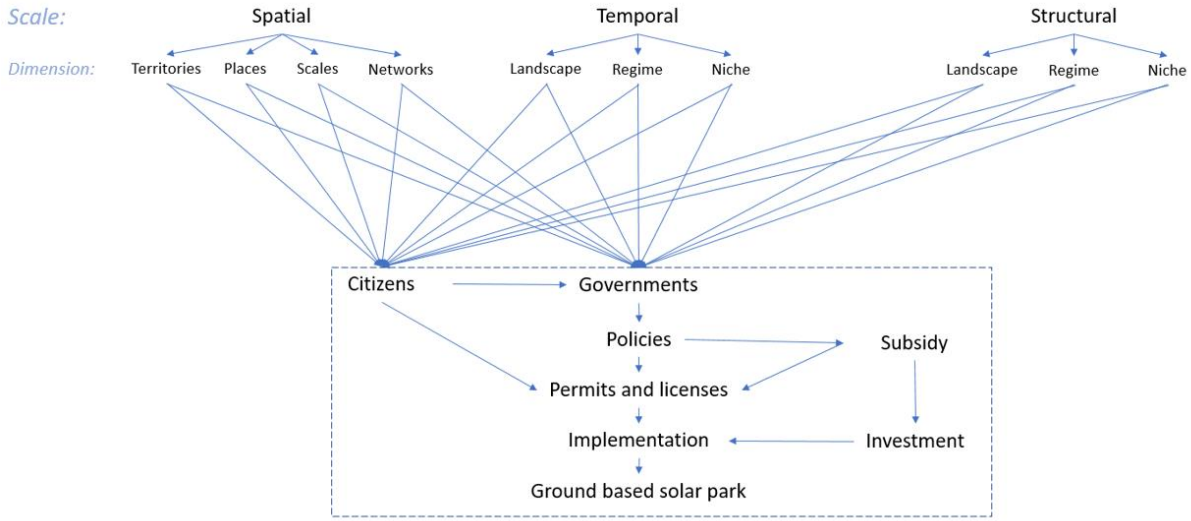

Figure 9 Schematic overview of the theoretical framework.

The figure shows that the implementation of a ground-based solar park is influenced by two main groups, citizens, and governments. They have the biggest influence on the potential realization of a ground-based solar park. In this thesis, I will look at three scales that have been determined by the MLP method that influence these two groups. These three scales have been divided into three or four dimensions.

The temporal scale is about the time in which a ground-based solar park is being set up. This means that I will mention the relevant temporal contexts of this innovation. This, on the three different levels, includes

at least the technical, political, socio-cultural, and economic context, in other words, the time we currently live in, and the influence of the timing of this innovation (ground based solar parks).

In the structural layer, I will include the role of the different actors in the projects. I will do this by defining what level of agency each actor has. At the landscape level, the actor has no influence, but can only adapt to the situation. At regime level, a set of rules has been provided in which the actor has a degree of agency and a systemic, predictable, and effective influence. At niche level, actors have relatively more agency and freedom, but still limited power, there is no specific rule set for the innovative idea of the actor.

The spatial scale is divided into four different dimensions (territories, places, scales, and networks. Territories in this research are defined by the ownership, the authority, and who gets the profits from the ground-based solar park. Places are defined by the place-making of the site. So, how the place is perceived, and what the relative proximity and reach of the place is. The scale is defined by the physical ground-based solar park. In other words, what is the size of the solar park and how does that fit into the landscape. The last concept is the networks. These are the networks, for instance, co-operations or protest groups, that have been used or set up to realize the ground-based solar park and the interdependencies between them. At the spatial scale the different networks will be defined and at the structural scale, the impact of these networks will be defined. Figure 10 shows which concepts are determined and derived from which level.

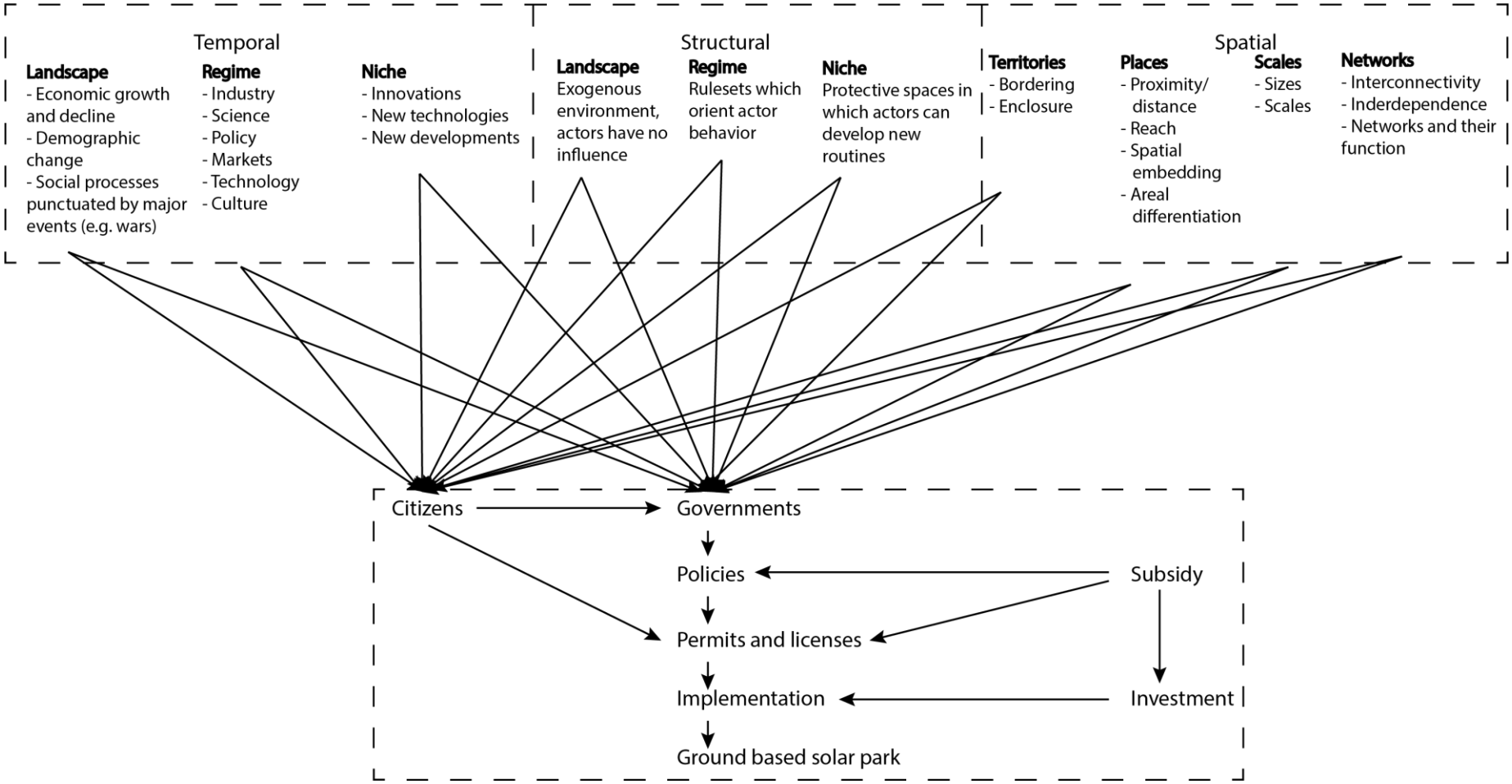

Figure 10 Scheme of concepts in the theoretical framework.

3. Research objective and methodology

3.1 Research questions

In the theoretical framework, three important factors within socio-technical and sustainability transitions have become clear. Therefore, I will focus on the main factors from the MLP approach, the temporal scale, the structural scale, and the TPSN concepts in the spatial scale. In this thesis, I will focus on the implementation of a ground based solar park, focusing on the factors related to spatial planning.

The temporal layer is about the timescale of the intervention. The timescale includes what the effect is of the intervention (ground-based solar parks) in each dimension. These dimensions are the (socio-technical) landscape, regime, and niche. So, what factors at the temporal dimension influence the implementation of ground-based solar parks.

The structural layer introduces the governance aspect of ground-based solar parks. This scale is about who orders who and at what level actors have agency, at what level does the system lead the actors, and how can this system and the actors be influenced. What is the role of the government in the implementation of ground-based solar parks and what is the governmental or political process to implement a ground-based solar park.

The last layer is the spatial layer, which is divided into four different concepts. These concepts include the socio-spatial factors, the territory on the bordering and enclosure, so who is formal the owner and who feels connected to the ground-based solar park. The places are about how the ground-based solar park is experienced, what is the impact on the visual and experienced landscape, is it a huge change, or does it have little impact. The scales are about the scalar division of political power, so what is the political power of which government. Since I already include the structural scale which also includes this, I will not repeat this in the spatial layer. The last concept is networks. Networks are the organizations that are connected to or the base of the idea of implementing a ground-based solar park. These networks have different functions and roles in the implementation process and are often interconnected. In my research, I will include their impact on the implementation process of ground-based solar parks.

In the introduction, I have emphasized that the implementation of ground-based solar parks is not a solitary development. In fact, it is part of the energy transition. Therefore, I will include this in my research by including the lessons learned from the implementation process of other energy sources and the implementation of ground-based solar parks. The lessons learned from other energy sources can give insight or direction towards what factors are relevant and which factors are not.

Therefore, my main research question is:

Which factors related to spatial planning influenced the process of the implementation of the ground-based solar parks on the landscape, regime, and niche level in the Netherlands?

To answer this question, I have distinguished a several sub-questions. These sub-questions are:

- Which factors on the socio-technical landscape-level influenced the process of implementation of ground-based solar parks in the Netherlands?
- Which factors on regime level influenced the process of implementation of ground-based solar parks in the Netherlands?

- Which factors on niche level influenced the process of implementation of ground-based solar parks in the Netherlands?
- Which factors on the spatial scale influenced the process of implementation of ground based solar parks in the Netherlands?
- What lessons on the implementation of ground based solar parks can be learned from the EU, Germany, the UK, and Denmark?
- What kind of interactions are taking place between these levels which create windows of opportunities for the implementation of ground based solar parks?

3.2 Research purpose

The purpose of this research is to describe which factors had a major role in the implementation of ground-based solar parks. Different cases will be researched which will help me gain insight into the role of spatial planning and spatial planners in the implementation of ground-based solar parks. This will give a first impression of the status of ground-based solar parks and how we deal with energy transition. I will get insight into why these parks have been implemented. The nature of this research is a combination of a descriptive and exploratory study (Kumar, 2014).

The research objective is leading the research method, as described by Flyvbjerg (2001). This research will be conducted through a qualitative research methodology, as this allows an overall and in-depth understanding of the situation. The qualitative methodology allows getting a variety of dimensions, views, understandings, experiences, and perceptions of participants that can be explored (Flyvbjerg, 2001). In the qualitative research, the researcher collects and interprets the data that participants provide. Corbin & Strauss (2015) emphasize that the interpretation of the researcher becomes of great importance in this kind of research. As a result, the researcher becomes part of the research process. Flyvbjerg (2001, p. 33) described this as "*just as the people studied are part of a context, research itself also constitutes a context, and the researchers are a part of it. The researchers' self-understanding and concepts do not exist in a vacuum, but must be understood in relation to this context. Context both determines and is determined by the researchers' self-interest."*. Therefore, it is important during the research to realize that what is identified as relevant information is subject to the interpretation of the researcher and the self-interpretation of the participants. This should be acknowledged during the research (Flyvbjerg, 2001).

Spatial planning has its roots in the natural and social sciences. Natural sciences have succeeded in developing a general, context independent, and predictive theory, social sciences have not. An overall theoretical construction does not exist within the social sciences. Flyvbjerg (2001) describes that the phenomena researched in social sciences cannot be separated from their context as the context gives meaning to the action. "*While context is central for defining what counts as an action, context must nevertheless be excluded in a theory in order for it to be a theory at all. It is this contradiction which punctures the aspirations of the social sciences to become normal sciences in the Kuhnian sense [a natural science]."* (Flyvbjerg, 2001, p. 42).

The MLP theory, as described in the previous chapter is a context-dependent and non-predictive theory. However, Flyvbjerg (2001, p. 3) describes the important and well-developed part in social sciences as *"the reflexive analysis and discussion of values and interests, which is the prerequisite for an enlightened political, economic and cultural development in society"*. Hence, theory can be used to analyze and reflect on interests and values of actors within a certain context. This context is essential to understand the action. In social sciences, the context-dependent knowledge is of great value and importance, as Flyvbjerg (2006) describes.

3.3 Worldview

The research is based on a 'social constructivists' perspective, as described by Cresswell (2013). According to this perspective, every person is trying to understand their surroundings, and everyone understands it at their own way. Everyone is developing a view, a perspective, and interpretation of the processes, structures, and objects in their lives. This means, that also on certain processes or objects, multiple perspectives are available. Social constructivism emphasizes the importance of these multiple perspectives. In understanding what occurs in society, the culture and context are important. Knowledge is constructed, based on this understanding (Kim, 2001). In the previous chapter, the landscape and regime dimensions are about the culture and context, the slow changing structures, habits and beliefs, which influence what happens at the niche level. Socio-constructivists would say the culture and context (landscape level) determine which niche activities will be successful. As explained in the previous chapter, this context is of major importance in this research.

3.4 Research strategy

To explore the factors influencing the implementation of ground-based solar parks, I use a qualitative research methodology. The first step of this research was the elaboration of a theoretical lens, through which I analyzed the reality. This theoretical lens was developed through a literature study, in which I have analyzed the existing literature on socio-technical systems. As a result, I used the MLP framework to research the implementation of ground based solar parks.

The MLP framework distinguishes different concepts which influence a socio-technical transition. To research if these concepts also influence the socio-technical transition towards renewable energy sources, I chose to select cases. I researched these cases on the factors distinguished by the MLP framework and if these factors played a role in the implementation. The selection process of the cases will be explained in the next section. After, I compared the outcome to three other countries and wind farms. I also concluded which factors created the window of opportunities for these cases.

3.4.1 Case studies

In the MLP governance is an important aspect of socio-technical change. Therefore, I want to include cases within which different governments were involved. So, multiple provinces and municipalities. The authority when implementing a ground-based solar park is the municipality. The development must fit within the zoning plan. If it does not fit, the zoning plan needs to be changed, on which the municipality needs to approve. This has to be checked by the province too. So, the municipalities are the authority, but when a zoning plan needs to be changed, the province also has a major role. Next to that, the province of Groningen wants to be actively included in the implementation of a ground based solar park, if the park is larger than 1 ha.

In the Netherlands two large subsidies have been created to support and encourage the realization of ground based solar parks; the postcoderoosregeling (PCR) (Eng. Zipcode arrangement), also known as the Regeling Verlaagd Tarief, and SDE+. The PCR allows members of cooperations to realize a park together and gain the profits from the project, including an energy tax discount. The SDE+ subsidy is already explained in chapter 1.4.2. In short, through a reversed auctioning system, people can get a certain amount of subsidy for each produced kWp. This amount of subsidy is changing each year, and because of

the reversed auctioning system differs within the subsidy year too. To subscribe for one of the subsidies, you need a business plan, and also the right permits and licenses.

These subsidies are needed for the investors to be prepared to invest in the project (RVO, 2016). Most PCR projects are realized on the roof, as can be seen in the list of hieropgewekt.nl (2017). Next to that, I want to include projects from large investors, I chose to only include projects with an SDE+ subsidy. RVO has published a list of PV-projects[7] which have gotten the SDE+ subsidy. This list includes 245 projects, including building integrated PV. The projects need to be realized within 3-4 years after they have gotten the subsidy. This is described in the rules of the subsidy. As I want to describe which factors influence the implementation, I want to select cases that are. Therefore, I will focus on cases that got a subsidy in 2014, as before only the project on Ameland was realized in the years before. Solar parks from 2015 or later still have one or more years to be developed. Also, this reduces the role of the subsidy itself, as the height of the subsidy will be equal. This allows me to focus more on the spatial planning factors instead of the financial factors.

Because of logistic reasons, I live in the north of the Netherlands, I will choose projects in the north of the Netherlands. Fryslân, Groningen, and Drenthe are all three relatively 'open' or rural provinces. All three provinces claim to be a progressive province with renewable energy. In the sense that these three provinces are trying to be the most sustainable provinces. Looking at Appendix IV 13 projects in the three provinces got the subsidy in 2014. Six of these projects have actually been implemented, or at least will be implemented in 2017. This shows that there is no project in Drenthe left. The project in Assen is already realized in June 2016. The Solar Parks in Hoogkerk and Groningen are in the same municipality. Since the project in Delfzijl is also initiated by a project developer, I chose to exclude the project in the city of Groningen. The three other projects, in Delfzijl, Garyp, and Hoogkerk, have been implemented shortly after each other. This minimizes the effect of the timescale because for instance, an earthquake could have a large impact on the attitude towards renewable energy. Therefore, I will include these three cases in the research.

Table 14 Cases.

Name initiator	# PV-panels	MWh	initiator	Province	Location	Date realized
EK Garyp	27.000	5.500	Civic initiative	Fryslân	Garyp	jan-17
Sunport Delfzijl BV	120.000	30.800	Commercial	Groningen	Delfzijl	jan-17
Municipality Groningen	7.777	2.090	Governmental	Groningen	Hoogkerk	jul-17

In these cases, I will determine the implementation process and the factors that influence this process, though using the MLP framework including the TPSN framework. Per case, I will describe as much information on the process of implementation. This way, the cases will be used to obtain as much information as possible.

3.4.2 Data generation

First, I have done desk research into these cases, among others on published documents, newspaper articles, websites. After this first rough analysis, I have contacted interviewees through email,

[7] https://www.rvo.nl/file/sde-projecten-beheer-april-2017

subsequently, appointments for interviews were made. The interviewees were representatives of the initiating organization, someone from the municipality, and representatives from both provinces. The interviews were semi-structured interviews. The interview approach was chosen because of the complexity of the problem and because I need more in-depth information. In a questionnaire, this information is harder to generate, as described by Kumar (2014). Also, the researcher does not need to follow exactly the order and formulation of the questions. It provides a guide for the interview to keep the focus on the subject of the research (Dunn, 2010; Longhurst, 2010). General, open questions were defined, which led the conversation. In a semi-structured interview, the conversation can just flow, but I will not forget to discuss the relevant points, available in the questions. The interview protocol is included in Appendix V. After the first interview with the province Fryslân, I changed the interview protocol a little bit, as I could explain things in a more understandable way to the interviewee. All interviews were conducted in a personal conversation with the stakeholder. The initiators of solar park Garyp did not want to be interviewed, they directed me to the organization that helped them. This organization had no time to help me. However, the organization wrote every few weeks an article in the local newspaper. This article includes an update on the solar park and what they dealt with, therefore, instead of interviewing the initiators, I used these newspaper articles to describe factors that influenced the case.

3.4.3 Data analysis

The interviews were all recorded, as the participants agreed on this. The interviews were held in Dutch and Frisian, depending on the preference of the interviewee. By interviewing everyone in their preferred language, they could express themselves best. Therefore, the transcripts are also in the spoken language. After, the interviews were analyzed. The interviews were transcribed pragmatically. This means a verbatim text was produced, which excludes things not needed for the particular analysis at hand (e.g. stuttering) and include aspects thought interesting or relevant (Evers, 2011). As in this research, the most important part is to reveal factors influencing the process of ground-based solar park implementation and not on the feelings about it, this way of transcribing is accurate enough.

After the transcription, I coded the relevant parts using Atlas.ti. In this program, a researcher can attach codes to the primary data generated in the interviews. The interesting parts are the parts of the process of implementation and the influences on the process. These codes are in English. Hence, these codes give me insight into the process in practice, and also which factors on this process were important for that particular project.

There are two types of coding, deductive and inductive, both are used in the research. Through deductive coding, the researcher can assign codes to the data, derived from the theoretical framework. The keywords from the theoretical framework are translated into codes which can be assigned to the data (Cope, 2010). The codes that have been derived from the theoretical framework are shown in Appendix VI.

First, I deductively assigned codes to the interviews. After, if from the interviews a new factor can be derived, a new code was added and therefore is an inductive code (Cope, 2010). This process of adding new codes is highly depending on the interpretation of the researcher. The new codes that were added are the ownership, at temporal regime level and the physical network at the spatial network level. In this research, ownership is defined as the actual and perceived ownership of the land and the solar park. The physical network is defined as the physical network that is needed for the solar park. These two codes will be further explained in chapter 6.1.

3.5 Influences on the research

To enable the reader to understand the research entirely and to show the reader the background of this thesis, I will explain the underlying influences on this research that I have distinguished in this paragraph. The research is carried out from January 2017 until October 2017. Necessarily, the cases needed to be known before or during that period and the interviewees needed to be available during this period. If it was possible during this period, more representatives from stakeholder groups and more cases would have been selected.

Also, an exhaustive list of initiated ground-based solar parks is not available. In the media, only the extreme cases are discussed and therefore not representative. As I wanted to give a general view of the process of implementing ground-based solar parks and the influences on it, I have chosen to only look at the list of SDE+ projects from 2014. Since 2015 the 'postcoderoosregeling', which is a subsidy for more civilian based projects, is also used for ground-based solar parks. I now exclude these parks, which causes a limited choice in selecting projects. Moreover, the smaller ground-based solar parks are excluded from the subsidy.

4. Description of the projects

In this chapter, I will give a general description of each project, on the location and a short overview of the project.

4.1 Enerzjy Kooperaasje Garyp (EK Garyp)

The location of the solar park of Energiekooperaasje Garyp (EK Garyp) (Eng: Energy cooperation Garyp) is shown in Figure 11. The solar park is located outside of the village, near a large road, see Figure 12. It is a former dump site. How the idea of the solar park started, is written in the local newspaper 'De Rabbelskûte'. The idea started with local representatives of 'Dorpsbelang', a group of chosen people who deal with the issues in the village and keep contact with the municipality. They saw other villages start different initiatives to save energy and collectively buy energy or solar panels. Dorpsbelang is not a political party, but a group of inhabitants that deal with mostly minor issues in the village. In the beginning of 2013 still no one in the village volunteered to look into the energy possibilities for the village. On behalf of Dorpsbelang, the municipality distributed a flyer on the possibilities for a more sustainable life. Dorpsbelang thinks the support from locals is very important, therefore, they wanted to have concrete chances and concrete possibilities which inhabitants can implement. Also, Dorpsbelang is trying to share their experience with sustainable solutions like solar panels. This way everyone can learn from each other.

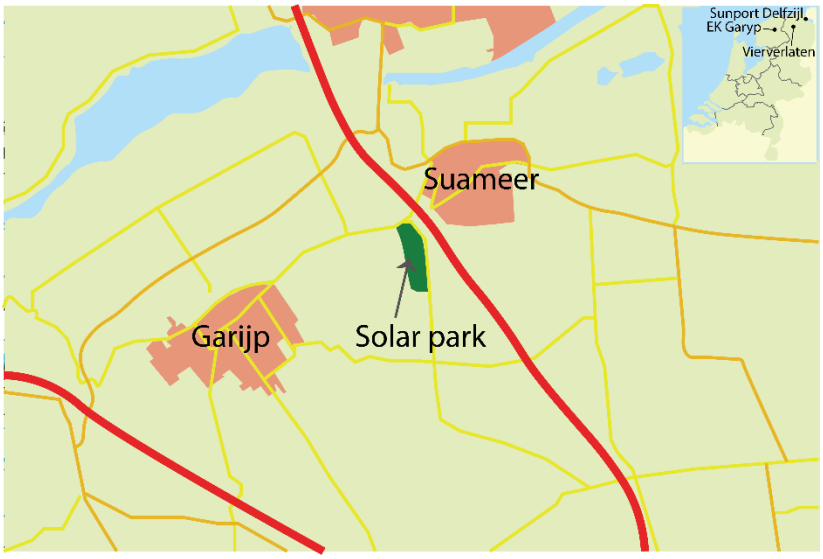

Figure 11 Location of Solar Park Garyp.

In March 2013 at the annual members meeting of Dorpsbelang, the usage of the old landfill was discussed, but still no concrete outcomes. Next to that, the research on saving and producing energy was not finished. In June 2013 the results of the research were published. One of the results was that it should be possible to start a local energy cooperation in Garyp. The idea is to place solar panels on the larger buildings in the village, these panels will produce more energy than needed in these buildings. Not only the owners of the large buildings can participate, but also private persons can participate. They can choose to participate in the energy cooperation and use this 'spare' energy of others, but also choose to buy solar panels through the cooperation. Dorpsbelang has appointed a commission to research concrete what is possible and what not. This commission is called 'Enerzjy'.

Figure 12 Photograph of the solar park. Source: www.EKgaryp.nl.

In November 2013, the committee Enerzjy had written criteria for the installations, panels, revenue of the panels and when they should be

delivering. During the meetings of this committee, a strong feeling came forward that the inhabitants preferred one large common 'source' of energy above placing solar panels on all different roofs. In 2014 this idea was made concrete.

4.2 Sunport Delfzijl

Sunport Delfzijl is located in the industrial area in Delfzijl, see Figure 13. Delfzijl is located on the coast and has a big chemical industry. At one of those industrial area's the solar park is located, see Figure 14. It is (still) the biggest solar park in The Netherlands, 30 ha. The idea of the solar park came from a developer which approached the landowner, Seaport Delfzijl. Seaport Delfzijl has two goals (GID, 2017), first to develop the harbor and industrial area in Delfzijl by selling and leasing land to others. The second is to strengthen the business climate of Delfzijl. Seaports is closely connected to the municipality, the municipality is the owner of Seaport. Seaport looked for a parcel which was not easy to sell. That is why this location was chosen as it is next to a chemical company with a risk contour. Not many companies want to be placed next to it.

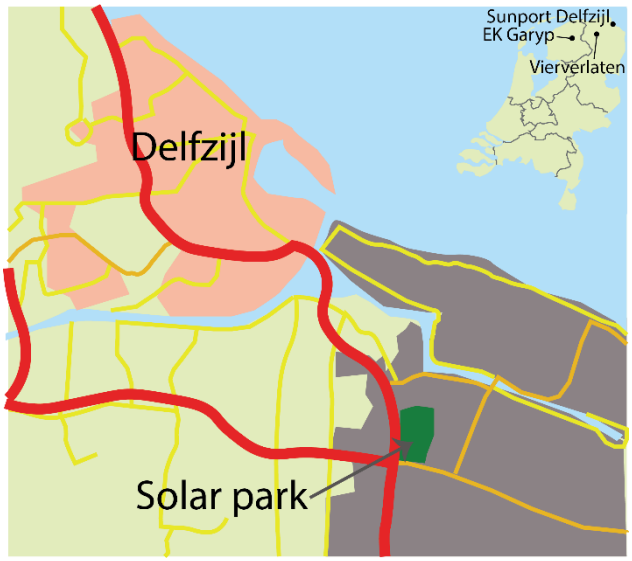

Figure 13 Location of Solar Park Garyp.

As Seaport owns the land, it was not very complicated. However, seen from the financial side it was not that simple, as the land price is reduced significantly while it is used as a solar park. Seaport has a specific set of clients who want to buy land instead of lease land. This means Seaports get once a big sum of money and does still have long-term obligations. By investing this money into a solar park, this big sum of money gives every year a small revenue from which the Seaport can be strengthened and also adhere to the obligations.

"The initiative also surprised us, first we saw this as a usual land business, it is not an A-customer, so our account manager of SMEs is project leader. It is a standard lease contract, but in the meantime, we thought maybe we can participate in it. This led to the decision to realized parks ourselves, which of course is linked to a business model. We want to have more solar parks in the region. So, we changed from a reactive attitude to a pro-active attitude to develop parks ourselves." (GID, 2017).


Figure 14 Photograph of the solar park. Source: www.groningen-seaports.com.

As the municipality is the formal owner, the permits and licenses were not a major issue. As the terrain was already determined in the zoning plan as an industrial area, there was no need to change the zoning plan. So, no long procedures needed to be gone through.

"The solar park fits within our policies and the industrial area is used now as agricultural land, but is industrial land. Therefore, there is no problem, on one condition, that if tomorrow a big company with many job opportunities wants to build at that location, the solar park should be removed for the company. Therefore, we gave a temporal permit and licensed in such a way the solar park can be relocated." (GGD, 2017)

In the project of Sunport, there is no citizen participation. There are no direct neighbors, the chemical company did not want to participate. Also, the municipality named it a 'unique project' which stimulates the sustainability of the area. Looking at where people live and where the park is situated, the park is placed in the middle of nowhere. To spatially embed the park a wall will be placed around it, but that's it. This also prevents to create an idea of a "city of glass". The experience of a "city of glass" can be when many solar panels are implemented at one place, just like the glass houses in the Dutch horticultural area.

4.3 Vierverlaten

The municipality Groningen has set a goal to produce over 40% of the used energy of the municipality within the municipality through solar energy. They describe their goals for the coming years in "De zonnewijzer, Groningen energieneutraal 2035" This means at least 500 MW solar energy has to be realized. An ambitious goal, but according to the municipality achievable. Of this 500 MW, at least 250 MW will be produced by solar panels on roofs. A faster transition will be realized through (temporal) solar parks. Solar parks will account for another 250 MW of solar energy.

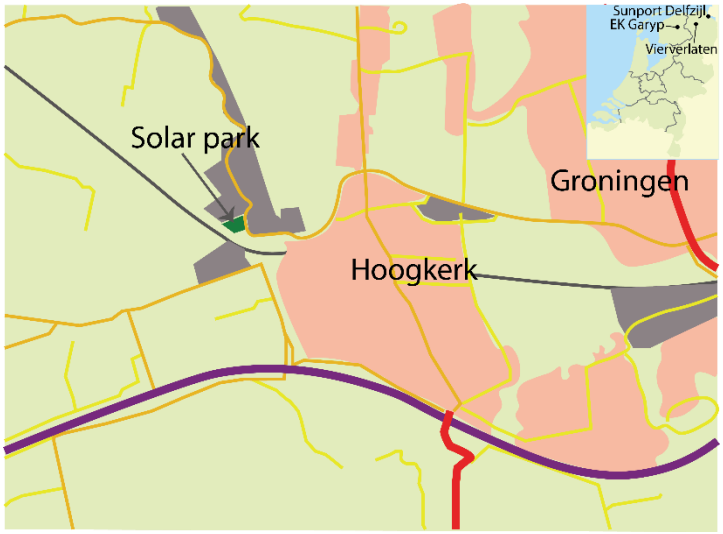

Figure 15 Location of solar park Vierverlaten.

The municipality owns a lot land to facilitate future developments. Almost 700 ha land where no developments are expected before 2030. This land is appropriate for temporarily use of solar energy. Based on this 700 ha and the fact that 1 ha counts for around 1 MW, it should be possible to produce the 250 MW on municipal land. With this knowledge and the knowledge that at the end of 2014 a lot subsidy was left, so the subsidy would be very high. The municipality knew this in an early stage, so they looked for a piece of land on which a solar park can easily be realized. They looked for land with a fitting zoning plan for a solar park, because changing the zoning plan takes at least a year. The council was not enthusiastic about the first location, so the municipality changed to the location of Vierverlaten. This is an industrial area, but not so popular within the industry, and

Figure 16 Photograph of the solar park. Source: www.grunnegerpower.nl.

suitable for solar energy. Because of the zoning plan, industrial activities were allowed, which leaves plenty room to fit a solar park, see Figure 16.

The municipality had different roles in this project; landowner, initiator and the owner of the park, and inspector, enforcer, and licensing authority. The municipality has these roles through different people within the 'institute' of the municipality. This is also why these roles were not conflicting, according to the municipality. The rules for the permits and licenses were known, and could not and should not be changed just for this project. Most critical was the planning authority who had some critics on the spatial embedding, but since it is an industrial area without a quality norm for the area, most arguments were not valid.

"It took a while before we knew how to organize this, in a municipality where no one knows how to realize a solar park. Different people have worked on this project. Eventually, we ended up with buying through purchase criteria for the tender. We demanded some things from the panels, ecology, and spatial embedding. Those were the three main criteria, next to price and production. Even though the solar park is located in an industrial area, it is a location which will not be used for 20 years, therefore the tenderers needed to include ecology." (GGV/GIV, 2017).

5. Results

In this chapter, I will explain the results from the interviews and the analyzed documents from the case of EK Garyp. In Appendix VII is shown how often which code was determined. The codes were appointed to certain parts of the interviews based on the definitions given in Appendix VI.

5.1 Temporal scale

The temporal scale is about the temporal factors which influenced the implementation of the ground based solar parks. As described, three levels have been distinguished in the temporal scale, the landscape, regime, and niche level. I will discuss the landscape and niche level of all three cases together, as these circumstances at landscape level are 'slow changing structures', which influenced all three cases. At niche level the differences between the factors that influenced the cases were neither very different, therefore I also discuss the three cases together. I will discuss the three cases separately at the regime level. I will conclude with a short summary of the outcomes.

5.1.1 Landscape

The landscape level is about the slow changing structures. Examples of these are economic growth, demographic change or social processes. These social processes can be punctuated by major events as wars or natural disasters. During the interviews only one factor was mentioned, the effect of the economic crisis of 2008. This effect is visible through the fallow land of (semi)governments or at the industrial areas. Many municipalities bought a lot of land, which they expected to develop as industrial area. Because of the economic crisis, they did not develop these areas and do not expect to build all these areas in the coming years. This is a factor why the development of solar parks is possible on this land. However, as the value of land used for solar panels is much lower as the value of land for industrial area, the accountancy of the municipality have to agree on this devaluation of land (GGV/GIV, 2017).

However, looking at the definition of this level and only one factor was mentioned, I may need to look at the scale of the transition itself. In the introduction, I mentioned that one of the reasons the European Union has set goals is because of the oil crises and wars. This is a factor on the temporal landscape scale. Looking at this, I can conclude that the innovation of ground-based solar parks itself is a result of the oil crises and wars.

Another factor on the temporal landscape scale is climate change. That is another reason for the ambition and the goals. As solar parks are a mitigating as well measure to reduce the impact climate change, we can say that also climate change can be put as a factor on the temporal landscape scale.

5.1.2 Regime

The regime level is about the institutions, cultural repertoires, and market structures. The regime is about rulesets and structures we have created ourselves to order our living environment. These structures and rulesets include cultural 'agreements', traditions, norms, values, and habits we have institutionalized and internalized in our communities. To a certain level, actors have influence on it. The concepts I have distinguished at regime level are industry, science, policy, markets, technology, culture and ownership. In the interviews, these concepts within the levels were interpreted frequently during the coding of the interviews. I will discuss these concepts in the next section per case.

5.1.2.1 EK Garyp

Industry

In the case of EK Garyp the solar park is the result of the supply and demand. The village decided that they did not want all the roofs to be covered with a few solar panels, but they preferred to have a few large roofs covered by solar panels. The commission in the village saw and got the chance to realize one large location instead of using several roofs. So, the demand from the village, and the demand to centralize the energy source led to this park.

Science

The knowledge and skills of the inhabitants and solar park committee were decisive in this process. The municipality supported this park, as they trusted the skills and knowledge of the committee members (FG, 2017). Therefore, knowledge and skills had a large impact. Not only the skills and knowledge on ground based solar parks but also other skills and knowledge on for example finances. The knowledge of the inhabitants played a crucial role, as well. The municipality and committee had to work hard to create this knowledge in the village, as at first no one was prepared to research the possibilities. They got help from the municipality through which they achieved to get enough knowledge and trust to get enough people to participate.

Policy

The municipality has a sustainability policy in which they allow the municipality to spend 5% more on sustainability projects and sustainability goals. This helped the implementation of the solar park enormously, as the municipality could decide to lower the fees for the solar park:

"We want to be a sustainable municipality, and we know as a municipality you need to put effort in it. Therefore, we were also able to decide within a month on the fees. (…) This also led to the decision, later on, to allow them to skip the OZB. Also, when you put 600 solar panels on a roof, you do not have to pay OZB, so why would you have to pay that tax when you place the same solar panels on the ground instead of a roof." (FG, 2017)

Therefore, policies were essential in the case of Garyp. The municipality looking for a new use for the dump site and allowing the solar park to fit in the zoning plan helped the project.

Markets

This project got an extra impulse through the market, as the inhabitants can gain a profit from the park. This caused the inhabitants to be interested in the park and developing the idea of the park. Further, the market did not play a major role in this case.

Technology

Technology was not mentioned in the interviews about this case.

Culture

The beliefs and vision of the people in the village is seen as the culture. These consist of the idea of being sustainable and producing sustainable energy. The culture within the municipality and village, to include as many inhabitants as possible, played a role in this project too. This is the first influence of the culture. Second, as explained in the policies concept, the culture within the municipality also played a major role. This culture of willingness to pay more on sustainability is important, as this led to a (more) positive business case for this project. The concept of culture did play a major role in this case.

Ownership

The ownership is an inductive concept, which I have added during the coding. The ownership as a code can be defined as the physical or perceived ownership of the land or solar park. The ownership of the solar park was mentioned by the municipality as important in the way that the municipality liked and preferred that the initiative came from citizens and that a part of the solar park is owned by citizens. In this way, the ownership played a role in the process.

5.1.2.2 Delfzijl

Industry

The project in Delfzijl started, because developing companies are looking for large areas they can buy or lease to realize a ground based solar park. Groningen Seaports (GSP) were approached in 2014 by a developer, that they wanted to develop a solar park on their land. GSP assigned this location to them, as this is a less profitable location. It is located next to an industrial company which has high emissions, so until now there were no companies that wanted to build next to it. It is a less profitable location and by locating the solar park there, GSP is able to gain a profit from it and use this to maintain the harbor (GID, 2017).

Next to that, the industry demands more green energy, preferably locally produced. Different companies wanted to buy the energy from the park. So, the solar park provides in a need for the local industry. Companies like Google and Facebook demand the supply of green energy. By providing them this, more companies will build here and the employment opportunities grow in the area (GGD, 2017; GID, 2017). Hence, also the second objective of GSP is actively worked on by solar parks. The municipality did have one precondition. As the solar park mainly gives indirect employment opportunities, the solar park should be moved to another location if a large company with a lot of employment opportunities wants to settle there. So, the demand for employment in the municipality is larger than for green energy.

The development of the solar park was done by a developing company. GSP did not see these advantages directly, but when the park was built, they became a shareholder in the park. They saw the chances given by the solar park. This chance to invest in the solar park is also partially given by the specific set of clients of GSP. Usually, companies like GSP lease the land to companies and receive every year a certain amount of money from the company. Most companies in Delfzijl, mainly chemical plants, want to buy the land. This gives GSP the space to pay for the solar parks.

The demand and supply of green energy led to a changing strategy of GSP (GID, 2017). GSP changed from a reactive attitude in 2014 to an active attitude now. They are actively looking into the less profitable land, like sludge depots and linking them to companies with a demand for green energy. The municipality is now looking into constructions to stimulate the production of solar energy.

Science

In the case of Delfzijl, science only played a role in a sense that GSP did not know the chances of solar parks or green energy before. Through this project, GSP learned what chances they could get from the implementation of a solar park.

Policy

In Delfzijl the relevant policies were mainly the policies of the municipality, especially the zoning plan. The province had not made any policy yet (GP, 2017). However, the zoning plan of the municipality could be interpreted in such a way, that a solar park fitted within the zoning plan. So, as the zoning plan allowed a solar park, the initiators only needed a simple license. However, officially the municipality of Delfzijl still has no policy on solar parks, so the provincial policy is applicable here, which will be explained in chapter 5.4.2. The municipality does have a draft policy, which the alderman will propose as policy.

The municipality wants the industry to be more sustainable (GGD, 2017). To achieve this, the municipality accepted a plan to build a wind farm of approximately 350 MW. The municipality now receives many requests regarding solar parks, and that is why they are now actively making a policy and trying to make it official. This policy not only includes reasons why a solar park should be implemented but also why it should not be implemented. Through making a policy before allowing many solar parks, the municipality wants to prevent to have the same discussion on solar parks as on wind farms. (GGD, 2017)

Officially, there was no policy on solar parks when the solar park was built; the alderman in Delfzijl finished writing a memorandum and wants to make this official. This memorandum describes on what grounds a solar park will or will not get a license. The memorandum will consist to first cover the roofs with solar panels. Second, there is plenty fallow industrial area, this can be proportionally used for solar parks. Third, other residual building space, for instance of farmers, can be used for solar parks too. But the solar panels cannot create a “city of glass”, as GGD (2017) explained.

This reactiveness of the municipality led to this situation, a supply of 300 ha’s of solar park, but no policies yet. The province is quite vague in their policies and only has written down rules for a more general level. The municipality wants to actively make the policies and have clear policies on what is possible and what not. This is also because the municipality is closer to the inhabitants than the province (GGD, 2017). They want to stimulate the sustainability, for instance by stimulating replacing asbestos roofs with solar panel roofs (GGD, 2017). The municipality is looking into those strategies.

The draft policy of the municipality is at the general level similar to the policy of the province. The main difference is that the province is not explicit in prohibiting solar parks on agricultural land. On ground-based solar parks, they municipality prefers solar parks in or against the urban area. The municipality focusses not on the location of the land itself, but more on the zoning plan. The province lets the municipalities decide if they allow the solar park or not unless the solar park is larger than 1 ha, or if it is situated in the rural area (GP, 2017).

In a way, the policy of preferring solar parks against or in the urban area has worked, as the solar parks that have been realized, are in or against the urban area. (GP, 2017) However, the ambition of the province is to realize 300 MW in the rural area through solar parks. The province realizes the most requests and the biggest requests are now for large solar parks in the rural area. So, to create a comprehensive landscape, the province wants the municipalities to write a vision for the area in which they want to allow a solar park. Also, the province wants to use these to create a provincial vision to create in cooperation with the municipalities a cross-border vision on ground-based solar parks.

Important is that the strategy on sustainable energy in and of the municipality also needs to consider the local population. With this, the industry, Groningen Seaports, needs to take into account this strategy as well. In the municipality, a wind farm of 350 MW will be built. Therefore, the politics is at the moment more careful with the acceptance of solar parks, as a lot will be built. Hence, the strategy of the municipality to fill the demand is also one that requires care and careful implementation in order to prevent the local population to protest against these developments (GID, 2017; GGD, 2017).

GSP did mention as well this as an important point, as the municipality Delfzijl uses an enormous amount of energy, they should produce this in their region. According to GID (2017), the municipality of Delfzijl uses around 15% of the total energy in the Netherlands. The municipality and GSP see this as an impossible assignment, with the techniques of today (GSP, 2017; GGD, 2017).

The solar park in Delfzijl was relevant for the province, as it is bigger than 1 ha, but the zoning plan allowed the building and the municipality and province agreed on the realization, the province did not interfere in this process.

Not only the authorities have policies, but also GSP has its policies. Related to solar parks, they had no policies in 2014. When they saw a solar park could help achieving their goals, they started more and more actively looking into solar parks. GSP changed from a reactive attitude into an active attitude nowadays. Their policy is to produce green energy and look for land that is suitable for it, like sludge depots. Of course, this needs to be proportional to the demand for green energy.

Markets

The main reason to realize a ground-based solar park is that it is economically beneficial (GID, 2017). The authorities need to make sure the benefits stay, otherwise no other solar park will be realized (GGD, 2017). The profits from the agriculture have not been enormous, this is why investors of solar panels, are able to close a deal with owners of land (GGD, 2017). GSP leased the residual land now to farmers but realized they could gain not only the profit of the lease but also from the indirect benefits of green energy. So, GSP found an area which was not economically that viable, but through building a solar park, the land becomes economically more beneficial. This was possible because of the enormous amount of land of GSP. They own 700 ha's of land because they expected this would be needed for all the industry that wants to build there. The markets changed and GSP was left with the land. On this 700 ha's, the 30 ha's were not that big of a deal, it is only around 4% (GID, 2017).

This was possible because of the earlier mentioned specific set of industry of GSP. The industry in Delfzijl wants to buy the land instead of leasing it, which leaves GSP with a big sum of money which they need to spend over 30 years. Through investing the money, they are able to guarantee this and to even gain a profit on the money. That is why they became a shareholder of the solar park as well, they realized solar parks are a chance to strengthen the area. Hence, the economic market for the GSP played a major role in the realization of the solar park. They will continue to realize solar parks if it stays economically beneficial. GSP has their objectives and goals and is also a business who needs a profit.

Another economic market factor is the precondition of the municipality in the contract. The precondition is that the park will be moved to another location if a company with many employment opportunities wants to build at the location of the solar park. Because of the appealing markets of solar parks and the economic benefits, the municipality has to make their policies now. The municipality sees it as they owe it to their employment opportunities. They need to make a policy to make sure the area is still livable, while they do gain a profit from the chances they get.

Technology

The technology itself did not play a major role in the case of Delfzijl. The solar panels are racked east-west, which is now an advantage for Google as Google now actually (virtually) uses more renewable energy than when the panels were racked south. Virtually, because it is not allowed to have a direct connection of a solar park to a company. However, it did not influence the case.

Culture

Another important concept is culture. Different approaches of cultures play a role in this case. The first one is the culture of the inhabitants of the municipality. There were no protests against the solar park (GID, 2017; GGD, 2017). This is according to the municipality due to the habits and interests of the inhabitants, as the first idea was that an industrial plant would be built at that location, so the reasoning of the municipality is that the inhabitants prefer a solar park above another industrial plant (GGD, 2017).

Next to that, the municipality has tried to influence the perception of the inhabitants of this solar park, by naming it a unique park, which would enhance the sustainability of the area (GGD, 2017). Among other things because the municipality recently allowed a wind farm 350 MW in the area. Not only the inhabitants are sensitive to this perception, also the industry is sensitive to this. The industry wants to have a green character and therefore are prepared to invest in these parks, or in the green energy from the park. Hence, the perception of green energy and being sustainable plays a major role.

Another important thing in the Dutch culture nowadays is participation. Participation is often used by initiators to include inhabitants in the project, to make the park an interest of the inhabitants too. This way they hope the inhabitants will not protest against the solar park. (GID, 2017) The province wants the inhabitants to not only see the park but also to profit from it (GP, 2017).

GSP struggles with the participation, as the general feeling towards them is that they are the 'demolishers of Delfzijl'. They demolished many buildings in the area (GID, 2017). On top of that, they are a large company, partially owned by the authorities. That is why GSP feels like people have a negative perception of their company (GID, 2017). To prevent this negative perception to influence the company, they are now looking into possible participation options, to include people in the project and make it an interest of the people themselves (GID, 2017).

Last, the culture, the beliefs, of the GSP itself changed. As explained before, the attitude of GSP changed from a reactive attitude into an active attitude to develop more green energy. This changed during the building of the park and now has led to GSP being a shareholder of the park.

Ownership

The ownership has been crucial in this case, as the developer actively asked GSP to look at their own land to develop the solar park. So, the ownership of GSP has determined for a great part which locations were and were not suitable for the solar park. Not only their capital gives GSP the ability to invest in solar parks, the amount of land they own offer this opportunity too. GSP owns about 700 ha's land (GID, 2017). The ownership of this amount of land gave GSP the chance to develop the solar park.

5.1.2.3 Vierverlaten

Industry

The effect of the concept industry in the case of Vierverlaten is visible in the location of the solar park. Because there are only a few large network cables around Groningen, the solar park needs to be placed near one of these transformers (GGV/GIV, 2017). This is the only factor within the concept of industry that influenced the implementation of the solar park.

Science

The municipality and initiators struggled with the fact that this was the first solar park within their municipality, which caused no one to know what to do. This lack of knowledge led to a lot of delay as the civil servants needed to explain, consult, and discuss everything they had to decide upon, as explained by GGV/GIV (2017).

Policy

Within the concept of policy, the national policies on subsidies have led to the realization of the solar park. In 2014 it seemed like the subsidy would not be used entirely. The municipality of Groningen saw this as a chance for them to get a high subsidy (GGV/GIV, 2017). So, only because of the policies regarding the subsidy, the municipality has decided to start this project.

After getting the subsidy, the municipality needed to find out what they wanted for themselves. The different civil servants had to agree on how to implement this park. This is because of a knowledge gap, and this knowledge gap had to be filled. The policies had to be written and interpreted and this takes time. Next to that, before and after getting the license, different researches have to be done. These researches are soil, ecological, and archeological researches (GGV/GIV, 2017). The outcomes of these researches can have large consequences for a solar park project, for instance:

"if the soil comes out contaminated, you will need to clean the soil before you can start to build. Or if it turns out a special flower is growing on your project location, the whole project can be canceled. These researches not only are relevant for the project location but are also relevant for the location of the new cable to the transformer." (GGV/GIV, 2017)

This location of the cable needs to be researched too, so also the policies on the location of the cable can delay the project.

As shown in the case of Garyp, the municipality Groningen came across the fees. This led to the decision to lower the fees because otherwise, it would not be possible to realize the solar park. However, GGV/GIV (2017) does make a remark that the municipality is always reactive at this sort of things. They only change things, because it does not work for some reason. However, when changing these things they are always late because someone already experienced it as a problem.

Markets

The market created by the subsidies, the market of the SDE+ subsidies has, first of all, created the opportunity for the municipality to realize the solar park. This reversed auctioning system led to a chance for the municipality which they thought they could not pass (GGV/GIV, 2017). Next to that, the market of the industries which was smaller as expected offered the municipality this chance. Because there were no

companies that wanted to build at that location, the municipality had the chance to build there. Those were the markets that influenced the starting of the idea.

The aforementioned reduction of the value of the land (in section 5.1.1), was a delaying factor from the market. The market decides on the value of the land, and by using the land as a solar park, even though it can be used as an industrial area when the park is removed, causes a value reduction on the land.

After getting the subsidy, the market had a delaying effect on the project. The developer took its time to sign the contract. This is because the developer needed to have certainties, which could not be offered earlier. Both the municipality and the developer wanted and needed guarantees, like what will be done with the park after 30 years, who will remove it, etc.

Technology

The interviewee of Vierverlaten did not talk about any effects from technology. The municipality found a developer through a tender, in which the best technologies available were demanded.

Culture

The concept of culture did have an effect on this project. The project started because the municipality wanted to be a good example for the city (GGV/GIV, 2017). So, the whole project is realized because the municipality believed it was in their best interest the park would be realized. Moreover, the culture in the municipality affected how they deal with the park now, in the way that they want to give it to the inhabitants of the city, the 'stadjers'.

When the fees came up, the culture, the beliefs, and values of the municipality played an important role. Because of their beliefs and the value of the project for the municipality, the municipality agreed on lowering the fees. This was important for the project because otherwise, the project would be less profitable. Next to that, way the municipality dealt with the reduction of value of land is because of the culture, as they think it is valuable for the municipality to develop this project.

Ownership

Just like Sunport Delfzijl, also, in this case, the ownership determined for a great part the location of the solar park. The municipality saw a chance for a high subsidy and looked for a location at which they could easily realize the solar park at their own land.

5.1.3 Niche

Innovations

The concept innovations is in this research about the innovations within a new technique, for example, solar panels integrated into roof tiles etc. So new techniques within the solar energy. The technique of placing solar panels on the ground can be also seen as an innovation itself. In that way, all three cases did affect the regime in the same way in the sense that they were pioneer projects in their municipality and province. Because of these parks, policies have been innovated, so the solar parks as an innovation did change the regime a little bit in a way that people need to find a way how they want to integrate them in the physical environment.

At the case of EK Garyp, the placing of the solar panels on stelcon slabs, as shown in Figure 17, can be seen as an innovation within the placing of solar panels. It is a combination of two techniques, stelcon slabs and solar panels, and therefore can be seen as an innovation to prevent drilling for the foundation.

Figure 17 Solar panels placed on stelcon slabs. Source: www.netwerkduurzamedorpen.nl

New technologies

The concept new technologies is defined in this research as new techniques that did not exist before. New technologies have come up during the interviews, but not related to the cases. All interviewees mentioned the need for new technologies, developments, to make sustainable energy work in the society. For instance, batteries that can help regulate the peak flows of solar energy. Techniques that can help visualize the future landscape with the solar park can help during the licensing.

New developments

The concept of new developments is about the new developments within solar energy. Neither did this came up during the interviews related to the cases, but it did come up as a wished development. For instance, better solar panels need to be developed to use space more efficient.

5.1.4 Summary Temporal Scale

At the landscape level, the temporal scale is visible at the start of the energy transition. Europe wants to be less depending on other countries, because of all the oil crises and wars. Next to that, the shrinking amount of gas in the Dutch ground and the disastrous consequences of the drillings have a major influence on the drive of people to use more sustainable resources. Not only the consequences of these drillings but also the changing climate influences the demand for sustainable energy. Finally, in these cases, the economic crisis of 2008 played a major role, as two of the three cases have been built on ground which was bought to create a bigger industry, but because of the crisis, the industry did not grow as fast.

At regime level in the case of EK Garyp, the demand for one big sustainable energy production site, instead of covering all the roofs with solar panels, had a large impact. The culture of trying to be a sustainable village and the municipality trying to stimulate this sustainability had a major positive influence. This, combined with the knowledge, and skills of the initiators led to enough trust within the municipality in the initiators and the project. The municipality played a major role, as they are prepared to spend 5% more on sustainability projects. This led to a positive business case, which led to the inhabitants of Garyp to participate in and profit from the park. So, the inhabitants of Garyp can be seen as the partially financially and perceived owner of the park, which was seen by the municipality as positive.

In the case of Delfzijl the regime level also played a major role. First of all, the industry of GSP influenced the case, as they saw a possibility to profit from the park. They profit from it, as industrial companies demand green energy and GSP profits from the companies. Through the solar park, GPS could strengthen the business climate and being the owner of the land, and now also of the park. Next to that, thanks to the specific set of clients of GSP, they had the ability to invest in the solar park. This knowledge now, that GSP can profit from the ground based solar parks, changed the strategy of GSP to active, instead of reactive. The municipality is reactive in their policies. They now have decided to first make a policy, and

then see what solar parks are acceptable in their landscape. The area of Delfzijl is very industrial, so they are used to industrial developments. The development of a solar park had less impact than the development of a large chemical plant. However, GSP is aware of the negative perception of their company and therefore is looking for participation options.

In the case of Vierverlaten the number of network cables influenced the location of the solar park, just like the ownership of the location. The municipality struggled with their knowledge gap on ground based solar parks and how to deal with them in their municipality. This slowed down the process. The mandatory researches on soil, ecology, and archeology slowed down the implementation. The market of SDE subsidy led to the idea of the project, but also caused that this project needed to be implemented fast, as the municipality decided last minute to participate in the subsidy. This is because the municipality wanted to give a good example to their inhabitants. This too led to lowering the fees in the municipality.

At niche scale the innovation of ground based solar panels itself caused some projects to be slowed down, as all three municipalities needed to find a way to deal with this new innovation. In the case of EK Garyp the placing on stelcon plates can be seen as a new technology.

5.2 Structural Scale

At the structural scale, it is all about actor relationships. Is an actor able to form the structure entirely (niche), or is the actor being steered by rulesets, which come from the regime level. The last level is the landscape level, in which the actors only have influence in the long term. Only if actors choose to fight an uphill battle against the mainstream, they can change this structure. In this chapter, I will discuss these actor relationships within the cases. So, is the case a niche-project at the structural scale, and did the initiators have to fight some uphill battles? If so, which uphill battles. Also, which regimes have influenced the project. As this is very intertwined, I will not discuss the levels separately, but I will discuss the structural scale per case on all three levels.

5.2.1 EK Garyp

In the case of EK Garyp, it was the first solar park in the municipality. In that way, it is a niche project, as the initiators had to develop new routines and alternative structures since the municipality had never dealt with projects as these before. However, looking at the municipality and their progressiveness in the policies, the municipality was partly ready for projects like these, as they already had a few rulesets for this kind of projects. In that way, the policies were already at the regime level.

Looking at the fees, the initiators had to fight an uphill battle. The initiators needed to create a new vision, standard, and norm at the level of fees. They chose to fight the landscape, and as the municipality was prepared to change these and saw the necessity. The municipality then decided to change its socio-technical landscape, thanks to the policies and culture. When discussing the cable with the network companies, they had to fight an uphill battle, as the network company did not want to pay for the cable.

Another important point at the structural scale was the ruleset on the location, a dumpsite. Around the trash on the dumpsite, a ‘wrap’ has been made, to make sure the trash does not leak and the environment is not harmed. This ‘wrap’ cannot be touched, a little layer of soil and grass is covering this wrap, so almost no digging or drilling could be done. Therefore, the different authorities, initiators, and designers decided the panels would be placed on stelcon slabs. So within the rules, they sought for the best solution.

5.2.2 Sunport Delfzijl

The uphill battles that needed to be fought in Delfzijl were not many. During the interviews mainly a few more general points were mentioned. A major factor within the landscape scale is the fact that the municipality is a shareholder of GSP. This is not something the initiators can influence easily. They have to deal with this 'double' influence at this scale. Another municipal relation that is influencing the development of solar parks, is the earlier mentioned implementation of the wind farm. GSP has no influence on this at all, but it does influence the caution with which the municipality wants to implement other renewable energy sources.

Another factor in the north of the Netherlands was the municipal re-division in the North of the Netherlands. This did not influence the park in Delfzijl, but the neighboring municipality, Eemshaven, will be re-divided.

The last factor is the location of the cables and transformers, so the physical network. A cable is very expensive, as GID (2017) explained, so if the transformer is at several kilometers distance, this does influence your business case significantly. Just like if there is not enough or no space at all at the transformer.

At the regime structural scale, it is mainly about the laws and policies within which the initiators should look for possibilities. These laws and policies have also already been described in the chapter on the policies. In short, the municipality of Delfzijl officially did not have a ruling policy, but they had one which was orienting them and giving them and the initiators rulesets and orientation. The zoning plan allowed the park to be implemented here. The policies of the municipality and the province also allowed the park there. Next to that, the policies and rulesets of their own company allowed the solar park to be realized at their own land.

These policies and laws are all rulesets, as they can be interpreted in different ways. In this case, they are explained in ways which are positive for the solar park. However, they could also be explained in a way that would negatively affect the solar park. The willingness of politicians and civil servants is crucial.

Through Sunport Delfzijl, GSP has used a niche. They claim to be one of the first companies to link green energy with employment opportunities. They saw a chance to develop a new routine, so to bring the supply and demand of green energy together, while strengthening the local business climate. This development already changed in a structural regime at GSP, as they now are proactively developing more solar parks.

5.2.3 Vierverlaten

At the structural scale, mainly the ideas, perceptions, and explanations of laws have helped in the realization of the solar park. At landscape scale, the researches related to the soil, ecology, and archeology played a role. The actors could not influence these researches, but apart from a tree that needed to be chopped, for which a license was needed, there were no problems encountered.

At the structural landscape scale, the physical network also played a role in the choice for the location. The location should be near a transformer, otherwise, the business case would not be positive. Moreover, the time the network companies need to lay the cable is essential. On this, the actors do not have an influence.

An important point in the process of Vierverlaten, was when one of the aldermen did not agree on the location. This led to the initiators to find another location, on which all aldermen could agree on. This is at the regime scale, as the actors could influence this. The municipal policies also play a major role in this case. These policies need to be written and with the different roles of one municipality, the actors had a big influence on how these policies should be written and interpreted.

Looking at this project, in a way this was at the structural level a niche project for the municipality, as the municipality did not know how to deal with this development, but felt the ability and possibility to realize the park. At the level of ground based solar parks, this was a niche project. At the level of renewable energy sources, it was a regime project.

5.2.4 Summary Structural Scale

At the structural scale, it was for all three cases clear that in all three cases the governments needed to find a way to deal with this innovation. It was a new development in all three municipalities, but because all three municipalities are aware of the need for sustainable energy, the municipality was prepared to think along. All cases function as an example in the municipalities. So at niche level, the initiators all felt the space to initiate such a project. At regime level, all three municipalities had to overcome some difficulties. The municipalities wanted to take a lead in this but had never dealt with such a project. Both provinces were still writing the policies, so all three municipalities were quite careful with what to allow. However, all three locations were chosen carefully, which did not cause any frictions in the municipality itself. So the policies and laws have structured the cases in such a way, that all three initiators picked a location well-aware of the policies and laws. At landscape level, the laws and policies gave some friction, mainly the fees were a major struggle for the initiators. Also, the network cable and how to connect the solar park to it gave some trouble.

5.3 Spatial Scale

As explained in the theoretical framework, the concepts in the spatial scale, or TPSN framework, should not be used separately from each other, but how they mutually influence each other. Therefore, in this chapter, I will explain the concepts on the spatial scale first individually and then as intertwining and iterative concepts.

5.3.1 EK Garyp

At EK Garyp the land was owned by a private person, who agreed the cooperation could lease the land. The authority on the licenses was the municipality. The park fitted within the zoning plan, and within the policies of the province, as this is a special location. The FUMO is responsible for the safety of the dumpsite, therefore they were included to guarantee the safety. The municipality mentions the location itself, a former dumpsite, as a major factor. It is a piece of land the municipality was already looking at to give a new function. Not many usages are possible here, so they were very enthusiastic about this plan. Therefore, the territory influenced the place in the way that it was a distinct place in the municipality.

The plan of the cooperation to include every inhabitant of the village fits within the enclosure. However, the question needs to be to what extent the park is for every inhabitant, as they need money to invest in the park. So, even though they claim they try to include everyone, the poorer part of the village is automatically excluded. However, indirectly these people also profit from the park as the profits will be

divided and spent in the village. An independent commission will decide which initiatives will get support from the park. Hence, the concepts within the territory did play a major role in this case. The intertwinement of territory and place did play a major role, as the distinct place, the dumpsite was a major factor in the choice for this location.

The places at EK Garyp is about the place itself, so the areal differentiation. It is not a controversial location. It was a 'useless' piece of land, near the highway, far from the villages. The distance to sensitive objects (like houses) was too big to be controversial. The reach of the park is not that big, as it is not visible from a distance. The dump was spatially embedded, the initiators only needed to take into account the maximum height.

The size and scale of the solar park in Garyp has not been a discussion. The park fits on the dumpsite without changing the location, so the landscape allowed this size. The size and scale have never been an issue within the municipality or cooperation.

The networks have been of major importance for the solar park. Starting with the social network of the initiators. This network allowed the municipality to trust and have faith in the initiators.

"We saw the business case of the ideas and trusted the initiators. That is what you need. The initiators had enough know-how, knowledge, and perseverance, which led to the decision to support this initiative by allowing them not to pay a fee." (FG, 2017)

Another social network of major importance is the network of the Energiewerkplaats. The Energiewerkplaats (Eng. Energy working place) is a location at which initiators can come together and get help to be more sustainable at a local level. Three different organizations are actively trying to help the initiators during meetings. The Energiewerkplaats is supported and initiated by the province. These networks also played a major role during the financing of the project. The project is partly financed through banks, and by the FSFE is a foundation that has been founded to contribute to the sustainability in Fryslân. So, the territory also influenced the networks, as the province of Fryslân set up the networks just for their territory.

Another important point is the physical network. The network manager, Liander, did not want to pay a part of the costs of the network cable. The cooperation had to find a way to pay for this cable. This led to a delay of the project.

5.3.2 Sunport Delfzijl

The case of Sunport Delfzijl started because GSP owns a lot of land. This land has been bought because they expected the industrial area to expand. Hence, thanks to the areal differentiation, which includes in this case an ideal location for the chemical industry, the location is later seen as suitable for the solar park. The municipality and GSP agreed on this, also because of the bordering. The location merges into the environment, as it is an industrial area. Hence, the borders are not an issue, as the borders of the solar park are part of the industrial area. As no one lives near the solar park, no one had an issue with the existing borders. These borders are now constituted by a wall, which is now grown by grass. This reduces the visibility of the park and the reach as well. The park is only visible from a few angles. This is also because it is located at an industrial area, the reach is relatively small, as the plants have a reach as well. This reach is often more concerning for people, as a chemical plant can be more polluting (GGD, 2017). So, the territory did play a role in this case, but more as an influence on the place.

As the reach is not big, local inhabitants have not played a role in the solar park. The initiators of the solar park only enclosed the municipality, the province, GSP, energy consumer, and themselves, the developing party. The province was included because the solar park is larger than 1 ha and the municipality did not have a policy on solar parks. The province agreed with the plan, so they let the municipality be the authority. The municipality gave the license to build the solar park. GSP was first included as the landowner, but along the way, they started to be more interested and are now shareholder of the solar park, together with the developing party. The developing party was the initiating party as well, to build the solar park. Finally, the company who buys the energy was included too. These two shareholders had their own social networks, within their organization and also between these organizations, so their interconnectivities are important. Next to that, the interdependence between the organizations is important, as the municipality needs the approval (explicitly or implicitly) of the province. Moreover, the GSP was depending on the opinion the shareholders of this plan, so the opinion of the municipalities, and province.

The wall around the solar park was a precondition to build the solar park. This way, the solar park is integrated into the landscape and the wall reduces the visibility of the park. The size and scale are not discussed as such, the size is determined for this park by the amount of land GSP wanted to lease to the developing company. The developing company wanted around 30 ha's. The scale is related to this, as the solar park is one of the largest, if not the largest, solar park in the Netherlands. This was only possible because of the height of the vegetation surrounding the solar park. So the areal differentiation also affected the size of the solar park. This park could be realized here because of the large-scale developments in the area.

Finally, the physical network was important. GID (2017) explains that the absence of the physical network can be disastrous for the business case. Sunport Delfzijl is next to the transformer, so in this case, the physical network did not affect the case at all.

5.3.3 Vierverlaten

As explained in section 4.3, the location of Vierverlaten was chosen based on the land the municipality owned. The speed with which the municipality could get a license to build a solar park, played a major role in this (GGV/GIV, 2017). So the areal differentiation, what location is it and how does a solar park fit in there, played a major role. Therefore, the site is also located at an industrial area. This is the reason why the spatial embedding is not that relevant, as GGV/GIV (2017) explained. There is not an image quality plan (NL: beeldkwaliteitsplan) for this area, there are hardly any building restrictions, therefore the solar park easily fitted in the area. So, the territory concepts did not play a major role in this case. There were not really major constraints in how to embed the location in the area. In the tender, the municipality did ask for a good spatial embedding. This consists now of a fence which will be grown by vegetation in a few years. The current usage, grassland, will be continued. Sheep can walk under and between the solar panels, hence the usage does not really change, there is only an additional usage, solar energy.

This location in an industrial area as well has another consequence. There are no local residents who will experience any annoyance from the park. The reach of the park is almost absent, the park is only visible from the road and the agricultural land behind it. Hence, the proximity/distance and reach are almost zero. This is also emphasized by GGV/GIV (2017). Until now they have chosen locations with none or very limited effect for the local inhabitants. Therefore the municipality did not have to include inhabitants in the park. The inhabitants are enclosed after the realization, as the municipality wants the solar park to be of the inhabitants.

The ownership of the land is related to the size and scale of the park too. The park is near the city, at an industrial area. The parcel is not very big, and next to that the transformer has reached its maximum capacity. A transformer has a certain amount of capacity, which cannot be overfed. So, not only because of the size of the parcel but also because of the capacity of the transformer, the park is as big as it is. (GGV/GIV, 2017) Hence, the physical network determined the size of the solar park. The interconnectivity is of importance in this case, as well. The park is initiated by the municipality, and also needs the license to build from the municipality. However, a different department of the municipality needed to decide on the license. The aldermen had to decide on the solar park. So, the interconnectivity of the networks in the municipality and the interdependence on these networks have influenced the process.

5.3.4 Summary Spatial Scale

In all three cases, the spatial level has been a major factor. All three solar parks were implemented at locations which did not lead to discussion or protests in the municipality. So, the locational choice played a major role in these cases. This is also visible in the relevance of the bordering of the park. As all three cases are situated at 'special' locations, the bordering becomes less relevant. The parks are not really visible or located at critical locations, therefore, people did not protest against them. The territorial concept played in the case of EK Garyp the biggest role, as in this case the initiators tried to let the whole village participate. In Vierverlaten the municipality is now trying to do this also, but in the case of Sunport Delfzijl, the inhabitants are not enclosed.

This also has its effect on the concept of place. The areal differentiation helped the initiators choose the locations. So, the initiators already had been critical on which location to choose, based on how the park would fit in the landscape. The locations were not very critical, the proximity/distance, and reach were not very big, so this did not cause any difficulties. All three initiators were well aware that they needed to embed the park in the surroundings and were prepared to do this. In the case of Vierverlaten, this was less relevant than in the other cases.

The sizes and scales of the parks were at the spatial scale not mentioned. Only in relation to the capacity of the transformer, this was relevant. So, the physical network was relevant. In all three cases, this influenced the case, positively or negatively. EK Garyp was delayed because of difficulties with the network manager, Vierverlaten had to pick a location near a transformer, and Sunport Delfzijl was lucky enough to be able to place the park next to a transformer. The networks of all three initiators can be seen as very relevant. Mainly, in the case of EK Garyp, the social network of the initiators was essential, as this gave the municipality confidence to support the initiative. The networks within the municipality, in the case of Vierverlaten, gave the initiators the chance to develop the park. Without having the social networks, and knowing the interconnectivity, and interdependence, implementation of the case would be much more difficult.

When looking at the intertwining concepts on the scale of the cases, the intertwining is not very visible. All three initiators are aware of the multi-area governments, interstate (municipal) systems, but in the studied cases, they only need to deal with their own authority. At the beginning of the initiative they were all aware of the effect of the location they picked, therefore all three initiators chose an easy to realize location. So, the most visible intertwining concept is the concept of territory-place.

5.4 Provincial politics

In chapter 3.4 it has become clear, I only focus on Fryslân and Groningen. I interviewed staff members of both provinces, but as they had none or a very limited role in the projects, I will discuss the outcome of these interviews here, combined with the policies of the provinces and their ideas on how to deal with solar parks in the future. This information gives insight into the policies of the province and their role in the socio-technical transition towards a more sustainable future, more specifically the role of the province when implementing a ground based solar park.

5.4.1 Fryslân

The province Fryslân sees solar energy as an important part of the mix of energy in the province, as described in the memorandum 'Romte foar Sinne' of the province Fryslân (2015). At the end of 2015 more than 70 MW of solar panels were implemented in Fryslân, the goal of 50 MW in 2015 was already accomplished. The goal for 2020 is 500 MW, for 2025 1.300 MW. This means a yearly increase of over 100 MW. High ambitions, with many demands for the spatial embedding, social support, and business cases. The provincial policies on solar parks have been summarized in the memorandum 'Romte foar Sinne' (2015). In addition to this, ten starting points have been formulated in the memorandum 'Sinnefjilden yn it lânskip'. These starting points are aimed at a careful siting and embedding of solar parks.

These ten starting points have been divided into three phases, the orientation phase is the first phase. In this phase profits are important. Not only the amount of produced energy compared to the energy need of the city or village, but also the profits for the future, what are the future plans, will the solar park be enlarged, is it still at the right place then, and what happens if the solar park is terminated? These questions are summarized into two starting points, as described in Sinnefjilden yn it lânskip (2017):

1. Consciously determine the ambition;
2. Make a little peek into the future;

The next phase is the location phase. When looking for a suitable location, the crucial question is if the solar park can be spatially embedded in the surrounding landscape. Important here is the sum of a solar park with other elements in that landscape or the sum of multiple solar parks. The proportionality of the solar park is important as well, the size and scale of the landscape and the solar park need to be in the right proportions. Therefore, the third starting point is:

3. Choose a location in which the solar park is connected to the surrounding, its character, size, and scale

The third phase is the implementation phase. In this phase the question is how the solar park fits within the surrounding. Which spatial embedding fits in this surrounding and how is the experience from a distance. Attention needs to be given to every part, including the edges, security, converters, transformer or the required infrastructure.

4. Utilize chances for multifunctional use;
5. Use and repair the structure of the landscape;
6. Keep the landscape visible;
7. Keep distance from infrastructures, buildings, nature, and historical values;
8. Make an edge in the landscape;
9. Follow the allotment, make one clear arrangement of the park;

10. Create a clean total image.

Looking at these points and the theoretical framework, the location and implementation phase are aimed at the spatial scale. The starting points describe how space should be designed, they provide a ruleset for the initiators of a solar park and the municipalities. These rulesets are aimed to orient the actor behavior. This is also what is shown in the interview with the province, the aim of the province is to help and facilitate municipalities and initiators to implement ground based solar parks (FP, 2017) and keep the social support for solar energy. The province has created a provincial vision and policy, municipalities need to make sure their plans fit within this vision and policy; municipalities are responsible for the plans. Hence, the province is mainly working at the structural regime level to see what they want to allow in the province and what not. Most of the time they are not actively involved, but in the background, they study all initiatives to make sure they are coherent and fit in the landscape as a whole.

For instance, the province sees the struggles of the network companies with the physical network. As a province, they have the possibilities and tools to discuss the legislation that is hampering and slowing down these projects and developments. Within the network dimension, the province has created an 'Energiewerkplaats' which can help civil initiatives to realize their project (FP, 2017). So, the province has to set up a network for local, or small initiatives.

The province is available for questions and thinking along with people, but will not actively interfere. Only when a solar park does not fit within the vision of the municipality and province, this will and can be discussed at the provincial level. In the policy there is only space for solar parks on special locations; to be able to allow more solar parks the province is changing the policy to where the Provincial Executive can allow solar parks at more locations, which not directly fit according to the policy.

Almost every municipality has gotten applications for solar parks. The province wants to facilitate the process of implementation, as they saw the processes are difficult and slow. They wanted to keep the social support for solar energy and therefore the province developed an integral method for the realization of solar parks, called 'sinnetafels' (solar tables). Through physically gathering around a table with all the different stakeholders, a lot of information can become clear about the different (im)possibilities, chances, and interests in a short amount of time. At these tables, the techniques, business cases, main connection, locational choice, spatial embedding and the process are discussed. The only precondition for a Sinnetafel is the possibility to come to a widely supported conclusion.

These sinnetafels have shown an interesting point. As is also shown in the cases, the question on where to locate the solar park is mostly answered by the ownership of the land, as FP (2017) said:

"*when a farmer quits, he is the landowner and the solar park will be located there, just because that land is free to be used for a solar park. You can also look at this differently, for example, we will look for the most ideal and logical location. (…) So, there are two ways to reason, first from ownership, and second from the landscape and space."* (FP, 2017).

If someone owns the land and is prepared to develop a solar park on it, the solar park will be realized there, even though this location might not be the ideal location at all seen from the landscape, network, policies, etc. The province of Fryslân wants to stop reasoning from this physical ownership, and start reasoning from what the ideal locations are seen from the landscape, network, and policies. So, the province Fryslân wants to start this discussion.

Hence, the province is seeking to intertwine the different concepts on the spatial scale. They are trying to connect these different concepts. For instance, through combining networks and territory, the province is

trying to create cross-border thinking. The place-network intertwining is important, as they are trying to bring together the different governments. So, the province is mainly focusing on the network concept, combined with other concepts. The province tries to function as a connecting government and bringing the different governments together. Second, the province is focusing on the intertwining concepts territory and place, through stop looking at the ownership and start looking from what would make sense from the perspective of the landscape.

5.4.2 Groningen

The province of Groningen is giving space to initiatives to implement ground based solar parks, with attention to landscape and social engagement. In the 'omgevingsvisie 2016-2019' new policies for solar parks have been summarized, the rules are recorded in the 'omgevingsverordening'. In this chapter, I will shortly summarize these policies and rules. A solar park is defined by the municipality as 'a spatial coherent, ground based, or floating installation for producing solar energy, larger than 200 m^2.

The province of Groningen wants to stimulate the use of solar energy. For the province spatial embedding and local participation is of major importance. The province prefers solar parks in the urban area, but they give space to solar parks in the rural area. Important is that the solar park is connected to and fits within the landscape structure and building characteristics. Solar parks in nature areas are a no-go. The province has made a spatial assessment framework which municipalities can use to guarantee the spatial quality and careful use of space.

Groningen explicitly gives municipalities the responsibility for the right location choice and spatial embedding within the urban area and in the rural area connected to the built-up area with a maximum of 1 ha. The province wants to be involved in the decision making if a solar park is:

- Connected to the built area larger than 1 ha;
- Connected to a building block or with a linear arrangement.

"We see that in order to make big steps toward sustainability, people mainly focus in the rural area. In contrary to our preference, but until now, the solar parks that have been realized are in the urban area. (…) Our goal is to be in 2035 60% sustainable, and in 2050 100%. We are now studying what this means, how many solar parks and how many windmills these ambitions mean." (PG, 2017)

Solar parks in the rural area only can be realized on locations appointed by the province. The municipality can propose a location, after which the Provincial Executive will decide. The Provincial Executive has different boundary conditions, the realization of the solar park needs to have an added value for the region, local participation, and spatial quality. Solar parks will only be allowed temporarily, based on their technical-economic lifespan.

"The role of the province is large when a solar park is planned in the rural area. The municipality has to develop a vision for the area on solar parks, so municipalities need to explain why this location is suitable for a solar park. This can only be explained when the whole landscape is taken into consideration. This is needed for a decision of the Provincial Executive." (PG, 2017)

This vision of the area is within the borders of the municipality. The province facilitates this process, to make sure one clear vision is made on a certain type of landscape. Different municipalities should not make different visions for the same landscape. Therefore, the province is working on a provincial vision. *"Their framework is not clear yet. In every meeting the 'how' question is the main question." (PG, 2017)*.

The province Groningen mainly focusses with this on the intertwining concepts of territory and place, and territory and networks. The province wants a vision for the whole province, so a vision on all the landscapes in the different municipalities. These visions should be coherent and complementary to each other.

In the 'Handreiking locatiekeuze en ontwerp zonnepark' (2016) five design principles have been stated on landscape level:

- Look for a location that fits with the wished size based on the characteristics of the surrounding;
- Research the characteristics of the surrounding to find the possible production of the location;
- Describe the cumulative effect of multiple parks on a higher scale;
- Show the characteristics of the settlement development and the landscape;
- Make sure the solar park fits within the most important spatial structures.

On parcel level these five design principles can be translated into:

- Fit the solar park within the existing allotment structure;
- Keep enough distance to vulnerable spatial elements;
- Use the characteristics of the landscape and strengthen if possible;
- Design the edges as a fitting green transitional space;
- Give the solar park a recognizable entry.

At the level of the solar park itself, the following design principles are described:

- Limit the height of the rows of solar panels as much as possible;
- Adjust the azimuth of the solar panels to the direction of the parcel;
- Have a clean edge;
- Organize transformers and inverters nicely in the landscape;
- Decide per place on the design of building structures;
- When using fences, use a dark-colored fence;
- Aim for multifunctional use of space;
- Try to let people experience the qualities of the space.

On the provincial level, it is hard to include people in the process, as people prefer to participate in a concrete project, instead of an abstract idea to come up with a vision for the area.

"Participation is a difficult thing to demand from initiators. We advise and sometimes demand a participation plan. This participation plan should make clear how people can participate in the process or financially. This should include multiple options, as not every participation model is suitable for everyone." (PG, 2017)

The municipality is aware that participation is not a solution for everything, "*I think the constraints are not in the landscape, but in the society. Society needs to transform and this will lead to a transformation in the landscape." (PG, 2017).*

The main stakeholders according to the province are:

- Province;
- Municipality;

- Citizens
    - Pioneer citizens – who started themselves with renewable energy;
    - Ignorant citizens – are not doing anything with renewable energy;
    - NIMBY citizens – as long as it does not change anything for me.
- Energy cooperation
    - Of villages;
    - Of cities – more professional, commercial, bigger and on a different scale than village energy cooperations.
- GREC – Groningen energy cooperation, the umbrella cooperation for all Groninger energy cooperations;
- NLD – includes all three umbrella cooperations of Groningen, Drenthe, and Friesland.

This network is quite complex, "*we are creating a new energy organism, not just a technical or social, but it includes emotions and privacy." (PG, 2017)* During the meetings on solar energy, this idea led to a new slogan, 'eerlijk, eigen en efficient' (ENG: honest, own and efficient). This slogan is based on the experience of the citizens. Honest because of the division of energy and the division of advantages and disadvantages, own because the province sees that if a RET is owned by the people self, there is less resistance, and efficient because the province wants to implement it in an efficient way.

This is also related to if we compare the sustainable energy production with energy from oil and gas. We all get now the revenues from mainly the gas production, and a little bit oil production. But with sustainable energy, the solar panels and windmills are placed in a landscape, while not everyone gets the revenues from it, while everyone pays taxes from which the SDE+ subsidy is paid. So the province wants to look for a financial participation model to keep the money within their own provincial borders.

At the national level, it would be helpful to have a central fees regulation, with every solar park every municipality has to make the same decision. Those are things that can be regulated centrally.

5.4.3 Summary of the provincial politics

So, looking at the provinces and their policies, both provinces have a different approach for solar parks. In essence, they are the same. Both provinces start with starting points and are aware they can mainly steer on the spatial concepts and effects. Therefore, they both designed their design principles and starting points. However, the province of Groningen wants to be included at solar parks larger than 1 ha, and in the rural area. Fryslân only at solar parks in the rural area. Fryslân has set up a concept to create a network and facilitate villages with a network to think about the possibilities of a solar park. Groningen is trying to create a provincial-wide vision, created by the municipalities. So, both provinces see it as their function to let the municipalities think border-crossing. Both provinces are still looking for the perfect way to do this.

5.5 European practice

To illustrate how these practices are in Europe, I will describe the main temporal and structural factors. The start of the energy transition and RETs is on the level of slow changing structures. At this level the leaders of the EU have decided that climate change is a major event, no matter if we act upon climate change, we actively try to change the landscape, or if we do not act, climate change will change our structure. Hence, on the landscape level, the EU has set goals, as presented in Appendix I. In order to achieve these goals, the energy transition is triggered and in order to do so, the EU has created support strategies on institutional level.

To understand the support strategies and how they are formed, first a very short history of the support strategies in Europe is presented. Before the 1970s, the European countries mainly focused on the electrical network, which created large monopolies on the electrical network. In the 1970s, the energy policy became increasingly important (Johansson & Turkenbrug, 2004). From then, the European countries were concerned on the "*security of energy supply, environmental issues, competitiveness of European economies, and regional developments"* (Johansson & Turkenbrug, 2004, p.5). To put it in other words, Europe became afraid they were depending too much on others and became worried about the environmental consequences of their own energy supply. The EU determined two methods to reduce the dependence. The first method was to use less energy from other countries, thus to use more domestic, renewable flows of energy. The second method was to use the existing energy and material more effectively, as described by Jochem, et al. (2002). To achieve this, the EU set up a public support system for RET's (renewable energy techniques), primarily in the form of investment subsidies and research efforts.

During the 1980s and 1990s, different countries experienced with new mechanisms. They tried to encourage the market actors without budget limits. All electricity users largely carried the costs through Feed in Tariffs (FiTs) that remunerated producers of RET well above energy costs in the marketplace, as was the case in Denmark, Germany, and Spain, in the UK and Sweden the RE (renewable energy) certificates were used. In the period 2000-2012 the European countries led the renewable energy market. Nearly 70 % of the global renewable energy capacity was added by European countries. Europe dominated the PV market and was responsible for 57% of the new installed capacities in 2012. This means that Europe installed 16,9 GW PV-capacity in 2012. This seems large, but it was a downfall compared to 2011. This was due to the country's retrenched FiT policy. As also described by Johansson & Turkenbrug (2004), the conditions on taxes and subsidies and other market conditions are very significant in the energy transition.

Hence, from 1970 on a lot has happened on the temporal scale. On the short time span, a lot has been discussed in the corridors of the EU. In these corridors is discussed on how to decide later on how to act on the major event of climate change, which has consequences on the institutional and short time span level. As the decision was made to try to mitigate the consequences of climate change, alliances had to be made to have an influence on how to influence the institutional level.

5.5.1 Support strategies

The development of the renewable energy market has been encouraged through the implementation of several support strategies, with this the PV market was also encouraged. The support strategies are aimed to reduce the gap between the costs for renewable energy and the costs for fossil energy. The

consequence for the PV market was that it stimulated the PV market and reduced the costs of energy from PV-panels. Dusonchet & Telaretti (2015) even describe a 'fuel parity' in 2012/2013 in some countries. This is what the EU aims to do on the institutional level, to create a renewable energy market that can compete with the market of fossil fuels. However, the PV market still needs these support mechanisms in 2017. To understand the different support mechanisms, I will describe them in the next section.

5.5.1.1 Feed-in Tariffs (FiT)

Using the FiT system, governments offer renewable energy producers long-term contracts. These contracts are generally based on the generation costs of each technology. The producer receives a paying tariff determined by the public authorities. These tariffs are guaranteed for a fixed period. For each generated kWh of produced electricity, the producer receives a full tariff. This includes a premium added to or above the market price. When getting an FiT subsidy, it excludes tax rebates or other production subsidies from the government. Each country determines their own FiT rate, based on the construction and maintenance costs. Dusonchet & Telaretti (2015) describe that the most successful examples of FiT systems can be seen in Germany and Italy.

According to Dusonchet & Telaretti (2015) the FiT system is, in general, a successful system, however, it needs a periodic update to avoid uncontrolled market development. For instance, Germany adapts their FiT every month, depending on the amount of PV panels installed. Other countries have developed an FiT system that includes geographical parameters, as different regions have different solar radiations. The SDE+ subsidy in the Netherlands is an example of an FiT system. The SDE+ subsidy is updated twice every year.

5.5.1.2 Electricity compensation schemes

Several countries are starting to develop rules allowing local consumption of the RES electricity produced. These rules are known as self-consumption or net-metering schemes. The rules allow a reduction of the PV owner's electricity bill.

Self-consumption allows the electricity producer to be compensated for the PV energy immediately or within a 15-minute timeframe. Net-metering allows RES producers to compensate the energy generated over a long period of time, ranging from a month to several years. Customers can offset their electricity consumption with small-scale RES over an entire billing period using it at a time other than when it is produced, without considering when it is produced or consumed and storing their energy in the utility's grid. A bi-directional energy meter is needed. Countries using this net-metering system are for example Italy, Denmark, Belgium, and the Netherlands.

5.5.1.3 Direct capital subsidies or tax credits

A major barrier for investing in PV systems is the high upfront investment. Even though the maintenance and fuel costs are low, the initial investment is significantly high. Therefore, many governments have introduced policies to reduce the weight of the initial investment. For instance Belgium, at regional level, France, at local level, and Germany, France, Italy, the Netherlands, and Sweden. Off-grid applications use these systems more often since FiT's haven't yet been adopted to off-grid PV applications. Tax credits are used in Belgium, France, Italy, the Netherlands and the UK. They do depend heavily on government budgets and are highly sensitive to the political climate.

5.5.2 Practice in different countries

As shown in the previous part of this chapter, the European Union has thought of some support strategies, but the countries themselves have to implement them and create a budget, depending on the country, its culture, and the available budget. Therefore, I will describe for a Germany, Denmark, and the UK which factors and developments have been distinguished as important for that country.

5.5.2.1 Germany

Germany is in the front of the developed countries at the development of renewable energy sources. Germany started its renewable energy policy after the oil crisis in 1974. In 1979 they introduced the RES-E policy. This policy is divided into two important parts. First one is the price management, the second one is the support investors can get for their RES-E capacity. The German government has tried to strengthen and encourage the renewable energy sector through laws, policies, and regulations.

The politics are important in the renewable energy strategy. For example, Bechberger & Reiche (2004) described the importance of the strong lobby of the SPD party in Germany against wind power and in favor of the coal sector. The result of this lobby was that between 2006 and 2012 a subsidy was granted for the hard coal mining industry. Another result is that some contracts with important suppliers of gas will not expire until 2030. Bechberger & Reiche (2004) describe different conditions that are important for the successful development of RES in Germany. They divided these conditions into four categories: instrumental, political, structural, and cognitive. In the next part of this section, I will elaborate on these conditions.

Within the industrial conditions, Bechberger & Reiche (2004) distinguished two important factors: the security for investors in RES projects, and the promotion measures for RES. The promotion measures in Germany are called the EEG. The EEG consists of a guarantee for the purchase and remuneration of RES electricity for 20 years. The EEG also consists of a technology-specific remuneration for RES electricity. This means that the EEG is part of a larger promotion approach, which determines the remuneration rates depending on the used technology, size of the plant, and in case of wind energy also on the age and the generated power output of the installation.

The second one is the political conditions. After the elections of 2002, the Green Party changed the administrative responsibilities for RES from BMWA to the BMU. The decision to phase out nuclear energy in Germany through a law in April 2002, positively affected the development of renewable energy as well.

Third are the structural conditions. Germany depends on energy import, as they cannot produce enough energy themselves. To reduce this dependence, the amount of national produced energy needs to grow, therefore, Germany actively supports RES.

Last is the cognitive conditions, with mainly the low resistance against wind power projects. Bechberger & Reiche (2004) claim this is due to two things. The first one is that the development of wind farms has always been connected to associate companies. This could sometimes include a high development of the local population. The second one is that the municipality had to actively write down in the spatial planning what locations are feasible to build RES plants. This makes it easier for the investors and reduces the resistance as well. The results of the cognitive conditions are shown in the fact that in 2001 more than 100.000 households decided to invest in a solar thermal installation.

The positive results of this German approach of RES is also shown in the numbers now. In 2010 the National Renewable Energy Action Plan (NREAP) has projected the shares of renewable energy in the

future in Germany; 38 % by 2020, 50 % by 2030, 65 % by 2040 and 80% by 2050. The total cumulative capacity of solar PV would be 51,75 GW by additions of 3.5 GW per year. The latest numbers on the cumulative installed PV capacity is on 2014. Until 2014 38 GW of PV capacity was installed in Germany (IEA International Energy Agency, 2015).

5.5.2.2 Denmark

The Danish are known for their renewable energy policy, which mainly has led to a lot of wind power. Not only wind power got public support, also biogas and solar power were given this. So, these forms have been developed in Denmark. Not as fast and big as wind power, the wind power accounts for about 19% of the Danish electricity consumption in 2003 (Johansson & Turkenbrug, 2004). This fast penetration of wind power is due to several reasons. The most important one is the favorable FiT's for electricity from renewables, including wind. In 1999 this FiT's changed, the Danish government did not anticipate on this change. As a consequence, more uncertainty for investors in wind power led to a significant reduction in investments in wind power plants.

Next, the new government in 2001 changed the renewable energy policies radically. The governmental support for the development and demonstration of renewable energy systems was to a large extent abolished. Instead, the development should rely on the commercial market. In 2009 an FiT was introduced. This FiT differentiated the rates of different energy sources and this FiT got an addition in 2012 with the Energy Agreement. This Energy Agreement provides an extensive framework of energy saving and RE production measures (Oteman, etal., 2014). However, the NIMBY responses have increased, when the local community does not gain a revenue, as described by Oteman, et al. (2014). Nevertheless, the local community is still investing in RETs. The goal is to produce 100% of its energy use through renewable energy. Appendix I shows Denmark is ahead of the European goals.

5.5.2.3 United Kingdom

Newbury (2016) describes that the UK has tried almost every policy to support RES at least once. The UK still had an uneconomic competition going on in 2004, between fossil fuels and renewable energy techniques (RETs). In 2000 the UK implemented the Renewables Obligation, this has improved the prospects, together with the capital grants to support research and development plants for a wide range of RETs. The UK implemented through the Energy Act 2013 its electricity market reform (EMR). They implemented this to stimulate the RES, to meet their targets. In contrast to the European Union, this policy aims to replace their own used FiTs with FiTs which are more similar to the European FiTs, as described by Newbery (2016). At the same time, the government has set some really challenging targets for the contribution of RETs to the energy supply in the UK; 10% in 2010 and 20% by 2020. However, as described in Appendix I, the 10% is still a challenge for the UK, even though they have tried every RES policy. An important part of achieving these goals is to create more awareness in the public, as up to 30% of RET projects fail at the developed planning consent stage (Johansson & Turkenbrug, 2004).

5.5.3 Conclusion

Looking at these other countries, I can conclude that the financial benefits and non-commercializing of the RET's had a major influence on the development of renewable energy sources in Germany and Denmark. This led to a fast growth of renewable energy sources in both countries. The governments taking away the uncertainties on the investments were beneficial for the development of RET's in both countries. In Germany and the UK, the awareness in the public and the involvement of the public also played a major role.

6. Conclusion and discussion

In this chapter, I will present the conclusions of this research. These conclusions will also be discussed using the theoretical framework. First, I will discuss the results in the light of the theoretical framework, and I will discuss the method I have chosen. Second, I will answer my research question. Finally, recommendations for further research will be proposed.

6.1 Results

The purpose of this research, described in section 3.2, was as follows:

"to describe which factors have had a major role in the implementation of ground-based solar parks. Different cases will be researched which will gain insight into the role of spatial planning and spatial planners in the implementation of ground-based solar parks. This will give a first impression of the status of ground-based solar parks and how we deal with energy transition. We will get insight into why these parks have been implemented."

In this research, I have researched three different cases. These cases were all three realized ground based solar parks, which got in the end of 2014 an SDE subsidy. I have researched these cases by using the MLP research framework, combined with the TPSN framework. MLP consists of the temporal, structural, and the later added spatial scale. I have further defined this spatial scale by using the TPSN framework. On the temporal and structural scale, the landscape, regime, and niche level are distinguished, at the spatial level, within the TPSN framework, I have used the territory, place, scale, and networks as structuring concepts.

The main research question of this research has been as follows:

Which factors related to spatial planning influenced the process of the implementation of the ground-based solar parks on the landscape, regime, and niche level in the Netherlands?

Based on the sub-questions discussed in the previous chapter, and the topics repeated above, we can reach the following conclusion. The Netherlands have to deal with many issues in order to be able to realize more ground-based solar parks to achieve their goals. For, the three solar parks discussed in this thesis have been realized at fairly 'easy' locations, the Netherlands will run out of available 'easy' locations and have to consider locations closer to residential areas. In the Netherlands, there is a lot of pressure on land use since there are relatively many people living in a small area. Therefore, the discussion on ground based solar parks will play a role in the future planning of the use of land. In Appendix VII the total results of the coding are shown. It shows the landscape scale was very hard to determine for the interviewees. They did not directly mention the concepts in such a way I would code them. Neither did the interviewees mention the innovations in the temporal niche level, as explained in the previous chapter. In Figure 18 these results of the coding are presented in a chart. The graphic shows that the most relevant concepts are policy, markets, areal differentiation, culture and the structural regime in the three studied cases.

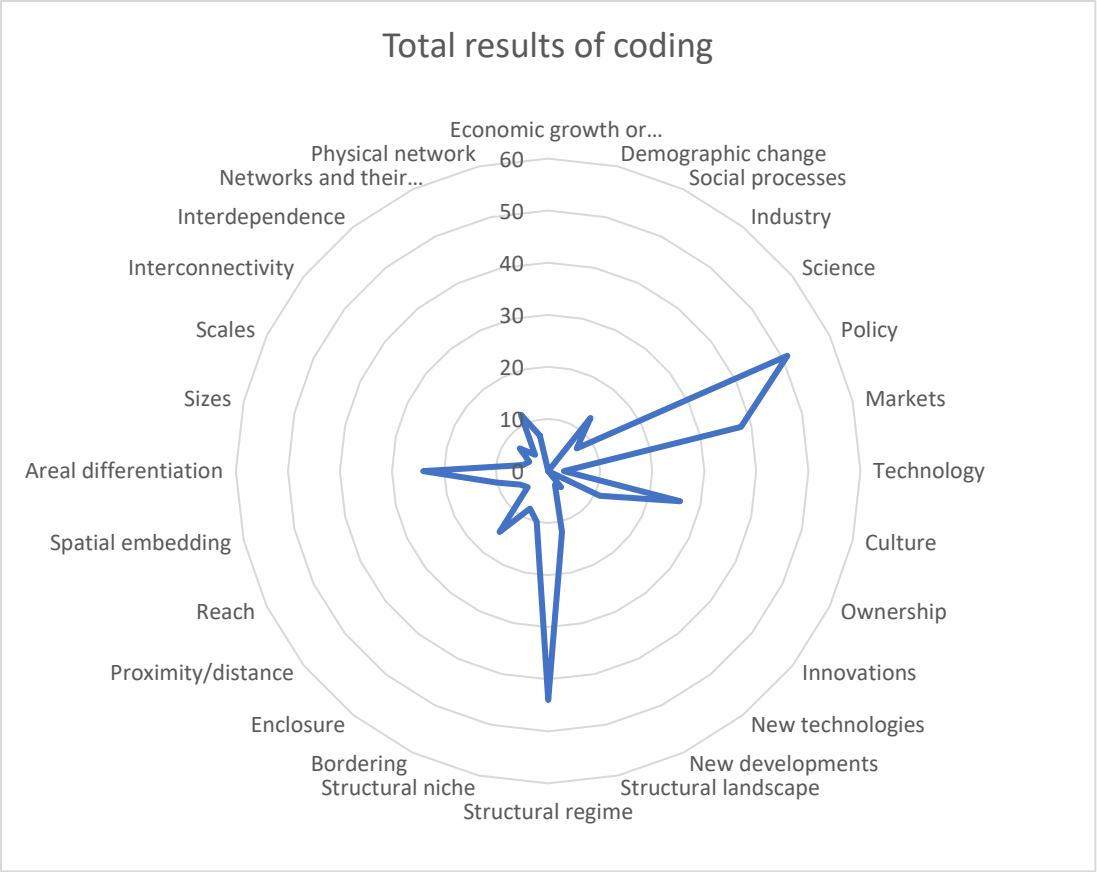

Figure 18 Results of the total coding

However, as the land will become more scarce, other factors can become more important. Factors such as ownership, social processes, enclosure, bordering and reach potentially will have to be taken into account, and therefore it is continuously necessary to research the development of the planning of usage of land in relation to the realization of sustainable energy projects in the Netherlands.

Even though the landscape dimension of the temporal scale, I can lead some factors back to this scale, like the ownership of a huge amount of land by the municipality, which was affected by the economic crisis in 2008 as the development of industrial area was much smaller than predicted. Also the consequences of our fossil fuel energy consumption become clear, through for example the consequences in the environment, earthquakes or the changing climate. To mitigate these consequences and fill the fallow land because of the economic crisis, the land was used for the realization of the ground based solar parks. At the temporal regime level mainly the culture, policy, and markets were mainly mentioned as the most important factors, as shown in Figure 19. In the case of EK Garyp, science was important. At the niche level, the innovation of ground based solar parks itself was the limiting factor. All three municipalities needed to find a way to deal with this innovation.

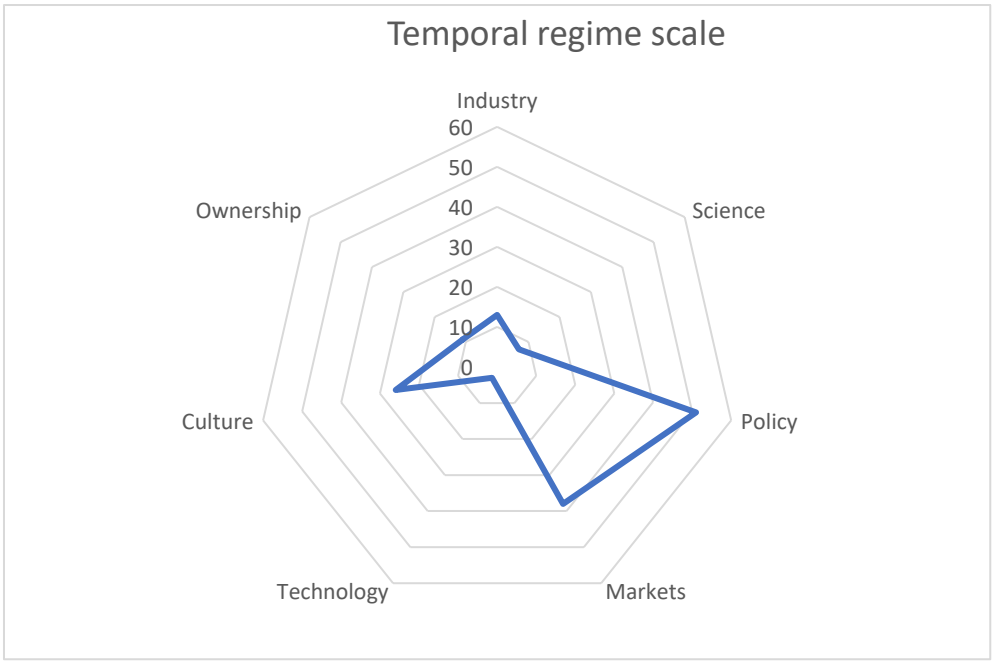

Figure 19 The results of the temporal regime scale.

At the structural scale, the municipality was in all three cases the authority. The provinces set their rules at the landscape level. These rules were not official yet, however, they were already developed, so these rules are used when the parks were implemented. Within the landscape dimension the laws and policies, mainly the fees, gave the biggest struggle. The ground based solar parks can be seen as an innovation at the niche level, for which the initiators felt the freedom to initiate. As the municipalities and provinces were still developing their policies, all three parks were seen as test cases. However, as all three parks were also realized at 'special' places, there were no large struggles encountered.

At the spatial scale, the largest factor was the areal differentiation, as is shown in Figure 20. This is because all three locations are special, or 'easy' locations. This also showed in the relevance of the other concepts. As there were no civilians in the surrounding which complained about the parks, the other concepts were less relevant. However, all three municipalities are thinking about the concepts, in case solar parks will be realized on more sensitive locations.

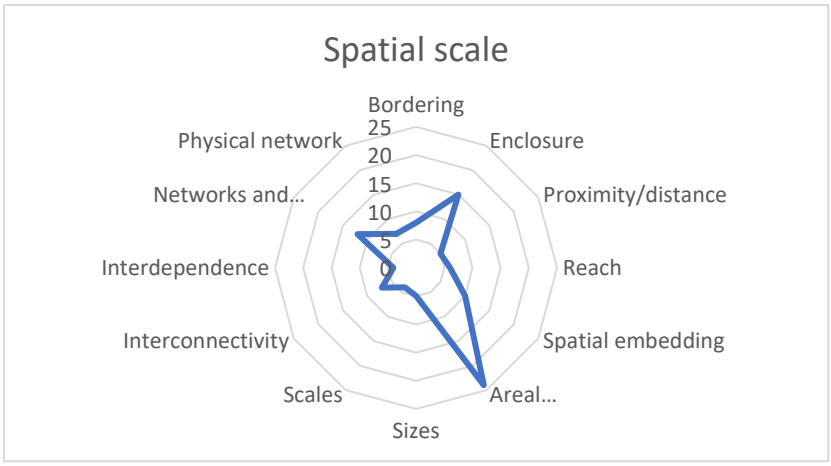

Figure 20 The results of the spatial scale

The sub-questions have been answered in the previous chapter. I have researched three different cases on the implementation of ground based solar parks. The most important findings of this research are summarized hereafter.

Ground based solar parks is a new development, of which the importance is still growing, as the Netherlands want to produce more sustainable energy. Solar energy forms an important part of the sustainable energy mix, which can lead to a reduction of GHG emission. The Netherlands should have a 25% reduction of GHG compared to 1990, according to the EU norms in 2023.

The three cases discussed in this thesis contribute to the reduction of GHG-emission, as the solar energy will replace energy from fossil fuels and therefore, reduces the GHG-emission. Looking at the three cases discussed in this thesis, it was crucial for these cases that the location was not discussed by the local citizens. This is crucial as protest or discussion can delay the project significantly. All three locations do not directly visually pollute the view for inhabitants. Or, in other words, no one can see the park directly from their home. Also, all three locations are special locations, two industrial areas, and one dump site. Especially for the dumpsite, the municipality was already looking for a new usage of the location. The industrial areas were meant to be used by the industry, but as the industry does not develop as fast as expected, they offered a location for the solar parks to be developed. These three cases, EK Garyp, Sunport Delfzijl, and Vierverlaten were among the first ground based solar parks realized in the Netherlands. They were able to create the space they needed and they were able to obtain this space. They had to overcome some difficulties with the municipalities and network managers, but the willingness to realize the parks made the projects to a success. Hence, looking at this success, the concepts of industry, culture, and areal differentiation came back as the most relevant in my research. The industry in the sense of the demand and supply for green energy. Without a demand for green energy from the local region, all these projects would not have been realized. The culture for the willingness and preparedness to invest in the project and the areal differentiation for the distinct places that have been chosen have been crucial for the realization of the projects.

However, these ‘easy’ to realize locations are now taken. This results in new projects having to look at more ‘difficult’ to realize locations, more near inhabitants, and further away from transformers, for example. Moreover, the municipalities are now actively developing policies, which can make the implementation more difficult. For instance, in Delfzijl, the alderman wants to make the policy official first, before allowing any more solar parks. Furthermore, because people see the success of these projects, people want to participate. As explained in the cases, initiators do not know yet what the best way is to include people in the projects. In this thesis, I have mentioned the factors which influenced the implementation in the three studied cases. This helps to see what factors are relevant and important to pay attention to when implementing a ground based solar park.

As is also concluded in chapter 5.5, the financial benefits and non-commercializing is a major factor in the development of renewable energy sources. Another large factor is the awareness of the public and the involvement of the public. The authorities have tried to keep the financial benefits through the subsidy. As mentioned, the awareness of the public is growing, as the consequences are more visible. This will need to be taken into consideration at new cases. To conclude, for the future, when the land is scarcer and the ‘easy’ land is already used, the public, political, and policies need to be aligned. If we want to achieve our renewable energy goals, we need to work on the policies and with that the public opinion. This means the politicians need to actively support RET’s and create the right policies. Through the policies, the politicians need to keep the public opinion positive towards solar energy. This can be done through the different concepts the MLP distinguishes and I have distinguished.

6.2 Discussion of the Theoretical framework

6.2.1 MLP

In this research, I have used the MLP framework to research three local cases. The MLP framework can be used to explain why transitions on a national level appear. This can be researched by determining the interactions among the niche, regime, and landscape level. I have investigated the relationship between the implementation of ground based solar parks and the concepts that are distinguished in MLP. MLP is a framework to study sustainability transitions. Even though the ground based solar parks are part of the sustainability transition, and can be seen as a sustainability transition itself, I can conclude it is challenging to use this framework for specific cases, as MLP is aiming at a higher level, so at the level of RETs instead of three specific cases. Looking at the interviews, the different concepts from the temporal, structural, and spatial layers are mentioned, but the landscape and niche level are hardly explicitly discussed. Mainly the regime level is mentioned. Quite logical, since it is the level people directly see the influence of as the regime is about the structures and rules we use every day. Especially the landscape level is harder to see for someone involved in a case, as the landscape is about slow changing structures, which cannot be changed in one case. An interesting difference was visible between the cases, for in Delfzijl GSP and the municipality are aware of their production for the whole Netherlands. They are also aware that they also need other parts of the Netherlands, to be sustainable. So, they produce for a larger scale and are somehow also able to look more easily at that larger scale.

6.2.2 TPSN

Next, I have used the TPSN framework to describe the spatial scale and the intertwining of this spatial scale. The TPSN framework is about the territory, place, scale, and network of the ground based solar parks and their influence on each other. As has also become clear in the results, spatial factors were important, however, they could have been researched more in depth when the solar parks were widely discussed in the communities. These discussions could have led to more demands on the location and siting of the park. In the cases I have researched there was no discussion about the locations because the initiators chose their location carefully, and they fit well within the area and zoning plan. The TPSN framework did have a valuable addition to the MLP, as the MLP does not focus on the spatial impact. I think the TPSN can be helpful with solar parks that will be implemented in the future, as the interviewees did acknowledge that these factors become more important as space becomes scarcer.

6.2.3 MLP and TPSN

However, it was challenging to combine TPSN and MLP in this research. Raven, et al. (2012) have added a spatial scale into the MLP framework, however as I have recognized during the research, the spatial scale as Raven, et al. (2012) have distinguished was not applicable on the ground based solar parks, as it lacked the physical spatial component. As already mentioned in the MLP part, the MLP focuses mostly on the transition itself, while I researched cases in which the parks had already been established. The TPSN gave a more applicable framework to research the cases. The combination of TPSN and MLP was not very successful. As there was hardly a relationship between those two methods. In another research, the MLP can be used to research the general transition of renewable energy or solar energy. The TPSN framework can be used for specific cases in which a lot discussion on the siting has been going on.

6.2.4 Window of opportunity

As written in the Theoretical Framework, a transition can occur when a window of opportunity is opened. A window of opportunity is opened when certain circumstances allow this to happen. According to Kingston (1984), this window of opportunity is opened when a public stream, political stream, and a policy stream create this window of opportunity. De Haan and Rotmans (2011) mention that tensions, stress, and pressure can create the right circumstances for a window of opportunity to open to start a transition. Looking at the cases, I can determine these three streams.

The public is interested in the production of sustainable energy, mainly the case of EKGaryp shows that. At the same time, the European goals show that there is also the political and policy stream that have to be taken into account for sustainable energy goals to be reached. However, the numbers in Appendix I and II tell us, the political and policy stream are showing slow progression, although they have developed more in the last years. So, this window of opportunity is maybe now growing. However, the public stream is becoming more negative, as also shown in the interviews. The tensions, stress, and pressure, as described by De Haan and Rotmans (2011) can also be identified. The EU is putting more pressure on the Netherlands and the stress on climate change is growing in the communities.

So, the circumstances needed for a window of opportunity to open up further, are present, possibly even more now than in 2014, when the cases discussed in this thesis received their subsidies. Climate change has become more evident and the consequences of the Netherlands drilling for gas have become clearer in Groningen in the past few years. However, the growing tensions and growing scarcity of land is putting more pressure on sustainable developments like these cases discussed. As also shown, the speed with which municipalities are able to deal with the transitions is very slow. Moreover, one part of the public stream is aware of the need for a sustainable transition. The question is when the other part of the public stream will see this need. In the interviews, it came to the fore that the authorities can have concrete demands on the landscape scale, but that it is difficult for them to demand a certain amount of participation, as each area deals with a different (social) situation. Not all inhabitants want to participate, in poorer areas, not everyone can participate, and in again other areas, citizens prefer to put solar panels on their own roofs. To keep the balance between top-down planning (planning a solar park where it would fit best) and bottom-up planning (planning a solar park where people think it would fit best) will be an ongoing process and important for everyone to keep in mind.

6.3 Recommendations for further research

This research has given an overview of factors which have influenced the implementation of three ground based solar parks in the Netherlands that had an SDE subsidy from 2014. The research shows that each case is different and that each case deals with different factors that are relevant to the specific case. Therefore, it is interesting to keep an eye on the effect of the changing subsidy, as subsidies are being lowered. This is specifically relevant for the coming years, 2018 and 2019 since the SDE subsidy has been lowered significantly. It would be interesting to see the effect of the height of the subsidy on the number of implemented parks and the relation with the growing need for the parks.

Another interesting topic to consider could be on the participation of citizens in the implementation of ground based solar parks. I have focused primarily on the SDE subsidy, but the 'postcoderoosregeling' is allowing people more easily to participate themselves. I chose not to research this subsidy, as most projects with this subsidy have not been realized since there have not been enough willing participants. Therefore, another interesting research would be why people will not participate and what needs to be changed to let people participate.

This research has contributed to getting more insight in factors influencing the implementation of ground based solar parks. With this knowledge, the energy transition can be fastened, for the Netherlands most definitely have the potential and the need to achieve their sustainable development goals if they implement more ideas like these.

7. Reflection and limitations

7.1 Limitations of the Research

To select the cases and make the cases somehow similar, I chose to research only the cases with SDE subsidy. This selection was based on the available knowledge and information on this subsidy. To be able to select these cases without researching 50 solar parks on roof, I have selected the cases larger than 1 ha. Moreover, I have selected cases that should have been realized by now, so cases from 2014. The newer projects can have been more interesting and valuable as cases, as these cases are all sited on 'special' or 'easy' locations. However, only for the cases with a subsidy from 2014, it is clear if they are or are not going to be implemented.

The appointments for the interviews were made with people involved in the chosen projects, or involved in solar park projects in the municipality or province. The approached people were stated as the contact person of the municipality, province, or initiator. However, in the case of Sunport Delfzijl, the initiator was not available, so I interviewed someone who is now involved in realizing more solar parks for the company. In the province of Groningen, the civil servant who was involved in 2014 and 2015 was not working at the province anymore, so I spoke his successor. The initiator in the municipality of Groningen was also the one who is responsible for the supervision on other solar parks in the municipality, which are not initiated by the municipality. Therefore, he had a dual role, which complicated the interview. However, according to him, no one else in the municipality knows as much on the policies on ground based solar parks as he does. In the case of EK Garyp, the initiators were too busy with the solar park, so they did not have time for an interview. The supporting organizations were too busy to talk to me. Even though the local newspaper gave a good insight into their side of the story, it would have been interesting to talk to the initiators.

The interviews were held in Dutch or Frisian, depending on the spoken language by the interviewee. The interviews were transcribed in the language the interview was held. The (two) Frisian interviews are translated into Dutch. When needed, quotes have been translated into English. The codes used are in English.

7.2 Reflection on the coding

The coding part of this research is a subjective activity. The interviews are coded, depending on the interpretation of the researcher. Another researcher might have linked parts of the interview to different codes. To reduce the subjectivity of the coding, the interviews could have been coded by different researchers.

To ensure the consistency in the coding, the interviews were analyzed several times. First, I coded the interviews to get familiar with the coding. Then, I analyzed the interviews again and reviewed and changed the coding if necessary based on what I learned during the coding. This way, I made sure the interviews were coded similarly. A challenge during the coding was the overlap sometimes between the codes and what the interviewees told. Despite the definition given to each dimension, the concepts still overlapped. For example, the culture in the municipality of Tytsjerksteradiel led to a policy which allowed them to pay for sustainability. I tackled this problem by coding consequently and also by acknowledging that some parts of the interviews could belong to multiple codes.

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List of figures

PICTURES ON FRONTPAGE:

Upper picture: http://www.gezinsbode.nl/nieuws/71839/zonnepark-vierverlaten-feestelijk-geopend/
Middle picture: https://www.alexanderkooistra.nl/mijn-werk-portfolio-voorbeelden/
Lower picture: https://www.eemskrant.nl/grootste-zonnepark-nederland-delfzijl-wordt-volgende-week-geopend/

LIST OF ABBREVIATIONS AND FREQUENTLY USED ABBREVIATIONS AND VALUES:

RESEARCH

Appendix I Share of renewable energy in gross final energy consumption

Share of renewable energy in gross final energy consumption and the 2020 target.

Share of renewable energy in gross final energy consumption				
%				
geo\time	2014	2016		TARGET
EU (28 countries)	16,1	17		20
EU (27 countries)	:	:		20
Belgium	8	8,7		13
Bulgaria	18	18,8		16
Czech Republic	15	14,9		13
Denmark	29,6	32,2		30
Germany	13,8	14,8		18
Estonia	26,3	28,8		25
Ireland	8,7	9,5		16
Greece	15,3	15,2	(e)	18
Spain	16,1	17,3		20
France	14,7	16		23
Croatia	27,8	28,3		20
Italy	17,1	17,4		17
Cyprus	8,9	9,3		13
Latvia	38,7	37,2		40
Lithuania	23,6	25,6		23
Luxembourg	4,5	5,4		11
Hungary	14,6	14,2		13
Malta	4,7	6		10
Netherlands	5,5	6		14
Austria	33	33,5		34
Poland	11,5	11,3		15
Portugal	27	28,5		31
Romania	24,8	25		24
Slovenia	21,5	21,3		25
Slovakia	11,7	12		14
Finland	38,7	38,7		38
Sweden	52,5	53,8		49
United Kingdom	7	9,3		15
Iceland	70,4	72,6		:
Norway	68,6	69,4		:
Switzerland	:	:		:

Source of Data: European environment agency (EEA)
Last update: 07.02.2018
Date of extraction: 09 Feb 2017 15:38:40 CET
Hyperlink to the table: http://ec.europa.eu/eurostat/tgm/table.do?tab=table&init=1&plugin=1&language=en&pcode=t2020_31

Appendix II Share of renewables in gross inland energy consumption

	Renewable energy	of which: Biofuels & renewable wastes [3]	Hydropower	Wind	Solar	Geothermal
EU-28	13.0	8.4	1.8	1.6	0.8	0.4
Belgium	6.7	5.2	0.1	0.9	0.5	0.0
Bulgaria	10.8	6.5	2.6	0.7	0.8	0.2
Czech Republic	10.1	9.1	0.4	0.1	0.5	0.0
Denmark	28.4	20.6	0.0	7.2	0.5	0.0
Germany	12.2	8.2	0.5	2.2	1.3	0.1
Estonia	14.5	13.5	0.0	1.0	0.0	0.0
Ireland	7.6	3.0	0.5	4.0	0.1	0.0
Greece	11.3	5.4	2.1	1.6	2.2	0.0
Spain	13.7	5.6	2.0	3.5	2.6	0.0
France	8.6	5.7	1.9	0.7	0.3	0.1
Croatia	23.0	15.5	6.4	0.8	0.2	0.1
Italy	16.8	8.6	2.5	0.8	1.4	3.5
Cyprus	6.5	2.1	0.0	0.8	3.5	0.1
Latvia	35.1	31.2	3.7	0.3	0.0	0.0
Lithuania	20.5	19.0	0.4	1.0	0.1	0.0
Luxembourg	4.9	4.2	0.2	0.2	0.3	0.0
Hungary	12.0	11.1	0.1	0.2	0.1	0.4
Malta	2.6	1.0	0.0	0.0	1.6	0.0
Netherlands	4.7	3.6	0.0	0.8	0.2	0.1
Austria	29.0	17.3	9.6	1.3	0.8	0.1
Poland	9.4	8.2	0.2	1.0	0.1	0.0
Portugal	21.6	12.6	3.2	4.3	0.6	0.8
Romania	18.4	11.5	4.4	1.9	0.5	0.1
Slovenia	16.1	9.9	5.0	0.0	0.5	0.7
Slovakia	9.6	7.2	2.0	0.0	0.3	0.0
Finland	31.6	26.7	4.3	0.6	0.0	0.0
Sweden	42.2	24.8	14.2	3.1	0.0	0.0
United Kingdom	7.7	5.3	0.3	1.8	0.4	0.0
Iceland	84.9	0.3	20.4	0.0	0.0	64.2
Norway	44.7	4.5	39.5	0.7	0.0	0.0
Montenegro	30.0	17.5	12.5	0.0	0.0	0.0
Former Yugoslav Republic of Macedonia	15.6	8.9	5.9	0.4	0.1	0.3
Albania	34.3	10.7	23.1	0.0	0.6	0.0
Serbia	13.1	7.2	5.9	0.0	0.0	0.0
Turkey	11.9	2.4	4.4	0.8	0.6	3.7
Bosnia and Herzegovina [1]	*25.7*	*19.2*	*6.5*	*0.0*	*0.0*	*0.0*
Kosovo [2]	10.9	10.4	0.5	0.0	0.0	0.0

ec.europa.eu/eurostat

(*) 2014.

(*) This designation is without prejudice to positions on status, and is in line with UNSCR 1244/1999 and the ICJ Opinion on the Kosovo declaration of independence.

[3] The category "Biofuels and renewable wastes" includes wood and solid biofuels, liquid biofuels, biogas and renewable wastes

Source: Eurostat (online data codes: nrg_100a and nrg_107a)

Share of renewables in gross inland energy consumption

Source of Data: European environment agency (EEA)
Last update: 05 October 2017
Date of extraction: 03-01-2018
Hyperlink to the table: http://ec.europa.eu/eurostat/statistics-explained/index.php/File:Share_of_renewables_in_gross_inland_energy_consumption,_2015_(%25)_YB17.png

Appendix III Renewable energy in the Netherlands

Renewable energy in the Netherlands; final use and avoided use of fossil energy

Renewable energy; final use and avoided use of fossil energy				
		Subjects	Gross final consumption renewable energy	Gross final consumption renewable energy
		Subjects	Final consumption	Final consumption relative
Energy sources/techniques	Energy application	Periods		
Total energy sources	Total energy applications	2013	104583	4,77
		2014	110473	5,54
		2015	119215	5,84
Hydro power	Total energy applications	2013	362	0,02
		2014	367	0,02
		2015	355	0,02
Wind energy, total	Total energy applications	2013	19324	0,88
		2014	20914	1,05
		2015	24900	1,22
Solar energy	Total energy applications	2013	2861	0,13
		2014	3953	0,2
		2015	5174	0,25
Geothermal, total	Total energy applications	2013	4140	0,19
		2014	4906	0,25
		2015	6082	0,3
Biomass, total	Total energy applications	2013	76667	3,5
		2014	78740	3,95
		2015	80683	3,95

Source of Data: CBS
Last update: 21.12.2016
Date of extraction: 09 Feb 2017
Hyperlink to the table: http://statline.cbs.nl/Statweb/publication/?DM=SLEN&PA=83109eng&D1=0-3&D2=0,2-5,20&D3=0&D4=23-25&LA=EN&HDR=T&STB=G1,G2,G3&VW=T

Appendix IV PV-parks with SDE+ subsidy

Number	Year subsidy	Applicant	Zip code	Location	Province	MWh	Realized	in year	Initiative by
5	2014 Zon groot	Zonnepark XXL B.V.	9405TE	ASSEN	Drenthe	5.800	Yes	2016	Project developer
8	2014 Zon groot	Sunport Delfzijl BV	-	DELFZIJL	Groningen	30.800	Yes	2017	Project developer
15	2014 Zon groot	***	***	GARYP	Fryslân	5.500	Yes	2017	Civic initative
16	2014 Zon groot	Gemeente Groningen	-	HOOGKERK	Groningen	2.090	Yes	2017	Civic initative
17	2014 Zon groot	Zonneparken Nederland BV	9723BP	GRONINGEN	Groningen	16.000	Yes	2017	Project developer
2	2014 Zon groot	Zonneparken Nederland BV	-	APPELSCHA	Fryslân	4.300	No	-	Municipality
3	2014 Zon groot	Zonneparken Nederland BV	-	APPELSCHA	Fryslân	2.000	No	-	Municipality
4	2014 Zon groot	Zonneparken Nederland BV	-	APPELSCHA	Fryslân	4.500	No	-	Municipality
10	2014 Zon groot	Zonneparken Nederland BV	8435XV	DONKERBROEK	Fryslân	2.000	No	-	Municipality
11	2014 Zon groot	Zonneparken Nederland BV	9761KT	EELDE	Drenthe	1.200	No	-	Project developer
18	2014 Zon groot	Zonnepark Harlingen B.V.	-	HARLINGEN	Fryslân	1.028	No	-	Civic initative/ municipality
19	2014 Zon groot	Zonneparken Nederland BV	-	HAULERWIJK	Fryslân	7.200	No	-	Municipality
21	2014 Zon groot	Gemeente Leeuwarden	8911MA	LEEUWARDEN	Fryslân	3585	No	-	Municipality

Appendix V Interview protocols

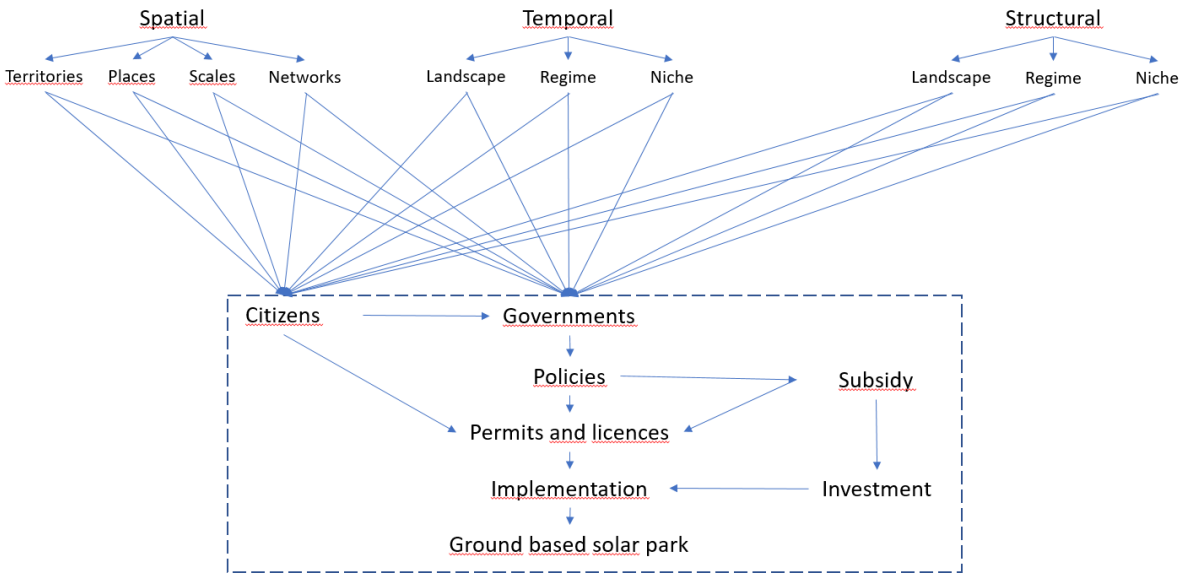
PROVINCIE FRYSLÂN

Mag ik dit gesprek opnemen?

Ik ben mijn onderzoek begonnen met de vraag waarom zijn er zo veel ideeën voor zonneparken en zo veel subsidie aanvragen, en worden er slechts een paar gerealiseerd. Wat zijn de ruimtelijke ordeningsfactoren die dit proces beïnvloeden en hoe kan de ruimtelijke ordening bijdragen aan het realiseren van de projecten? Hiervoor heb ik vanuit de literatuur onderzocht wat daar als belangrijke factoren worden genoemd, graag zou ik van jou horen hoe de provincie omgaat met de ontwikkeling van zonneparken en dus de transitie naar duurzame energie.

1. Wat is de rol van de provincie wanneer er een aanvraag voor een zonnepark bij een gemeente binnenkomt?
2. Wat is de rol van de Sinnetafels en het sinneteam?
3. Wat is de rol van burgers in dit proces?
4. Hoe is het provinciale beleid tot stand gekomen?
5. Hoe overlegt de gemeente met de provincie over hun beleid?
6. Zijn er nog invloeden op Europees, landelijk of regionaal niveau die volgens jou een rol spelen bij de implementatie?
7. Wat zijn volgens u doorslaggevende momenten in de realisatie van een zonnepark?
8. Zijn er nog factoren van invloed op dit proces waar we het nog niet over hebben gehad?

Als ik nog vragen heb, zou ik u dan mogen contacteren?



<table>
<tr><td colspan="4">Temporal scale</td></tr>
<tr><td colspan="2">Landscape
- Economic growth and decline
- Demographic change
- Social processes</td><td>Regime
- Industry
- Science
- Policy
- Markets
- Technology
- Culture</td><td>Niche
- Innovations
- New technologies
- New developments</td></tr>
<tr><td colspan="4">Structural scale</td></tr>
<tr><td colspan="2">Landscape
- Exogenous environment
- Actors have no influence</td><td>Regime
- Rulesets which orient actor behaviour</td><td>Niche
- Protective spaces in which actors can develop new routines</td></tr>
<tr><td colspan="4">Spatial scale</td></tr>
<tr><td>Territories
- Bordering
- Enclosure</td><td>Places
- Proximity/distance
- Reach
- Spatial embedding
- Areal differentiation</td><td>Scales
- Sizes
- Scales</td><td>Networks
- Interconnectivity
- Interdependence
- Networks and their function</td></tr>
</table>

GEMEENTE GRONINGEN

Hallo, mijn naam is Rinske Pollema, ik studeer Landschapsarchitectuur en Ruimtelijke Planning in Wageningen en ben bezig met het laatste stukje van mijn studie, de scriptie. Daarnaast werk ik op dit moment twee dagen in de week bij Ekwadraat, een adviesbureau in duurzame energie. Mijn scriptie gaat over het proces van implementatie van zonneparken. Ik focus mij op welk proces moet worden doorlopen en wat voor factoren dit proces beïnvloeden en doorslaggevend zijn. U bent initiatiefnemer van een zonnepark. Graag zou ik dus met u over het proces praten die u hebt doorlopen en wat voor factoren u bent tegengekomen wat het implementatieproces beïnvloedde.

1. Hoe kwam de gemeente op het idee om een zonnepark te realiseren?
2. Kunt u mij meenemen in het proces vanaf idee tot aan realisatie?
3. Wat waren volgens u doorslaggevende momenten in het proces? Positief/negatief?
4. Wat zou u in een ander project anders doen?
5. Wat was de rol van de gemeente in dit project?
6. Heeft de provincie nog een rol gehad? Zo ja, wat voor rol?
7. Vanuit de literatuur heb ik reeds aantal factoren benoemd, graag zou ik deze met u doorlopen en kijken of u nog aanvullingen heeft hierop.

Territories	Places	Scales	Networks
- Bordering - Enclosure	- Proximity/distance - Reach - Spatial embedding - Areal differentiation	- Sizes - Scales	- Interconnectivity - Interdependence - Networks and their function

8. Is er op landelijk of Europees niveau iets wat volgens u invloed heeft op de realisatie van zonneparken in het algemeen?
9. Zijn er nog invloeden op dit proces waar wij het nog niet over hebben gehad?

Hartelijk dank voor dit interview, zou ik nog contact met u op mogen nemen wanneer ik aanvullende vragen heb?

SUNPORT DELFZIJL

Hallo, mijn naam is Rinske Pollema, ik studeer Landschapsarchitectuur en Ruimtelijke Planning in Wageningen en ben bezig met het laatste stukje van mijn studie, de scriptie. Daarnaast werk ik op dit moment twee dagen in de week bij Ekwadraat, een adviesbureau in duurzame energie. Mijn scriptie gaat over het proces van implementatie van zonneparken. Ik focus mij op welk proces moet worden doorlopen en wat voor factoren dit proces beïnvloeden en doorslaggevend zijn. U bent initiatiefnemer van een zonnepark. Graag zou ik dus met u over het proces praten die u hebt doorlopen en wat voor factoren u bent tegengekomen wat het implementatieproces beïnvloedde.

1. Wat is uw rol geweest bij het zonnepark?
2. Kunt u mij vertellen hoe het idee van het zonnepark tot stand is gekomen?
3. Kunt u mij meenemen in het proces vanaf het idee tot aan de realisatie?
4. Wat waren volgens u doorslaggevende momenten in het proces? Positief/negatief?
5. Wat zou u in een ander project anders doen?
6. Wat was de rol van de gemeente in dit project?
7. Heeft de provincie nog een rol gehad? Zo ja, wat voor rol?
8. Vanuit de literatuur heb ik reeds aantal factoren benoemd, graag zou ik deze met u doorlopen en kijken of u nog aanvullingen heeft hierop.

Territories	Places	Scales	Networks
- Bordering - Enclosure	- Proximity/distance - Reach - Spatial embedding - Areal differentiation	- Sizes - Scales	- Interconnectivity - Interdependence - Networks and their function

9. Is er op landelijk of Europees niveau iets wat volgens u invloed heeft op de realisatie van zonneparken in het algemeen?
10. Zijn er nog invloeden op dit proces waar wij het nog niet over hebben gehad?

Hartelijk dank voor dit interview, zou ik nog contact met u op mogen nemen wanneer ik aanvullende vragen heb?

GEMEENTE DELFZIJL

Mag ik dit gesprek opnemen?

Ik studeer Landschapsarchitectuur en Ruimtelijke Planning in Wageningen en ben bezig met het laatste stukje van mijn studie, de scriptie. Mijn scriptie gaat over het proces van implementatie van zonneparken. Ik focus mij op welk proces moet worden doorlopen en wat voor factoren dit proces beïnvloeden en doorslaggevend zijn. U bent als wethouder van Delfzijl met ruimtelijke ordening in uw portefeuille betrokken geweest bij de realisatie van Sunport Delfzijl. Graag zou ik dus met u over het proces praten die u hebt doorlopen en wat voor factoren u bent tegengekomen wat het implementatieproces beïnvloedde. Dit kunnen lokale factoren zijn, maar ook landelijke of Europese factoren zijn.

1. Hoe is dit project bij de gemeente binnengekomen?
2. Kunt u mij meenemen in het proces vanaf idee tot aan realisatie en de rol van de gemeente hierin?
3. Wat waren volgens u doorslaggevende momenten in het proces? Positief/negatief?
4. Wat zou u in een ander project anders doen?
5. Heeft de provincie nog een rol gehad? Zo ja, wat voor rol?
6. Vanuit de literatuur heb ik reeds aantal factoren benoemd, graag zou ik deze met u doorlopen en kijken of u nog aanvullingen heeft hierop.

Territories	Places	Scales	Networks
- Bordering - Enclosure	- Proximity/distance - Reach - Spatial embedding - Areal differentiation	- Sizes - Scales	- Interconnectivity - Interdependence - Networks and their function

7. Is er op landelijk of Europees niveau iets wat volgens u invloed heeft op de realisatie van zonneparken in het algemeen?
8. Zijn er nog invloeden op dit proces waar wij het nog niet over hebben gehad?

Hartelijk dank voor dit interview, zou ik nog contact met u op mogen nemen wanneer ik aanvullende vragen heb?

PROVINCIE GRONINGEN

Mag ik dit interview opnemen?

Ik ben mijn onderzoek begonnen met de vraag waarom zijn er zo veel ideeën voor zonneparken en zo veel subsidie aanvragen, en worden er slechts een paar gerealiseerd. Wat zijn de ruimtelijke ordeningsfactoren die dit proces beïnvloeden en hoe kan de ruimtelijke ordening bijdragen aan het realiseren van de projecten? Hiervoor heb ik vanuit de literatuur onderzocht wat daar als belangrijke factoren worden genoemd, graag zou ik van jou horen hoe de provincie omgaat met de ontwikkeling van zonneparken en dus de transitie naar duurzame energie. In de provincie kijk ik specifiek naar de cases Vierverlaten en Sunport Delfzijl.

1. De provincie heeft beleid geschreven voor het plaatsen van zonneparken, bij zonneparken in het buitengebied boven de 1 ha, is de provincie bevoegd gezag, hoe is dit beleid tot stand gekomen?
2. Kunt u mij meenemen in het proces wanneer een aanvraag voor een zonnepark binnenkomt?
3. Wat is de rol van burgers in dit proces?
4. Hoe overlegt de gemeente met de provincie over hun beleid?
5. Wat zijn volgens u doorslaggevende momenten in de realisatie van een zonnepark?
6. Wat waren volgens u belangrijke factoren in de cases van Vierverlaten en Sunport Delfzijl?
7. Vanuit de literatuur heb ik reeds aantal factoren benoemd, graag zou ik deze met u doorlopen en kijken of u nog aanvullingen heeft hierop.

Territories	Places	Scales	Networks
- Bordering - Enclosure	- Proximity/distance - Reach - Spatial embedding - Areal differentiation	- Sizes - Scales	- Interconnectivity - Interdependence - Networks and their function

8. Zijn er nog invloeden op Europees, landelijk of regionaal niveau die volgens jou een rol spelen bij de implementatie?
9. Zijn er nog factoren van invloed op dit proces waar we het nog niet over hebben gehad?

Hartelijk dank voor dit interview, zou ik nog contact met u op mogen nemen wanneer ik aanvullende vragen heb?

GEMEENTE TYTSJERKSTERADIEL

Mag ik dit gesprek opnemen?

Ik studeer Landschapsarchitectuur en Ruimtelijke Planning in Wageningen en ben bezig met het laatste stukje van mijn studie, de scriptie. Mijn scriptie gaat over het proces van implementatie van zonneparken. Ik focus mij op welk proces moet worden doorlopen en wat voor factoren dit proces beïnvloeden en doorslaggevend zijn. U bent vanuit de gemeente Tytsjerksteradiel betrokken geweest bij de realisatie van de Griene Greide. Graag zou ik dus met u over het proces praten die u hebt doorlopen en wat voor factoren u bent tegengekomen wat het implementatieproces beïnvloedde. Dit kunnen lokale factoren zijn, maar ook landelijke of Europese factoren zijn.

1. Hoe is dit project bij de gemeente binnengekomen? Is er eerst bijvoorbeeld een rondetafelgesprek geweest of is er gelijk een vergunningaanvraag binnengekomen?
2. Wat voor stappen heeft de gemeente vervolgens genomen?
3. Kunt u mij meenemen in het proces vanaf idee tot aan realisatie en de rol van de gemeente hierin?
4. Wat waren volgens u doorslaggevende momenten in het proces? Positief/negatief?
5. Wat zou u in een ander project anders doen?
6. Heeft de provincie nog een rol gehad? Zo ja, wat voor rol?
7. Vanuit de literatuur heb ik reeds aantal factoren benoemd, graag zou ik deze met u doorlopen en kijken of u nog aanvullingen heeft hierop.

Territories	Places	Scales	Networks
- Bordering - Enclosure	- Proximity/distance - Reach - Spatial embedding - Areal differentiation	- Sizes - Scales	- Interconnectivity - Interdependence - Networks and their function

8. Is er op landelijk of Europees niveau iets wat volgens u invloed heeft op de realisatie van zonneparken in het algemeen?
9. Zijn er nog invloeden op dit proces waar wij het nog niet over hebben gehad?

Hartelijk dank voor dit interview, zou ik nog contact met u op mogen nemen wanneer ik aanvullende vragen heb?

Appendix VI Coding

Interviews

- Municipality Delfzijl	GGD
- Initiator Delfzijl	GID
- Province Groningen	GP
- Municipality Groningen / initiator Vierverlaten	GGV/GIV
- Municipality Tytsjerksteradiel	FG
- Province Fryslân	FP

Scale	Level	Concept	Definition	Code
Temporal	Landscape	Economic growth or decline	The economic trend during the implementation of the case.	TL1
		Demographic change	The demographical trend during the implementation of the case.	TL2
		Social processes	The social processes which are punctuated by major events during the implementation of the case.	TL3
	Regime	Industry	The outcome of mutual positioning and strategies of supply and demand. (based on Geels, 2002)	TR1
		Science	Knowledge, technique, and skills (based on Geels, 2002) regarding ground based solar parks.	TR2
		Policy	Policies regarding ground based solar parks.	TR3
		Markets	The working of the market, the demands, needs and behavior of the market and the stakeholders involved and the market involving ground based solar parks. (based on Geels, 2002)	TR4
		Technology	The technology used	TR5
		Culture	The symbolic meaning of things, perception, habits, beliefs, values and interests of actors. (based on Geels, 2002; Franzeskaki & De haan, 2009)	TR6
		Ownership	Who owns the land of the solar park and who owns the solar park	TR7
	Niche	Innovations	Revolutionary new techniques within a technique	TN1
		New technologies	New techniques that did not exist before.	TN2
		New developments	Developments based on an older technique.	TN3
Structural	Landscape		Exogenous environment, actors have no influence	STL
	Regime		Rulesets which orient actor behavior	STR
	Niche		Protective spaces in which actors can develop new routines	STN
Spatial	Territories	Bordering	What are the borders of the park, where are the physical borders, how are these borders constituted.	SPT1
		Enclosure	Who is included and who is excluded in the park, at the level of politics but also at the social level.	SPT2
	Places	Proximity/distance	What is the distance to 'sensitive objects' like houses, civilians.	SPP1
		Reach	How visible is the site from a distance, how big is the visibility of the solar park.	SPP2
		Spatial embedding	How is the site integrated into the area.	SPP3
		Areal differentiation	What kind of area is it and how does a solar park fit in the area.	SPP4
	Scales	Sizes	What is the size of the solar park	SPS1
		Scales	What is the scale of the solar park in relation to the surrounding landscape.	SPS2
	Networks	Interconnectivity	Which different networks are used to realize the ground based solar park.	SPN1
		Interdependence	What is the interdependence these different networks.	SPN2
		Networks and their function	What is the use of the used networks.	SPN3
		Physical network	The physical network that is needed for the solar park	SPN4

Appendix VII Results of coding

	GGD	GP	FG	FP	GID	GP	Total
Economic growth or decline	0	0	0	0	0	0	0
Demographic change	0	0	0	0	0	0	0
Social processes	0	0	0	0	0	0	0
Industry	7	1	0	0	4	1	13
Science	0	2	0	1	4	0	7
Policy	12	7	10	5	11	6	51
Markets	7	5	2	1	13	10	38
Technology	0	0	0	0	3	0	3
Culture	6	4	2	1	8	5	26
Ownership	1	4	0	1	5	0	11
Innovations	0	0	0	0	0	0	0
New technologies	0	2	0	0	0	2	4
New developments	1	2	0	0	0	0	3
Structural landscape	1	0	0	0	4	7	12
Structural regime	10	7	0	7	6	14	44
Structural niche	0	1	0	0	4	5	10
Bordering	0	5	0	2	1	0	8
Enclosure	0	8	0	2	4	1	15
Proximity/distance	1	1	0	0	3	0	5
Reach	0	2	0	1	2	1	6
Spatial embedding	1	3	1	0	2	3	10
Areal differentiation	7	9	2	1	4	1	24
Sizes	0	1	0	0	2	2	5
Scales	1	0	0	0	2	1	4
Interconnectivity	1	2	0	2	2	0	7
Interdependence	0	2	0	0	2	0	4
Networks and their function	3	0	4	4	1	0	12
Physical network	0	0	0	0	4	3	7
Total	59	68	21	28	91	62	329