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Diffusion of wind energy, a case of the Netherlands

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Abstract: Wind energy has not been able to diffuse widely in the Netherlands, despite the great history of harnessing wind power. To understand the factors responsible for the slow diffusion of wind energy in the Netherlands, a qualitative study has been performed through semi-structured interviews. Drawing on insights from regime influences, this study has applied the multi-level framework by Geels (2012) for the interpretation of the interview results. This study concludes that the major barriers to faster adoption of wind energy in the Netherlands include the core alliance formed between the Dutch government and energy companies that have resisted the pressures formed from climate change and negates the fundamental system change within the energy regime from wind energy. It further suggests that governmental support is necessary on the local level to enable wide diffusion of wind energy in the Netherlands. Future agendas in research should therefore pay more attention to the destabilization of gas regimes while future agendas in policy should consider focusing on the creation of supporting policies for local level initiatives regarding wind energy production.

Key words: wind energy, multi-level perspective, energy transition, resistance

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List of Abbreviations

MLP	Multi-Level Perspective
SNM	Strategic-Niche Management
kW	Unit of energy equal to 3.6 megajoules
MW	1000 kW

1 Introduction

Renewable energy has become a hot topic around innovation technology over the past years, due to the expectation of solving current climate change issues (Negro, Hekkert & Smits, 2007). By signing the Paris Agreement in 2015, the countries around the world acknowledged that climate change is a common concern and agreed to limit the rising temperature to below two degrees of Celsius (Paris Agreement, 2015). While the world is facing environmental and climate challenges that are mainly caused by the fossil fuel industry, it remains the most dominant source of energy in the world (Jacobsson & Lauber, 2006). The climate change developments have led to increased realization that environmental problems need addressing by transitioning away from fossil fuels towards renewable energy technologies (Geels, 2014). Renewable energy has been chosen as a substitute for fossil fuel, as it has the potential of becoming the main energy source in the future despite its complexity to serve the growing population (Negro, Hekkert & Smits, 2007).

To meet the environmental challenges, a wide use of renewable energy is seen as a solution to arrest climate change challenges (Jacobsson & Lauber, 2006) and to accompany a wider use or renewable energy, specific renewable energy targets set by the EU (Energy and Climate Policies beyond 2020 in Europe, 2015). Moreover, a transition to renewables would require new infrastructures, policies and user practices (Geels, 2014). However, the success of integration of renewable energy has not been experienced similarly across Europe. Countries such as Germany and Denmark to have successfully implemented renewable energy into society, while the Netherlands has not experienced the same success (Fig. 4, Appendix I). In the year 2009, the Netherlands agreed, under the legally binding obligation of the European Commission under the 'Renewable Energy Directive', that fourteen percent of the final energy consumption would be sourced from renewables by the year 2020 (Nationaal actieplan voor energie uit hernieuwbare bronnen, 2009). However, the Netherlands will not be able to comply with this target as the total current renewable energy generation is approximately six percent of the total end use. The Dutch government has officially declared in the year 2017, that the target of fourteen percent in renewables that was set for 2020 is not to be achieved (NEV, 2017).

Wind energy was expected to be one of the promising renewable energy sources that would aid in achieving the target set for 2020 (NEV, 2017). Despite the large investments in R&D over the previous decades (Negro, Hekkert & Smits, 2007), the Netherlands has yielded little success in the diffusion of wind energy (Verbong, Geels & Raven, 2008). Moreover, the implementation and diffusion of wind energy in the Netherlands is falling behind when compared to other European countries (Fig. 6, Appendix I), especially when compared to other European countries that have made similar R&D investments, such as Germany, Denmark and Sweden (Jacobsson & Lauber, 2006) With the new plans of significantly decreasing gas consumption and production from the year 2019, it is expected that electricity will play a larger role in the Netherlands. Solutions will be partially derived from renewables and wind could potentially play a role in the transition (NEV, 2017). However, for wind to play a role in the transition, the technology should be more diffused. It is yet unclear whether the Netherlands will comply to goals set for the future, such as the 2030 goal of producing twenty-four percent of electricity from renewables (NEV, 2017). Whether it will have the chance to play a role in the Dutch energy transition remains the question. In particular, the lack of diffusion in the Dutch wind energy sector is interesting due to its glorious history of harnessing wind power through the use of windmill in previous centuries. Wind energy used to be one of the dominant source of energy in the Netherlands (Gales et al. 2007), however this is no longer the case.

1.1 Aims and Purpose

There is a copious amount of information regarding various factors that have affected wind energy, however, to align information, verify factors and gather new factors, this research strives to generate an overview of the main factors that are responsible for the slow diffusion of the wind energy in the Netherlands. The purpose of this study is to examine why wind energy has not diffused in the Netherlands, where the diffusion bottlenecks are shaped, and which role policy plays in the diffusion of wind energy. Therefore, the research question of this paper is as follows:

RQ: Which factors are responsible for the slow diffusion of wind energy in the Netherlands?

This study will analyse the driving economic factors behind the slow diffusion of wind energy. As renewable energy in the Netherlands has experienced slow diffusion, this would presumably serve as an interesting reference point to examine where the bottlenecks lie (Negro, Alkemade & Hekkert, 2012). To adequately answer this question, the multi-level perspective (Geels, 2012), which will be further referred to as MLP, will be applied to understand the transition of the wind energy sector in the Netherlands. The framework of the multi-level perspective would aid in defining involved actors in the diffusion of wind energy in the Netherlands. By mapping the main actors involved in delay of the goal of reaching wind energy goals for 2020, this research would provide a clear analysis of the wind energy transition. This is a qualitative study which draws on semi-structures interviews with seven experts within the field of wind energy in the Netherlands. Results from this study will contribute to understanding the lack of diffusion of wind energy in the 21st century in the Netherlands. The results from this study will contribute to policy making regarding renewable energy in the future. This thesis ends with suggestions for a new policy and research agenda.

2 Literature Review

This chapter discusses the findings from existing literature on the diffusion of wind power in the Netherlands. This literature review explores the following: firstly, the case of wind power will be illustrated with a historic perspective by reflecting on the great history of the Dutch windmill. Innovation occurred differently in the 18th and 19th century than in the 20th and 21st century (Geels, 2002), therefore, the history section will not go in-depth regarding the socio-technological transition and only serves the purpose of a historic reflection. Secondly, an elaborate description of the MLP framework will be set out to create an understating of the specific levels and actors within the multi-level dimensions. Thirdly, the MLP will be applied to the Dutch wind energy market, within the European context, to understand the differences and similarities between the Netherlands and European countries such as Germany and Denmark regarding the diffusion paths taken. Moreover, analysing the levels and actors relevant to the Dutch wind energy sector would provide the possibility of identifying and aligning factors responsible for the slow diffusion of wind energy in the Netherlands.

2.1 Background

The Dutch windmill has a glorious past in the Netherlands as wind power played an important role in the Dutch economy from the 17th to the end of the 19th century. Nowadays, the image of the Dutch windmill is iconic for the Netherlands and is known worldwide (Munro, 2002; Gales et al., 2007). This does not come as a surprise, as wind power became one of the main sources of energy used for mechanic power for centuries in the Netherlands (Munro, 2002; Gales et al., 2007) and with that one of the most powerful prime movers of the preindustrial era and the Dutch Golden Age (Smil, 2017; Stroop, 1977).

2.1.1 The history of harnessing wind power in the Netherlands

Windmills have existed for centuries, however, they were still quite rare before the 14th century and watermills were more common at the time (Kander, Malanima & Warde, 2013). The watermill was widely diffused across Europe for centuries and served as the dominant source of mechanic power in the small industry sector of the European economy (Munro, 2002). Similar to the watermill, the windmill gained popularity with the improvement of easing labour-intensive work by replacing hard work for manual grain milling (Smil, 2017). It is said that windmills were built where the lands are dry and water power cannot be harnessed and in regions as such, wind power became “an indispensable source of energy” (Minchinton, 1980). The Netherlands did not have many waters with strong streams and so the windmill gained more popularity over the watermill (Stroop, 1977).

The Netherlands stands out from other countries as the windmills played a large role in the Dutch economy. The only other countries that were increasingly using windmills in the 17^{th} and 18^{th} century included England, Germany and France. However, the role it played in those countries was less significant as more energy was derived from other sources such as firewood and the muscle power of men and animals (Smil, 2017). Although, the wide diffusion of the windmill started in the late 17^{th} century in the Netherlands, the Dutch ended up having the largest number of 'working' windmills in Europe (Smil, 2017). The Netherlands stands out through its extensive commitment to the use of wind power (Kander, Malanima & Warde, 2013).

The windmill was able to diffuse in the Netherlands for two economic reasons. Firstly, the population was growing and therewith the demand for grinded grains and cereals was rising (Minchinton, 1980) (Biraben, 1979). Minchinton (1980) claims, that the diffusion of windmills reflected the need for mechanic power as it allowed the production of large quantities of flour, which was used to make bread. By the 14^{th} century, windmills became increasingly popular in the north of Europe (Minchinton, 1980). With the growing population since the 9^{th} century, the Netherlands went from a population of 600.000 in the 14^{th} century to 2 million in the 17th century (McEvedy & Jones, 1978), with that increasing the demand for flour (Minchinton, 1980). The second purpose of the windmill was to irrigate land. By driving the mill, water is raised from the streams which allows the irrigation of the land (Kander, Malanima & Warde, 2013). The first drainage mill invented by the Dutch, in 1430, was named the 'wipmolen' and served to drain peatlands (Minchinton, 1980). Although, the introduction of the drainage mill to the low-lying lands of the Netherlands was in the 15^{th} century, it was not until the 16^{th} century that the windmills would diffuse more widely (Smil, 2017). The significant role played by the windmill for the purpose of land irrigation does not come as a surprise, as half of the country's surface is close to or below sea level (Gales et al. 2007) and this technology allowed the reclamation of land, therewith increased areas of habitation (Minchinton, 1980). The Dutch flatlands and constant winds, provided an ideal climate for the harnessing of wind for stationary power (Kander, Malanima & Warde, 2013), with that the application of windmills for irrigation and milling seem to have come as a natural decision for the Netherlands.

The diffusion of the windmill took place in the 16^{th} and early 17^{th} century when the windmill served the many industrial purposes during the Dutch Golden Age (Stroop, 1977). By then, the windmill had various functions, as it not only allowed the grinding of cereals but also the production of oil, spinning of cotton, sawing of wood and manufacturing of gunpowder among others (Minchinton, 1980). The sawing of wood, with the help of the sawmill, played a significant role in the Dutch economy as the increased production of wood allowed the construction of ships that were used for import and export at the time (Stroop, 1977). The number of windmills was increasing steadily during that time, reaching a total of approximately 4000 windmills in the 17^{th} century (Kander, Malanima & Warde, 2013). Around 1850, wind and peat together represented approximately 40 percent of the energy consumption in the Netherlands (Gales et al. 2007), with approximately a total of 9000 windmills (Kander, Malanima & Warde, 2013). At the time, this was very remarkable compared to other European countries. Especially when compared to Italy, where the energy consumption from wind and water was around 1 percent by 1850 (Gales et al. 2007). This is remarkable as Italy was the first European region where windmills were spread back in the 12^{th} century (Kander, Malanima & Warde, 2013). Countries such as Sweden, Italy and Spain consumed less than two percent energy derived from wind at that time (Gales et al. 2007).

2.1.2 A windless period

With the introduction of the steam engine, the glorious past of the Dutch windmill came to an end, replacing the windmill as the most important energy source in the Netherlands (Verbong, 1999). The number of windmills decreased to approximately 2000 working windmills in the year 1890, while the number of steam engines experienced an explosive increase with approximately 4000 steam engines by 1890. By the 20th century windmills no longer played a significant role in the Dutch energy system (Verbong, 1999). The continuously growing population came with dependence on higher energy flows which were provided by the steam engine and later the combustion engine (Smil, 2017). The energy consumption was ever-increasing due to the growing population and in addition to having a higher quality of life. With the combustion of fossil fuels for electricity and heat, a high energy civilization emerged (Smil, 2017). It was not until the oil crisis that wind power started becoming interesting again for the Netherlands (Verbong, 1999).

2.1.3 Wind energy in the 21st century

The current situation in harnessing wind power is significantly different from the 17th and 18th century in the Netherlands, as the Netherlands is significantly falling behind when compared to other European countries such as Denmark and Germany (Fig. 6, 7, Appendix I). The Netherlands had an approximate energy consumption for the year 2015 of 50 MW (NEV, 2017), while the share of wind energy capacity per capita in the year 2015 was 0.2 kW, this was significantly lower to its counterparts Germany and Denmark (Fig. 6, Appendix I). In 2015, Germany ended at 0.56 kW and Denmark at 0.9 kW. This is surprising considering the strong tradition of harnessing wind power in the past. The Netherlands was considered a leading country in the harnessing of wind power in the 16th and 19th century, especially when compared to other European countries (Kander, Malanima & Warde, 2013; Gales et al. 2007; Smil, 2017). Therefore, one would expect path-dependency with regards to harnessing of wind power. However, the diffusion of the wind turbine has not been successful in the Netherlands and yet remains a niche technology (Verbong & Geels, 2007). Despite the fact that the Netherlands has made a commitment to achieving 6000 kW from wind energy by 2020, this goal has been declared to be out of reach as the total current wind energy generation is approximately 4000 kW of the total end use (NEV, 2017). To understand the factors involved in the diffusion of wind power in the 21st century, the following chapters will firstly elaborate on the MLP framework that will be used throughout the study and secondly discuss the possible factors involved within the framework of the MLP.

2.2 The Multi-Level Perspective

2.2.1 Introduction to the MLP

The multi-level perspective enables one to create an understanding of the development of technological transitions by reflecting on the interaction between technology and society (Geels, 2012). By drawing on innovation, sociology of technology as well as history of technology theories, the MLP enables one to create an understanding of the actor interactions from a multi-dimensional perspective (Geels, 2005). The actor interactions are explored through the interplay of various developments along the following three analytical levels: the micro-level considers technological niches, the meso-level considers the socio-technical regimes and the macro-level considers the socio-technical landscapes (Geels, 2012) (Fig. 1).

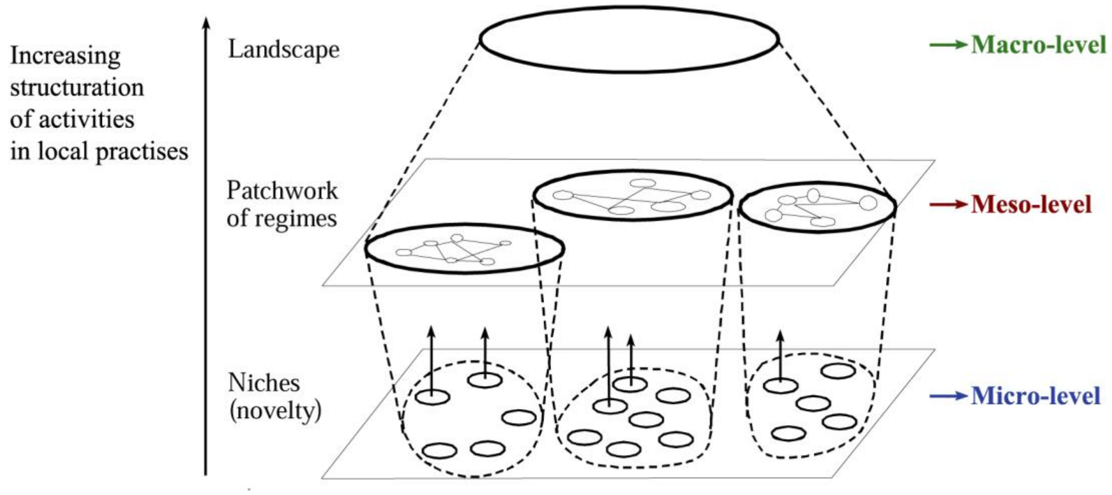

Fig. 1 - Adapted from Geels (2012), Multiple levels as a nested hierarchy

The traditional MLP theory suggests that established systems are defined by stable regimes and locked-in mechanisms where incremental changes occur on occasion along predetermined trajectories referred to as the sociotechnical regime (Geels, 2012). However, in the context of climate change and "green innovations" (Geels, 2014), the socio-technical regime is adapted to include dynamics related to politics and power. This allows the conceptualization of regime actors deliberately hindering green transitions within *the socio-technical regime* (Geels, 2014). Potential transitions in established regimes may occur through the emergence of radical innovations that are initiated by actors outside of the regime, such as entrepreneurs and social movements. Innovations as such are referred to as the *technological niches* (Geels, 2012). However, the emergence of the radical innovation is said to be influenced by *the socio-technical landscape* in which the regime is embedded. The socio-technical landscape is characterized by macro-economic trends such as environmental issues, as well as gas and electricity infrastructures. The MLP includes multiple dimensions to enable understanding where stability and change occurs and through actor groups interactions (Geels, 2012).

2.2.2 Niche

Novel technologies emerge in the niche when there is a protective environment in the form of R&D laboratories, small market niches or subsides demonstration projects (Geels, 2012). The niche actors such as pioneers and entrepreneurs create radical innovations that depart from the accepted norm or standard that is embedded in the existing regime. The ultimate goal of the radical innovation would be to embed it in the existing regime or potentially replace it (Geels, 2012). The internal processes within the niche are identified through the framework of strategic niche management (SNM) that are aligned with the MLP (Geels, 2012) and defined by Schot and Geels (2008) as the following:

1) Set *visions and goals* to guide the direction of innovation activities
2) Construction of *social networks* and recruitment of additional actors for potential technology expansion and diffusion
3) *Learning process* across the multiple dimensions to overcome early innovation bottlenecks in addition to issues related to organization, policy instruments and market demand

These social processes represent the layers within the niche level that need be considered before the niche is able to gain momentum and become broadly accepted (Schot & Geels, 2008). Niches are considered to be crucial to motivate structural changes within the regime in the form of technological transitions (Schot & Geels, 2008; Geels, 2012). However, embedding the radical innovations is challenging as the regime is stabilized by lock-in mechanisms (Geels, 2012) or in the context of climate change, the regime integration of "green innovations" may be actively resisted by policy and power influenced regime dynamics (Geels, 2014). The niche is connected to the regime as it needs to be embedded in the regime by building up internal momentum within the niche, in order to create a shift or a potential replacement of the regime (Geels, 2012).

2.2.3 Socio-Technical Regime

In the context of climate change, with the introduction of politics and power into the regime dynamics, the MLP theory of socio-technical regimes is altered and suggests that the regime is resisting fundamental system change rather than being locked-in (Geels, 2014). This is considered as an improvement of the theory as the traditional MLP theory suggests that regime stability is a given (Geels, 2014). Where tradition MLP theory argues that sociotechnical systems are established regimes that are characterized by the stability of the existing systems that are locked-in by mechanisms and path dependence (Geels, 2002), the conceptualization introduced by Geels (2014) adds on to the MLP theory by recognizing that regime actors may actively resist fundamental change. This concept allows the introduction of power and politics into the MLP, as policy was previously included solely as one dimension (Geels, 2014). To understand the regime dynamics where resistance against climate change occurs, this can be analysed on the three following levels:

1) Identify and define problems through *diagnostic framing*
2) Formulation and positioning of the solution to the problem through *prognostic framing*
3) Formulation of a rationale for action through *motivational framing*

Diagnostic framing includes policy goals and problem definitions identified within the regime and affect the landscape and niche level (Geels, 2014). This level focuses on how problems are defined and portrayed. Geels (2014) uses the example of the White Papers from 2003 that define climate change as the problem and green innovations as the solution to transition to a low-carbon economy. In this scenario, climate change forms the landscape and green innovations form the niche. When green innovations are introduced to the market, novel technologies created in niches will compete with established technologies (Geels, 2014). The established technologies have well-developed systems to support them in the form of regulations, infrastructures and markets. These established systems shape the socio-technical regime and are maintained by regime actors that are embedded in the socio-technical regime. The regime actors include engineers, firms, social groups, policy makers and civil society actors (Geels, 2012), that form and coordinate regulations, infrastructures and markets that create market entry barriers. Regimes are sustained by social factors such as habits of use, mind-sets and established industries. *Prognostic framing* analyses the solutions formulated and implemented regarding the positioning of the green innovation by regime actors (Geels, 2014), such as firms, governments and civil society actors (Geels, 2012). In the context of green innovations, the solutions are related to the actions taken on and the positioning of renewable energy by the regime actors (Geels, 2014). *Motivational framing* analyses the attitudes of the regime actors towards the identified problem and solution. In the context of green innovations, this would include the level of public concerns in regard to climate change, including the sense of urgency and motivation behind taking action by enacting a low-carbon transition and the prioritization of economic tasks (Geels, 2014). When aligning these levels of resistance, regime resistance may be formed by political cultures, governance structures and ideology that are formed by "broader institutional power" that are embedded in the structure of sociotechnical-regimes (Geels, 2014).

2.2.4 Socio-Technical Landscape

The socio-technical landscape is formed by macro-economic trends that are beyond the control of individual actors (Geels, 2012). In the context of the electricity regime and green innovations as the niche, the landscape is said to formed by climate change (Geels, 2014). The dynamics of niches and regimes are influenced by the sociotechnical landscape. Where traditional MLP theory states that the regime can be destabilised and creates a window of opportunity when changes at the landscape level exert pressure on the regime (Geels, 2012). When the levels are aligned in the way that niche innovations develop internal momentum, changes in the landscape level exert pressure on the socio-technical regime and the regime is destabilized and this would create a window of opportunity for innovation diffusion (Geels, 2012). However, the introduction of policy and power implicates that the regime may resist landscape pressures and reject fundamental system change (Geels, 2014). Both the niche and the landscape are connected to the regime as technological transitions occur within the socio-technical regime (Geels, 2005). Therefore, the alignment of the traditional MLP levels is no longer a guarantee for the breakthrough of "green innovations" (Geels, 2014).

2.2.5 Critiques and limitations of the Multi-Level Perspective

The general criticism on the MLP seems to be the descriptive nature of the framework that allows discrepancies in interpretation to arise (Smith, Stirling & Berkhout, 2005; Markard & Truffer, 2008). Smith, Stirling and Berkhout (2005) argue that the MLP framework requires more explicit and conceptual tools in order to provide a more systematic framework, while Markard and Truffer (2008) argue such tools could become more explicit through clearer identifications and definitions or the inter-level relationships. The lack of explicit boundaries within the framework require interpretive creativity and have resulted in unsystematic identifications, as argued by Genus and Coles (2008). This may result in discrepancies between studies that have implemented the MLP framework (Genus & Coles, 2008). The criticism towards the regime level within previous case studies, is the lack of systematic identification caused by the lack of robustness of the MLP regarding socio-technical regimes and identification of actors within the regime (Genus & Coles, 2008). However, it is argued that theoretical sensitivity is required to guide the researcher during the identification process of mechanisms, patterns and relationships when applying the MLP framework (Smith, Voß & Grin, 2010). The implementation of the MLP framework therefore draws on interpretive creativity that may result in empirical discrepancies between case studies.

2.3 Applying the Multi-Level Perspective

The MLP will be applied throughout the case of wind energy in the Netherlands to understand the effects of the regime dynamics on the complex transition of wind energy. The wind turbine technology is considered an established technology but yet remains a niche within the energy market in the Netherlands (Verbong & Geels, 2007). The Netherlands has invested heavily in wind energy technologies over the past years (Verbong, Geels & Raven, 2008) as this technology has the potential to contribute significantly to the sustainable development of the energy sector in the Netherlands (Verbong & Geels, 2007). Niche innovations are known to have the ability to build up internal momentum that may lead to a regime shift (Schot & Geels, 2008), in the case of wind energy this could potentially result in a regime shift in the established electricity sector. With reference to previous research, the assumption is made that wind energy technology has gained momentum and but has not been able to diffuse widely due to difficulties in societal embedding (Verbong, 1999; Verbong & Geels, 2007; Jacobsson & Johnson, 2000; Breukers & Wolsink, 2007; Negro, Alkemade & Hekkert, 2012). The lack of wind energy integration is confirmed by the low share of wind energy in the gross final energy consumption, as it has been lower than 2 percent for over the past twenty years (Fig. 5, Appendix I). The regime level from the MLP that will be applied throughout the analysis, is diagnostic framing. This level allows the identification of problem definitions within the regime that are affecting the landscape and niche level (Geels, 2014). To understand the low integration of wind energy in the Dutch regime the following paragraphs serve to analyse potential resistance of regime dynamics in the electricity regime regarding wind energy.

2.3.1 The Niche & the Regime

Large-scale projects

The large-scale projects opposed to small-scale projects, initiated by the Dutch government and the electricity-generating firms (regime actors), seem to still be dominant and not overcome by the wind energy sector (niche) (Verbong, 1999; NEV, 2017). The "*learning process"* is from the SNM theory that serves to identify and overcome innovation bottlenecks related to organizational challenges (Schot

& Geels, 2008). However, a bottleneck is possibly persisting as it seems that wind energy has not overcome issues related to the scale of organization of the green innovation.

Energy companies, energy researchers and the government, came together to secure the development of the wind energy niche technology with the initiation of the first wind energy research in the year 1976 (Verbong, 1999). From the beginning of the wind turbine developments, the design of large-scale wind turbines have been prioritized, as the goal was to generate enough wind energy for a significant contribution to the Dutch energy supply (Verbong, 1999).The importance of a protective setting for a niche technology to emerge and diffuse is highlighted by Geels (2012); the technology would need to be shielded from regular market conditions during the development process to ensure protection from the regime. However, one could argue to what extent the wind turbines have been developed whilst shielded from regular market conditions as the technology was put to test in an early phase during the constructions of the first large-scale wind park in the early 80s (Verbong & Geels, 2007). Initially, the first wind park would have been under the protective wing of the national research framework. Despite the conclusion drawn by 'First National Research Program on Wind Energy' that more research was needed to test turbine efficiency before any large-scale implementation (Verbong, 1999), the regime actors forced the technology into the market by making the wind park into a power plant (Verbong & Geels, 2007). The large-scale wind turbines in the Netherlands have supposedly led to poor designs and thus unreliable technology (Negro, Alkemade & Hekkert, 2012). At the time, the wind turbine technology was at an early stage of development and engineers were still in search of the most optimal turbine efficient design, hence the early market push resulted in the failure of the first project due to the unreliability of the wind turbines (Verbong, 1999). Therefore, one could argue whether the wind turbine technology was given the opportunity to emerge and diffuse sufficiently in protective settings, or if it was pushed into regular market conditions in the early stages of development.

The persisting large-scale approach in the wind energy market has been due to the dominance of the electricity-generating firms, as claimed by Verbong (1999). The dominance of the electricity-generating firms is said to be reflected in the first production of wind turbines, that consisted of solely large-scale turbine units. The large-sized wind turbines were expected to result in high turbine capacity (e.g. 150kW per 50m turbine) and were chosen over small sized wind-turbines (Verbong, 1999). This large-scale approach seems to be in contrast with countries that have been more successful in the diffusion of wind energy. In contrast to the Netherlands, Denmark and Germany focused on small scale wind turbines that were gradually unscaled (Negro, Alkemade & Hekkert, 2012). Denmark implemented a "learning by doing" concept and with their first wind turbine build in 1950 (e.g. 200kW) and kept experimenting with wind turbines of various scales (e.g. one 265 kW, one 300kW, five 750kW and one 2MW turbine) until the end of the 1980s (Kamp, Smits & Andriesse, 2004). This search for the ideal sized turbine resulted in Denmark choosing for small-scale wind turbines, as they were considered more reliable and cheaper than the large-scale turbines (Kamp, Smits & Andriesse, 2004). Whereas, Germany commenced with testing small- (e.g. 10kW) to medium-sized (e.g. 200 – 400 kW) wind turbines between 1977 and 1989 (Jacobsson & Lauber, 2006). Therewith, the research trajectories of Denmark and Germany are significantly different in comparison to the wind energy research trajectory in the Netherlands; wind energy research commenced in 1976 and was put to the test by the early 1980s through the implementation large-scale wind-turbines in a large-scale wind park (Verbong, 1999; Verbong & Geels, 2007). However, the large-scale approach seems to still persist in the energy regime in the Netherlands, as the set wind energy goals are to be fulfilled with large-scale wind parks positioned in the sea as well as on land (NEV, 2017).

2.3.2 The Regime

Local initiatives

The wind energy sector in the Netherlands is surrounded by regime actors such as the government, energy firms and engineers while ignoring other regime actors such as local initiatives, nature protection organisations and self-builders (Breukers & Wolsink, 2007). Breukers and Wolsink (2007) argue that wind power implementation on the local level was neglected. This ignorance of the local level is in particularly interesting as local initiatives together with local governments have endorsed the diffusion of wind energy in Denmark as well as in Germany (Jacobsson & Lauber, 2006). The success of the diffusion on the local level in Germany was made possible through the Feed-in Law implemented in 1991, that offered a set electricity tariff to all electricity produced from wind energy (Jacobsson & Lauber, 2006; Breukers & Wolsink, 2007). The guaranteed price of feed-in tariffs provided a financial incentive for the production of wind energy for local regime actors such as private citizens and small farms in addition to taking away the risk by guaranteeing that the wind turbines would be connected to the grid and the electricity will be purchased by electricity firms for a fixed price (Jacobsson & Lauber, 2006). Jacobsson and Lauber (2006) argue that the urgency for the large-scale diffusion of wind energy was caused by the Chernobyl incident in 1986 which resulted in increased opposition of nuclear power and increased popularity of renewables. Therefore, the landscape that was formed by the Chernobyl incident has exerted pressure on the German energy regime and the regime was changed due to initiatives from parliamentary groups (regime actor) that pressured the government (Jacobsson & Lauber, 2006). Similar to Germany, local initiatives in the form of locally owned and governed turbines were supported by the government in Denmark. With environmental pollution as the driver behind the motivation to switch to renewables (Kamp, Smits & Andriesse, 2004), climate change can be identified as the landscape in the case of Denmark. The wind turbine industry in Denmark had the goal of creating a wind energy industry instead of solely focusing on creating technically superior wind turbines, as argued by Kamp, Smits and Andriesse (2004). With this mind-set, ten small wind turbine companies were established by 1978 with investment subsidies introduced by 1979. With negotiations regarding feed-in tariffs, the Danish wind energy market was able to flourish due to the small-scale approach (Kamp, Smits & Andriesse, 2004).

Innovation Policy

The Dutch policy and subsidy schemes have often been criticized and mentioned as a structural factor of instability and risk in the diffusion of renewable energy in the Netherlands (Negro, Alkemade & Hekkert, 2012). The so called ‘stop and go’ policies have supposedly caused structural misalignment between institutions due to the continuous adaptation of policies and subsidy schemes that have been carried out from the year 1998. The ‘stop and go’ policies are initially long-term policies that are made by policymakers (regime actors) and are implemented to support the diffusion of innovation technologies. However, due to continuous reviewing and redesigning after implementation, the policy is disrupted and is to be adapted or entirely discarded. Negro, Alkemade and Hekkert (2012) have argued that the ‘stop and go’ policies have created policy instability as subsidy schemes have been continuously interrupted with a frequency of every two years from the late 90s, and in some cases terminated without announcements, to be introduced at a later point in time in an alternative form. Such policy instability supposedly caused a decrease in investments in renewable energy technologies due to increased risks for potential investors (Negro, Hekkert & Smits, 2007). Although, one may argue that the continuous adaptation of the subsidy schemes and policies have taken place due to possible ineffectiveness of them (Lundvall & Borrás, 2005). The uncertain policy environment that has resulted from the 'stop and go' policies is said to have created a lack of continuous build-up and momentum for renewables as the attention shifted away due to constant changes in policy perspectives (Negro, Hekkert & Smits, 2007). With that, it seems that the continuous adaptation has done more harm than good in the diffusion of renewable energy.

Compared to Germany and Denmark, the Dutch support system for wind power has been highly volatile (Jacobsson & Lauber, 2006; Negro, Hekkert & Smits, 2007). Germany and Denmark have experienced stable institutional support that was able to maintain the feed-in system for a long period of time, whilst only performing alterations within agreement with the wind energy sector (Negro, Alkemade & Hekkert, 2012). Negro, Alkemade and Hekkert (2012), have stated that the stable policy implementation and careful alterations of the feed-in system implemented by Germany and Denmark have resulted in a large-scale implementation. Breukers and Wolsink (2007), have argued that the Netherlands has not experienced stable institutional support due to fragmentation. The anticipation of energy market liberalisation during the 1990s supposedly resulted in the fragmentation of the wind power policy community, the abolishment of renewable energy investment subsidies and reintroduction of subsidies within the decade. Therewith, the mobilising of support, on the local as well as national level, proved to be unsuccessful (Breukers & Wolsink, 2007). It is argued that the 'stop and go' policies were efforts made to bring the demands of liberalisation of the energy sector in line with the policy. The energy market was liberalised from the year 1998 in the Netherlands (Breukers & Wolsink, 2007).

Top-down approach

The government and energy firms in the Netherlands seem to have adopted the top-down mentality from the early stages of wind energy development (Breukers & Wolsink, 2007). With prioritization of the large-scale wind energy projects, producing wind energy would only be made available for established energy firms (Verbong, 1999; Verbong & Geels, 2007; Negro, Alkemade & Hekkert, 2012). The planning policies made on the level of the national government (regime actor) are said to have impeded participatory and inclusive planning by excluding other regime actors such as environmental organizations and municipalities resulting in automatic rejection of local initiatives. With pro-active incentives being absent for local authorities, top-down approaches were enforced and became more dominant projects (Breukers & Wolsink, 2007).

The Netherlands and Sweden have spent the most resources in comparison to other countries when it comes to R&D of diversified renewable energy technologies (Negro, Alkemade & Hekkert, 2012). Although wind energy was mostly researched in the Netherlands, Sweden and Germany (Negro, Alkemade & Hekkert, 2012), it is most broadly diffused in Denmark, Sweden and Germany (Schot & Geels, 2008; Fig. 6, Appendix I). During the implementation of the wind turbine technology, the Netherlands decided to commence with a top-down approach as significant contributions of wind energy were only expected to be derived from large wind parks with high capacity wind turbines (Verbong & Geels, 2007). The large wind turbines experienced many technological difficulties and changes in the design (Verbong & Geels, 2007). In contrary to the Netherlands, Denmark used the bottom-up approach, by starting with small scaled wind parks and windmills which were gradually scaled up. The bottom-up approach is seen as a successful and impactful approach which was mimicked by Germany, together with the feed-in tariffs (Jacobsson & Lauber, 2006). Two reasons behind the success of Germany and Denmark that are often mentioned, are the long-term and bottom-up dynamics of Danish and German energy regimes and implemented policies at the niche level that led to the success of the diffusion of the renewable energy (Verbong & Geels, 2007; (Jacobsson & Lauber, 2006). Verbong and Geels (2007) have claimed that renewable energy is not prioritized in Dutch energy policy. The implemented policies in the Netherlands regarding renewable energy have been criticized by many researchers and even mentioned as the main reason for the slow diffusion of renewable energy. Moreover, innovation policy is considered to play a large role in the diffusion of renewable technologies (Lundvall & Borrás, 2005). In particular, the continuous process of reviewing and redesigning of innovation policies would allow optimal support of innovation technologies. However, it seems to have created less diffusion than instability in the Netherlands. Although, the option of adaptation serves the purpose of accommodating innovation best, it seems to enable the emergence of policy instability.

The Energy Regime & the Dutch Disease

The statement made by Verbong and Geels (2007), that renewable energy has never been "a top priority in Dutch energy policy", could potentially be the reason behind the small renewable energy market in the Netherlands. Despite the Netherlands having implemented a diversification law in the year 1974 with the objective of exploring alternative energy sources, the renewable energy market has remained relatively small while natural gas has remained the main fuel dominating the electricity regime in the Netherlands since discovery in 1968 (Verbong & Geels, 2007; Fig. 8, Appendix I). The diversification law was a reaction to the oil crisis in 1973 that formed the external landscape at the time (Verbong & Geels, 2007). The extraction of gas in the Netherlands has become an economic phenomenon that has received the term "Dutch Disease" that refers to the negative effects of the natural gas manufacturing. The natural gas discoveries have supposedly led to the reduction of international competitiveness and a de-industrialization process (Corden, 1984).

Similar to the Netherlands, the UK has a liberal market economy, a liberalized energy market and a small renewable energy market (Geels, 2014). The electricity regime in the UK is dominated by coal, natural gas and oil, while wind energy and other renewables still remain a small niche (Fig. 9, Appendix I). It is argued that the regime actors such as policymakers and energy firms, were able to resist climate change pressures due to the formation of a core alliance between the regime actors (Geels, 2014). Geels (2014), has argued that the policymakers and energy firms were able to form a core alliance at the regime level because of mutual dependencies. The mutual dependencies would be formed by the firms' necessity of governance structures such as property rights and obligation of contracts to be able to do businesses. These structures are provided by the government in the form of patents, tax concessions, tariff protection and subsidies. Having economic growth as a mutual interest, the energy lobbies by energy firms are taken into account by governments and interest of energy firms are prioritized. The Netherlands seems to have a similar core alliance between the government and energy firms, as it has been argued that resilience has been observed from electricity firms in the Netherlands previously. Specifically, the energy firms would have expressed their preference for gas-driven power plants due to the relatively expensive and lower energy yield of wind turbines (Negro, Alkemade & Hekkert, 2012).

In the UK, the liberal market economy in combination with the core alliance formed by the government and electricity regime, has resulted in the situation that green innovations are having to fend for themselves in the energy market (Geels, 2014). The liberal market economy implies that the government adopts a "hands-off" approach to remain neutral, however, in effect the British government is offering support to the already established regimes such as coal and oil (Geels, 2014). Moreover, Geels (2014) has argued that even when environmental goals would be undermined, the government will not step in to take action as policymakers would be sympathizing with the well-established energy firms as both would have common goals regarding economic growth (Geels, 2014). Similarly, the Dutch market is mostly driven by liberalization (Verbong & Geels, 2007) and large energy firms have previously stated that diversification will not be necessary due to the large national gas supply, as claimed by Negro, Alkemade and Hekkert (2012). With gas still prevailing as the dominant energy source in the electricity regime in the 21st century (Fig. 8, Appendix I), the assumption is made that the landscape shaped by climate change is resisted by regime actors. The strong ties to gas and electricity structures could possibly be connected to the "Dutch Disease". However, to the best of my knowledge no other research has found this connection, which is why this theory will be further explored through qualitative research.

2.3.3 The Landscape & the Regime

The landscape

Where pressure should possibly have been felt from the pressing issue of climate change that has captured a lot attention from the EU (Energy and Climate Policies beyond 2020 in Europe, 2015), it seems that possible regime resistance is able to suppress the pressures of climate change. The EU has set out to tackle the issue of climate change together, requiring participation from all countries through the voluntary Paris Agreement (Paris Agreement, 2015). To ensure that the EU meets the set climate and energy targets, the 20-20-20 goals were enacted in the year 2009 by the UN. The 20-20-20 goals are a set of binding legislations for the EU that are in place to ensure that the EU meets its climate and energy targets for 2020 (Energy and Climate Policies beyond 2020 in Europe, 2015). These goals consist of the following three key targets goals for the EU regarding energy: firstly, greenhouse gas emissions need to be cut by twenty percent compared to the levels from the year 1990. Secondly, twenty percent of the energy in the EU should come from renewables. Thirdly, the energy efficiency should be improved with twenty percent in EU countries (Energy and Climate Policies beyond 2020 in Europe, 2015). Based on the commitments made by the Dutch government regarding total renewable energy production goals for the year 2020 (14 percent) and future goals for 2030 (24 percent) and 2035 (28 percent) (NEV, 2017), the assumption is made that the landscape is formed by climate change. Geels (2012), has defined that the landscape may include heterogeneous macro-economic factors such as environmental problems as these are beyond the control of individual actors. However, the level of renewable energy in the Netherlands is far from the target set by the EU for 2020. With a total of approximately six percent in the year 2016, the goal for 2020 for producing fourteen percent of energy from renewable resources is out of reach (NEV, 2017). Similar to the case of the Netherlands, the UK has experienced strong influences from energy firms and policymakers that seem to have resisted fundamental system change due to their strong aligned interest and power to oppose regime change (Geels, 2014). Therefore, one might question whether regime resistance against green innovations is occurring. Although, climate change served to be a successful landscape with the case of Denmark, as it was able to exercise pressure on the regime, the stable policy and supportive government seem to have played a crucial role in the diffusion of wind energy in Denmark (Kamp, Smits & Andriesse, 2004; Negro, Alkemade & Hekkert, 2012). The Netherlands, having experienced 'stop and go' policies, gas prioritization and top-down approaches do not seem to have experienced the same political stability and mentality as Denmark and Germany. The policy planning in Germany included a strong focus on the ‘common good’ by prioritizing climate change above the energy markets concerns (Breukers & Wolsink, 2007). Therefore, even when the levels are aligned in the Netherlands in the way that niche innovations developed internal momentum, the landscape seems to be resisted due to rejection of the regime to fundamental system change (Geels, 2014). Both the niche and the landscape are connected to the regime as technological transitions occur within the socio-technical regime (Geels, 2005). Therefore, the alignment of the traditional MLP levels seem to no longer be a guarantee for the breakthrough for wind energy in the Netherlands.

3 Methodology

The present study was designed to identify the main factors behind the slow diffusion of wind energy in the Netherlands. To answer the main research question, this study draws on a combination of context-relevant literature from the literature review section and explanatory expert interviews. The aim of this chapter is to set out the methodological approach undertaken to discover the main factors behind the slow diffusion of wind energy in the Netherlands. This chapter will firstly elaborate on the methodological framework and approach adopted. Secondly, the data section collection includes a detailed elaboration of the sample selection, data collection and data analysis process. Finally, the limitations and potential biases associated with this study will be discussed.

3.1 Method

3.1.1 Qualitative Approach

A qualitative approach was chosen, as the research method for this study is to understand the context and complexity of the wind energy transition in the Netherlands. The qualitative approach was considered more relevant to undertake this study as it allows greater capacity to gain more in-depth information on the context of the topic of wind energy in addition to mapping involved actors within the various layers of society; niche, regime and landscape. Moreover, most of the previous research conducted on the topic of wind energy in the Netherlands is of quantitative nature or focused on a single factor of the wind energy diffusion such as policy. The exploratory nature of the research would potentially allow the discovery of new main factors behind the slow diffusion of wind energy in the Netherlands. In addition, this research method allows the validation of factors found in previous research (Saunders, Lewis & Thornhill, 2009). The case study strategy is applied to the wind energy diffusion in the Netherlands, as this strategy is in line with the research aim, which is understanding the context and process (Saunders, Lewis & Thornhill, 2009). Moreover, the case study strategy includes exploratory and explanatory research (Saunders, Lewis & Thornhill, 2009), this is in line with the nature of the study as the aim is to explore the factors involved that explain the slow wind energy diffusion. Qualitative data collection was considered appropriate to address a research problem in which new variables need to be explored and old variables confirmed. Specifically, factors such as policy instabilities and technological issues are already known and would be either confirmed or rejected.

The qualitative data collection will be held through semi-structured telephone interviews, conducted in Dutch. The semi-structured nature of the interviews would allow new issues and in-depth information to emerge for exploration (Saunders, Lewis & Thornhill, 2009). The in-depth interviews of semi-structured nature will provide new insights and validate findings from previous research (Saunders, Lewis & Thornhill, 2009). Exploration through interviews would allow to learn more in-depth as well as historical information from participants (Creswell, 2013).

The gathering of new in-depth information from experts through telephone interviews is chosen due to geographical boundaries (Ritchie, Lewis, Nicholls & Ormston, 2013). The participants that will participate in the interviews will be selected on their experience with wind energy, preferably with various backgrounds and professions, with the goal of selecting a diverse group of experts to gain in-depth information.

3.1.2 Multi-Level Perspective

The analysis of the three levels is expected to contribute to a deeper understanding of the technological innovation and transition process (Markard & Truffer, 2008). The multi-dimensional perspective of the MLP framework is expected to serve useful in understanding and analyzing the main factors from various levels within as well as along the MLP that are involved in the slow diffusion of wind energy in the Netherlands. Through the three-levelled dimensions (niche, regime, landscape), the MLP allows the mapping of the factors involved from a multi-dimensional perspective (Geels, 2012). The three levels of the MLP serve to understand system innovations and analyse actors involved from wider context through the regime and landscape level (Geels, 2014) and policy influenced regime dynamics (Geels, 2014). The levels of the regime dynamics will serve to create an understanding whether there is a resistance of climate change and if so, on which level it is created. In the context of wind energy, regime resistance will be analysed to understand whether it is formed by political cultures, governance structures and ideology that are embedded in the socio-technical regime structures (Geels, 2014). The regime level allows the analysis of mesoeconomic factors such as the deep structure of the electricity regime, while the landscape level allows the analysis of macro-economic factors such as environmental problems. The interaction of the regime and landscape level, is seen as crucial in understanding innovations (Geels, 2012).

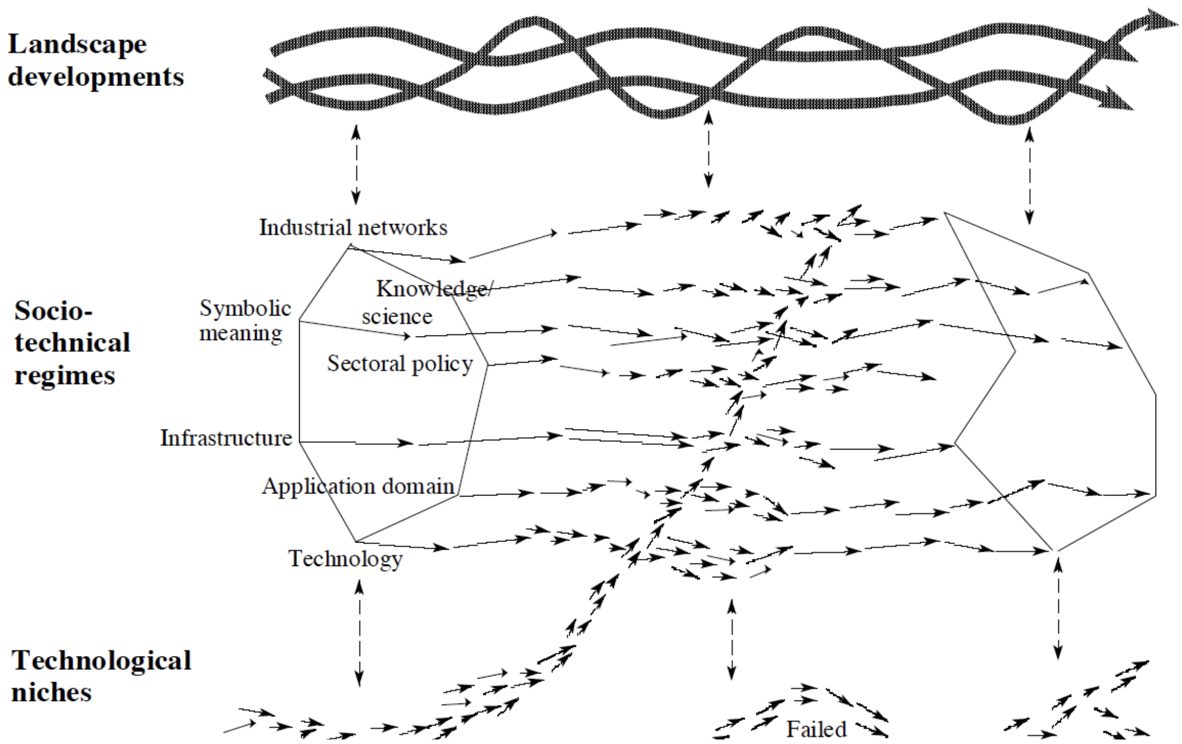

Fig. 2 - Geels (2002), Multi-level perspective framework on technological transitions

Moreover, the niche is considered to be significant for the emergence of transitions as it provides the means for the radical innovation and creation of regime shifts (Schot & Geels, 2008). The niche level allows the analysis of microeconomic factors such as the technological innovation. To understand the internal processes of the niche, the strategic niche management (SNM) approach is applied (Geels, 2005). The SNM approach is seen as complementary to the MLP framework in the analysis as it allows the understanding of the location of variety and specific bottlenecks (Schot & Geels, 2008). The strength of the MLP in comparison to SNM is that the framework allows "to account for emergent effects in innovation processes that occur beyond individual niches" (Markard & Truffer, 2008). All actors identified through the MLP framework would contribute to a basis for the analysis of the transition process (Markard & Truffer, 2008).

3.2 Data

3.2.1 Sample selection

Seven semi-structured interviews were conducted for this research through purposive sampling in order to obtain relevant information on the research question. Purposive sampling is considered strategic, as it serves to establish coherent correspondence between the research question and sampling (Creswell, 2013). The purpose sampling method used, allowed selection of experts in the field of wind energy that have extensive knowledge of the Dutch energy sector. The participants were chosen based on the following two main criteria: firstly, the participant has professional work experience within the field of wind energy in the Netherlands for five years or more. Secondly, the participant is currently still involved with field of wind energy in the Netherlands. These criteria were set to enable a detailed understanding of the theme of wind energy diffusion in the Netherlands. In addition, the knowledge restriction aims to provide a more coherent group, which makes comparison between the subjects more relevant (Creswell, 2013). Furthermore, to balance the sample across occupations and ensure that enough diversity is included, three specific criteria were set (Ritchie et al. 2013). Firstly, the sample group should contain diverse academic backgrounds. Secondly, the sample group should contain diverse employers. Thirdly, variation in the years of experience within the field of wind energy. The diverse academic background, employers and years of experience are expected to ensure that different perspectives can be explored during the semi-structured interviews (Ritchie et al. 2013) (Table 1).

Table 1 - Interview participants, April and May 2018

Expert	Job Title	Employment	Years of experience in the field of wind energy
1	Policy Advisor Energy Economics	Dutch government	5 - 10
2	Senior Energy Consultant	Dutch technology consultancy	15 – 20
3	Professor Environmental Geography	University of Amsterdam	35 – 40
4	Senior sales manager offshore wind	Dutch Technology company	10 – 15
5	Professor Aerospace Engineering	Technical University Delft	35 - 40
6	Project manager Wind Energy	Dutch wind park development	5 – 10
7	Project developer wind on land	Dutch energy company	10 – 15

Experts were sought through personal contacts as well as social media channel LinkedIn. The social media channel LinkedIn was chosen as it allowed prior screening of the participants professional experience with wind energy. The experts were contacted either through email or LinkedIn. Selection of interviewees occurred by the researcher upon availability and willingness of interviewees. The number of experts were chosen through the idea of saturation (Guest, Bunce & Johnson, 2006). The point of saturation was hit at seven experts, as new research did no longer reveal new insights (Saunders, Lewis & Thornhill, 2009). The sample was limited through the idea of saturation to retain the depth of data collection (Ritchie et al. 2013).

3.2.2 Data collection

The interviews were collected by means of telephone during the months of April and May 2018. The interviews were held in Dutch and were of approximately forty to fifty minutes of duration. To enable re-listening and transcription, the interviews were audio-recorded to achieve an unbiased analysis and allowing direct use of quotations (Saunders, Lewis & Thornhill, 2009). The potential disadvantages of telephone interviews were taken into considered before carrying out the research, such as not seeing the facial expressions or body language (Ritchie et al. 2013). However, the physical cues are considered out of the scope of this research and therefore not seen as a limitation. The interview questions were semi-structured and of open-ended nature with the intension of verifying factors and eliciting new factors from the experts (Creswell, 2014) (Table 3, Appendix II). The semi-structured interviews were chosen, as this type of questioning allowed control over the line of questioning and the option for experts to share historical information. A list of themes and questions to be covered during the telephone interviews were prepared in advance (Saunders, Lewis & Thornhill, 2009).

The list of questions was made relevant to the topics described in the Literature Review that address the main question: "*Which factors are responsible for the slow diffusion of wind energy in the Netherlands?*". In particular, the interview questions covered topics related to the niche market of wind turbine technology, innovation and 'stop and go' policy, gas and electricity infrastructures and the relationship between the topics (the interview script can be found in Appendix II). To establish a good rapport between the interviewer and interviewee, the interviews commenced with a short personal introduction followed by an introduction of the research topic. During the interviews, open questioning techniques were used to elicit extensive and elaborate responses (Ritchie et al. 2013) and there was a strong focus on understanding the relationship between the factors in addition to verifying factors and gaining new factors. Follow-up questions were asked in order to understand the relationship between the factors mentioned by the experts to allow interpretation through the MLP framework. However, the order of the questions varied on the course of the conversation and some questions were omitted in particular interviews, due to highly specific context and knowledge variations of the experts (Saunders, Lewis & Thornhill, 2009).

3.2.3 Data analysis

The aim of this chapter is to provide a detailed description of the step-by-step process undertaken to organize and analyse the data. The data from the semi-structured interviews was analysed by qualitative content analysis (Ritchie et al. 2013). To familiarize with the dataset, notes were taken of the concepts that were found during the interviews as well as the transcription and verification process (Ritchie et al. 2013). Before analyzing the data, the themes and categories in accordance to the MLP framework were identified from the literature review that were formed into codes. The micro-, meso- and macro levels of the MLP framework were taken into consideration, together with the notes taken during the interviews. The themes related to the MLP framework were the following: niche market of wind turbine technology, innovation and 'stop and go' policy, gas and electricity infrastructures. The main key codes, categories and themes identified (Table 2) were reviewed in accordance to the MLP to reflect on the dimensions and actors within the society. When the categories were formed into themes, the MLP framework was used during the formation of inter-factor connections.

Table 2 - Main key codes, categories and themes identified from interviews April and May 2018

MAIN KEY CODES IDENTIFIED	**MAIN CATEGORIES IDENTIFIED**	**MAIN THEMES IDENTIFIED**
POLICY	POLICY	POLICY
POLICY + TOP-DOWN	MARKET FORCE	MARKET FORCES
POLICY + BOTTOM-UP	ENERGY FLEXIBILITY	ENERGY FLEXIBILITY
POLICY + SHORT-TERM	TOP-DOWN APPROACH	
POLICY INSTABILITY	BOTTOM-UP APPROACH	
POLICY + MARKET FORCE	SHORT-TERM APPROACH	
MARKET FORCE	GAS MAIN PRIORITY	
MARKET FORCE SOLUTION	POTENTIAL SUSTAINABILITY DRIVER	
MARKET FORCE + TOP-DOWN		
TOP-DOWN APPROACH		
BOTTOM-UP APPROACH		
ENERGY FLEXIBILITY		
POTENTIAL SUSTAINABILITY DRIVER		
DRIVER SUSTAINABILITY		
GAS A PRIORITY		
NO TRANSITION		
GOALS & VISIONS		

Data structuring

The data was organized in the following way: firstly, the data was transcribed and afterwards verified by re-listening. During this process, the participants were made anonymous (Saunders, Lewis & Thornhill, 2009). Secondly, to structure the transcripts, the data was coded with primary and secondary codes. The primary codes were drawn from reading previous theoretical works as well as the interview questions (Silverman, 2016). Due to the semi-structured nature of the interviews, additional information was revealed that was not previously mentioned in the interview questions nor theoretical works, therefore secondary codes were added accordingly. To avoid misinterpretation sources, language dictionaries were used to translate the codes as well as context from Dutch to English. The transcribed interviews were then coded line-by-line (Silverman, 2016), with codes drawn from previously identified from the theoretical framework, interview questions and newly created codes specific to the transcript. During the coding, specific coding combinations were used such as: policy + top-down, and similar items were coded with the same code (Silverman, 2016). Combining the codes allowed to search for links between them in addition to creating more conceptual and abstract codes (Silverman, 2016). The framework of Geels (2012, 2014) was used to identify such coding combinations. After coding all the transcriptions, the codes were evaluated and recoded accordingly (Silverman, 2016).

Identification of key codes

Thirdly, by looking for patterns, sequences, relationships and associations, the key codes were identified (Silverman, 2016). The most frequent key codes used per interview, were verified by re-reading the transcripts and a list of main key codes was made (Table 2). This process allowed to categorize the data based on the frequency of the key codes and reduce the number of different pieces in the data. During this stage several codes were eliminated based on low frequency of repetition throughout the transcriptions along with reflecting the codes against the research question in terms of relevancy (Ritchie et al. 2013). The codes that were used less than five times throughout all transcripts were eliminated.

Identification of main themes

Fourthly, themes were assigned based on the categories to identify the major elements that were derived from the interviews. The coding combinations provided a way to merge the code and category into themes (Silverman, 2016), such as: market force + top-down, which became market force. Moreover, the coding combinations provided a way to analyse the connection of themes and categories from a multi-level perspective. The various levels and layers of the societal dimensions became clear by merging the categories into themes. From the analysis of the interviews, three main themes were created: 1) Policy; 2) Market forces; 3) Energy flexibility (Table 2). Fifthly, the data was verified by checking the codes and transcripts to verify the themes and codes again (Saunders, Lewis & Thornhill, 2009).

Data interpretation

Lastly, the data was interpreted through identification of the reoccurring themes, the highlighted similarities and differences in the data and the combined categories. The categories together with the main themes lead to the development of key findings, leading to the results. The data was interpreted based on the main themes together with combinations of main categories, factors and relationships between factors were concluded. The data was summarized by using themes from interviews, policy, market forces and energy flexibility along with the identified MLP levels that include the following:

the niche and regime dynamics, the regime dynamics, the landscape and regime dynamics. To retain the content and essence of the data during summarization, a substantial amount of detail and context were included in the data summary that is presented in the findings section (Ritchie et al. 2013). To avoid misinterpretation sources, language dictionaries were used to translate the factors as well as context from Dutch to English. The key terms and phrases are as close as possible to expert's language. However, potential misinterpretation of the data is not excluded from this research as it was translated by the researcher who is a native speaker of both languages.

3.3 Limitations

There are several weaknesses of the MLP framework that have been contextualized previously. Specific definition of technological innovation systems would have benefited the translation of results as argued by Markard and Truffer (2008). The absence of clarification of specific relevance and application of each conceptual element has a tendency to result in overly complex research (Smith, Stirling & Berkhout, 2005; Markard & Truffer, 2008). The elements should be separated more clearly through clarification of the inter-element relationship. Due to the abstract focus of the model, the specific roles, strategies and interactions between the identified actors could be left undefined (Markard & Truffer, 2008). To overcome this limitation, the framework was more extensively used during the data collection, data analysis, results and discussion section of the research. Moreover, other limitations could include potential research bias due to the qualitative interviews. The interviews could include bias from the interviewer and interviewee in addition to the questions as the quality of the data generated from the interviews is affected by the skills, experience and commitment of both the interviewer and the interviewee (Creswell, 2013).

4 Results

This section will draw upon the findings that are organized in accordance to themes which arose from the interview process and subsequent data analysis. The key themes that emerged following data analysis regarding the factors responsible for the slow diffusion of wind energy in the Netherlands include: policy, market forces and energy flexibility. An elaborate analysis of the theme selection can be found in the method section.

4.1 Findings

4.1.1 Policy

There are a number of fundamental choices that have been made in policy that seem to have disturbed the diffusion of wind energy that are identified by the experts. Throughout the interviews, it has been mentioned several times that the Dutch government uses a top-down approach that often leads to strong hierarchical decision-making. Several issues were mentioned in relation to policy, however the most prevailing one is the top-down approach that seems to trickle-down and result in several bottlenecks.

The top-down approach adopted by the Dutch government is criticized by most of the experts. The wind projects in the Netherlands are carried out in large-scale, in the form of large wind parks and tall wind turbines that come at a high price, making them only available for energy companies (Expert 6). Many of the large size projects initiated were cancelled in the past due to large costs that made them unfeasible (Expert 1).

"*The starting big is recognizable, the thought is: we will do it either way, so let's make it extremely big*" (Expert 1)

Expert one has mentioned a specific project that was carefully researched by architects in the province North-Holland in 2010, that was "*very top down and received a lot of criticism at the time*" because of its large size. The project was meant to generate wind on land on a large scale in the province of North-Holland. However, because of the large size of the project it was turned down by the politicians and has not been executed. Meanwhile, there were local society initiatives in the same province, but due to the high priority of the project these projects were turned down (Expert 1). Large projects have been prioritized numerous times and local citizens such as farmers were not allowed to purchase small quantities of wind turbines (Expert 1, 3). Experts one and three, argue that the large-scale top-down approach of the Dutch government has created barriers to energy for local people such as farmers and groups of citizens to participate in the production of wind energy. This group of people is said to have never been prioritized and even hindered regarding the production of wind energy (Expert 1, 3). To avoid situations as such expert two has argued that the issue of wind energy diffusion should be handled from the micro-governmental level in the Netherlands. Scaling-up is important when it comes to the diffusion of wind energy, however, the scale should not become so large that it becomes unfeasible (Expert 2). The diffusion of wind energy has become more of an organizational question and should be dealt with from the micro governmental level, which is the municipality, where the most impact could be achieved (Expert 2).

"The success of wind energy is dependent of legislation that is supportive and offers the possibility of initiatives by society. Because that is where it must come from, it does not come from the national government, it comes from the local level in which individual people, cooperating people in cooperatives, who jointly set up new companies or existing companies that invest in wind energy. To what extent they receive the opportunity to make projects successful." (Expert 3)

Several experts have mentioned that the Dutch society should have been involved more. The success of Germany is mentioned numerous times, as well as the feed-in tariffs that Germany has implemented. Most experts believe that the Netherlands should have done similarly as to Germany. The reason behind the success of the feed-in tariffs in Germany and in that sense the failure in the Netherlands according to expert 3, was a combination of factors. The two main factors that were not implemented in the Netherlands included firstly, the guaranteed price for the wind energy delivered to the grid and secondly, the right for each citizen to participate in delivering wind energy to the grid:

"The most important factor was, and that was the factor that the Netherlands also tried when implementing the feed-in system, only the most important factor in that they always left out. That is, that everyone has the right to generate power with the help of wind and with the help of sun. That everyone has the right to deliver that to the grid and received a guaranteed price for it." (Expert 3)

The solution to the misaligned policy that was mentioned by most experts was the focus on local markets:

"*To sustain the energy transition, that is almost by definition something local, as national government it is not possible to steer that directly in any other way except for outlining certain frameworks. Subsidies, tax exemptions and large funds must all be filled in locally*" (Expert 2)

The 'stop and go' policies

It has been confirmed by all experts that the 'stop and go' policies have taken place and played a role in the diffusion of wind energy. The comparison is made several times that Denmark and Germany have experienced more success with the diffusion of wind energy because of their stable policies for many years (Expert 1, 2, 3, 4, 5). While most experts acknowledge that various kinds of policy changes have been made since the mid-1990s, experts one and three find that fundamentally nothing much has changed since then. As still policies are constantly terminated and re-introduced regarding wind energy but also other renewables (Expert 1). The 'stop and go' policies remain a structural factor that is fundamental for the diffusion of renewables (Expert 3).

4.1.2 Market forces

The importance of the market force is mentioned numerous times throughout the interviews by all experts. The government is said to not want to take a leading position in the energy transition (Expert

1, 2, 3, 6, 7). This would supposedly be caused by the fear within the government of taking a market position as market forces should not be disrupted at any cost (Expert 1, 2).

"*In the Netherlands we still believe and trust in the functioning of the market. Mainly at the ministry of economic affairs and climate it simply still applies that market forces are sacred, and the disruption of market forces is a greater sin than stimulating sustainability*" (Expert 2)

Experts one, three and seven have argued that the Dutch government expects the energy companies to take responsibility and with that take action in the transition towards renewable energy. The market force and therewith the industry is prioritized and is expected to take responsibility for the renewable energy transition as the governmental approach has been and still is: industry first and then households will follow (Expert 1, 3, 7). The focus on the industry would supposedly exercise pressure on the national level of the government, as interests are said to intersect in terms of electricity flexibility (Expert 1, 3, 4, 5). This attitude is said to have trickled down in policy making as well (Expert 1, 7). The energy companies are expected to take initiative in building large wind parks in cooperation with regional governments and / or municipalities. However, many regional governments do not prioritize such tasks which has led to postponement and interruption of the implementation of wind parks (Expert 1, 7). According to expert one, ta misalignment is created when the national government provides specific goals and appoints certain provinces, while the province already has set other goals, directions and priorities. Provinces are said to be overwhelmed by the national government especially because they do not receive specific budgets for such projects (Expert 1, 7). It is said during the interviews that the government has been provided with many reports and step by step scenarios have been written on how to accelerate the energy process (Expert 1, 2, 3). However, to not act upon it is said to be "political choice and absence of long-term thinking" within the government (Expert 1). The focus on the industry and therewith the short-term thinking has trickled down to policy makers (Expert 1, 2, 3, 5, 7) causing projects that would take seven or more years to pay off to not be implemented, even though it would offer a good solution (Expert 1).

"*The Netherlands also has a vision and that vision is indeed: the market must do it. That means that everything is organized as if it were a market. The major problem with renewable energy is, for the time being, hardly a market, hardly, not at all."* (Expert 3)

Consequentially, the focus on the market force would result in a top-down way of organization of large-scale wind parks (Expert 1, 3, 4, 5, 6, 7) as the government is more focused on achieving an energy transition first in the industry and then in the households (Expert 1). This means that the civil society is not given the chance to participate in the energy transition as they would not be able to invest in such large-scale wind parks (Expert 1, 3, 4, 5, 6, 7). Moreover, the extensive research required before a wind turbine can be placed on any location, the law of having a minimum of three windmills installed and even having to remove old wind turbines before installing additional ones has created additional barriers for civil society to participate in the production of wind energy (Expert 6, 7).

4.1.3 Energy flexibility

The organization of energy carriers within the electricity sector in the Netherlands is mentioned to be one of the most crucial elements in understanding the diffusion of renewable energy sources (Expert 3, 5). The integration of various renewable energy sources would only be possible when changing the entire energy system through aligned coordination (Expert 3, 5). However, the extent of prioritization of renewables in the Netherlands is questioned by all experts. The government wishes to stay flexible when it comes to choosing specific energy carriers to diffuse, therefore, a wide variety of energy carriers will most probably remain in the Netherlands (Expert 1, 2,) and self-sufficiency through renewables will only become a priority when it becomes a must (Expert 1, 7). Specifically, when the priority is recognized and acted upon from every governmental level in the Netherlands in an aligned way, only then wind energy will be able to diffuse (Expert 1, 3, 5, 7).

The Netherlands has set up a diversification law after the oil crisis in 1975 with the goal of becoming more energy interdependent. This initiated much research for alternative forms of energy that could be produced locally in the Netherlands, with wind being one of them (Expert 3, 5). Expert five was involved with the first research project initiated and has experienced, along with expert three, the slow diffusion of wind energy in the Netherlands from the beginning. The main reason for the Netherlands to research wind energy, was to find alternative forms of energy that could be extracted locally (Expert 3, 5). However, it is hypothesized by some experts that despite the new course set out by the Netherlands to find alternative forms of energy, the Netherlands did not want to develop other dominant energy sources that could potentially compete with the Dutch natural gas. The focus on gas by the Netherlands has been labelled 'The Dutch Disease' and is mentioned several times throughout the interviews. Experts one, two, three, four, five and seven argue that the political and industrial focus on gas in the Netherlands is one of the main factors behind the slow diffusion of renewable energy. The focus on natural gas from Groningen supposedly has led to low prioritization of alternative energy carrier. This priority of gas is said be sustained by the strong alliance between the Ministry of Economic affairs and Shell (Expert 3, 4, 7). The interests of the Dutch government and Shell are said to always been considered to be quite overlapping (Expert 3, 4, 7).

"*The primary focus of the Dutch energy policy has always been the natural gas, especially that from Groningen … that ensured that this was never really given priority to the development of other energy sources*" (Expert 3)

The development of alternative energy has never been prioritized and argued to have never existed due to the presence of natural gas in the Netherlands (Expert 1, 2, 3, 4, 5, 6, 7). Although, a new law will be passed from 2019 to bring down the use of gas, the experts find that the energy system will not become more environmentally sustainable as consequence of the law (Expert 1, 2, 3, 4, 5, 7). As for the substitute for gas, non-environmentally sustainable short-term solutions have been chosen (Expert 1, 2, 3, 4, 7). Moreover, the change in gas consumption is expected to be driven by primarily by the Dutch industry (Expert 1, 2, 3, 7).

"…*the government has decided that the phasing-out should come primarily from the industry and then the households will follow*" (Expert 1)

The Dutch government focuses on the industry and expects that the change in gas consumption will be driven top-down (Expert 1, 4) and with that continuing the top-down management regarding energy industry by prioritizing the industry above civil society yet again.

5 Discussion

In reviewing the literature and results, various factors have been identified that were expected to be connected to the slow diffusion of the harnessing of wind energy in the Netherlands in previous years. The many factors presented in the literature have been analysed with the purpose of verification in addition to discovering new factors during the interviews. Prior studies have mentioned the importance of specific factors such as local initiatives and the ‘stop and go’ policies. However, a clear overview of relevant factors responsible for the slow diffusion of wind energy in the Netherlands has been found missing in addition to a clear connection to the energy regime from a multi-level perspective. Therefore, the present study was designed to identify the factors responsible for the slow diffusion in wind energy in the Netherlands while reflecting on the connection between the factors from a multi-dimensional perspective.

The MLP framework below has been adapted to the results found during the interviews. The framework includes the factors identified from the interviews that would supposedly play a fundamental role in the slow diffusion of wind energy in the Netherlands (Fig. 3). The framework aims to present the connection of the factors from a multi-dimensional perspective in the Netherlands.

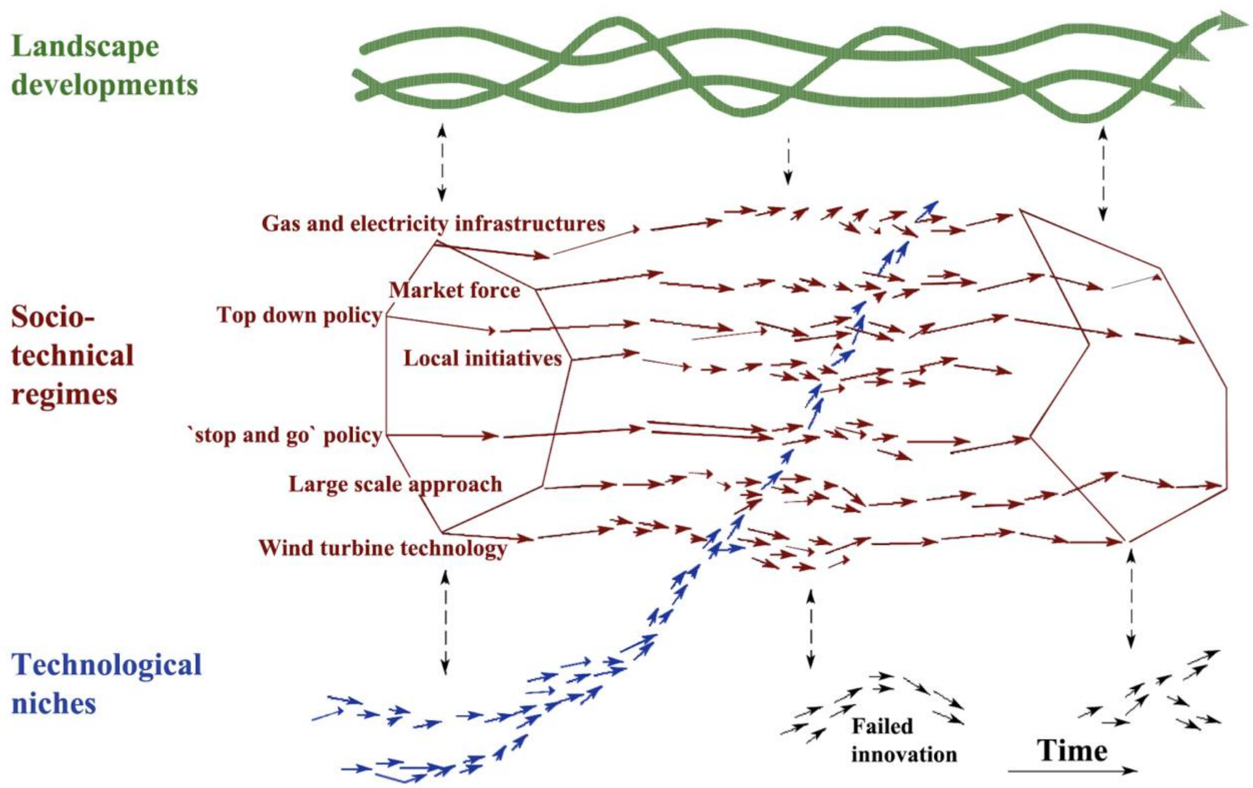

Fig. 3 - Adapted from Geels (2002), a dynamic multi-level perspective on wind turbine technology in the Netherlands, 2018

5.1 Technological niche & Socio-technical regimes

5.1.1 Large-scale approach

The regime actors that have been identified from the literature review of the large-scale approach are the electricity-generating firms and the Dutch government (Verbong, 1999; Verbong & Geels, 2007). The prioritization of the large wind parks and large-scale wind turbines was said to be derived from the Dutch energy regime, with the aim of achieving significant energy contributions to the Dutch energy supply (Verbong, 1999). Moreover, the large-scale approach is in contrast to the small-scale approach of more successful countries regarding wind energy, such as Denmark and Germany that have been able integrate wind energy it into the regime and create a regime shift (Kamp, Smits & Andriesse, 2004; Jacobsson & Lauber, 2006, Fig. 6, 7, Appendix I). The large-scale approach of the regime actors in the Netherlands, has influenced the niche in terms of prioritization of large wind parks and large-scale wind turbines, which has been established from the beginning of the developments of the wind turbine (Verbong, 1999). Presumably the large-scale approach is still present in the Dutch energy regime (NEV, 2017) and this would indicate that the wind energy niche has not overcome the level regarding the learning process that is part of the MLP as well as SNM theory. Organizational challenges such as the large-scale approach, seem to have remained an issue throughout the implementation of wind energy into the regime (Verbong, 1999; Verbong & Geels, 2007; Negro, Alkemade & Hekkert, 2012). The results have confirmed that the prioritization of the large wind parks and large-scale wind turbines is still present and implemented by the government as well as the energy sector. The actors behind the large-scale approaches identified from the results, include the government and energy firms, which are regime actors in accordance to the MLP theory. Therefore, these regime actors seem to still have influence on how the organization of the niche. However, the results suggest that such large-scale approaches are problematic as they often result in cancelled projects because of unfeasibility reasons such as the large costs that result in withdrawal by regime actors such as the government or energy firms. This would indicate that wind projects of large-scale are not being implemented and potentially would indicate that the large-scale approach is a main factor behind the slow diffusion of wind energy in the Netherlands.

5.2 Socio-technical regimes

5.2.1 Local initiatives

The implementation of wind power on the local level in the Netherlands is said to be neglected, and regime actors such as local initiatives, nature protection organizations and self-builders would be ignored by regime actors such as the government, energy firms and engineers (Breukers & Wolsink, 2007). In contrary to the Netherlands, countries that proved to be successful in the diffusion of wind energy such as Germany and Denmark, have specifically focused on the local-level and small-scale wind turbine units that were gradually scaled-up, which allowed the widespread diffusion of wind energy (Kamp, Smits & Andriesse, 2004; Jacobsson & Lauber, 2006). The results have confirmed that previously local initiatives have not been prioritized or in some cases even rejected by the government, a regime actor. The results have indicated that the large-scale approach has made the production of wind energy only available for energy companies (regime actor). Therewith, confirming the inaccessibility of wind energy production to local initiatives as a factor behind the slow diffusion of wind energy in the Netherlands. The confirmation of local initiatives as a factor behind the slow diffusion of wind energy in the Netherlands was not surprising, as this phenomenon has been observed by previous studies (Verbong, 1999; Breukers & Wolsink, 2007; Verbong & Geels, 2007; Negro, Alkemade & Hekkert, 2012). Therefore, confirming the inaccessibility of wind energy production to local initiatives as a factor behind the slow diffusion of wind energy in the Netherlands. However, what was interesting was the strong indication, that wind energy would only be able to diffuse widely if local initiatives would be supported by regime actors such as the government. The local level governments such as municipalities, are suggested to act upon the engagement of regime actors such as individuals and groups of citizens. Therefore, if the Netherlands would wish to mimic the success of Germany and Denmark, it might need to reconsider potential involvement of the local level. Germany has experienced extensive support from the German government with the law passed in Germany in 1991, that gave the right to all citizens to generate wind energy that would be delivered to the grid and purchased by electricity firms for a fixed price (Jacobsson & Lauber, 2006; Breukers & Wolsink, 2007). Moreover, the results suggest that the success of the wind energy is dependent on the supportive regulations regarding the support of local initiatives by individuals or cooperating citizens. This would be part of innovation policy that is made by policymakers that are regime actors. Taken together, these results suggest that if wind energy is to diffuse widely, the Dutch government would need to provide the right to everyone within the Dutch society to participate in the production of renewable energy, including the right to deliver the energy generated to the grid for a guaranteed price. This is similar to feed-in system that has been implemented by Germany and Denmark (Jacobsson & Lauber, 2006; Negro, Alkemade & Hekkert, 2012).

5.2.2 ‘stop and go’ policy

The Netherlands has not experienced stable policies or subsidy schemes regarding renewables in particular during the 1990s and onwards (Breukers & Wolsink, 2007). According to the literature the ‘stop and go’ policies originate from the desire of bringing demands of liberalisation of the energy sector in line with the policy as fragmentation of the energy market that was anticipated by the Dutch government throughout the 1990s (Breukers & Wolsink, 2007). The results have confirmed that the ‘stop and go’ policies are perceived to be a fundamental structural factor for the diffusion of renewables in the Netherlands. What is interesting is that the results have suggested that this type of policy structure is still embedded in the society as supposedly the policies are still terminated and re-introduced regarding wind energy but also other renewables. Therefore, the ‘stop and go’ policies might still be affecting the diffusion of wind energy or other renewables. Moreover, structural misalignment between institutions would be responsible for the ‘stop and go’ policies (Negro, Alkemade & Hekkert, 2012). The results suggest that the municipalities instead of national governments (regime actors) should steer subsidies, tax exemptions and large funds regarding renewables. Therewith, again suggesting that local level governments (regime actors) would be the drivers behind the wind energy diffusion. However, this study has not been able to demonstrate whether there is a connection between ‘stop and go’ policies and the market force. Therefore, the ‘stop and go’ policies seem to not be connected to all the identified actors of the MLP.

5.2.3 Top-Down Policy & the Market Force

The top-down mentality adopted by the government and energy firms, is said to have formed during the early stages of the niche due to the prioritization of large turbine units and large wind parks, therewith excluding small-scale actors such as local initiatives and nature protection organizations (Verbong, 1999; Verbong & Geels, 2007; Negro, Alkemade & Hekkert, 2012). This top-down approach would ensure that significant contributions would be made by the wind energy market through the implementation of large wind parks and high capacity wind turbines (Verbong & Geels, 2007). Initial observations suggest that there may be a strong link between the top-down policy and market force. The results indicate that there is a strong possibility that the top-down policy originates from the prioritization of the industry, due to expectations from the government of energy companies to take responsibility for the renewable energy transition. The results suggest that the strong focus on the energy companies by the Dutch government originates from the fear of disrupting market forces and therefore the government leaves the responsibility of renewable energy transition to the market. Prior studies that have noted the prioritization of the energy market, have suggested that the liberal market economy is counterproductive to the renewable energy transition (Negro, Alkemade & Hekkert, 2012; Geels, 2014). The priority of the liberal market economy in the UK, has resulted in the government adopting a 'hands-off' approach with the intention of remaining neutral in the energy transition. However, this approach is said to be counterproductive in the UK with regards to the renewable energy transition because the UK government in effect is offering support to already established regimes such as coal and oil (Geels, 2014). Similar to the case of the UK, the findings of this study strongly suggest that the Dutch government does not have the intention of taking a leading position in the energy transition and therefore leaves it up to the market force. Therewith, confirming similarities between the UK and the Netherlands, as the 'hands-off' approach of the UK government seems to be applicable for the Dutch government. It is interesting to note that all seven interviewees have indicated that the priority of diffusing renewable energy has been absent due to the presence of natural gas in the Netherlands. This result supports the hypothesis that the Dutch government is in effect supporting the gas regime in the Netherlands and not prioritizing the diffusion of renewable energy such as wind energy. Therewith, confirming the claim made by Verbong and Geels (2007) that renewable energy is not prioritized in Dutch energy policy.

Moreover, the previous study evaluating the dynamics of policy and the regime by Geels (2014) has observed that the strong relationship between policymakers and energy firms is formed because of mutual dependencies. With economic growth as a mutual interest, the government has provided energy policies tailored to the existing energy infrastructures in the form of governance structures such as property rights and subsidies (Geels, 2014). Similar alliances between the Dutch government and energy firms (regime actors) in the Netherlands have been has been observed in the study by Negro, Alkemade & Hekkert (2012), as resilience from electricity firms and strong preference for gas-driven power plants has been reported. The formation of the core alliance at the regime level between energy firms and the government in the UK is said to have resulted in regime resistance against climate change pressures (Geels, 2014). Very little was found in the literature on the question whether the energy firms in the Netherlands and policymakers have formed a core alliance and are therefore able to resist climate change pressures. This study has been able to demonstrate that the political and industrial focus has been on the Dutch gas, in particular the gas from Groningen. The results suggest that the priority of gas was sustained by the strong alliance between the Dutch governments and energy companies as the interests of both regime actors are considered to have been overlapping. This would suggest that the Netherlands has the similar situation as the UK, with green innovations such as wind energy having to fend for themselves in the energy market. Therefore, the results from this study seem to corroborate with the ideas of Geels (2014), who suggests that policymakers and energy firms were able to form a core alliance at the regime level, therewith leading to low prioritization of alternative energy carriers such as renewables and resist climate change pressures. The present results are significant in at least two major respects. Firstly, the core alliance between the Dutch government and energy firms would implicate that not only does the Dutch government not prioritize renewable energy but is also actively resisting fundamental system change by resisting climate change pressures (landscape). Secondly, this would implicate that further environmental goals, such as the electricity production from renewable energy resources goals for 2023 (17 percent), 2030 (24 percent) and 2035 (28 percent), would possibly not be reached if the resistance of the regime were to remain. The resistance of climate change pressures at the regime level would potentially be one of the main factors responsible for the slow diffusion of wind energy in the Netherlands. However, very little literature was found regarding potential resistance of the Dutch government and energy companies, therefore, a further study on the topic of strategic alliances between the Dutch government and energy companies is suggested. Further research would be particularly interesting as the results have suggested that top-down management regarding the energy companies will remain.

5.3 Landscape developments & Socio-technical regimes

5.3.1 Gas and electricity infrastructures

Climate change previously served to be a successful landscape in the case of Denmark as it was able to exercise pressure on the regime and enable the diffusion of wind energy (Kamp, Smits & Andriesse, 2004), however, the results have suggested that this has not been the case for the Netherlands. With the 20-20-20 goals far from being met by the Netherlands (NEV, 2017), the landscape seems to be resisted by regime actors. Despite the goals set by the Netherlands, it seems that regime resistance against climate change is taking place. The current study found that policymakers and energy firms were presumably able to form a core alliance at the regime level, which enabled the resistance of climate change (landscape) pressures, therewith resisting fundamental system change from the integration of renewables. Where pressure should possibly have been felt from the pressing issue of climate change (Energy and Climate Policies beyond 2020 in Europe, 2015), the presence of the core alliance between the Dutch government and energy companies seems to resist fundamental change on the regime level from the landscape. Political prioritization and stability both seem to be important factors regarding the diffusion of wind energy in Denmark and Germany, as both countries show a strong focus by prioritizing climate change above energy market concerns (Kamp, Smits & Andriesse, 2004; Breukers & Wolsink, 2007; Negro, Alkemade & Hekkert, 2012). The Netherlands, having experienced ‘stop and go’ policies, gas prioritization and top-down approach do not seem to have met the same political stability and mentality as Denmark and Germany. The resistance of climate change pressures at the regime level would potentially be one of the main factors responsible for the slow diffusion of wind energy in the Netherlands.

6 Conclusion

The climate change developments have led to increased realization that environmental problems need addressing by transitioning away from fossil fuels towards renewable energy technologies (Geels, 2014). To tackle climate change, the Netherlands agreed that fourteen percent of the final energy consumption would be sourced from renewables by the year 2020 (Nationaal actieplan voor energie uit hernieuwbare bronnen, 2009). However, the Netherlands will not be able to comply with this target and the Dutch government has officially declared that the target will not be achieved (NEV, 2017). Wind energy was expected to be one of the promising renewable energy sources that would aid in achieving the target set for 2020 (NEV, 2017). However, the diffusion of wind energy in the Netherlands has been less successful in comparison to the diffusion of the windmill, as the wind energy market still remains a niche in the 21st century. This study served the purpose of identifying the factors responsible for the slow diffusion of wind energy in the Netherlands.

The previous discussion has shown how regime actors such as the Dutch government, energy companies and policymakers in the Netherlands have created barriers to the diffusion of wind energy in the Netherlands and resisted climate change related pressures. The Dutch government and industry seem to have strongly aligned interests that have resulted in top-down, large-scale approaches that seem to have trickled down in policymaking. Moreover, the previous discussion has shown that until now the Dutch government has not prioritized or in some cases even rejected local initiatives. With the new plans of significantly decreasing gas consumption and production from the year 2019, it is expected that electricity will play a larger role in the Netherlands (NEV, 2017). If the Netherlands wishes to enable wide diffusion of wind energy as a response to the growing importance of the electricity sector, it is suggested that the Dutch government and policymakers consider the prioritization and creation of supporting policies for the local level such as municipalities, local initiatives or local individuals. Therefore, the policy recommendation that is made is to create supporting policies that prioritize and offer the possibility of local small-scale initiatives to produce wind energy that is connected to the grid and guarantees a price for the energy produced. With regards to future research, a further study on the topic of strategic alliances between the Dutch government and energy companies is suggested. Further research would be particularly interesting as the results have suggested that top-down management regarding the energy companies will remain. Moreover, a better understanding of not only regime resistance but also potential destabilization and decline of the existing regime in the Netherlands is an important topic for future research.

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8 Appendix

8.1 Appendix I

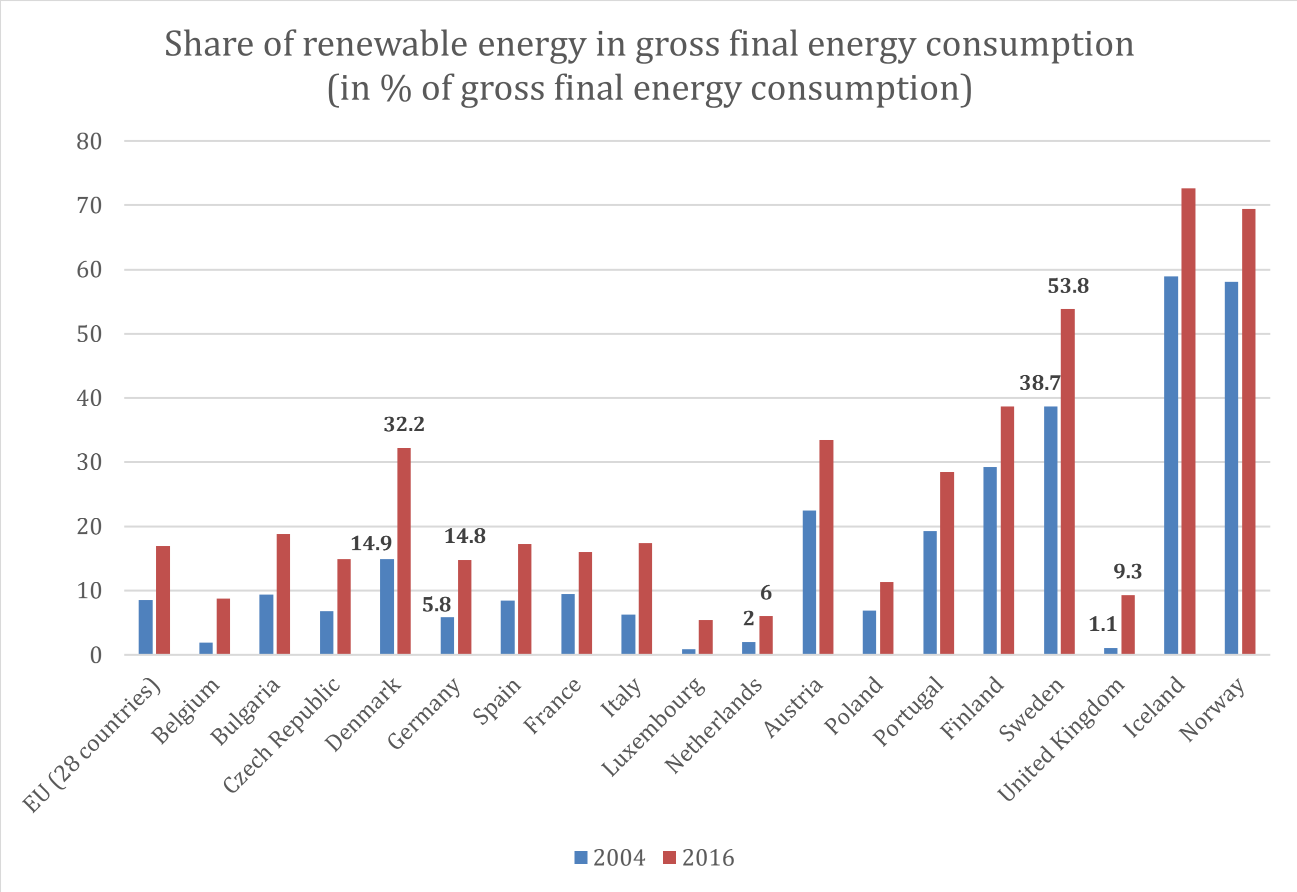

Fig. 4 - Eurostat, Share of energy from renewable sources in EU countries in % of gross final energy consumption, comparison 2004 and 2016

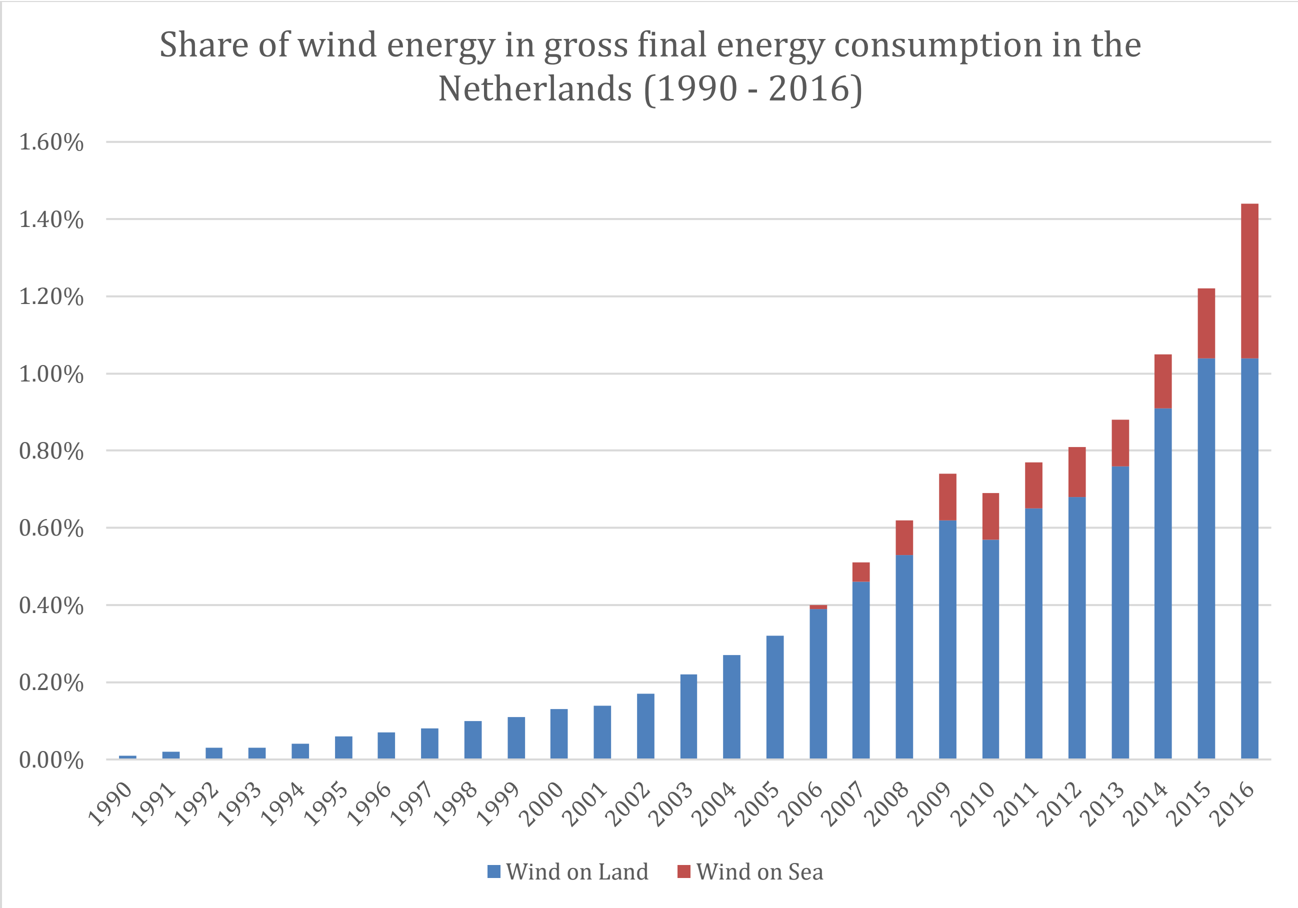

Fig. 5 - CBS, Share of wind energy in the Netherlands in % of gross final energy consumption, comparison 1990 to 2016

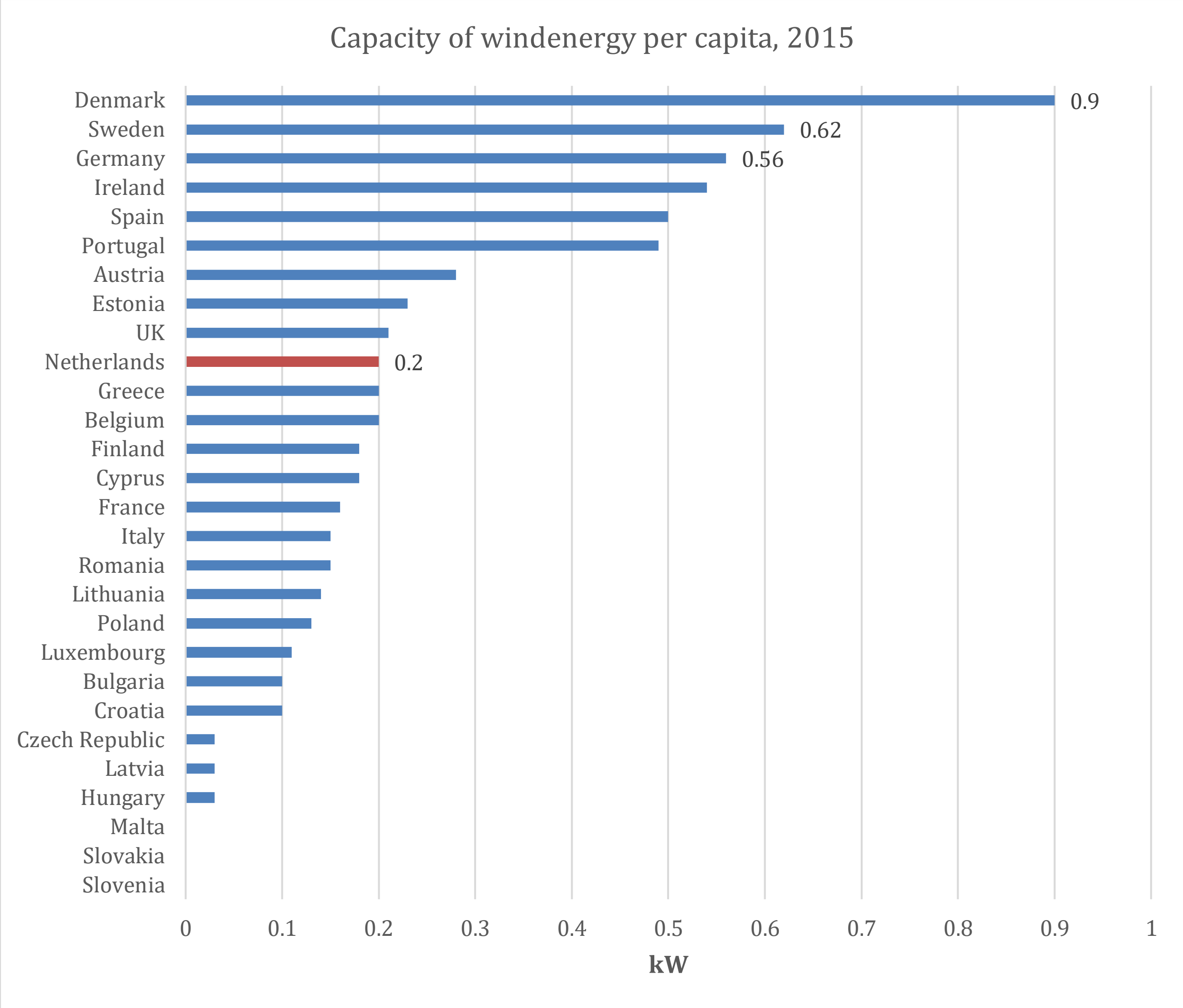

Fig. 6 - EWEA and Eurostat, Wind energy capacity per capita 2015 in kW

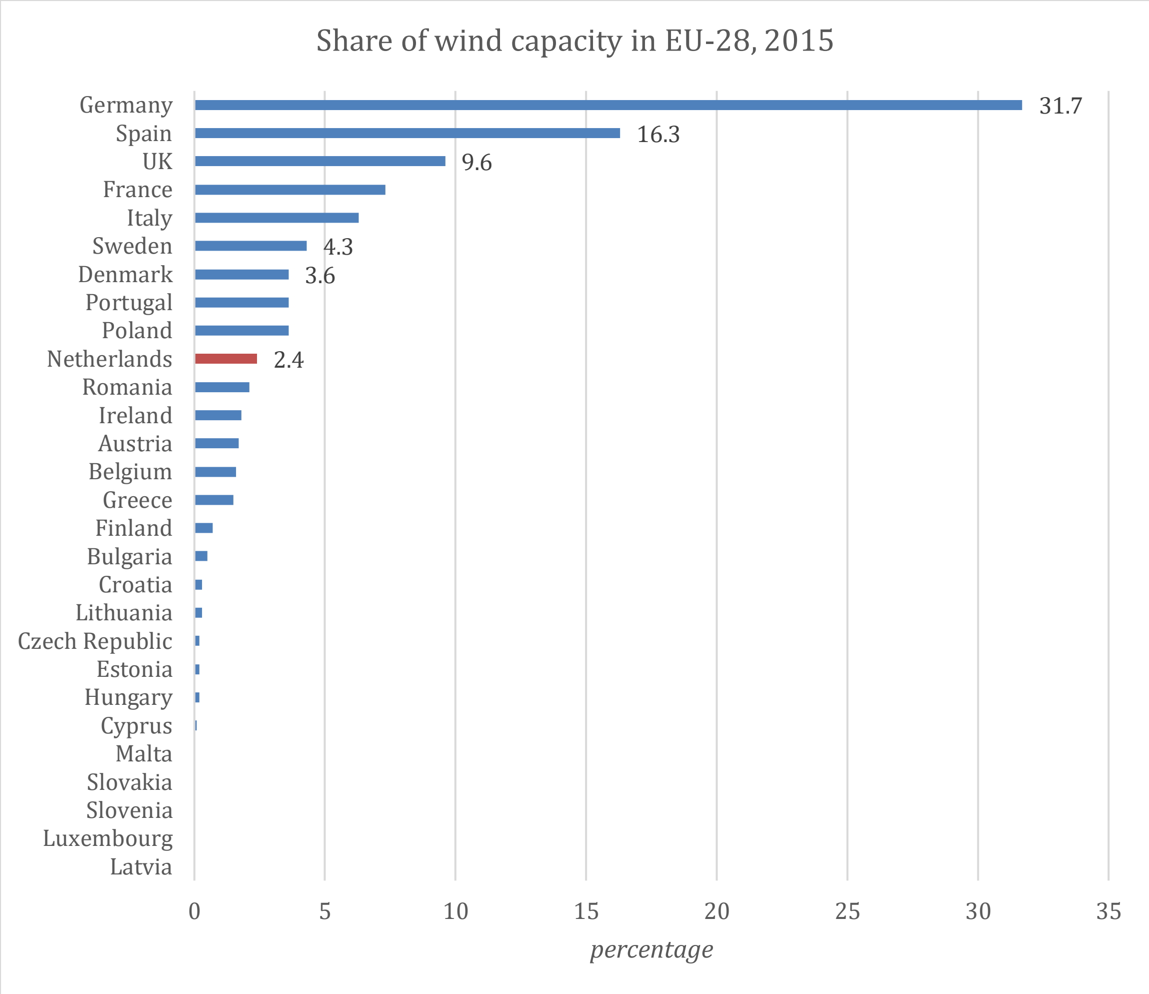

Fig. 7 - EWEA, Share of wind capacity in Europe- 28 in 2015

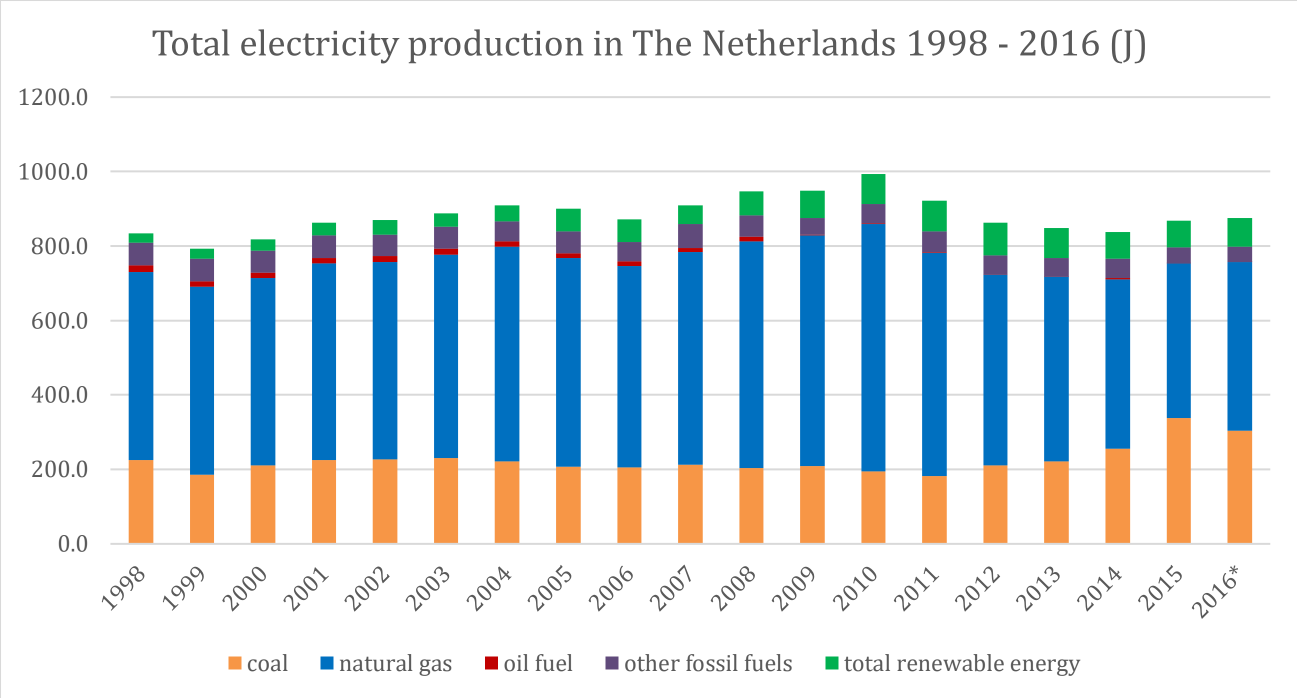

Fig. 8 - CBS, Total electricity production in the Netherlands, 1998 - 2016, in joule

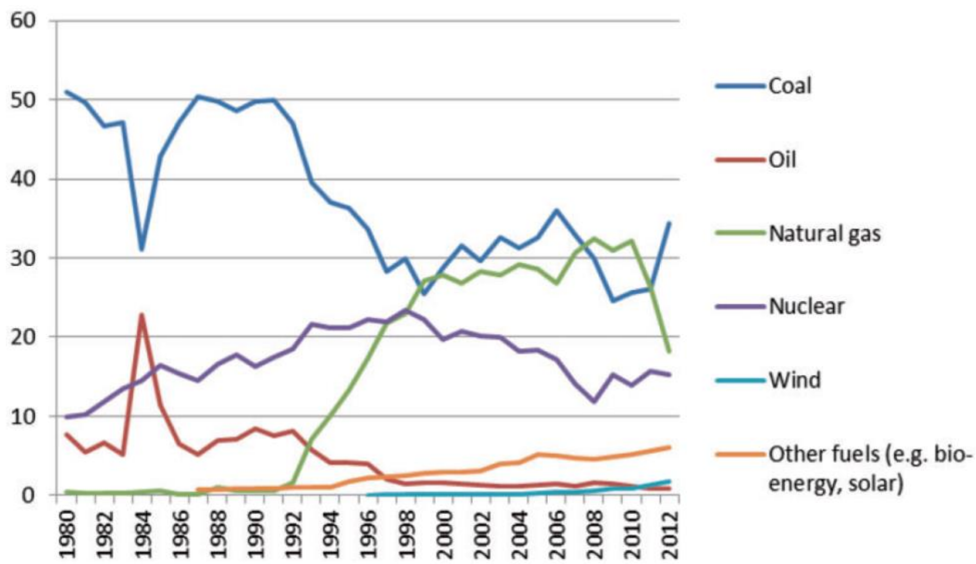

Fig. 9 - Geels (2014), Fuel input to central power generation in the UK, million tons of oil equivalent

	2016	2017
Germany	78,598	104,900
Spain	48,906	49,100
United Kingdom	37,367	45,510
France**	21,400	24,000
Italy	17,689	17,492
Sweden	15,479	17,100
Denmark	12,782	14,772
Poland	12,588	14,412
Portugal	12,474	13,040
Netherlands	8,170	10,223
Romania	6,590	7,100
Ireland	6,149	6,600
Belgium	5,436	6,174
Austria	5,235	6,100
Greece	5,146	5,676
Finland	3,068	4,802
Bulgaria	1,425	1,450
Lithuania	1,136	1,357
Croatia	1,014	1,107
Hungary	0,684	0,700
Estonia	0,594	0,700
Czech Republic	0,497	0,573
Cyprus	0,226	0,211
Luxembourg	0,101	0,211
Latvia	0,128	0,150
Slovakia	0,006	0,006
Slovenia	0,006	0,006
Malta	0,000	0,000
Total EU 28	302,893	353,472

Fig. 10 - Eurostat, Electricity production from wind power in the EU in 2016 and 2017 (TWh)

8.2 Appendix II

Table 3 - Interview questions

	INTERVIEW QUESTIONS FOR SEMI-STRUCTURED INTERVIEWS
1	The government has made a statement regarding the wind energy goal for 2020, that it will not be reached. However, the government is expecting to reach the goal for 2030. What should have been done differently to have reached the goal for 2020 and why would the goal for 2030 be reached?
2	Do you think that the government has played a role in the Dutch energy transition regaring renewables such as wind energy? (for example, the stop and go policies)
3	The Dutch government has implemented the diversification law after the oil crisis, would you say that this law has had an effect on the diffusion of renewables such as wind energy?
4	Would you say that the Dutch government and the industry are implementing a top-down or bottom-up approach?
5	Should renewable energy be organized from the local or regional level within the Dutch government?
6	Who should take responsibility for the renewable energy diffusion in the Netherlands?
7	What would you say are the main factors behind the slow diffusion of wind energy in the Netherlands?
8	What would be the main driver behind a wide wind energy diffusion in the Netherlands?
9	With the new law regarding the reducing of natural gas production and usage in the Netherlands, would you say this would have an effect on the diffusion and / or prioritization of renewable energy in the Netherlands?