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The Future of Sustainable Energy

The green transition for Europe's regions.
What are the obstacles, challenges and opportunities?

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Sustainable energy

What are the political possibilities and obstacles for the transition to renewable energy in different European regions?

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Abstract

The purpose of this study is to identify political obstacles to the transition to green energy in Europe. Previous studies have not fully analyzed political barriers blocking or frustrating the implementation of renewable energy on a regional level. To identify political barriers to renewable energy on a regional level, five European regions were examined by conducting interviews and reviewing literature. The authors hope the outcome of the research will guide European regions in the development of their energy policies and better equip them with expertise on regional best practices, as well as on how to avoid repeating past errors. The research findings were presented at the conference of the European Free Alliance and the Fryske Nasjonale Partij in Leeuwarden.

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Content

Introduction

The transition to renewable energy is motivated by a combination of both scientific and political factors. We currently possess knowledge about technological and economic dimensions of renewable energy that makes the transition technologically and economically feasible. However, in many situations, the sociopolitical climate hinders the actual implementation of this transition. Lack of financial resources and limited public acceptance are other factors that can obstruct a full transition from taking place.

Although emphasis is often placed on the economic and technical aspects of the transition to renewable energy, this study focuses on the sociopolitical obstacles encountered prior to or during the transition by answering the research question: What are the political obstacles to the transition to renewable energy? This paper defines political obstacles as any political elements that restrain or obstruct the transition to renewable energy.

Our study looks into renewable energy sources that are relevant in the context of the European Union (EU), like biomass, concentrated solar power, geothermal energy, hydropower, tidal energy, wave energy, and wind turbines.

The primary methods used for this research are case studies, literature review and interviews. To understand the transition to renewable energy and the political obstacles impeding its implementation, it is pertinent to analyze case studies of different regions by examining the transparency and efficiency of the implementation process and any barriers faced by authorities. The regions examined in these case studies are Friesland, Yorkshire, Flanders, Silesia and Galicia. These regions have been selected due to their affiliation with the European Free Alliance, a European political party. The findings in this report are based on interviews with relevant experts from the Netherlands, the United Kingdom, Germany, Poland and Spain.

Earlier research has looked at different barriers to renewable energy within Europe in different countries. Ecofys (2010) has done research on the assessment of non-cost barriers to renewable energy growth in EU member states, considering that financial support schemes and improving grid-access conditions for renewable electricity received the most attention over the past decade. These barriers, which include administrative hurdles, defficient grid connection, access barriers, limited information and lack of awareness, have severely impeded the transition to renewable energy.

Multiple studies have been done on renewable energy in the Netherlands. Agterbosch et al. (2004) conducted a technology-focused study on wind power implementation in the Netherlands. Others like Negro et al. (2008) have examined uncertainty as a barrier to the rapid diffusion of biomass technologies. Dutch renewable energy policies have been researched by Van Rooijen and Van Wees (2006). They address not only political barriers but also:

- The lack of stable renewable energy investments
- The failure of the Dutch government to reduce market uncertainties and build investor confidence due to unclear and unstable policy goals and procedures
- The lack of meaningful stakeholder participation in Dutch energy policy making

Verbong and Geels (2007) examined the ongoing energy transition in the Dutch electricity system. Their study displayed great pessimism regarding the following ten years of the transition, partly due to lack of awareness or concern about environmental issues and the resistance of local communities. They conclude that the Netherlands is not ready for radical changes in the system yet, but that it is important to keep radical ideas alive. Gommans, L.J.J.H.M. (2012) wrote guidelines for an optimal energy system and developed regional plans with case studies for Southeast Drenthe and Limburg, focusing mostly on spatial planning. The renewable energy policies of Spain and the Netherlands are addressed in the research of Dinica (2006).

A report by Alonso et al., describes the dramatic change that took place in Spain in 2012, when all subsidies for renewable energy were removed by an act of parliament, specifically RD 1/2012. As a result, it completely halted renewable energy developments and created considerable uncertainty for the future of renewable energy in Spain. Del Río and Unruh (2007) wrote about the different barriers to implementing wind and solar energy in Spain, such as high costs for solar panels and regional differences.

Various reports and studies have focused on energy sources in the United Kingdom. Data about renewable energy has been central to these reports. The Digest of UK Energy Statistics (DUKES) gives extensive data about past and present energy production. Lipp's (2007) study focused on policy and its effectiveness. It found that the UK's policy approach resulted in energy shortages, higher costs (compared to other countries) and lack of diversity in supply. A significant amount of research linked to renewable energy has focused on the effectiveness of technology, such as Lissaman's study on the effectiveness of wind turbines.

Many studies have focused on renewable energy in Poland. In 2017, as many as 42,100 studies related to renewable energy were published. When zeroing in on political barriers to renewable energy, the study of Stephens (2008) on the sociopolitical barriers can be taken as an example. Stephens proposes a systematic, interdisciplinary framework for an integrated analysis of regulatory, legal, political, economic, and social factors that influence energy technology deployment decisions at the state level. The aim of the study was to enhance awareness of the interconnections between these factors and to improve overall energy policy and planning, thus accelerating change in energy infrastructures. This study focuses on the United States, but it can serve as an indication of how to carry out similar analyses.

In 2016, the International Energy Agency (IEA) published a report on energy policies in Poland. This report analysed policies, sectors and technologies, stated relevant data, and provided recommendations for improving Polish energy policies based on IEA principles.

Since political debates in Poland have revolved around the negative impacts of coal, many reports have investigated the correlation between long-term exposure to urban air pollution and the relationship with life expectancy among 3.5 million people in Silesia.

In Belgium, a study by Reinhard Haas (2011) stated that the current system in Belgium has a rather complicated political structure. Haas outlines the current structure, stating that "the federal authorities are responsible for the national equipment programme in the electricity and gas sector, electricity generation (power stations), electricity transmission (high-voltage lines) and tariffs. The regional authorities are responsible for local transmission and distribution of electricity (under 70 kV), public gas distribution, cogeneration, promotion of renewable energy sources (RES) and rational use of energy (RUE)". This is a non-cost barrier to the implementation of renewable energy. Other barriers identified by the American Chamber of Commerce in Belgium (AmCham Belgium) include Belgium's unfavourable geology for energy resources. According to Haas et al. (2011), it was clear from the beginning that due to Belgium's small market, liquidity would also be a barrier to the implementation of renewable energy.

Methods

This study examines the political obstacles in the transition to renewable energy sources in Friesland, Yorkshire, Flanders, Silesia and Galicia, dedicating a separate chapter to each region.

These chapters are subdivided into the following sections: general profile of the region, history of the region's energy sources (including renewables), the current situation, and possibilities for the future and potential sociopolitical obstacles.

The primary methods used in this research are case studies, literature review and interviews. The findings in this report are based on interviews with relevant experts from the Netherlands, the United Kingdom, Germany, Poland and Spain.

For the case study of Friesland, interviews were conducted with three people: Johannes Kramer, a Frisian politician from the Fryske Nasjonale Partij and member of the provincial executive; Bouwe de Boer, an energy coordinator of the municipality of Leeuwarden and founder of Fossyl Fry Fryslân; and lastly, Jaap Koen Bijma, a guest lecturer and campaigner behind initiatives like Doarpswurk and MienskipsEnergie.

For Yorkshire, an interview was conducted with Chris Whitwood, deputy leader of the Yorkshire Party.

Another interviewee was Fernando de Llano Paz, a professor in energy studies at the University in Galicia. He also provided information about Spain and the region of Galicia.

The situation in Poland was discussed with Natalia Pińkowska, a political assistant from the Silesian Autonomy Movement (Ruch Autonomii Śląska) in the Silesian district, and with Ewa Kolka, a Polish architectural engineer.

Our interviewees provided us with insights into and perspectives of various institutions and political parties. The interviewees differ in areas of expertise; some work for local governments, others are employed in industry, and another group represents non-governmental organisations and academia. Where possible, two contacts were interviewed per case study in order to obtain a broader perspective on the topic. Information gathered from interviews was complemented by policy and legislative reviews and analyses of existing academic literature.

The following assumptions were made during the interview process:

- The interviewees were knowledgeable of the topics at hand
- The interviewees were truthful in their claims and assumptions
- The interviewees were who they said they were.

This research was done by a team of students that worked to the best of their abilities. The objectivity of the report is limited in that parts of it are based on input from individuals.

Regional case study

Friesland

General profile of Friesland

Friesland (Fryslân in Frisian) is a province in the northwest of the Netherlands. As of January 1st, 2017, Friesland has 646,874 inhabitants (CBS, 2017) on its 5,748.74-km^2 territory (Brouwers, 2009). Friesland is adjacent to the IJsselmeer in the south, the Wadden Sea in the west and borders the Waddeneilanden in the north, which is also connected to the North Sea.

The landscape of Friesland is characterized by open spaces and lakes. Within Friesland, there are four national parks: Schiermonnikoog, De Alde Feanen, Lauwersmeer and Drents-Friese Wold (Schroor, 1993). The landscape is divided into eight types in the 2007 regional plan (Streekplan 2007): the clay area, the moorland, the lake area, the hilly Gaasterland, the northern forests, the breeding area, the IJsselmeer region and the Wadden Sea islands (Provincie Fryslân, 2007).

The Netherlands is a constitutional monarchy with a democratically elected government. Those above eighteen years of age can vote for their representatives

Figure 1: Map of the Netherlands, showing the Friesland region in red.

in the legislative branch of power, which is called the Second Chamber (or the de Tweede Kamer in Dutch), the core of the national parliament, with 150 seats elected by proportional representation.

The Netherlands is a decentralized unitary state. Regions have different governmental bodies with limited authority in accordance with national law. Regions and municipalities are allowed to adopt rules independently and on their own initiative, but these can only apply within their own jurisdiction and cannot contravene national laws. The national government can undo rules that are in conflict with national legislation. This can result in different rules among similar municipalities.

There are twenty-four municipalities in Friesland. Friesland is governed by the provincial house (called the *provinsjehûs*) in Leeuwarden (*Ljouwert* in Frisian), the capital of Friesland. The regional legislative body currently has forty-three members, representing eleven different regional political parties. Elections take place every four years.

The official languages of Friesland are Frisian and Dutch. Friesland is the only one of the twelve provinces of the Netherlands to have its own recognized language.

Important actors:

- The national government in the Hague
- The regional government with eleven political parties (Het college van Gedeputeerde Staten)
- Twenty-four municipalities
- Businesses
- Local community

The history of Friesland's energy sources

The Netherlands

The Netherlands has been mainly using energy from fossil fuels since the 1950s. In that period, a massive oil and gas infrastructure was constructed, following the discovery of natural gas as an energy source. For decades, the Dutch energy demand was met by using fossil fuels, of which only a small amount were provided by sources from the Netherlands (Rotmans, 2010). In the Netherlands, wind power had a reasonably strong legitimacy in the late 1970s and early 1980s. Some demonstration projects in the early 1980s supported new prototypes and turbines in new applications, such as fiscal incentives and capital grants (Bergek and Jacobsson, 2003).
In addition, from 1986 onwards, investment subsidies were given due to a revived political interest in wind power after an energy cost crisis in 1984. Thus, a Dutch wind power market was formed that was larger than Germany's in the second half of the 1980s, with fifteen to twenty firms entering the wind turbine industry at the time.

The Dutch government has supported renewables with fiscal instruments (green funds, tax credits and an energy tax) since 1996. In 2001, as a follow-up to the new green energy market and the mandated share set by the energy companies, the government introduced a system for tradable green certificates. On July 1st, 2001, the market for green electricity became liberalized and consumers of green electricity were then free to choose their own suppliers, which resulted in an increase in the number of green consumers, which rose to 700,000 by the end of 2001 (Kwant, 2003). However, in reality this so-called "green" energy only has a small percentage of *actual* green energy. This is due to the fact that the green energy produced is put on the general energy network together with all other electricity sources. This makes it difficult to differentiate between green and grey electricity, since they both come from the same network (Gaslicht, 2017). Therefore, even though households and companies can freely choose the type of energy they would like to consume, it is difficult to ascertain whether the energy sources are actually green and renewable (De Boer, 2017).

With the 2005 Kyoto Protocol, EU member states had to reduce the emission of greenhouse gases by 5% (compared to 1990) between 2008 and 2012. The Netherlands aimed to reduce their emissions by 6%. This was implemented in the Dutch environmental policies (Greenpeace, 2008). Between 2007 and 2011 the Netherlands attempted to increase sustainable energy production by further developing wind energy technology and doubling their onshore wind energy potential (Ministerie van VROM, 2007).

On July 15th, 2008, 1.740 MW of onshore wind energy and 228 MW of offshore wind energy was produced (Wind Service Holland, 2008). However, in 2008 new goals were adopted in the National Plan of Action for Wind Energy (Nationaal Plan van Aanpak Windenergie). These goals consisted of four thousand MW in 2011 and approximately six thousand MW in 2020 of onshore wind energy. For offshore wind energy, goals were set at six thousand MW in 2020 (Ministerie van VROM, 2008). With this plan of action, wind energy would likely cover 30% of final electricity use (NWEA, 2008).

Renewable energy produced by wind and solar power over the last seven years in the Netherlands can be found in figure 2.

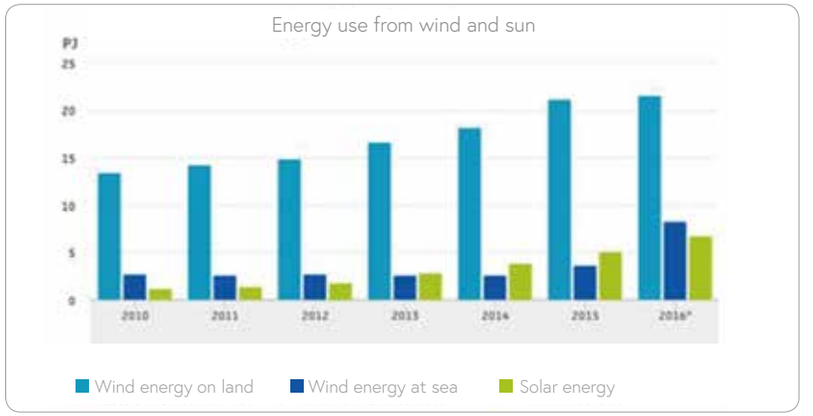

Figure 2: Use of wind and solar energy in the Netherlands (Gaslicht, 2017).

Friesland

Jolink (2009) researched the case of Friesland and looked at wind energy policies implemented in the different municipalities. In general, Frisian municipalities showed lower levels of ambition, meaning that the municipalities did have some goals for implementing wind energy, but did not have the means or time. Of the sixteen researched municipalities, ten municipalities had goals but no means, five had goals and means but no time, and only one municipality had goals as well as means and time.

One of the researched municipalities adopted a provision for financial compensation for residents and villages with regards to windmill implementation. They also created a village fund where a significant part of the income was used to benefit its inhabitants, while the rest was used to fund other sustainable projects and landscape development initiatives (Jolink, 2009).

The current situation

The Netherlands

The Netherlands is currently dependent on politically volatile countries for fossil fuels, making its energy supply highly vulnerable. However, fossil fuels are still essential in order to ensure affordable energy for households and companies. The fossil fuel-based energy supply is deeply embedded in Dutch society, making it difficult to change the current situation (Rotmans, 2010).

The Netherlands' 2020 target for renewable energy is 14% of all supply, which is significantly lower than the average target of 20% set by EU member states. For the Netherlands, and hence also for Friesland, it looks like the 2020 target will not be reached at the current rate of progress. This also applies to the 2020 goals for sustainable energy growth as mandated by the EU in 2013.

In 2012, the energy consumption of the Netherlands was based on fossil fuels such as natural gas, crude oil and petroleum products. Renewable energy and nuclear energy were less significant, with gross electricity generation of approximately 4.3% and 1.2% respectively. In 2011, 32.5% of all generated electricity was provided by cogeneration. This has remained at similar levels for multiple years now. Between 2008 and 2012, the share of renewable energy in gross final energy consumption grew from 3.4% to 4.5% (Eurostat). The electricity demand also declined by 1.5% between 2011 and 2012 (ACER/CEER, 2013), which is largely due to the economic crisis (Ministerie van Economische Zaken, 2012).

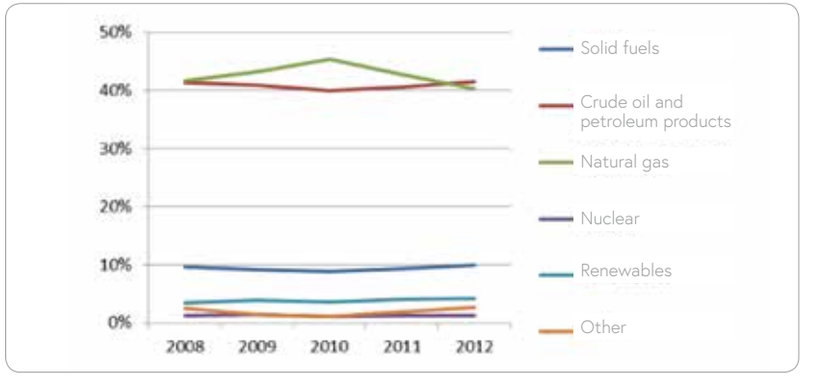

Figure 3: Gross electricity generation mix from 2008 to 2011.

Recently, natural gas production in Groningen has caused light earthquakes, giving rise to concerns about Dutch gas production. Subsequently, a reduction in gas production post-2017 was enforced.

In 2013, the Energy Agreement for Sustainable Growth was approved by more than forty social organizations, including local, regional and central governments. The aim of the agreement is to achieve a decrease in the final energy consumption of 1.5% annually and an increase of 14% in renewable energy generation by 2020, which corresponds to EU arrangements. The agreements also involved shutting down the five oldest coal-fired power plants in the Netherlands by 2017. After 2020, the long-term goal of reducing greenhouse gases by 80-95% is included in the agreement (SER, 2013).

Friesland

The majority of energy generated and consumed in Friesland is produced by fossil fuels, mostly gas or coal power plants. The rest is generated by renewable energy. The most common renewable energy sources in Friesland are windmills and solar

panels (Kramer, personal communication, 2017). Approximately 60% of all energy used in Friesland is gas, for domestic, industry, and transport consumption. The rest (40%) is electricity, gasoline and diesel. Approximately one third is used for transport, another third for households and the remaining third for industry, according to De Boer. However, at the moment approximately 7% of the energy is produced in a sustainable way. This has been achieved within the last twenty-five years and cannot be considered a transition (De Boer, personal communication, 2017).

According to Kramer, Friesland enjoys no financial benefits from investing in current energy sources like gas and oil. This is because Friesland is merely a consumer and has no connections with the gas and oil industry. For example, Friesland and Shell do not have any bilateral agreements, which prevents Shell from carrying out projects on Frisian territory. Instead, fossil fuels are imported from other regions merely for consumption (De Boer, personal communication, 2017).

Although Friesland does not currently benefit from the energy industry financially, there is potential for Friesland to experience financial gains in the future, as the region has many opportunities for renewable sources of energy, such as heavy wind at the coast, abundance of land availability for solar parks, and the potential for geothermal energy (De Boer, personal communication, 2017; Bijma, personal communication, 2017). With its use of biogas and energy-neutral housing, Friesland is already ahead of other regions. It is therefore possible that Friesland will experience further economic advantage in this area (De Boer, personal communication, 2017).

The extracting companies in the Frisian energy industry are mostly equitable to national operators such as Gasunie, GasTerra, Nederlandse Aardolie Maatschappij (NAM), Shell and others (Kramer, personal communication, 2017; De Boer, personal communication, 2017). Gas companies have a high interest in selling as much gas as possible and have strongly promoted the importance of gas within the region by disseminating vague statements like the so-called "green" energy example given above (De Boer, personal communication, 2017).

Changes over time

The Netherlands

In the Netherlands, the laws and regulations are conformable to climate change. In 2001, the project "Energietransitie" was set up with transition management but unfortunately it did not succeed and no real energy transition was supported by the Dutch government. Nevertheless, there has been a powerful societal transformation in the Netherlands regarding sustainable energy, the social dynamics of which have been growing, especially on a local scale (Rotmans, 2011). The explosion of approximately three hundred initiatives by local and regional energy corporations for decentralized green energy production that has taken place in recent years shows that the renewable transitions are not government-initiated but stem from the private sectors. These local actors require sound financial arrangements, reformed juridical barriers and a build-up of social networks to develop their ideas and projects. Many of these projects are held up by stragglers like oil companies who block the transition to renewable energy. There is a distinct need for solutions to these problems in the oil and gas industries because according to De Boer (personal communication, 2017) this is where conflicts are likely to arise.

Over the past few years, there has been a slow transition to renewable energy in the Netherlands. In 2010, 10% of all the energy in the Netherlands was green and in 2015 this percentage increased to 15%. This is an increase of 1% per year, which is not fast enough to be considered a progressive green transition (De Boer, personal communication, 2017).

Another problem is the low rate of renewable energy production in the Netherlands, which is not high enough for the demands of the Dutch consumers. Some energy suppliers choose to import renewable energy from foreign countries for this reason, such as hydroelectric energy, which is imported from Scandinavia (Kroon, 2002).

Friesland

The use and exploitation of energy sources in Friesland has undergone several shifts over time (Kramer, personal communication, 2017). Initially, coal and peat was used, which was very damaging to the environment. The region switched to electricity after World War I and began using natural gas in the period between 1960 and 1970, before shifting to gas and the renewable energy sources that are used today.

Due to the exploitation of energy sources, a shift to renewable energy is now of significant urgency. Kramer states that with new technological advances, the potential for the extraction of fossil fuels will broaden. In addition, more efficient engines can also help delay the depletion of the current non-renewable sources.

In 2010, Bijma observed a peak in discussions about the transition towards renewable energy. Discussions on the topic are currently on the rise again. De Boer (personal communication, 2017) has also noticed an increase in the demand for sustainability in the last two years. As society learns from past mistakes, a positive shift in societal perception of the possibilities of sustainability becomes more apparent.

Apart from the environmental arguments for the transition to renewable energy, there are also economic factors to keep in mind. The transition can lead to a circular model, which would be better than the current one from an economic perspective as well (Bijma, personal communication, 2017). For example, some companies incorporate more sustainable business strategies even when there is no demand to do so (Bijma, personal communication, 2017). Another motivation for the transition is public perception: many institutions such as schools and large companies want to be seen as sustainable. For example, the dairy company FrieslandCampina has taken initiative by implementing energy-neutral methods of farming and production, incorporating greater biodiversity, and using less medicine and greener transport (De Boer, 2017). Another example are car companies that are beginning to only produce electric cars. In 2017 the Dutch government ruled that gasoline or diesel cars will not be allowed to be sold after 2030 (De Boer, personal communication, 2017).

At the moment there are approximately two thousand cars driving on biogas and twenty-two gas stations in Friesland. Biogas production in the region started twelve years ago, when there were no gas stations in Friesland. Today, it is an extremely lucrative production, the benefits of which remain within Friesland, making it a potentially important industry for the region. In the last twelve years, all stakeholders have been brought together. If they were to craft a joint plan for effective production, sales and consumption, the result would be a circular economy (De Boer 2017). The import of fuels for cars would not be needed anymore and the industry would inject be beneficial to Friesland's economy (De Boer, personal communication, 2017).

The same is true for housing in Friesland, which could also benefit financially from sustainable projects. Construction companies are currently renovating existing houses to make them energy neutral. So far, approximately one hundred rented houses are being renovated in this way per year. This new movement allows people to invest in sustainable energy rather than paying for fossil fuels and also generates construction jobs (De Boer, personal communication, 2017).

Other subjects that have been gaining traction in recent times are transparency and locally produced energy, such as that produced by neighbouring fields of solar panels. One example of this is the Mienskips Energie initiative, which provides opportunities for local energy production, thus benefiting the economy of the Frisian region. Other positive benefits of this initiative are the local support and involvement it generates. The government should place greater emphasis on local cooperation, as this has been neglected in the past (De Boer, personal communication, 2017).

While some solutions are being sought at the government level, with lobbying for instance, there is also an increase in individuals seeking locally-initiated solutions by introducing different laws. In order to find a balance, a combination of bottom-up and top-down approaches are needed, which would in turn result in an inside-out approach (Bijma, personal communication, 2017).

The future of Friesland

The Netherlands

The Netherlands is predicted to stop producing natural gas by the year 2030, when the energy demand will be covered by local conversions to mostly wind and solar energy. If the coverage becomes insufficient for the demand, there will be a reversion to the national gas supply and, as a last resort, to the international electricity network. The emphasis will be on regional independence and efforts will be made to transition to a sustainable energy system that is:

- Based on reducing energy use and raising its efficiency
- Based on renewable energy sources
- Using the qualities of energy
- Using local resources

In Dutch energy developments, natural gas is seen as the transition fuel, as its reduction would lead to a stronger transition towards renewable energy.

The remaining natural gas infrastructure and equipment can then be used for purified biogas as a renewable energy source and for energy storage. This indicates that methane gas production from biological residues is a potentially important energy source for the Netherlands (Gommans, 2012).

Friesland

As reported by Kramer (personal communication, 2017), a sizeable part of Friesland will no longer be dependent on fossil fuels in twenty to thirty years. Given that conditions for current energy sources will change in the future due to exploitation, Friesland must change its current sources. It is important to utilize a mix of renewable sources and fossil fuels, because there is not one solution. There are also other energy sources that could be interesting for future development (Bijma, personal communication, 2017), such as geothermal sources, tidal centres and the interaction of salt and fresh water, all of which are still in an experimental stage. While these three sources are already being used on a small scale, further testing is needed to prove they are suitable and effective for Friesland. Geothermal energy is geographically suitable, due to the low-altitude and deep soil of Friesland. Earth warmth is is an interesting but limited energy source (Kramer, personal communication, 2017). According to Kies (2005) it is likely that there will be sufficient high-temperature geothermal heat available. De Boer states that thermal heat is the second most important potential energy source in Friesland, after wind energy. However, this energy source is relatively new and Frisians are generally hesitant to try new techniques (De Boer, personal communication, 2017).

In practice, Kramer expects most energy to be derived from the sun and wind. Solar panels are increasingly common and windmills are also on the rise, especially at sea, due to the fact that onshore wind energy is harder to implement in Friesland (Kramer, personal communication, 2017). Onshore windmills are not favourable in Friesland, due to politicians who ended the discussion on the matter for fear of losing public support (De Boer, personal communication, 2017). Kramer of the Frisian National Party (Fryske Nasjonale Partij, FNP) stated in an interview that the vision of the FNP is focused on "generating energy in a sustainable way that does not devalue the landscape". The FNP wants to find solutions to achieve this vision by reaching climate goals without the industrialization of the landscape. De Boer (personal communication, 2017) says that although there are possibilities for offshore windmills in Harlingen and Den Helder, there are no plans to expand to a bigger scale in Friesland. Because of political obstacles and a lack of social support, Friesland is, for the most part, twenty years behind with regards to important wind power achievements (De Boer, personal communication, 2017).

The political obstacles in Friesland

This section details the political obstacles to the transition to renewable energy both in Friesland and the Netherlands. Instead of separating the obstacles for the region from those of the country, as has been done for the other regional case studies, obstacles will be divided by type.

Misinformed users of green energy

As mentioned previously in this report, many energy suppliers in the Netherlands spuriously claim to provide green energy whereas in reality they often supply a mix of green and grey energy. Although the government has set up energy labels for energy suppliers – which consumers can check every year – not much is being done about it, because many consumers still do not check these labels (De Boer, personal communication, 2017; Gaslicht, 2017).

The energy supplying industry places business before the environment

The energy supply system also impedes the transition to renewable energy, prioritizing their financial objectives before the environment. The government currently subsidizes green energy for companies and households, giving discounts for installing solar boilers on roofs, for example, provided there is still money for this in the subsidies budget (Rijksdienst voor ondernemend Nederland). However, people are advised by energy companies not to put more solar boilers on their roof than they need because it is not beneficial for them financially, as it is more profitable for energy companies if consumers use a lot of energy. Energy companies buy energy from an energy producer and resell it at a higher price, adding fixed costs for energy transport as well. This approach impedes the green energy transition from producing as much green energy as possible and consuming as little grey energy as possible in the Netherlands. These examples illustrate that the energy supply industry is currently a business in which energy companies try to make as much of a profit as possible, at the expense of the environment.

Lobbying

Exploiting companies of the energy industry also pose an obstacle. The energy transition is slowly being overtaken by the gas and oil regime. This regime and its lobby involved themselves in the energy transition and have since steered the transition agenda (Rotmans, 2011). The large lobby of exploiting parties in the Hague—which local initiatives and smaller companies do not have—blocks local initiatives of small groups attempting to trigger a green energy transition. Nevertheless, although bringing together these conflicting perspectives is difficult, there is still potential for collaboration between local initiatives and large companies (Bijma, personal communication, 2017).

Frisian societal resistance to national governmental policy

Societal attitudes towards renewable energy sources in Friesland present a number of obstacles. Firstly, when the Dutch government signed the climate agreement in which they aimed to implement more wind energy in the Netherlands, Friesland was made to implement 6000 MW of windmills, despite difficulties achieving this on land. Although Frisian society wants to invest in renewable energy, they want to do so in a way that suits the region, and the plans from the government in the Hague are perceived to be ill-suited for Friesland, resulting in resistance and a lack of societal support. There is currently a great deal of opposition against renewable energy projects in Friesland. In addition to Kramer, Wüstenhagen's 2007 research found that lack of social acceptance can impede the implementation of renewable energy sources – especially wind energy – in the UK, the Netherlands, Switzerland and France. Debates between policy makers and society occur both on a local and a national level (Wüstenhagen, 2007). According to De Boer (personal communication, 2017) local support is not the most influential obstacle, however, although he believes the government should ensure it does not become a larger obstacle.

Perceived lack of urgency

Another obstacle is the lack of urgency perceived within Friesland for the transition to renewables. According to De Boer (personal communication, 2017) this is because goals have been targeted for the year 2050. There is no sense of urgency among society and governmental officials for the implementation of renewable energy at the moment. Greater pressure and a sense of urgency are needed in order for the community to accept change (De Boer 2017). Although climate change has been discussed for over thirty years, local communities do not perceive any direct effects. De Boer thinks that public opinion will change eventually, although unfortunately people will have to be directly exposed to the effects of climate change for them to realize the urgency of implementing renewable energy. It is also worth noting that climate change is a global problem, and as such, it can feel like an overwhelming issue for one region to take on. The earthquakes in Groningen mentioned previously are a symptom of adverse effects of fossil fuel consumption that have been felt by the Dutch community very directly and have awakened some consciousness of the problem.

Unbalanced factors

Unbalances within the triple bottom line decision-making framework—which can be broken down into the three Ps: planet, people and profit—are another obstacle. While these three factors should be in balance, profit is currently dominating. This is seen at every level but is especially evident in government systems, which hinder the transition to renewable energy (Bijma, personal communication, 2017). While local initiatives are providing a more holistic internal perspective that takes all three factors into account, the government is focusing mainly on collaboration and companies are focused on finances. Despite profit being the dominant factor, Frisians have difficulties identifying business potentials such as biogas production and energy-neutral houses – industries that Friesland is currently leading. De Boer states that Frisians tend to shift this task from their responsibility list and are quickly satisfied. An interesting point of research could be to question who should be responsible for translating potential businesses into a reality (De Boer, personal communication, 2017).

Systemic problems

Although local initiatives towards renewable energy are rising in Friesland, they are not supported by the current conservative government, according to Bijma (personal communication, 2017). This is because of the Netherlands' investment in education has resulted in innovative citizens who think independently, while the government remains conservative in its position and interests. Bijma (personal communication, 2017) states that the system is outdated. These conflicting stances pose a

problem, because a transition requires full cooperation from all parts of society and there is currently a distinct imbalance between the government and individuals (Bijma, personal communication, 2017). The lack of social organizational support is thwarting the energy transition, exposing a need to invest in environmental awareness initiatives. There is also a need to invest in new systems, as energy transition goes hand in hand with democratic renewal. Current government workers will be resistant to change, as they have specific expectations for their next four years in government. Bijma (2017) argues that Denmark can be an interesting model for Friesland, having implemented innovative systems in a forward-thinking manner (Bijma, personal communication, 2017).

Potential conflicts with the fossil fuel industry

To prevent future conflicts, the status of companies in the current fossil fuel industry must be addressed. Given that the fossil fuel industry will slowly disappear or transform over the years, it is difficult to make plans for these industries or predict what will come of them in the future. One possibility is that these companies may no longer have an interest in Friesland in the future, as they will not be extracting or producing on Friesian territory anymore (De Boer, personal communication, 2017). The institutions connected to fossil fuels are also in conflict with conservative people and business models, who will need to change their attitudes towards renewable energy for a transition to occur on that level. There is a small but growing number of people within these institutions who are beginning to accept the need for a transition to renewable energy sources. Attitude changes of this sort are difficult because of the continued demand for the old business system. This indicates the need for a change in the economic demand (Bijma, personal communication, 2017).

Potential conflicts in the forcefulness of the national government

Kramer (personal communication, 2017) has also identified potential political conflicts that may arise as pressure to reach climate goals increases. Kramer believes the new Dutch government plays an important role in the achievement of climate goals. For example, if the national government were to force Friesland to implement renewable energy sources like installing windmills over a short period of time, it would be difficult to achieve due to the lack of support from local society.

Regional case study

Yorkshire

General profile of Yorkshire

Yorkshire is formally known as the County of York. It is the largest historical English county and is part of the United Kingdom (Bartholomew, 1887). Yorkshire was originally a combination of the three subdivisions called ridings; North Riding, West Riding and East Riding. York, being the county town (capital) of Yorkshire, did not form part of the ridings but was part of Yorkshire. In 1974, the Local Government Act divided the three ridings into four counties: North Yorkshire, West Yorkshire, South Yorkshire and Humberside (the Yorkshire Ridings Society). Humberside included most of what was once the East Riding of Yorkshire plus the top part of Lincolnshire. In 1996 Humberside was divided and renamed. The area south of the River Humber was split into North Lincolnshire and North-East Lincolnshire, and the area to the north of the river was renamed the East Riding of Yorkshire. In most reports there is a section called Yorkshire and the Humber. This is the traditional Yorkshire and also North Lincolnshire and North East Lincolnshire (Whitwood, C. 2017).

Fig 4. Map of the UK with Yorkshire highlighted
Source: Dr Greg, Nilfanion and MRSC.

Yorkshire's eastern border lies along the North Sea and has a 72-km-long coastline. It has two complete National Parks within its boundaries: the Yorkshire Dales and the North York Moors, covering 1,762 km^2 and 1436 km^2 respectively (Yorkshire Times). Yorkshire has various rivers, such as the River Ouse and the River Swale.

The United Kingdom of Great Britain and Northern Ireland has the following governmental structure: Every five years a new House of Commons is selected, as dictated by the Fixed-term Parliaments Act of 2011. The executive authority lies with the monarch, which is exercised by the prime minister and the Cabinet. The Cabinet is the supreme decision-making committee that consists of the prime minister and the most senior ministers. The government is led by the prime minister, who in his term selects the remaining ministers. The ministers of the governments all are in the parliament (National Archive, 2012).

Yorkshire itself has no overarching regional government. The different levels of local government division are complicated, as Yorkshire is not considered as one. A quick overview is given in figure 5 (Whitwood, 2017). Yorkshire has various power stations with different types of fuel (Department for Business, Energy & Industrial Strategy, 2017). The region of Yorkshire and the Humber produces 15.83% of the national energy within the United Kingdom (Department for Business, Energy & Industrial

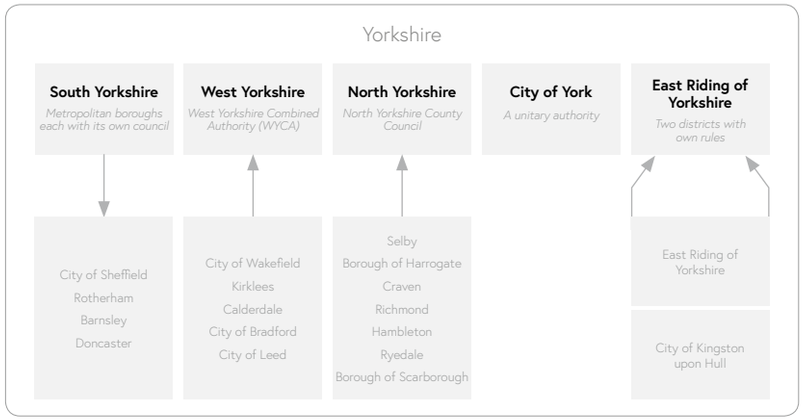

Figure 5: Flowchart of Yorkshire's governance system.
Source: Chris Whitwood; chart made by E.C. de Groote.

Strategy, 2017).

Actors:

- European Union
- The central government of the United Kingdom
- The councils within the region of Yorkshire
    - Council of
        - City of Sheffield
        - Rotherham
        - Barnsley
        - Doncaster
    - West Yorkshire Combined Authority
    - North Yorkshire County Council
    - East Riding of Yorkshire
    - City of Kingston upon Hull
- Businesses such as:
    - Drax
    - Siemens
- Local communities

The history of Yorkshire's energy sources

Historically, energy consumption in Yorkshire and the United Kingdom has been largely focused on coal.

Coal in the United Kingdom

Coal mining in the UK began in the 13th century (National Coal Board, 1950). The mining industry boomed in the 19th century, when the industrial revolution demanded an alternative to wood for firing the steam engine. This was necessary because meeting the demand with wood required use of the entire English farmland area (Clark & Jacks, 2006).

After 1912 coal production output decreased from 292 million tonnes, dropping to four million tonnes in 2016 (Department for Business, Energy & Industrial Strategy, 2013, updated 2017). There are multiple reasons for this. To begin with, numerous coal mines have closed in the UK over the years. In the 1990s there was a desire to switch to cleaner energies, with power stations switching to gas and biomass. To this day, coal, biomass and CCGT (gas) still constitute the largest percentage of energy production within the UK.

Coal in Yorkshire

Coal-dependent industries have switched towards cheaper imported coal. In 2001, the import of coal exceeded its production within the United Kingdom for the very first time. In 2003, there were three deep-pit mines: Hatfield and Kellingley Collieries in Yorkshire and Thoresby in Nottinghamshire. Hatfield, Kellingley and Thoresby were shut down in 2015 due to lack of coal demand (Esoteric, 2016) (*Yorkshire Evening Post*). In 2015 a march was held in Yorkshire to protest the closing of the last deep-pit coal mines (BBC news, 2015).

Coal mining is still an important industry in Yorkshire. Drax, a power station in North Yorkshire, has the highest generating capacity in the United Kingdom and the second largest in Western Europe. Eggborough is another power station that uses coal as its source. Drax and Eggborough have a high installed capacity: 1980 MW and 1960 MW respectively (Department for Business, Energy & Industrial Strategy, 2017).

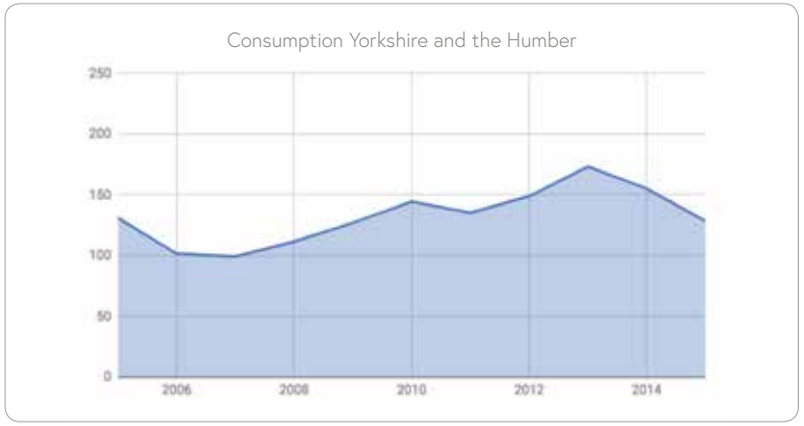

Figure 6: Consumption of coal within the region Yorkshire and the Humber.

Coal consumption within Yorkshire and the Humber for the period from 2005 to 2015 can be seen in figure 6. As can be seen from the graph, consumption fluctuates but stays relatively stable, so although coal production has decreased significantly, coal consumption within Yorkshire can be expected to stay stable, relative to the production of coal (Department of Energy & Climate Change, 2012).

History of renewable energy in the United Kingdom

Coal has always been a very important industry in the United Kingdom, but the renewable sector within the UK has become an increasingly important part of energy production and consumption. The United Kingdom has historically relied on fossil fuels for energy production and has had difficulties boosting the renewable energy sector. However, since 2000 the UK's renewable energy consumption has been steadily increasing, due to national and international incentives such as the EU Renewable Energy Directive. The United Kingdom has employed various combinations of renewable technologies, with biomass being the key fuel source in both electricity and heat generation (Department for Business, Energy & Industrial Strategy, 2017).

Renewable energy policies in the EU, the UK and Yorkshire

In April 2002, the Renewable Obligation (RO) came into effect, obligating electricity suppliers to have a set amount of renewable production or pay a penalty in return. Eligible sources for RO's according to the UK rule are wind energy, bioenergy, hydro energy, photovoltaics, wave and tidal energy, and deep geothermal energy. The value of the RO since 2009 can still vary. For example, onshore wind energy gets a 0.9 ROCs/MWh while sewage gas receives 0.5 ROCs/MWh. This value difference is called banding. All ROCs and their banding can be found in the main report of the Digest of UK Energy Statistics (Department for Business, Energy & Industrial Strategy, 2017).

In March 2007 the European Council agreed to find a strategy to tackle climate change. As a result of this agreement a Renewable Energy Directive (RED, Directive 2009/29/EC) was established. In this directive it was decided that by 2020 a total of 20% of the EU's energy should come from renewable sources.

From that moment, each member state was tasked with creating a National Renewable Energy Action Plan. As part of this plan, the UK set the ambitious goal of exceeding EU's required 20% increase in renewable energy, aiming for a 30% increase (Regional Renewable Statistics, 2017). The EU target of 20% was shared among all member states. The UK therefore has a 15% share that must be renewable by 2020.

In December 2015 the United Kingdom signed the Paris Climate Agreement, together with 194 countries. In combination, the Paris Agreement and the EU Renewable Energy Directive have pushed the increase in renewable energy sources within the United Kingdom over the past few years (The Digest of UK Energy Statistics [DUKES], Department for Business, Energy & Industrial Strategy, 2017).

Renewables in Yorkshire

While Drax is an important power station in Yorkshire and the largest energy producer in the UK, as explained previously, it has also set the first stones on the path towards renewable energy in the UK. In 2012 Drax changed three of its six production units to biomass after obtaining confirmation from the government (International Energy Agency, 2009).

It is apparent from looking at figure 7, which illustrates the energy consumption of Yorkshire and the Humber, that bioenergy and waste (shown in red) is on the rise in comparison to coal (shown in blue).

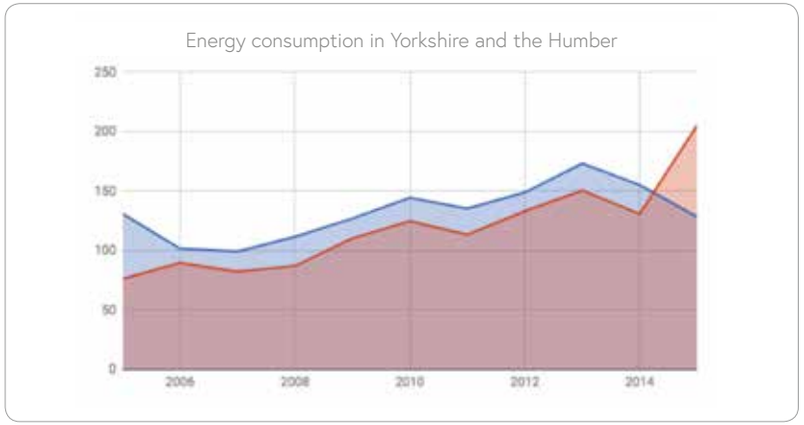

Figure 7: Consumption of coal and bioenergy within the region Yorkshire and the Humber.
Source: Data from gov.uk. Made by E.C. de Groote.

The rise of renewable production and consumption in the region is ostensibly due to governmental policies such as the closing of coal mines, among other factors.

In December 2015 the UK government reduced financial aid for solar power for households by 64%. While this affected the use of solar power within the UK, it does not seem to have directly influenced solar production within Yorkshire and the Humber. The solar power produced between 2010 and 2016 is plotted in figure 8 (Department of Energy & Climate Change, 2012). This graph indicates that the increasing amount of solar power has not been affected by UK cuts in financial aid. However, it is important to note that the graph shows only the region of Yorkshire and has very few datapoints after 2015, when the decision to cut subsidies was made.

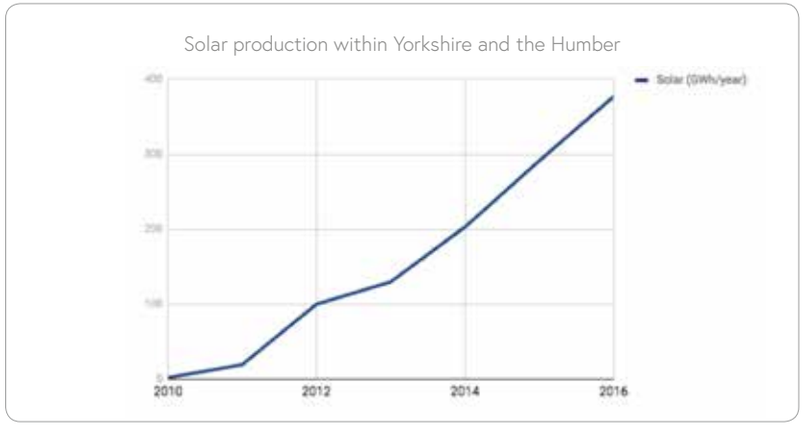

Figure 8: Solar production within the region Yorkshire and the Humber.
Source: Data from gov.uk. Made by E.C. de Groote.

The current situation

United Kingdom

Fuel-based energy production in the United Kingdom is partly renewable and partly non-renewable. Renewable energy is defined in the Oxford Dictionary as "Energy from a source that is not depleted when used, such as wind or solar power." Energy production in the UK is spread over the following non-renewable sources: coal, closed-cycle gas turbines, gas, gas oil, and open-cycle gas turbines (DUKES, Department for Business, Energy & Industrial Strategy, 2017). They are considered non-renewable as they deplete with use. Energy production via biomass, wind, solar photovoltaics, geothermal, hydro, shoreline wave and tidal power falls under the category of renewable energy. However, biomass can be considered both renewable and non-renewable.

Biomass is sometimes considered a renewable energy source because its inherent energy comes from the sun and because it can regrow in a relatively short time, and as such is a non-depleting source. If biomass feedstock is not replanted as fast as it is used, biomass energy becomes a non-renewable energy source. Renewable sources are often confused and seen as carbon neutral. Biomass is an example of an energy source that is neither renewable nor carbon neutral, as its renewability is

dependent on the way it is harvested, transported and replanted. In 2014, the U.S. Environmental Protection Agency (EPA) stated that "carbon neutrality cannot be assumed for all biomass energy a priori" (BBC News, 2015).

As part of the United Kingdom's adhesion to the Paris Agreement it has promised, together with other states, to respond to the threat of climate change and limit global warming (Rogelj, 2016). The State Secretary has stated that the United Kingdom will undertake serious actions to reduce the carbon emissions to fulfill its obligation towards the Paris agreement (Wilson, 2016).

Greg Clark, secretary of state for Business, Energy and Industrial Strategy stated: "My priority is to ensure that our country has the electricity it needs to meet all of our needs at the lowest possible cost and to ensure that we decarbonize our energy supplies in line with the UK's legally-binding commitments" (Wilson, N. 2016).

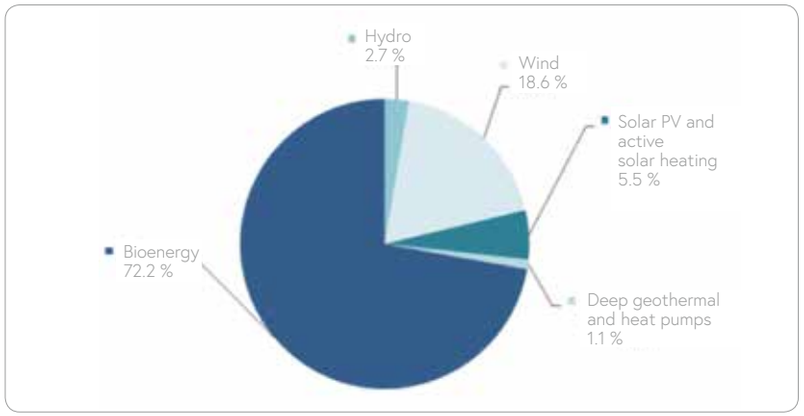

Figure 9: The use of renewable fuel in the United Kingdom in 2016.
Source: gov.uk (DUKES) [7].

Bioenergy is currently the main renewable fuel in the United Kingdom, as seen in figure 9. Bioenergy fuel is transportable and 27% of the bioenergy in the UK is imported. As much as 61% of plant biomass, such as wood pellets for electricity generation, is imported (DUKES, Department for Business, Energy & Industrial Strategy, 2017). Although these imported pellets are counted as renewable, their transportation could require the use of large quantities of non-renewable energy.

Given that more than half of the plant biomass is imported, it is doubtful whether biomass can be considered to be renewable. This depends on the distance traveled and if the mode of transport creates a large carbon footprint, and if it uses fossil fuels. When transport with fossil fuels is needed to produce energy with biomass, the biomass itself can no longer be considered renewable. In addition, the replacement of used biofeedstock must be planted as fast as it is used in order for the biomass to be considered a renewable source (DUKES, Department for Business, Energy & Industrial Strategy, 2017; (International Energy Agency, 2009). As 27% of bioenergy needs imported feedstock that is transported in ways that are powered by non-renewable energy, it can be considered a non-renewable source.

The UK's bioenergy strategy recognizes that an analytical approach is needed to provide further evidence of the wider impacts of bioenergy policies (Government of the United Kingdom, 2012).

Since 2015, the use of some renewable energy sources has increased while others have decreased. The consumption of renewable sources has gone from 8.2% to 8.9%, and electricity generation from renewable sources has dropped by 0.2%. Onshore wind generation has fallen by 8.4%, offshore by 5.8%, and generation from hydro sources by 14%. In turn, renewable heat has increased by 12%. The Renewable Heat Incentive supported 15% of renewable heat in 2016, which is an increase of 4% (DUKES, Department for Business, Energy & Industrial Strategy, 2017).

The changing political landscape of the United Kingdom is also relevant to the topic at hand. In 2016 a referendum took place in which 51.9% of the participating UK electorate voted to leave the EU in what has come to be known as Brexit. This will bring about many consequences for both the country and the energy industry (Foster, 2017). Rachel Kyte—chief executive officer of Sustainable Energy for All, and special representative of the United Nations Secretary General for Sustainable Energy for All—states that while the ways in which Brexit may influence energy productivity in the United Kingdom are still uncertain, it could potentially be very destructive for the transition to renewable energy (Vaughan, 2017).

According to the the EU Renewable Energy Directive, 15% of the energy production within the United Kingdom was set to be renewable by 2020. These targets are specified per nation and the collective EU requirement is to fulfill at least 20% of the total energy in order to be renewable (European Commission). Now that the United Kingdom is set to leave the EU, it is uncertain whether this target will be reached.

In addition to Brexit, there are many other factors that can influence the transition to renewable energy in the UK, which are covered more thoroughly in the section on "The future of Yorkshire". The UK government is currently working on an energy report that will indicate how the UK must proceed with regards to its energy strategy and will have a significant impact on future policies.

Yorkshire

Yorkshire has various energy sources and power stations. The total energy production within Yorkshire can be seen in figure 10. The percentage of energy generation and the power stations operating in Yorkshire in 2017 can be found in table 1, in the appendix. The table shows that no coal stations have opened since 2000. Most new power stations have had to deal with the tradeoff of carbon reduction.

The power plant with the highest installed capacity is Drax. Drax is a major coal power plant but has converted half of its production to biomass. In 2012 Drax got a confirmation of support from the government to start moving towards biomass. Andy Koss, CEO of Drax Power, said that Drax would like to convert the other half from coal to biomass as well (*Yorkshire Post*, 2017). Like Greg Clark, Andy Koss says there are three focus points that constitute a trilemma (said of a situation in which the goal is to achieve three aims but it is only possible to achieve one or two of them at a time). According to Koss, the three main goals are to bring carbon emissions down, to make bills affordable for citizens, and "to keep the lights on" (*Yorkshire Post*, 2017).

There are various forms of renewable energy production in Yorkshire. A great deal of the energy production industry is located within Yorkshire. The Port of Hull, also called the Green Port, has both production assembly lines and education initiatives focused on the energy sector. The Green Port is supported by businesses and by the university, together with the regions. Blade manufacturing takes place, very close to the North Sea, where an offshore wind park has settled (Green Port Hull). The Green Port employs mainly wind energy. There are also solar farms within Yorkshire. Ice cream producer Mackie's of Scotland has a solar farm called the Weidenhammer Solar Farm, with a capacity of 0.515 MW (Super User; renewablesmap).

Fracking is also being implemented in Yorkshire. Fracking is a technique used to recover gas and oil from shale rock. In September 2017 the company Third Energy began to build a fracking site at Kirby Misperton. While fracking is supported by the central governmental, many public uprisings and protests against it have taken place. This public opposition has made it hard to develop shale gas exploitation in the UK (Perraudin, 2017; *Yorkshire Post*, 2017; Whitwood, 2017).

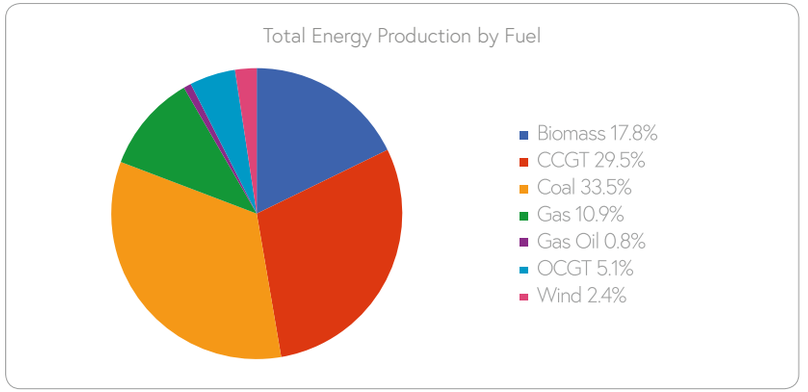

Figure 10: Yorkshire's total fuel-based energy production, May 2017.
Source: Information gov.uk (DUKES). Made by C. Whitwood.

The future of Yorkshire

Examining the history and the current situation of both Yorkshire and the United Kingdom allows us to make some prediction about the future of renewable energy on a regional and national level.

United Kingdom

In his interview, Chris Whitwood predicted that Brexit will cause a great deal of instability and insecurity. He expects this will have an impact on investments in the energy industry in general and renewable energy in particular. He is not alone in this prediction. Many energy industry experts and workers foresee problems within the industry due to the insecurity caused by Brexit (*Yorkshire Post*, 2017) The CEO of Drax has stated that security is essential for the energy industry, as large capital-intensive industries require certainty over ten or fifteen years. It is not yet clear what Brexit will mean for the energy industry in terms of the internal European energy market.

Despite the uncertainty caused by Brexit, some predictions can be made with confidence, for instance regarding the United Kingdom's aim to be coal free by 2025 (Vaughan, 2016; Evans, 2016). In November 2015, the government stated it would consult proposals to end unabated coal by 2025. On November 9th, 2016, the Department for Business, Energy and Industrial Strategy (BEIS) published a consultation that aimed to seek ways to ensure the use of coal in the United Kingdom is phased out by 2025 (Department for Business, Energy & Industrial Strategy, 2017; Vaughan, 2016; Evans, 2016).

Another development that can be expected after examining trends within the United Kingdom over the past few years in addition to governmental ambitions, is that the use of biomass and gas will increase, as a replacement for coal (Whitwood, 2017).

The UK has created an action framework that focuses mainly on financial aspects and technology. On the financial side, the government is reviewing the Renewable Transport Fuel Obligation (RTFO) and looking into feed-in tariffs in electricity as well as the possibility of a Green Investment Bank. The UK is proud of its developments within marine energy and has indicated it will do its best to encourage the development of this industry. Growth within the UK's marine energy industry can therefore be expected (International Energy Agency, 2009).

The UK is also focused on working towards cleaner air, and has taken action to improve air quality in recent years. In 2011 the UK announced its intention to end conventional car and van sales by 2040 and for the majority of cars and vans to be zero-emission by 2050. Therefore, a tremendous increase in electric cars in UK in the near future can be expected. The number of plug-in cars increased from 3500 in 2013 to almost 121,000 by the end of October 2017, a trend that is expected to continue (Department for Environment, Food & Rural Affairs, and Department for Transport, 2017; Lilly, 2017).

Yorkshire

The regulations of the United Kingdom also influence the region of Yorkshire. The predictions that biomass use will increase, coal usage will end, and electric cars will become the norm are also applicable to Yorkshire, as is the negative impact of Brexit.

More specific to Yorkshire will be the developments within the Green Port at the Humbersite and the increased use of solar and wind energy (Whitwood, 2017). Furthermore, Whitwood expects that tidal energy and fracking will play a more relevant role in Yorkshire in the future. As Yorkshire borders the sea, interest in tidal energy is high.

The implementation of fracking is expected to be met with resistance from local citizens, who began protesting against plans to begin fracking within Yorkshire in 2017. One of the protesters stated: "They may think they are going to frack in Yorkshire but we are doing our utmost to prevent it" (BBC, 2017).

Political obstacles

Observing the history, the current situation, and predictions for the future of the implementation of renewable energy in Yorkshire gives an insight into the state of energy production within the region. While we have discussed obstacles linked to economics and technology, there are also political obstacles towards renewable energy that must be taken into account:

- **Focus shift from transition to reduction**
  One obstacle for the transition to renewable energy is the government's perspective on the final goal of the Paris agreement, as the UK government is mainly focusing on decreasing energy use and implementing the use of cleaner energy, rather than purely investing in renewable energy. Shifting the focus to using cleaner and less energy will slow down the transition, as it does not create as high an incentive to develop renewables. Initiatives such as the "fifth carbon budget" illustrate the government's focus on reducing carbon dioxide in lieu of making a transition to renewables energy. The fifth carbon budget establishes how the UK will achieve decarbonization within the framework of the energy policy. The goal is to transition to a low-carbon economy while maintaining energy security and minimizing costs to consumers, particularly those in low-income households (UK Government 2011).

- **Biomass promotion**
  The energy industry is focusing on biomass, as it does not require many infrastructural changes and fits within traditional usage. Depending on whether

biomass is considered a renewable energy source, this could be an obstacle. Investing so much in a particular source makes it more difficult for other sources to grow. In the past, organizations such as the US EPA (2014) have considered biomass to be a non-renewable or not carbon-neutral source. If we agree with this argumentation, the government's incentives for and promotion of biomass can also be considered an obstacle to renewable energy use.

- **Brexit**
  As mentioned previously, the insecurity caused by Brexit is another potential obstacle. This insecurity affects the entire industry, not just the renewable energy industry.

  - Investments
    Brexit influences investments, as investors search for sources of investment that can provide security for ten to fifteen years.
  - Policy
    Brexit is expected to influence UK policy, including its renewable energy policies. Following its decision to leave the EU, the UK announced the implementation of the fifth carbon budget, along with other ambitious targets. Nevertheless, fears that the UK's climate goal will be a casualty of the EU referendum are still present, as policies implemented so far are not completely aligned with the ambitious targets that had been set (Vaughan, 2016).
  - Subsidies
    Uncertainty over funding for low-carbon innovation is a concern. Britain has the capabilities to produce green technology but an absence of funding or certainly could jeopardize this (Hepburn, 2017).
  - Attention shifts to different issues
    Large changes in national policy, such as Brexit, take away the focus and sense of urgency from other issues. This could cause the urgency of developing renewable energy sources to become overshadowed by the political distress the UK is currently experiencing.

Regional case study

Flanders

General profile of Belgium

Belgium is a federal state composed of three regions: Flanders, Wallonia and Brussels. This complicates energy policy-making due to the division of authority and responsibilities therein (Verbruggen, 2004). Belgium also has three linguistic communities: the Flemish-, the French- and the German-speaking communities. In Belgium, certain areas of the energy sector are the responsibility of both the federal and the regional authorities (Verbruggen, 2004). The federal government is in charge of offshore wind, ocean energy and biofuel standards, while the regional authorities are in charge of the remaining sources, regarding territorial issues (International Energy Agency, 2016).

Figure 11: Map of Belgium with Flanders in red.

According to Verbruggen's 2004 research on tradable green certificates in Flanders, the federal authorities are responsible for:

- The national equipment programme in the electricity and gas sector
- Electricity generation (power stations)
- Electricity transmissions (high-voltage lines)
- Tariffs

The regional authorities are responsible for:

- Local transmission and distribution of electricity (under 70kV)
- Public gas distribution
- Cogeneration
- Promotion of renewable energy sources
- Rational use of energy

General profile of Flanders

A familiarity with the political background of Belgium is important in order to understand the complexities of the political obstacles faced by Flanders. Flanders constitutes the northern half of Belgium and is composed of the provinces of Antwerp, East Flanders, Limburg, Flemish Brabant and West Flanders. A small portion of the region, Baarle-Hertog (Baerle-Duc), is located outside Belgium proper. Baarle-Hertog is a municipality administered by Antwerp province and is composed of a number of small enclaves in the Netherlands (the Dutch municipality

of Baarle-Nassau contains exclaves within these enclaves as well). The Brussels-Capital Region lies within but is administratively separate from Flanders, although the city of Brussels also serves as the capital of the Flemish region (Encyclopædia Britannica, 2010).

Important actors

- The federal authorities
- The regional authorities (Flemish Parliament and Flemish Government)
- Regional energy administration (Department of Environment, Nature and Energy within the Ministry of the Flemish Community and the Flemish Energy Agency)
- Five provinces and 308 municipalities

The history of Belgium's renewable energy sources

Belgium

Belgium has enforced several policies in the past that attempted to increase the use of renewable energy. A report by Energiewende Team (October 2016) describes a positive growth trend in Belgium's share of renewable energy. In fact, "over the last ten years, Belgium has seen the share of renewables in its final energy consumption grow from 2% in 2005 to 8% in 2014. The country is still on track to meet its 2020 objective of 13%. However, due to political bad blood between the regions and federal authorities, some doubts arise as to whether or not Belgium can reach its overall goal." This goal will not only require political change, but also societal change, as Belgium has an energy-intensive industry and an energy-greedy residential sector (Energiewende Team, 2016).

Figure 12 shows the development of several renewable energy sources for electricity generation from the year 1990 to 2007. The graph illustrates the strong growth rate of solid biomass from the 2000s, showing it to be the largest contributor to electricity generation during that period, with around 50% of Belgian renewable energy sources of electricity coming from solid biomass (Haas et al., 2011). The use of biowaste in electricity generation seems to remain consistent throughout the years. However, there has been a drop in the contribution of biogas starting from the year 2006. There has also been, more recently, a decrease in small- and large-scale hydropower generation and an increase in onshore wind turbines.

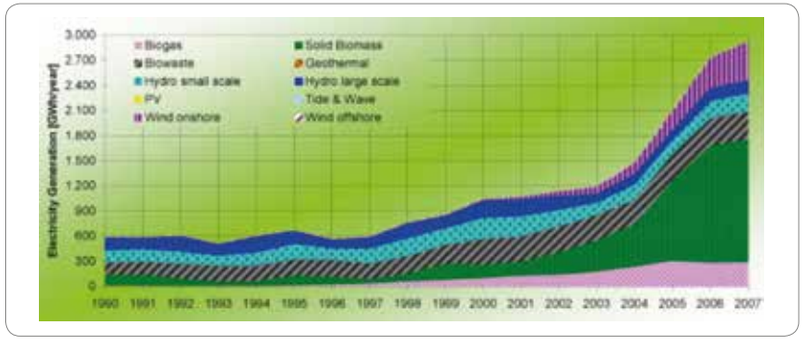

Figure 12: Use of renewable energy sources for electricity generation in Belgium [GWh/year]. Source: Haas et al., 2011.

Flanders

Contributions in Flanders have been more specific than those of Belgium as a country. A tradable green certificate (TGC) system was established in Flanders in 2002, parallel to that of Walloon. By this certificate, a defined member of the electricity supply chain has to present a fixed minimum of certificates each year, as set by a public authority. The federal government has also set minimum prices for electricity from renewable energy sources. Obligated parties can either purchase or generate these certificates in order to adhere to the guidelines. Alternatively, they may also pass on the cost of these certificates to the consumer (Fouquet, 2008). This started with the promotion of waste, biomass and wind energy in particular as renewable sources of electricity generation (Haas et al., 2011). Another policy introduction by Flanders was the quota obligation system, which was based on TGCs and placed the responsibility on electricity suppliers. All three regions have separate markets for green certificates.

Different individual green certificates have been implemented in each regionmaking interregional collaboration difficult. The certificates vary according to quota obligation, basis for granting green certificates, technology-specific support levels, calculation of minimum price levels, duration of support and tradability.

	Federal level	Flemish region	Walloon region	Brussels-Capital
Based on	MWh generated	MWh generated	CO_2 avoided	CO_2 avoided
Quota 2014, %	-	15.5	23.1	3.8
Quota 2017, %	-	19	33.0	5.8
Quota 2020, %	-	20.5	37.9	8.0
Minimum price / certificate. Purchasing entity	EUR 90 to 107 or LCOE (maximum EUR 138)	Price varies by technology. DSOs	EUR 65. TSO	-
Duration, years	20	10 (15 for wind and solar PV)	15 (10 for solar PV)	10
Fine, EUR / certificate not submitted	-	100	100	100
Certificates accepted	No tradability	Flemish only	Walloon only	Brussels-Capital and Walloon

Notes: DSO distribution system operator; LCOE: levelized cost of electricity generated; TSO: transmission system operator;
Sources: Federal and regional authorities.

Figure 13: An example of energy policies in Belgium.

In the past, conflicting interests and responsibilities of different authorities have obstructed the implementation of renewable energy sources in Belgium. The large number of powerful actors in the country made it difficult to reach an agreement regarding renewable energy policies (Fouquet, 2008). Haas et al. (2011) state that "it was clear from the beginning that, due to the small market, liquidity would be a problem". This is due to Belgium's important historical dependence on coal as an energy source. For this reason, the idea of shifting towards renewable energy sources has been met with opposition from the coal industry and the energy sector in the past (Haas et al., 2011).

The current situation in Belgium

Belgium

In Belgium, different regions have implemented different renewable energy policies.

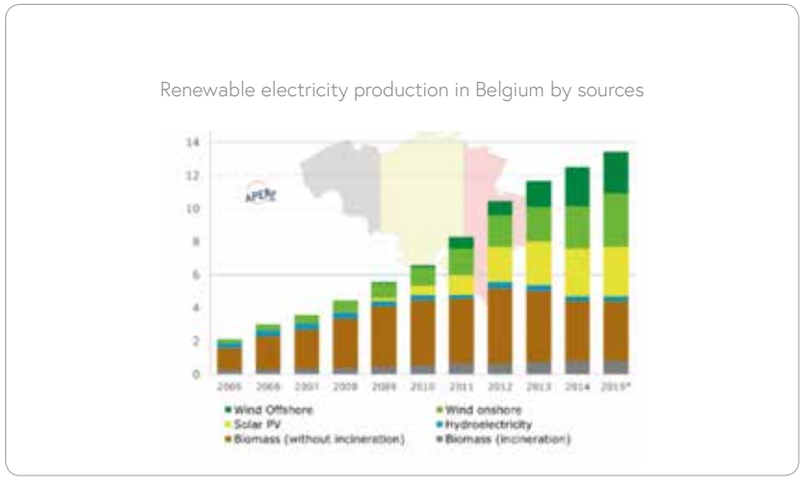

Figure 14: Renewable energy production in Belgium by sources (APERe).

The graph above shows the current distribution of renewable energy in Belgium, with the highest shares being solar PV, biomass and offshore and onshore wind activity. The use of wind energy (both offshore and onshore) and solar PV seems to have increased gradually in shares in recent years (APERe).

Individual green certificate systems have recently been reformed in order to better control the increase in renewable energy capacity and decrease technology costs, especially for solar photovoltaic (PV) energy (International Energy Agency, 2016). Thus, the system reform should bring about a better return rate on capacity investment.

Flanders

The implementation of TGCs in Flanders is still ongoing. TGC prices in Flanders are among the highest in Europe, ranking just below Italy, as shown below (Haas et al., 2011). Flanders also reformed its green certificate system in 2012 by cutting the duration, reducing the support levels and differentiating them by technology. To ensure that this system remains efficient, support levels are reviewed annually to guarantee consistency with the targeted rates of return for each technology (International Energy Agency, 2016). These targeted rates also differ between each region. For the Flemish region, the system aims to obtain a return on investment of 5% for solar, 8% for wind and 12% for biomass and biogas.

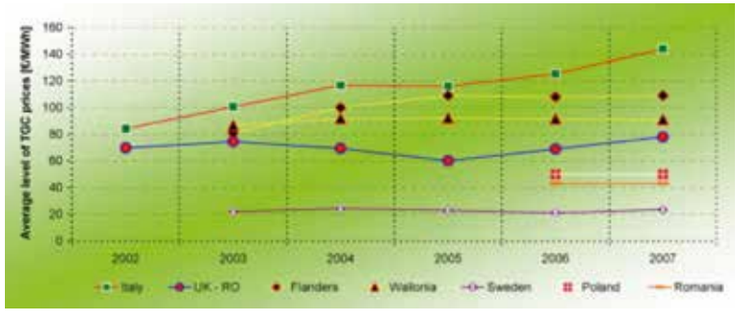

Figure 15: Average price levels of TGCs per region. Source: Haas et al., 2011.

This has definitely contributed to the amount of renewable energy sources in the region, as Flanders is currently ranked third on the list of countries with the highest number of solar panels per capita. Together, all regions occupied the fourth place of the EU-28 in 2015, with the highest wind offshore cumulative power capacity. This was made possible by TGCs and quota initiatives made by the regional authorities. Furthermore, onshore wind development has given rise to a large citizen movement of cooperatives, with increasing numbers of citizens investing in renewable energy cooperative shares (Energiewende Team, 2016).

The figure on the next page shows the share of renewables in final consumption, produced by Association Pour la promotion des Energies Renouvelables (APERe), an independent association that promotes the use of renewable energy. The graph shows that Flanders has room for improvement: while its use of renewable energy sources has increased over the years, it is still relatively low compared to other regions.

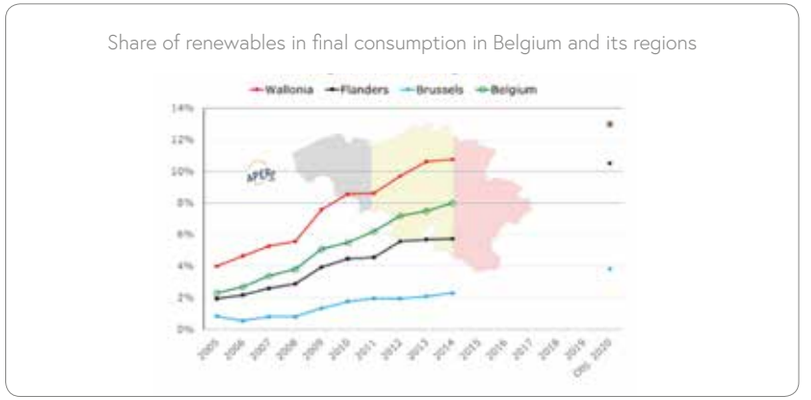

Figure 16: Share of renewable energy sources in final consumption in Belgium and its regions. Source: Energiewende Team, 2016.

Current policies and trends

Current green power certificates and other subsidies/incentives initiated by the Flemish government written by Johan Joos and Sam Voet from Eversheds Sutherland (International) LLP in 2016:

- Producers of solar energy installations can receive additional compensation for electricity produced by their solar panels. Such subsidies are structured as green power certificates.
- Only existing solar energy installations and new solar energy installations with a minimum power of 10kVA can benefit from the certificate system.
- Green power certificates and certificates of origin can either be sold or traded to third parties at market price.
- Investment deduction under Belgian income tax ("verhoogde investeringsaftrek"), increasing the attractiveness of investing in the installation of solar panels.
- Producers installing solar panels with a minimum power of 750 kVA can also apply for a project-specific technology subsidy from the Flemish Energy Agency.

Technological advancements such as the software programme Energy Atlas, developed by Vlaams Instituut voor Technologisch Onderzoek (VITO) in 2014, can be used to chart locations for renewable energy in Flanders. Within the project, VITO and the Flemish Environment Company (VMM) developed an information system to chart the run-off of polluted substances to surface water. This can help policy makers explore scenarios for renewable energy.

Changes over time

Belgium

In 2016 the International Energy Agency published an in-depth report that analyzed Belgium's current energy policies. The last report prior to that was published in 2009. The Belgian government has since launched a series of initiatives to meet its policy objectives and European Union obligations (International Energy Agency, 2016).

Technology	1990	2000	2005	2007	2008	2009	2010	2011	2012	2013	2014
Solar PV	0	0	2	20	62	386	904	1391	2581	2922	3024
Wind	5	14	167	276	324	608	912	1069	1370	1792	1930
Hydro	1401	1413	1412	1417	1418	1417	1425	1426	1427	1429	1429
Pumped storage	*1307*	*1310*	*1307*	*1307*	*1307*	*1307*	*1307*	*1307*	*1307*	*1310*	*1310*
Solid biofuels	26	47	294	329	442	554	640	701	678	640	553
Municipals waste	52	97	139	177	185	218	253	240	223	247	247
Industrial waste	120	139	105	111	111	111	111	111	130	62	60
Biogases	1	20	56	68	88	105	115	129	141	151	172
Other liquid biofuels	0	0	95	97	73	139	122	69	43	38	37
Biodiesels	0	0	0	0	0	0	0	12	12	12	13
Total capacity	**1605**	**1730**	**2270**	**2495**	**2703**	**3538**	**4482**	**5148**	**6605**	**7293**	**7465**
Solar collectors surface (1000m²)	34	41	77	139	176	319	371	420	527	570	615
Capacity of solar collectors (MWth)*	24	29	54	97	123	223	260	294	369	399	431

* Converted at 0.7 kW/m² of solar collector area, as estimated by the IEA Solar Heating & Cooling Programme.
Source: IEA (2015b), *Renewables Information*, www.iea.org/statistics/.

Table 1: Renewable electricity-generating capacity, 1990-2014 (MW).

The data n table 1 was taken from the in-depth report on Belgium conducted by the International Energy Agency in 2016. The table shows an increase in renewable energy sources over the years. Sources such as solar PV have been much more popular than sources such as hydropower and biogas. The report mentions that Belgium's energy policies have been improving in efficiency, but it must be noted that most of these policies have been obligations associated with EU regulations and directives.

Flanders

Since 2013, there have been calls for tender twice a year for project ideas that promote innovations in renewable heat and for the development of district heating from renewable sources or waste heat. The annual budget for these projects is 4.5 million euros (International Energy Agency, 2016). This research has increased interest in using renewable energy or waste for district heating, as it is much more sustainable. This is also a preferred alternative, as from January 2014 a certain portion of the energy used in new buildings in the Flemish regions must come from renewable sources. These projects are necessary, as this requirement will gradually be increased to meet the near-zero energy obligation by 2020. However, given that district heating competes directly with natural gas heating—a dominant form of space-heating due to its abundance—(International Energy Agency, 2016) it may be difficult to change ideas of where heating should come from.

The future of Belgium

Belgium

Belgium is optimistic regarding the implementation of renewable energy sources in the future. In 2011, a consortium was developed by the four Belgian ministers responsible for energy (one federal and three regional) and three scientific partners: the Federal Planning Bureau (FPB), the Institut de Conseil et d'Études en Développement Durable (ICEDD) and the VITO. This consortium was brought together to analyze the feasibility and impact of a Belgian energy system shift to using 100% renewable energy by 2050 (Devogelaer et al., 2012). They concluded that in order for Belgium to reach its target there would have to be a decrease in primary energy demand, extensive electrification and close to 100% renewable energy by 2030, as well as a strong decrease in energy imports and a paradigm shift in thought regarding energy. Although Belgium is currently on track to meet its target goal of 13% of renewable energy shares by 2020, major transitions are required to ensure energy security without compromising other needs. Therefore, rather than focusing on one sector, it would be best for Belgium to employ multiple

sources of renewable energy, perhaps including biomass, due to its substantial growth potential. Onshore wind capacity has been highly developed in Belgium and will continue to be an efficient source of renewable energy (Devogelaer et al., 2012).

Flanders

According to a 2013 study by VITO, Flanders will focus on onshore wind energy and solar energy (photovoltaic electricity). Other studies conducted by VITO have examined spatial planning, with the aim of effectively implementing renewable energy sources in the most efficient locations, for instance, placing onshore wind in places that have been tested for their wind-energy potential using GIS-based technology (Devogelaer et al., 2012).

Some renewable energy sectors, such as geothermal power and hydroelectricity, have already met their maximum potential and will not be able to be developed much further, as Flanders simply does not have the resources to promote such sources of energy (Devogelaer et al., 2012).

Political obstacles of Flanders

The political system

Belgium's current political structure is quite complicated. A study by Reinhard Haas from February 2011 outlines the current structure, in which "The federal authorities are responsible for the national equipment programme in the electricity and gas sector, electricity generation (power stations), electricity transmission (high-voltage lines) and tariffs. The regional authorities are responsible for local transmission and distribution of electricity (under 70 kV), public gas distribution, cogeneration, promotion of renewable energy sources (RES) and rational use of energy (RUE)". Due to the complexities of the political structure in Belgium, there is doubt as to whether Belgium will be able to reach the SDG objective of having 18% of its energy come from renewable sources by 2030, due to the lack of internal coordination of the energy policies within the regions and in Belgium itself (Energiewende Team, 2016).

Lack of potential resources

Belgium is not as abundantly endowed with renewable energy potential as other countries using current technologies (International Energy Agency, 2016). This is a non-cost barrier to the implementation of renewable energy. Barriers identified by AMCHAM Belgium (American Chamber of Commerce in Belgium) include Belgium's geology, which is unfavourable for energy resources. Renewable energy potential in Belgium is relatively low due to its rather flat, densely populated and somewhat cloudy environment. This poses challenges for large-scale use of hydro, onshore wind and solar solutions, as they may complicate spatial planning and public support (International Energy Agency, 2016).

Banning nuclear energy

The government's plan to phase out its main energy supply, which is nuclear energy, poses large problems for the region. Nuclear energy was said to have been banned in 2015, but due to its longevity, its lifespan has been extended to 2022–2025. This will be a serious problem for Belgium's future energy supply, as it will lose an estimated 5,000 MWe of generating capacity within a three-year period (Energiewende Team, 2016).

Efficiency of energy policies

Another problem is the inefficiency of energy policies and measures. Energy policies such as subsidies are not cost-effective and as such, may affect support from governmental officials and authorities. These measures may be counteractive, as they impose stress on the government due to the high costs of implementation (Haas et al., 2011).

Regional case study

Silesia

General profile of Silesia

Silesia is a region located mostly in Poland but also in the Czech Republic and Germany, as can be seen in figure 17. Silesia has had many rulers throughout its history and has been part of many different nations (Angulo, 2015). As a result of the 1815 Congress of Vienna, the province of Silesia was officially established and became part of the Kingdom of Prussia. In 1919, at the end of World War I, the province of Silesia was de-established.

That year the province of Silesia was divided into Upper and Lower Silesia. Today, its boundaries as a region or province are still disputed by different countries (Brukseli, Association of American Geographers, 1933).

Silesia plays a major role in the extraction of Poland's natural energy sources. Bituminous coal, better known as black or hard coal, is found in three of Poland's basins: Upper and Lower Silesia, and Lublin (Marek et al., 2017).

Figure 17: Map of Poland, with Silesia shown in red.

The majority of Silesia belongs to Poland, which is a democracy led by a president—who is head of state—and a council of ministers, headed by a prime minister. The parliament chosen by the Polish voters consists of the lower house and the senate. The administration is divided into provinces, which are in turn subdivided into counties and further divided into communes. Poland consists of sixteen regions, 379 counties and 2478 communes (OECD/IEA, 2016).

The province (or voivodeship) of Silesia, created on January 1st, 1999, covers most of the historic Silesian region. However, some of it still belongs to the Lubusz region and to the Lower Silesian and Opole voivodeships. The Silesian province is one of the wealthiest in Poland, as well as the most densely populated: almost five million inhabitants within an area of 12,300 km^2 (Silesian Voivodeship Office). The province's government is headed by the governor, Jarosław Wieczorek; who is assisted by the province's marshal, Wojciech Saługa (Dobrzańska. M., 2017; Samorząd Województwa Śląskiego).

Important actors:

- National government
- Silesian government
  - Provincial governor
  - Provincial marshal
  - Provincial assembly
- Businesses
- Citizens of the province
- European Union

The history of Silesia's energy sources

Coal is very important in Poland and Silesia (OECD/IEA., 2016). For Silesia in particular, both the production and the consumption of coal is essential.

Coal within Poland

Mining has been occurring in Poland since the Middle Ages, specifically in the area of the Upper Silesian Coal Basin (USCB) (Dulias, 2016). With the industrial revolution, coal began to play a larger role in Polish energy production.

Historically speaking, coal miners in Poland have been greatly appreciated for their work in the mines and have been well-regarded socially (Centrum Badania Opinii Spolecznej, 1999). This appreciation generates a sense of pride among miners, which is manifested in several ways, including a festive day called the Barborka (Miner's Day) and the tradition of miners wearing their mining uniform to funerals, ceremonies and weddings (culture.polishsite.us; Kolka, 2017). Coal is seen as a fundamental part of the history of Poland and Silesia, as it has driven the economy and is linked with the end of Soviet control (Kowalski, 2016). However, the production of coal has declined over the years, as can be seen from figure 18, which illustrates the history of coal production within Poland between 1973 and 2015.

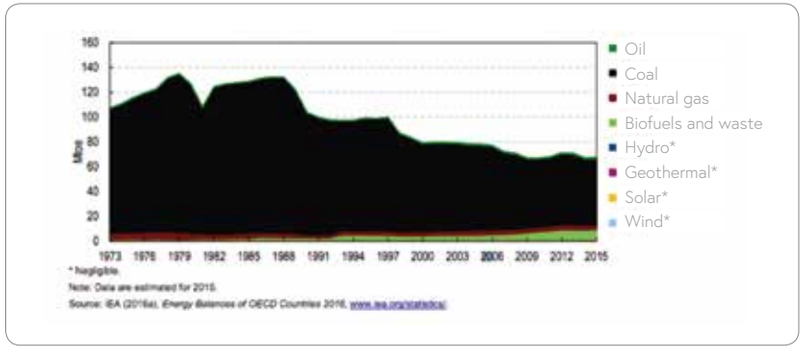

Figure 18: Coal output in the Upper Silesian Coal Basin.

Coal in Silesia

Silesia plays a key role in Poland's coal production, as one of the largest national sources of coal, both historically and currently. Silesia is a very industrial region and much of the energy it produces is used within the region itself (Natalia Pińkowska, 2017). According to the Polish Mining Institute, Poland has 51.9 gigatonnes of recoverable hard coal, with most of its reserves in Upper Silesia (OECD/IEA, 2016). Around 80% of the region's hard coal reserves can be found in the USCB. Figure 19 shows the amount of coal mined in the USCB between 1800 and 2009.

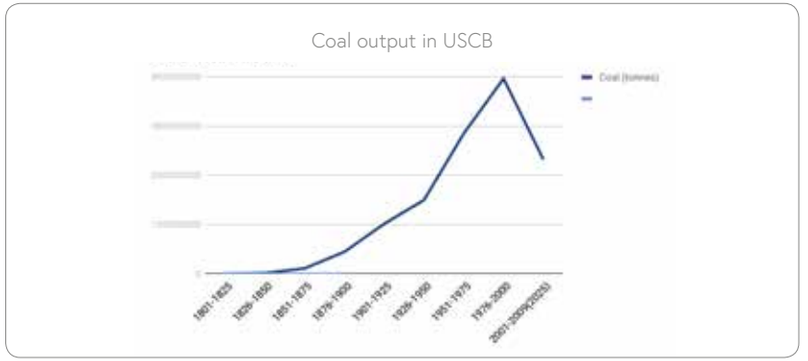

Figure 19: Coal output in the Upper Silesian Coal Basin.

History of renewable energy sources in Poland

In March 2007 the European Council agreed to seek a strategy to tackle climate change. A Renewable Energy Directive was established (RED, Directive 2009/29/EC) as a result of this agreement, stating that by the year 2020, 20% of the EU's energy should come from renewable sources. The EU Renewable Energy Directive mandated Poland to increase its overall renewable energy consumption to 15% by 2020. This was split into an electricity target (19%), a heat and cooling target (17%) and a transport target (10%) (OECD/IEA, 2016). The first National Renewable Energy Action Plan (NREAP) for Poland was submitted to the European Commission in 2010.

The share of renewables has significantly increased over the years, as can be seen in figure 20. The graph also shows that biofuels and waste clearly dominate the renewable energy sector in Poland, with a 91% increase between 2005 and 2015. From the five types of renewable energy examined, wind energy has shown the most growth in recent times. This increase is partly due to governmental policies such as the implementation of mandatory quotas for utilities and the certificate system that was implemented in 2005 (OECD/IEA, 2016). While both of these mechanisms been successful in developing wind capacity in Poland, investment in new technologies has decreased, as it is more favourable to co-fire biomass with coal in the existing plants. This has allowed the country to fulfil its renewable obligation without much additional investment in new technologies, which has resulted in a domination of green certificates for biomass co-firing. In turn, this has brought prices down and has resulted in an unbalanced mix of renewable energy sources, as it does not create an incentive to develop non-biofuel renewables (OECD/IEA, 2016).

Even though it seems like Poland is making an effort to promote renewable energy, it is important to note that it is mainly focused on biofuels and waste and has remained under 12% from 1973 to 2015. In 2014 a report by the Ecologic Institute stated that "Although it refers to sustainable development in its constitution (Art. 5), climate change only plays a minor role for decision-makers in Poland".

The report also stated that Poland is not willing to set ambitious reduction targets and opposes the further development of climate change policies on an EU level. Both the International Energy Agency and the Ecologic Institute have explicitly stated that the government's handling of green certificates has been an obstacle to the continued development of new renewable technologies (Poblocka, et al. 2014).

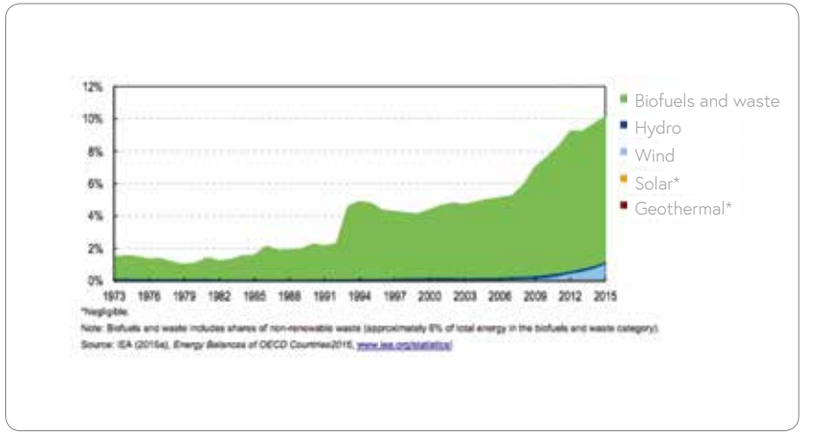

Figure 20: Renewable enegy as a percentage of TPES, 1973-2014.

While there are multiple political parties in Poland, parties must pass a threshold of 7% to enter the parliament (Kolka, 2017). The parties that have been in power in Poland over the years have also dominated policy making and therefore, also energy development. A detailed graph on the composition and transition of Polish political parties can be found in the appendix.

Table 2 shows Poland's major elected political parties from 1991 to the present day. Insights can be gained from examining it in conjunction with figure 20, which shows the history of renewable energy production in Poland. Slight increases in biofuels can be seen between 2001 and 2007, with a large increase in biofuels and waste between 2007 and 2011 and a smaller increase between 2011 and 2015. SLD-UP and PiS dominated the Polish political landscape between 2001 and 2007, while the Platforma Obywatelsk (PO) was the largest party between 2007 and 2015 (Millward Brown, 2017).

While no direct correlation can be drawn between renewable energy use and the government in power, it does evidence that renewable energy use showed an increase when the PO was leading in Poland, although this is only one factor among many in the development of renewable sources.

1991 - 1993	SLD - UP	UD	WAK	POC	PSL
1993 - 1997	SLD - UP	PSL	UD		
1997 - 2001	AWS	SLD - UP	UW		
2001 - 2005	SLD - UP	PO	SO	PiS	PSL
2005 - 2007	PiS	PO	LiD	SLD	LPR
2007 - 2011	PO	PiS	LiD	PSL	
2011 - 2015	PO	PiS	RP	SLD	PSL
2015 - current	PiS	PO	K'15		

Table 2.

Renewables in Silesia

Silesia, as mentioned previously, is a very industrial region that is quite dependent on coal. The industrial character of the region in combination with the poor quality coal used for heating is responsible for very poor air quality within Silesia, which can be improved by using renewable energy sources and better heating systems. To promote renewable energy and cleaner air, various workshops, school trainings and conferences have been held over the past years, such as:

- Konferencja "Śląskie bez smogu! Jak to zrobić?", a conference on smog-free Silesia
- Presence at the COP23 climate change summit in Bonn
- Citizenship lessons to teach students about the local, regional and societal impact of renewable energy. This year's theme was focused on clean air
- "Good Energy", a conference on the promotion of clean and energy-efficient constructions
- Educational campaign on the reduction of carbon emissions

Apart from these activities, the Woiwodschaft/province of Silesia is part of an energy platform that connects eleven regions together to work on energy-transformation strategies and support each other to enable a fast transition to a clean energy economy (OECD/IEA. 2016).

The current situation in Silesia

Poland

Figure 21 shows Poland's estimated overall energy production for 2015, which illustrates that coal is a very significant source of energy for the country.

Poland is Europe's second biggest coal consumer, after Germany (Greenpeace, 2008), and the ninth largest producer of coal in the world. Europe's largest open coal mine, Bełchatów, covers 2500 hectares.

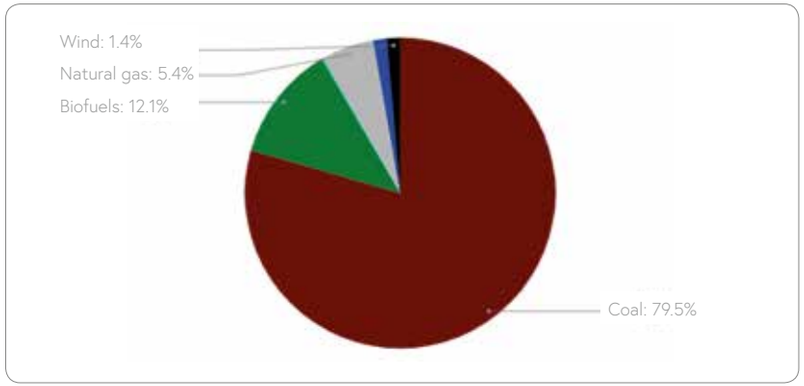

Figure 21: Overall estimated energy production for Poland in 2015 (OECD/IEA, 2016).

When looking at figure 21, it becomes clear that coal dominates Poland's energy production in figure 22 shows the distribution of all of Poland's renewable energy production in 2015.

The same issues with biofuels discussed in the regional study of Yorkshire apply to Silesia. Biomass is not always considered a renewable energy source. Due to the fact that its inherent energy comes from the sun and it can regrow in a relatively short amount of time, it is a non-depleting source. If biomass feedstocks are not replanted as fast as they are used, biomass energy becomes a non-renewable energy source. The way in which it is transported should also be considered when evaluating the renewability of biofuels.

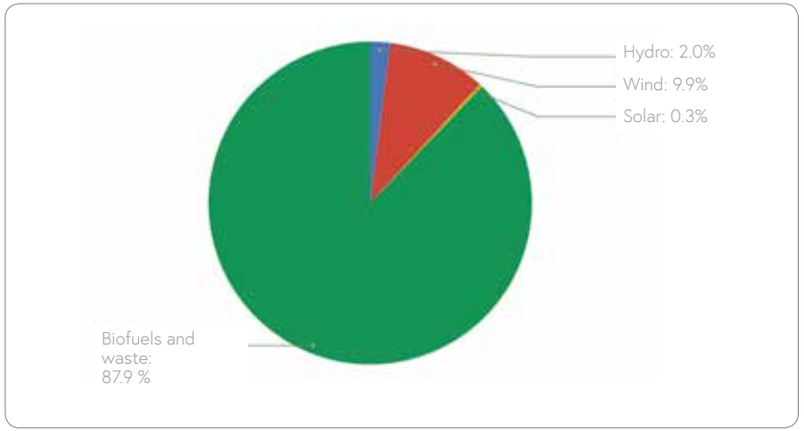

Figure 22: Distribution of Poland's renewable energy production in 2015 (OECD/IEA, 2016).

Another issue regarding biofuel and waste energy production in Poland is the recent discussion on the co-firing of "green" and "black" energy. Allowing companies to receive grants and certificates for burning a mixture of energy sources creates an incentive for coal companies to use some renewable energy sources. While this is positive in principle, on a practical level it also creates less of an incentive to shift to new renewable sources.

Because of this potentially problematic side-effect of green certificates, the Polish government drafted a new act whereby Poland will maintain the green certificate system for existing renewable energy source installations, with some changes to the existing rules.

The International Energy Agency has explained the changes. For renewable energy installations that started generating no earlier than January 1st, 2016, the act introduced the following support instruments:

- A net-metering system based on a rebate in the form of a discount on electricity bills for residential systems up to 10 kW and commercial systems up to 40 kW, or
- Feed-in premiums for larger renewable installations, where both feed-in tariffs and feed-in premiums would be awarded in auctions.

Projects that started electricity production after January 1st, 2016 will no longer be eligible for green certificates, and depending on their size may apply for a feed-in tariff or feed-in premium by means of an auction mechanism. Projects in the green certificate system will be allowed to switch from green certificates to feed-in tariffs or feed-in premiums and participate in auctions, which will be organized separately from the auctions for new projects (OECD/IEA, 2016).

In addition to the new rules for green certificates, an act on wind farms was recently introduced as well. The act dictates that the minimum distance at which the turbine should be is ten times the height of the wind turbine itself. The act also redefined what is considered a windfarm; a definition that would result in higher taxes for owners of a plant. The renewable energy industry and experts in the field have expressed their concerns about the negative impact of both the wind farm act and the changes to the Act on Renewable Energy Sources (OECD/IEA, 2016; Sokołowski, 2017; Globe Business Media Group, 2016).

The current ruling party within Poland is PiS, Prawo i Sprawiedliwość. In the past years PiS and PO (Platforma Obywatelsk) have had the majority within the parliament.

PO is a conservative, liberal and Christian democratic party, while PiS is a right-wing, populist, national-conservative and Christian democratic political party (Hloušek,et al. 2010; Associated Press, 2016). While neither party is specifically focused on climate change, prime minister Ewa Kopacz tried to close down coal mines in Poland while she was in power, from September 2014 to November 2015, but was unsuccessful in her efforts, as she was not supported by the Polish citizens. Her popularity declined after her attempt to close the mines (Kolka, 2017). Kopacz compared the situation to that of the UK: "When Thatcher tried to close the mines she had a very hard time getting it done. It is even harder now in Poland. More people work in the mines in Poland than they once did in the UK".

The mining sector currently employs 104,000 people and a further 208,000 people have a miners' pension. Add to this the financially dependent citizens and the result is around 500,000 voters, all of whom are dependent on the mines (Pacula, 2015; Gardiner, 2015; World Coal, 2015).

Silesia

There are currently fifteen mines operating in Silesia (Pinkowska, 2017), as shown in figure 23. Most energy producers are state owned and Silesia is industrially rich. There is much room for improvement regarding renewable energy in Silesia and as most of the citizens of the region are dependent on the mines, it will be difficult to make the change. According to Pinkowska, the largest obstacle within both Silesia and Poland is that climate change is not being discussed. The current national debate is focused on air quality, leaving discussions on new renewable technology in the background.

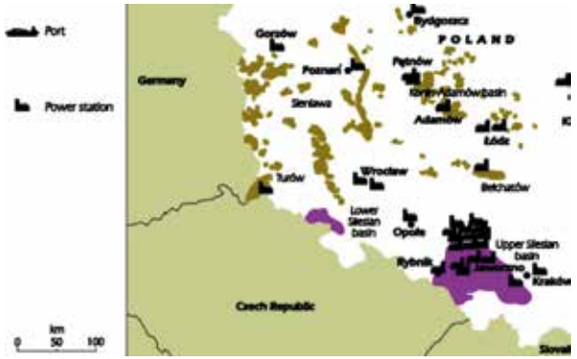

Figure 23: Power stations and ports within Poland, Silesia. Source: OECD/IEA, 2016.

However, in 2016, a new transition platform was launched. This global initiative supports highly industrialized, carbon-intensive state and regional governments in developing and implementing innovative clean energy policies to accelerate the low-carbon transition. Silesia is, among others, part of this platform, which puts focus on clean energy policies for industrialized regions (Energy Transition Platform, 2016; Pinkowska, 2017).

The future of Silesia

Having examined the history and current situation of both Silesia and Poland, a few predictions can be made about the future of renewable energy there.

Poland

Current policies indicate that wind energy technology is less likely to develop further now that the Wind Farm Act is in place. Biomass is expected to continue to be used at a steady rate, as it is necessary in order to achieve renewable energy targets. Should Poland reach its 2020 renewable energy target with co-firing, this achievement will be short-lived, as old coal plants, which provide the bulk of co-firing, will have to retire after 2020 to comply with EU regulations (OECD, 2012; OECD/IEA, 2016)

There is a possibility that nuclear energy will be further developed within Poland. In 2009, the Polish government confirmed its intention to have the country's first nuclear power plant in operation by 2021 or 2022 (NucNet, the Independent Global Nuclear News Agency, 2006). Current prime minister Beata Szydło has insisted that nuclear energy must be online within ten years. The government's plan is to build three nuclear plants in five-year intervals, starting in 2029.

Whether these plants will actually be built is uncertain, as similar projects have been delayed or cancelled in the past. After the Fukushima disaster in 2009 progress on atomic energy plans failed due to falling energy prices and negative public opinion.

During the interview for this study, Natalia Pińkowska expressed that it is unlikely that coal will disappear in Poland in the near future. Current Polish president Andrzej Duda has stated that Poland has enough coal for the next two centuries. Both interviewees stated that there is a perception that there is enough coal in Poland to continue using it undeterred, but some experts have warned that the cheapest sources of coal in the Silesian Basin are depleted, which means that unless a new plan is put into place, Poland must prepare for high costs in the future (© OECD/IEA, 2016). Minister Krzysztof Tchórzewski has stated that after current coal investments have ended, there will be no further large projects based on coal (Morgan, 2017).

PiS has been the largest political party in Poland since 2015, with no significant

changes in the years leading to 2017. It is predicted that PiS will lead again in the next elections, with PO following as the second biggest party, although this is not certain (Millward Brown, 2017). If the political environment stays the same, with the same parties creating (energy) policies in the future, little focus on development of new renewable energy sources can be expected.

The EU Renewable Energy Directive mandated Poland to raise its overall renewable energy consumption to 15% by 2020. According to o.a. Ecofys, it is unlikely that Poland will be able to reach this target. In an analysis by Ecofys, which offered several possible outcomes, it was concluded that whether things progress positively or not, Poland will not reach its 15% renewable energy target for 2020. The development of the transition to renewable energy beyond 2020 will be highly dependent on how the European Union responds to member states who fail to reach targets (Janeiro and Resch, 2017).

Silesia

As Silesia is one of Poland's most coal-dependent and coal-producing regions, it is likely to continue using coal in the future. As Silesia suffers from smog and air pollution, it is expected that public debate, and perhaps some policies, will focus on improving air quality in the region (Pinkowska, 2017). It is also likely that the use of co-firing will increase a great deal thanks to investments made to this end, in line with the trend that has taken place over the past few years (Pinkowska, 2017).

The biggest obstacle is the differing opinions among the political parties in Silesia, who have not been discussing ways of solving the problem. Some ideas for solving the problem of air pollution are:

- To increase the use of better-quality filters
- To increase the use of better types of coal
- To increase the use of renewable energy and stop using coal heating

Political obstacles

The profile and analysis of the past and present of Silesia, as well as predictions for its future, provides an insight into the state of energy production in the region. Aside from the previously mentioned economic and technological obstacles, there are also some political obstructions to the implementation of renewable energy.

Historical and cultural link with coal

Coal has historically had great social importance in Poland, especially in Silesia, and the industry and its workers are a fundamental part of its culture and history, as mentioned in the section about the history of coal in Poland. This cultural and historical link with coal makes the transition towards renewable energy difficult, because it is hard to change cultural traditions that are deeply ingrained. Furthermore, the fact that coal continues to be produced in similar amounts as it was previously means that there is less of an incentive to promote renewables.

Little public support

Silesia's mining community is relatively large. Since many citizens of Silesia and Poland are dependent on coal and the mines, politicians will have little support should they decide to make an effort to step away from coal energy production. An example of this is when prime minister Ewa Kopacz pushed for the closure of the mines and was met with a large protest organized by the miners (IndustriALL, 2015). Similar problems have arisen within other coal-dependent provinces within Europe such as Yorkshire. When Margaret Thatcher announced the closure of coal mines in the UK in 1984, a huge uprising took place.

Lack of urgency

The government and many citizens of Poland do not feel that there is an urgent need to transition to renewable energy. This perception might be more widespread within Poland than in other EU countries due to political statements that have been made by politicians like Andrzej Duda about Poland's wealth of natural reserves. There is also a great focus on improving air quality in Poland, rather than solving the climate problem.

Biomass

Biomass is an obstacle for the implementation of renewable energy in Silesia, much like it is for Yorkshire. Co-firing biofuels with traditional coal results in more investment in the coal industry rather than focusing on transforming the industry.

Political parties

Most member states of the European Union have a green political party. Poland's Green Party was only founded in 2003. Due to Poland's political system, only parties with more than 7% are allowed to enter parliament (Kolka, 2017). The Polish Greens have never reached this threshold and therefore have never had the possibility of working on energy policies. The political parties that have managed to get into power have had little to no renewable energy polices. This political environment creates a great obstacle for the transition to renewable energy.

Regional case study

Figure 24: Map of Spain, with Galicia shown in red.

Galicia

General profile of Galicia

Galicia is one of the seventeen autonomous communities that make up Spain. It is composed of four provinces: A Coruña, Lugo, Ourense and Pontevedra. The region gained its autonomy in 1981 when it elected its first parliament. Galicia's government is formed by seventy-five deputies who are elected every four years in the ordinary period. In the 2016 elections five political parties were represented. Today, the People's Party of Galicia remains the largest party in the region, with 41 of 75 seats.

The Spanish Constitution divides the power to establish energy policy between the regional and national governments, and the autonomous governments are responsible for most of the regulations and energy developments in their respective regions. The central government is mainly responsible for standardizing energy policy at the national level (Míguez et al., 2006).

Galicia is the northwesternmost region of Spain and, as of 2016, has a population of 2,718,525 and a total area of 29,574 km^2. Galicia has over 1,660 km of coastline bordered by the Atlantic Ocean, and with a hilly terrain, more than half of the area lies between elevations of 400 to 600 meters. The interior is dotted with mountains where numerous rivers and their tributaries drain-off seaward.

Important actors

- Spanish national government
- Regional government
- Four provinces
- Businesses, factories
- Five regional political parties
- Civil society

The history of Galicia's energy sources

Spain

In Spain, renewable energy sources have successively been promoted by the 1986 Renewable Energy Plan (REP) and the National Energy Plan (NEP) (Míguez et al., 2006). The 1997 Electricity Industry Act made deregulation of the electricity market a priority, allowing for the establishment of a special regime for renewable energy and allowing them guaranteeing access to the grid.

Renewable energy sources have been promoted in Spain through a set of measures with special powers granted to the regional autonomous communities. At the national level, these policies were framed through the Plan for Promotion of Renewable Energy Sources of 2000-2010, whose main purpose was to cover at least 12% of total energy use from renewable energy sources by 2010. This policy was revised by the Spanish REP in 2005 for the period from 2005 to 2010, maintaining its main purpose and setting new targets, like having 29.4% of electricity be generated by renewable energy sources and 5.75% of transport fuels to be met by biofuels (Ministerio de Industria, Turismo y Comercio, 2005).

The dominant instrument to promote electricity from renewable sources in Spain is a feed-in tariff (FIT), which has been in place since 1994. This is a generation-based, price-driven strategy, in which financial support is a fixed regulated FIT that a governmental institution, a utility or a supplier is legally obligated to pay to produce renewable electricity from eligible generators (R. Haas et al., 2011).

In 1998, two alternative payment options for renewable energy generators were introduced: a fixed tariff scheme and a premium tariff, which was paid for in addition to the electricity market price. Both options guarantee grid connection and purchase of green electricity. The choice is valid for one year, after which the generator may decide to maintain or change their option. Due to this support system, renewable energy sources expanded in Spain in the late 1990s, generating an additional 30 Twh of electricity (of which 80% was from onshore wind) (R. Haas et al., 2011).

Galicia

Energy production and consumption

Primary energy sources are resources that can be said to be extracted directly from nature and have been transformed before it can be used and consumed. In 2002, Galicia handled nearly 13,000 ktoe (the tonne of oil equivalent) of primary energy, of which about 23% remained local and 77% was imported (mainly oil and coal). Through several different processes, the total amount of primary energy converted was 7532 ktoe, to be used for final consumption.

In 1998, hydropower had the highest percentage of green power generation, at 87%, followed by wind and small-hydro, while solar and biomass accounted for an almost insignificant percentage. These numbers can be seen in figure 25, below (J.L. Míguez et al, 2006).

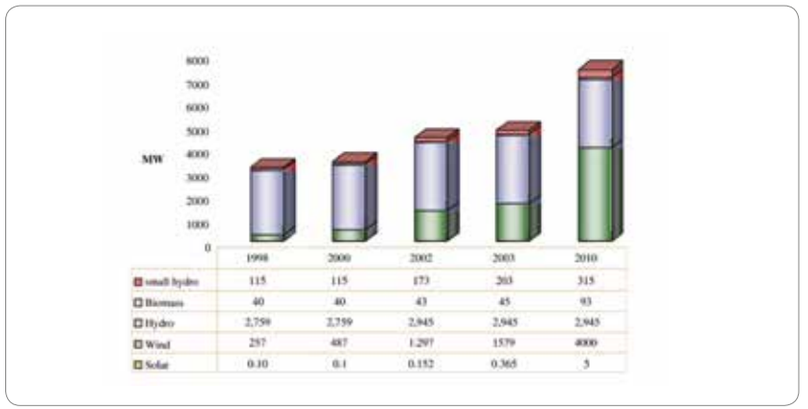

Figure 25: Distribution of installed capacity in Galicia by type of renewable energy. Source: Galician Ministry of Industry.

Due to the rapid growth rate of the Galician economy (which in recent years has been higher than the European average) there has been an increase in the use of primary energy in the autonomous community. Although local sources have increased, the additional energy needs have been met by importing energy resources. The increase in energy needs also brought about an increase in renewable energy sources. Between 2001 and 2002 there was an increase of 780

MW (11.9%), of which 85% involved facilities powered by renewable sources and the other 15% by CHP facilities.

Reduction in emissions in Spain and Galicia

In order to comply with the Kyoto Protocol targets, the Spanish government committed itself to an increase in CO_2 of no more than 15% between 2008 and 2012, since 2001 saw an increase of 32%. However, in 2002, renewable energy sources in Spain prevented 14 million tonnes of CO_2 emissions. Galicia assisted in reducing emissions through their increased use of renewable energy facilities, practically half through the use of wind power and the rest from large hydro.

The current situation in Galicia

Spain

As mentioned previously, Spain shows a negative trend in the fulfillment of the 2020 renewable energy objectives regarding the percentage of renewable energy used out of the total energy consumed. Reports have shown that the best-case scenario projects a range between 12.6 and 17.1%: far from the goal of 20%. The projection also represents a noncompliance with the objectives in the National Action Plan for Renewable Energy, whose goal is 22.7% and the Spanish government's Plan for Renewable Energies, which forecasts 20.8% for the period between 2011 and 2020 (Montoya et al., 2014).

In 2011, 11.6% of the country's primary energy consumption was through renewable energy, mainly Through biomass, wind and hydropower. The gross renewable energy power generated amounted to 86,600 GWh, equivalent to 29.7% of the total power generated in Spain. This means that renewable energy sources are the main source of electrical energy for the country, surpassing both natural gas (28.9%) and nuclear power (19.7%) (Montoya et al., 2014).

Use of oil

Oil is still the main fuel used in the Spanish transport sector, although the use of biofuels and waste has increased over the years, highlighting an increase from 0.4% in 2002 to 3.2% in 2013, with oil representing 95.1% in 2013. Industry relies on natural gas, oil and electricity for most of its energy, while the residential and commercial sectors consume mainly electricity (48.1%), followed by oil (21%) and gas (20%). These can be seen in following graphs (International Energy Agency, 2015).

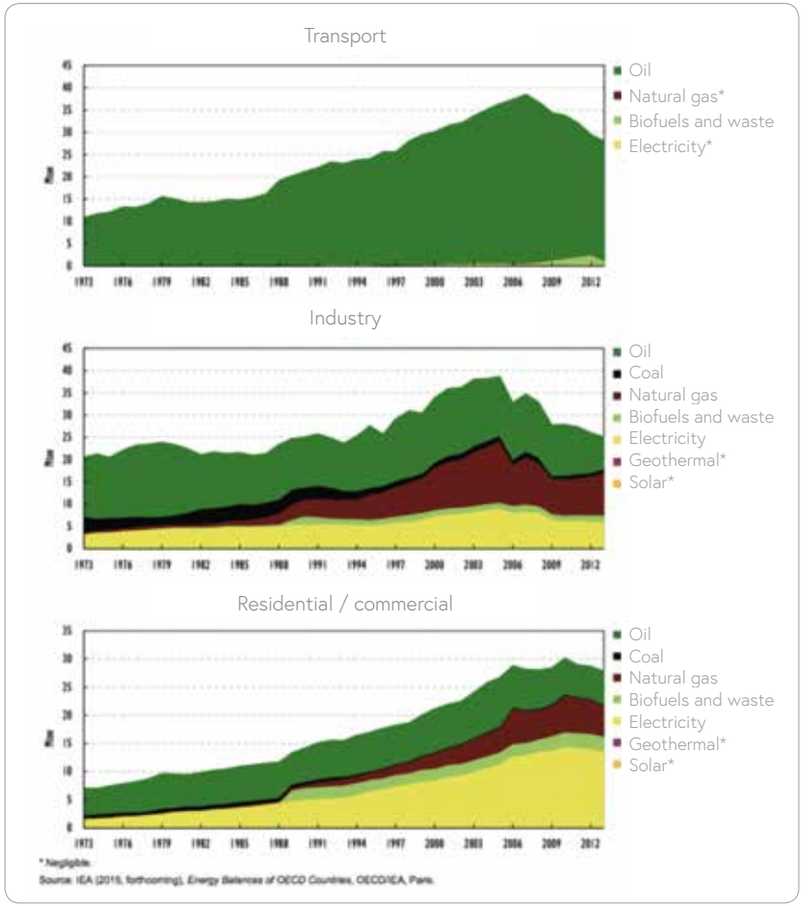

Figure 26: Energy use for transport, industry, and residential and commercial use.

Decline of autochthonous coal

Coal mines in Spain have seen a sharp decline in recent years. In 2011 Spain implemented a coal mine closure plan, with aid given to ease the closure process by covering production losses of the mines until closure, which is set for 2018. The European Commission granted this plan and plans to grant Spain €2.12 billion for the orderly closure of twenty-six uncompetitive coal mines (European Commission, 2016). Unfortunately, Spain shows no intention of decreasing its dependence on coal, as between 2010 and 2014, Spain more than doubled its proportion of electricity generated by coal-fired power plants (International Institute of Law & Environment, 2017).

Change in system of incentives

Spain's FITs and FIPs led to an investment boom for the PV sector, which in turn led to a tenfold increase in PV deployment. Although this may seem like a success for the implementation of renewable energy sources, it has led to a substantial increase in support costs for renewable energy sources. This concern has led to the implementation of new cost-containment regulations that affect all renewable energy technologies. Rather than feed-in tariffs, the government will hold auctions, or "competitive concurrence mechanisms" to provide support for new installations of renewable energy sources. Furthermore, all FITs and FIPs have been abolished and replaced by a sum to be allocated based on the plant's installed capacity (Del Río, P., 2016).

Galicia

Importance for Spain's total energy sector

Galicia is an important energy producer for Spain, generating 12% of Spain's electricity (Míguez et al., 2006). Míguez et al. also claim that Galicia has a 33% capacity for self-sufficiency in final energy (excluding the demand for petroleum products for transport). The region has large potential for harnessing renewable energy for wind power, small hydro and biomass. In 2006, the plan for Galicia set a target to achieve a 15% annual contribution from renewable energy sources towards final energy consumption: 1425 Gwh from wind, 1082 Gwh from small hydro and 964 Gwh from biomass.

Galicia transforms about 10% of all Spanish primary energy and exports around 40% of the final power it generates. However, despite its important position in Spain regarding power production, Galicia suffers from negative externalities with no fiscal compensation, meaning that they are left to bear the burden of environmental damage themselves (D.P. Fernando, 2017). Galicia currently imports 82.13% of its primary energy, while 17.87% is autochthonous (INEGA, 2016). The division of autochthonous primary energy is displayed in figure 27, which shows that a majority of the renewable energy in Galicia comes from biomass (34.15%) and onshore wind energy (32.39%), while most of the energy imported by Galicia is non-renewable, with crude oil comprising the largest part.Galicia consumes around 10.5% of Spain's energy, where 38% is used for transport fuel, 37% for heat and thermal fuel and the rest (26%) for power.

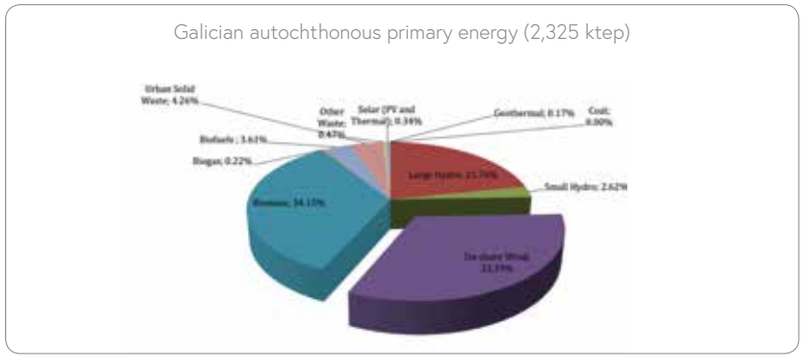

Figure 27: Autochthonous primary energy production in Galicia.

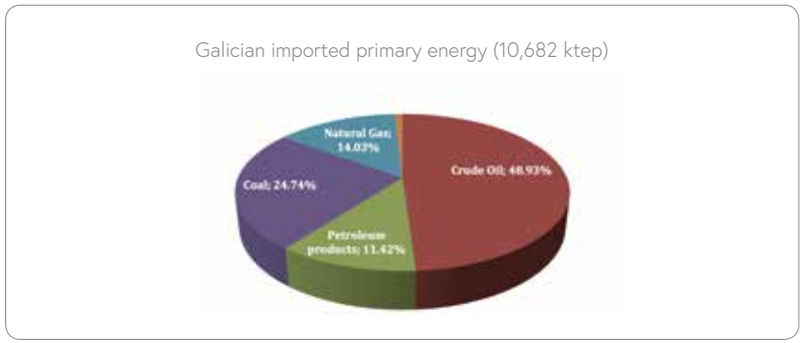

Figure 28: Primary energy imported to Galicia.

Changes over time

Spain

The growing need for energy in European societies has resulted in a greater emphasis on energy-saving strategies. Because of the large demand for final energy, European governments have agreed to increase their share of renewable energy in final energy consumption to 20% before 2020 (Montoya et al., 2014). Spain's energy energy dependence is well over the average for the EU at 76.44%, compared to the average of 53.84%.

Nonetheless, the use of renewable energy sources in Spain is growing and the potential for Spanish renewable energy is broad. The progress made in achieving renewable energy objectives has occurred due to the development of renewable power generation and also as a byproduct of the economic crisis, which has led to a reduction in energy consumption. In recent years, Spain has had a low coal penetration and higher renewable penetration compared to other European countries with comparable population and size.

The year 2000 has been taken as the starting point for Spain's transition to renewable energy, as that year marked a 17% reduction in GHG and power generation in the economic section was decarbonized, reducing emissions by about 40% (Amores and Álvarez, 2016).

At the international level, the European Directives 2009/28/EC and 2009/29EC as well as the 20-20-20 initiative have also contributed to these changes. To reach their goals, Spain has implemented a number of regulations, including the Spanish Climate Change and Clean Energy Strategy for renewable energies (De Miguel Perales and Lorenzo, 2016).

Galicia

Until 2008, Galicia had been employing autochthonous coal with poor calorific capacity. After that year however, this has been prohibited due to environmental and economic reasons, since Galician coal is generally inefficient, slow-burning and with low potential (DeLlano-Paz, 2017). Until the year 2002 Spain, thanks to Galicia, was considered a leader within wind energy production. However, the new government has ceased to distribute incentives to create new wind farms, hence the decline of wind as a renewable energy source. DeLlano-Paz stated in an interview that he believes the reason Spain is not implementing more renewable energies is that fewer employees are needed for wind farms than for oil refineries. Because many people already work in the oil sector and infrastructure is already in place for it, it is perceived as a difficult change.

There are several large coal-fired power plants based in Galicia. The regional government has introduced an environmental tax on S02 and NOx emissions, which is strongly opposed by the Spanish electricity industry. This tax is likely to have positive effects on CO_2 emissions, but at a very low rate, leading some to believe that it has been mainly implemented as a revenue raising instrument (Lofsted, RE., 2014).

The future of Galicia

Spain

Political stance

The People's Party of Galicia is affiliated with the People's Party of Spain, Spain's centre-right governing party. Their energy-sector reform plan creates both possibilities and setbacks. The PP seeks to slash subsidies for both wind and solar power energy, as the debt crisis results in expensive funding. Instead, they are likely to promote smart power grids and meters to match demand to the supply of renewable energy. The PP also looks to keep nuclear plants running (as long as they are safe) and wishes to establish a possible windfall tax on cheap nuclear power in exchange for an extension on the life of power plants (MacInnes & Pinedo, 2011).

Growth of renewable energy sources

The use and importance of renewable energy in the Spanish economy has been growing and is predicted to continue to grow in the next few years. In 2010, the direct contribution from the renewable energy sector for the Spanish GDP has shown a positive growth of approximately 56.7%. The International Monetary Fund

predicts an annual growth of 2.5% between 2016 and 2020 and believes the direct contribution of the country's renewable energy sector will represent 1.03% of the country's GDP by 2020 (MacInnes & Pinedo, 2011).

The transition towards the 2030 energy model

The energy sector aims to have a power generation mix of 100% renewables and storage by 2050, with the intention of energy efficiency no longer being to save energy, but to adapt to limited capacity. Although consumers will have to pay for the capacity, there will no longer be CO_2 taxes. To ensure an efficient transition, the different levels of government (national and regional) and the private sector in Spain need to collectively take decisive action to change the energy model.

The three main actions that are being considered to assist in this energy transformation are: 1) Switching to energy carriers that have lower emissions (such as replacing coal and oil with electricity), 2) Substituting the emission of power generation with renewable energy sources, and 3) Promoting energy efficiency (Amores and Álvarez, 2016).

Galicia

The growth of renewable energy sources in Galicia is very opportune for several reasons. Firstly, because of its autochthonous capabilities there is less dependence and risk of disruption and also greater security. Galicia also has unlimited renewable energy sources available, as opposed to limited fossil fuel stocks. This is likely to have a positive influence on the Galician GDP, with capital formation, efficiency improvement and an increase in employment demands (DeLlano-Paz, 2017).

Wave energy potential

Wave energy is seen as one of the most promising renewable energy sources for Galicia. The wave climate in Galicia is among the harshest in Europe. Iglesias et al. (2009) researched outcomes for the potential wave energy sources to assist in reducing the emissions of greenhouse gases as prescribed by the Kyoto protocol. Iglesias et al. (2009) discuss not just the technological and geophysical factors for wave potential in Galicia, but the environmental, human and socioeconomic factors. Galician onshore wind contributes 15% towards the total Spanish wind power. There are ongoing studies into the possibility of offshore floating platforms on the Galician coast (DeLlano-Paz, 2017).

Aside from wave energy, Galicia also has major rivers that produce up to 11% of total Spanish hydro power, and potential for solar thermal and PV power, which contributes to just 0.34% of the Galician power mix (DeLlano-Paz, 2017).

The political obstacles of Galicia

Spain

Spain seems to show a negative trend in fulfilling the 2020 renewable energy objectives. Their best-case scenario projection shows a range between 12.6% and 17.1% instead of the forecasted 20%. It has also seen an uneven growth in renewable energies due to its geography, largely its hilly terrain (Montoya et al., 2014).

Changes in policy

Changes in policy have also created barriers to improvement. The country experienced a decrease in newly-installed photovoltaic energy power in 2009 due to the enactment of new laws and ordinances that restricted and removed previously established incentives for the sale of electricity generated by PV systems (Montoya et al., 2014). Furthermore, Royal Decree laws 1565/2010 and 14/2010 have limited their compensation to twenty-five years and established a retroactive measure in existing installations that limits the equivalent hours of operation that have caused losses of up to 30% (Montoya et al., 2014).

Barriers to wind energy

- Institutional arrangements: Barriers created through authorization procedures, grid connections and the initiation of production, which in turn cause delays in granting permits, transaction costs and risks to developers. This is relevant on a national, regional and municipal level.

- Administrative issues: There are overlapping procedures between national and regional governments. The implementation of wind farms is affected by sixty different regulations, causing lead times of up to eight years.
- Regional differences: Since authorization differs between autonomous communities, there are inconsistencies at the state level, forcing investors to consult with the different regions where they plan to install (Del Rio & Unruh, 2007).

Barriers to solar photovoltaic energy production

- High costs: Cost reduction should be the priority
- Lack of an accurate legal framework and insufficient support: The FIT is significantly lower than that of most other European countries. Subsidies are not always granted and vary by region, creating institutional uncertainty for investors
- Administrative procedures to install PV modules are often complex, causing delays
- Financial barriers: Funding conditions are unfavourable compared to those of wind energy, creating high investment risks (more from Del Río & Unruh, 2007).

Galicia

Political instability

Galicia has faced several obstacles to the transition to a low-carbon energy economy. DeLlano-Paz (2017) identifies political instability and legal uncertainty as two of the key political obstacles. In 2012, the support system was modified and feed-in tariffs were reduced, thus reducing the return for investors. This has caused a decrease in private investment.

Lack of power

Secondly, DeLlano-Paz states there is a lack of power, resulting from the Spanish-Galician economic crisis, which affects economic activity and the investments available for the region. Thirdly, there has been an important decrease in Galician energy competence, which hampers the possibilities of the region in terms of energy planning.

Lack in public knowledge

Finally, there is a lack of public information and therefore a lack of knowledge from the civil society of the benefits of renewable energy sources and subsequently, the benefits of supporting these energies.

High costs

According to DeLlano-Paz (2017), there are further obstacles both for Galicia and Spain. Spanish power consumption has a high taxation rate for consumers of up to 21%, with consumers also paying the cost of the subsidy of the Spanish power tariff system. These barriers increase the costs of the use of power for local consumers.

Discussion

Major findings

Friesland

Until now there has been little action taken by the national and regional government of the Netherlands regarding renewable energy sources, which is a barrier for the transition to green energy. However, many local initiatives have been established throughout the Netherlands, particularly in Friesland. Therefore, there is a palpable shift towards green energy occurring within companies and organizations. Looking towards the future, there is great economic, geographic and social potential for renewable energy sources in Friesland, which can help spur along the green energy transition. For now, the Netherlands is struggling with multiple political obstacles that are holding back the transition, such as:

- **Lack of urgency**
  The urgency of transitioning to renewable energy is not expressed by the governments, so the local society does not perceive it to be an urgent matter.
- **Potential conflicts with the fossil fuel industry**
  When renewable energy is implemented, the fossil fuel industry will change or even disappear, which will lead to friction.
- **Lobbying**
  The fossil fuel industry is lobbying aggressively towards the national and local government, which makes it an industry that is still strong. This is a power that local initiatives do not posses.
- **Problems in the system**
  The current systems are conservative, which makes progressive change generally difficult.
- **Unbalanced factors**
  The three factors of triple bottom line decision-making—people, planet and profit—are unbalanced, with profit as the dominant language, blocking the transition towards renewable energy.
- **The energy supplying industry places business before the environment**
  The energy supply system is also controlled by this dominant language of profit, which discourages local society from using and producing green energy.
- **Misinformed users**
  Those who do choose to use green energy are actually not receiving 100% green energy but rather, a mix.

Friesland is also dealing with political obstacles specificto their region, such as:

- **Frisian societal resistance to (national) governmental policy**
  Frisian society protests against renewable energy projects founded by the government.
- **Potential conflicts with the national government**
  If the national government forces Friesland to implement renewable energy sources over a short period of time, this will cause difficulties for Friesland, due to societal resistance.

Yorkshire

It is apparent that both Yorkshire and the United Kingdom as a whole will have to make great efforts to make the transition to renewable energy possible. However, due to the country's focus on energy reduction and the uncertainties brought forth by Brexit, the transition is in danger. The following political obstacles were found in this study:

- **Focus shift from transition to reduction**
  Rather than working towards a system that utilizes renewable energy sources, the United Kingdom has focused on reducing energy use and decarbonizing the overall system.
- **Biomass promotion**
  The United Kingdom produces biomass, which, while renewable in theory, ceases to be so unless the feedstock is replanted and is not dependent on fuel transport. Biomass promotion causes an obstacle for the transition to renewable energy, as it prevents other renewable technologies from developing further.
- **Brexit**
  - **Investments**
    The current political insecurity in the United Kingdom causes investors to feel insecure as well, which results in fewer investments. This makes the transition to renewable energy sources very difficult, as investments are needed for further development and renewable energy production.
  - **Policy**
    It is expected that policies will change once the United Kingdom leaves the European Union. This will influence the policy-making on energy directives, as well. It is uncertain whether this could become an obstacle for the transition to renewable energy sources.
  - **Crisis takes more attention/urgency**
    The Brexit political crisis results in a tendency to put other pressing issues, such as the transition to renewable energy, aside. This causes the shift to renewable energy to be put on hold, as the country prioritizes dealing with its political issues.

Flanders

There are many complications in Belgium due to the complex political interregional structure. Due to differing political ideologies and authorities, there is much to be done before the country can move farther into the renewable energy transition. However, there have been recent efforts to adjust the current TGC systems in Flanders in order to make it more effective. Belgium is on track to meet its 13% renewable energy target by 2020, although to achieve this, effective collaboration between the regions is essential.

The main political obstacles found are:

- **Belgium's political system**
  Belgium has a divided political structure whereby the federal authorities are responsible for the national equipment programme in the electricity and gas sector, electricity generation (power stations), electricity transmission (high-voltage lines) and tariffs. The regional authorities are responsible for local transmission and distribution of electricity (under 70 kV), public gas distribution, cogeneration, promotion of renewable energy sources (RES) and rational use of energy (RUE). There is doubt regarding the progress of renewable energy sources within Belgium (and Flanders).
- **Lack of potential resources**
  Renewable energy potential in Belgium is relatively low due to its rather flat, densely populated and somewhat cloudy environment.
- **Future problems regarding nuclear energy**
  There is a large amount of demand for energy within Flanders. However, with the phasing out of nuclear energy (its main source), it will be difficult to find new sources and the question will remain as to whether they will in fact, be renewable.
- **Efficiency of energy policies**
  Current policies may not be as efficient and favourable as they should be.

Silesia

The main political obstacles found for Silesia and Poland were the following:

- **Historical and cultural link with coal**
  The historical and cultural importance of coal in Poland, particulary in Silesia, is an obstacle to the transition towards renewable energy because it is hard to change cultural traditions that are deeply ingrained. This reduces the incentive to promote renewable energy sources.
- **Little public support**
  Silesia's mining community is large, and since many voters are financially dependent on the coal industry, there is little public support for the transition. This lack of support is a barrier, as political parties are less likely to promote the transition, for fear of losing votes.
- **Lack of urgency**
  The public perception is that there is no great urgency to transition to renewable energy, as some politicians have implied there is no need to make

the transition now. These statements result in a reduced feeling of urgency among the Polish population. Silesia is also more focused on improving air quality than solving the climate problem, as most of the country's mines are in Silesia and the smog is high in the region.

- **Biomass**
  Co-firing biofuels with tradition coal results in more investment in the coal industry rather than focusing on transforming the industry. In addition, biomass cannot be considered renewable when there is not enough feedstock replanted and fossil fuel transport is needed. The promotion of biomass causes an obstacle for the transition, as it prevents other renewable technologies from developing further.
- **Political parties**
  The Polish political system requires parties to have more than 7% to be allowed to enter parliament. The Polish Greens have never reached this threshold, and therefore have never had the chance to work on energy policies. This political environment creates an important obstacle for the transition towards renewable energy, as parties whose programme focuses on the transition do not have power within parliament.

Galicia

The People's Party of Galicia is affiliated with the People's Party of Spain (PP), Spain's centre right governing party. The national PP seeks to slash subsidies for both wind and solar power energy, as the debt crisis results in expensive funding. Furthermore, there has also been a change in the incentives system. The previous FITs and FIPs caused an investment boom of the PV sector, which resulted in a substantial renewable energy support costs. This raised concerns that have led to the implementation of new cost-containment regulations that have affected all renewable energy technologies. Rather than feed-in tariffs, the government will hold auctions, or "competitive concurrence mechanisms", in order to provide support for new installations of renewable energy sources. All FITs and FIPs have been abolished and replaced by a sum that will be allocated based on the plant's installed capacity.

Looking into Galicia, four main obstacles to the implementation of renewable energy were identified in this study (through interviews):

- **Political instability and legal uncertainty**
  The new government seeks to change current regulations in the incentives program, hence hindering investment opportunities.
- **Lack of power**
  There is a lack of power, resulting from the Spanish-Galician economic crisis, that affects economic activity and the investments available for the region.
- **Lack of public knowledge**
  There is a lack of public information available, and therefore, civil society lacks knowledge about the benefits of renewable energy sources and subsequently, the benefits of supporting these energies.
- **High costs**
  Spanish power consumption has a high taxation rate for consumers (of up to 21%), who also pay the cost of the subsidy of the Spanish power tariff system. These barriers increase the cost of power for local consumers.

Comparing the case studies

Although it would be easy to assume that political obstacles in the transition towards renewable energy might be similar throughout different European regions, the reality is that the cultural, political, geographical and social landscape of each of them is very different. Every region is struggling with their own particular set of problems, many of which can also be identified as obstacles to their transition to green energy. The most common barriers in these regions are explained in table 3.

Obstacles	Explanation
Political problems	Political problems have been identified in every region analyzed by this study, ranging from instability, problems in the system, to Brexit. Most common among all regions is perhaps political instability, which is a hindrance to green energy transition across regions. Due to the diverse backgrounds of each region, the actions required to solve political instability will be different for each. Political issues play an important role but are also reflected in other political obstacles.
Lack of knowledge and public support	In four out of the five regions observed, political obstacles regarding lack of knowledge and/or public support were identified. This makes it hard to achieve goals and implement renewable energy policies. The obstacle of a lack of public knowledge was perceived in different areas and actors.
Lack of urgency	A lack of urgency is a political obstacle described in only three of the regions studied, although this study considers this to be a very important obstacle as this perception can slow down the green energy transition even when technology and financial sources are available.
Preference for other energy sources	Some regions have historical ties to a certain non-renewable energy source that is considered more effective or beneficial for the region, such as coal. Due to promotion and lobbying from the energy industries, attention is withdrawn from renewable energy sources. Future conflicts may arise when these regions eventually shift to green energy.

There is a close connection between the different barriers identified. For example, lack of knowledge results in a lack of urgency and social awareness, which in turn can result in social resistance to change. This means that informing the public society about all the different aspects of green energy is very important in the transition to renewable energy.

Limitations and further research

A few problems arose during the process of writing the regional case studies. It was difficult to receive interview responses for certain case studies, such as those of Galicia and Flanders, which received one and none, respectively. Furthermore, some of the interviewees did not have enough knowledge or background information to ontribute to the research. This search for oral information resulted in a long period of seeking and waiting, making time a limiting factor as well. Because few to no interviews were done for certain regions, the case studies had to be written by analyzing literature. This literature analysis was also limited for some regions.

Therefore further research is necessary in order to obtain more in-depth information for the case studies and analyze more regions to identify further political obstacles in the transition to renewable energy. For instance, it would be interesting to research more specific obstacles for Friesland and compare them with other regions in the Netherlands to obtain a clear overview of how the national and regional government can make it easier to adapt or renew their policies for renewable energy.

In Spain each autonomous region, including Galicia, has a different governmental system, each with its own political parties. Since the situation varies from one region to another, it would be interesting to look for connections between the political parties that govern each region and participation in the transition to renewable energy sources. Further research could look into the governmental change in both Spain and Galicia, what the new political parties seek to change or what they have already done with regard to renewable energy in Spain. Most articles written about Galicia are either outdated or written in Spanish, so there is room for updated literature.

The case of Belgium and Flanders is very unique, as the political structure within the country is very different from that of other countries. Thus, it would be interesting to conduct further research into how the political system affects renewable energy transition, as there is currently no scientific evidence or research that proves this to be true but it is clearly an important political obstacle. Due to lack of resources and a contact person, this study was unable to identify the specific factors and consequences of this. This limited the knowledge of what people in Flanders

perceive to be political obstacles to the transition towards renewable energy. It was also difficult to find literature relevant to Flanders, as each region in Belgium (others being Wallonia and Brussels) have different policies and political views. Therefore, there is definitely room for further research in Flanders.

Few political obstacles to the transition to renewable energy were found in the case study of the United Kingdom and Yorkshire. More research could be conducted to successfully identify all obstacles. To have a more complete view, more research should be done into the effects of Brexit, for example, as only a few potential obstacles were identified due to uncertainties about the country's political future and uncertainties within sources. It is very likely that many more political obstacles are at play and new results could be found with further research. Because the impact of biomass on the environment can vary widely, studying the environmental impact of the use of biomass within the United Kingdom and Yorkshire could help determine how much the promotion of bioenergy can impact the transition to renewable energy. Determining the impact of biomass on the environment as a whole will help many other regions as well, as biomass is a widely used source. Furthermore, determining the impact of biomass on the environment will help ascertain the severity of the promotion of biomass as an obstacle to the implementation of renewable energy sources.

The situation in Poland and Silesia is very particular. As Polish politics, culture and history are very much connected to coal mining, there is resistance to change. Given that many articles and written pieces on the connection between these three aspects in relation to the transition to green energy are in Polish or incomplete, further research is recommended. Identifying a direct link between policies and results could give more insight into the obstacles. Therefore, there is room for further research within this region.

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Appendices

Appendix A

Recommendations for Friesland gathered from the interviews with Kramer, De Boer and Bijma:

The transition has to be realized with the whole Frisian community, from producers to consumers and from farmers to residents. Given that Friesland has the possibility to fill in the plan itself, this process should involve everybody. Everybody should be able to make their voice heard. If there is not an opportunity for everybody, people will feel used in the discussion. What is also of importance, as stated by Kramer, is to see to what extent it is mandatory for Friesland to realize environmental goals on their own territory or if it is also possible to realize them somewhere else. This is statistical transfer. For example, the share of approximately 9000 MW that Friesland might have to implement nationally may be realized in Spain or any other place where it would be more suitable.
Kramer, 2017.

It is all about money, because the energy industry is very lucrative. For example, Friesland spends 1.8 milliard euros per year on energy, from energy bills to refueling cars. In ten years this results in a small twenty milliard, which could also be invested in sustainable energy, in such a way that the money stream can deviate from fossil fuels.

Nowadays schools and big companies want to be seen as being sustainable institutions. Friesland Campina, for example, is taking steps to make its farms energy neutral, to foster greater biodiversity, use fewer chemicals, greener transport, etc. If these institutions were supported locally, Friesland could become the greenest region in Western Europe. Becoming the greenest region and supporting this goal as a community could be feasible if we involve different parties. On the other side, people who suffer from renewable energy should be compensated, or should even experience benefits from the renewable energy source.
De Boer, 2017.

Democratic renewal is needed. The group of people who are taking initiatives is achieving business for political interest and therefore they should have the right to participate actively in the process as well. Hence, it would make sense for civil servants, counselors and initiators to collaborate instead of waiting. There can be initiators of all kinds, but they should all be given the opportunity to bring their local initiative to fruition. Klaas van Egmond predicts the formation of a new kind of elite, separated from the rest. This is already happening and it is creating a gap, which populists are quickly trying to fill. This means that only elites are capable of developing local initiatives, because they are the ones who have knowledge about the system and about entrepreneurship. However, it should be possible for all kinds of people to carry out local initiatives.

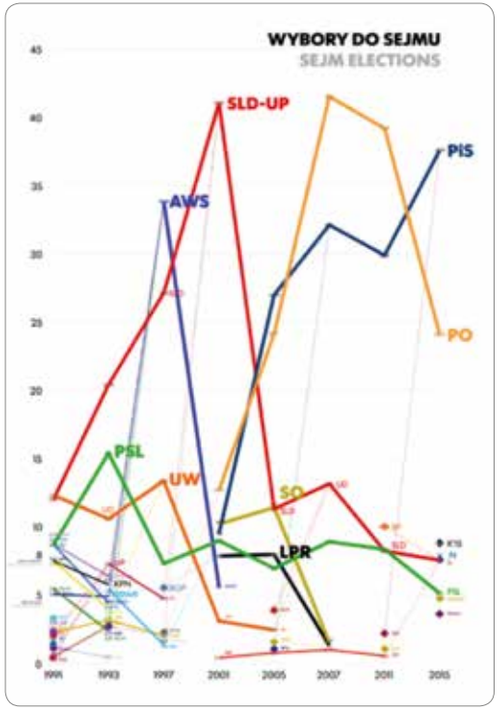
The transition to green energy must occur with the collaboration of everyone; people from all kinds of different backgrounds and with different kinds of knowledge. The current system is difficult to change, in part because the same groups of people continue to obtain subsidies from the government while it is possible that there are other groups with better ideas. Perhaps the government should stop giving subsidies, see what comes from the people, and give them the opportunities and collaboration they need.

The way to change the system is to educate the youngest generation, since it is more difficult to change the mindset of older generations. People are currently still educated in a way that allows them to adapt to the current system, which is not wanted anymore. Therefore, children should be educated to develop their thinking skills and to learn ideals and ways to foster diversity, instead of being made to memorize material they do not need
Bijma, 2017.

Appendix B

Company	Station	Fuel	Installed capacity (MW)	Year commission or generation started
Centrica	Glanford Brigg	CCGT	150	1993
Centrica	South Humber Bank	CCGT	1310	1996
Drax Power Ltd	Drax (coal units)	Coal	1980	1974
Drax Power Ltd	Drax (biomass units)	Biomass	1980	1974
Drax Power Ltd	Drax GT	Gas oil	75	1971
E.On UK	Blackburn Meadows	Biomass	33	2015
E.On UK	Castleford	CCGT	56	2002
E.On UK	Thornhill	CCGT	50	1998
E.On UK	Humber Gateway	Wind (offshore)	219	2015
Eggborough Power Ltd	Eggborough	Coal	1960	1967
ENGIE	Saltend (CHP)	CCGT	1200	2000
Ferrybridge MFE Ltd	Ferrybridge Multi-fuel	Biomass	79	2015
Scottish and Southern: Thermal	Keadby	CCGT	710	1994
Scottish and Southern: Thermal	Keadby GT	gas oil	25	1994
Scottish and Southern: Wind	Keadby	wind	63	2013
Third Energy Trading Ltd (formerly RGS)	Knapton	gas	40	1994
Uniper UK Ltd	Killingholme	OCGT	600	1993
VPI Immingham LLP	VPI Immingham (CHP)	gas	1240	2004
		Total	**11770**	
		UK Total	**74373**	
Total percentage of national energy produced in Yorkshire and the Humber			15.83%	

Appendix C



Appendix D

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/211292/ro_banding_levels_2013_17.pdf

A message from Coppieters Foundation

Coppieters Foundation is a research centre focusing on European affairs since 2007. Thanks to the support of European institutions and its own network, Coppieters Foundation develops new ideas and produces knowledge on the management of cultural and linguistic diversity, collective rights, multilevel governance, decentralization, stateand constitutional reform, statehood processes, self-determination, migration, conflictresolution, peace studies and the protection of human rights in Europe.

Coppieters Foundation is affiliated to the European Free Alliance political party, and isrecognized as a European Political Foundation by the European Parliament. Up to now, every book and policy paper published by Coppieters Foundation has contributed new reflections and visions for a diverse, fair and sustainable Europe. This is why I am particularly proud of this publication, because it represents a new and important contribution to European public policy debates. I am certain that it will have a significant impact on European lawmakers, policymakers, academic and researchers.

I would like to thank and acknowledge the authors, editors and coordinators of this study for their excellent contribution to Coppieters Foundation. I also thank you, the reader, for your interest in the work of our foundation.

Günther Dauwen
Secretary of Centre Maurits Coppieters
www.ideasforeurope.eu

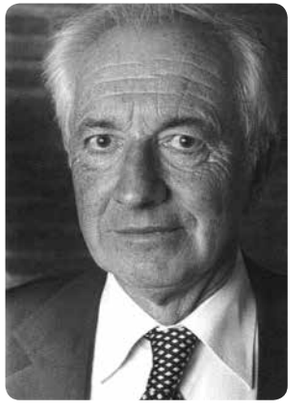
The aims of the Coppieters Foundation

- To develop new ideas and produce knowledge on the management of cultural and linguistic diversity, collective rights, multilevel governance, decentralization, state and constitutional reform, statehood processes, self-determination, migration, conflict resolution, peace studies, and the protection of human rights in Europe;
- To raise awareness on issues of special interest for the foundation and its members;
- To influence decision-making process at the European level and create a legal framework that allows for an enhanced implementation of the principle of subsidiarity, the right to self-determination, better protection of diversity and minority rights, and a stronger respect for human rights in Europe;
- To drive the EU towards an alternative institutional structure that is more democratic, more respectful of collective rights and more aware of complex (multi-national and multi-cultural) realities of EU Member States;
- To play a role as a platform for dialogue between academia, European institutions (the European Parliament, the European Commission and the Committee of the Regions) and other political actors;
- To transform scientific knowledge in the fields of political science, economy, sociology, philosophy and history into usable concepts for political action;
- To feed the European Free Alliance with politically relevant concepts, ideas, data, and knowledge, both in the institutional sphere and in EFA's action sphere outside European institutions.

Coppieters Foundation takes all necessary actions to promote and achieve the above stated goals by observing the principles on which the European Union is founded, namely the principles of democracy, respect for human rights, fundamental freedoms and the rule of law.

The geographical scope of the Coppieters Foundation is the European Union together with EU candidate and potential candidate countries. The partners of the organisation are based in 8 member states of the EU and active in 14 regions or stateless nations.

Maurits Coppieters
(Sint-Niklaas, 1920 – Deinze, 2005)



The Fleming Maurits Coppieters studied history and later became a Doctor of Laws and obtained a Master's degree in East European studies. During the Second World War, he refused to work for the German occupier. After many years as a teacher, he worked as a lawyer for a while. He was one of the people who re-established the Vlaamse Volksbeweging (Flemish People's Movement), of which he was the President from 1957-1963.

Coppieters' political career began when he became a member of the Flemish nationalist party Volksunie (VU), which was formed in 1954. With the exception of two years, Coppieters was a town councillor between 1964 and 1983. He was also elected as a member of the Belgian Chamber (1965-1971) and Senate (1971-1979). At the same time, Coppieters became President of the newly formed '*Cultuurraad voor de Nederlandstalige Cultuurgemeenschap*' (Cultural Council for the Dutch-speaking Community), from which the Flemish Parliament emerged, when the VU formed part of the government. In 1979, Coppieters was elected during the first direct elections for the European Parliament.

As a regionalist, he became a member of the Group for Technical Coordination and Defence of Independent Groupings and Members in the European Parliament (TCDI). Among other things, he made a name for himself when he championed the cause of the Corsicans. In the meantime, Coppieters also played a pioneering role in the formation of the European Free Alliance, of which he became the Honorary President and continued to play a role in its expansion, even after he said farewell to active politics in 1981. In 1996, Coppieters joined forces with the President of the Flemish Parliament, Norbert De Batselier, to promote 'Het Sienjaal', a project with a view to achieve political revival beyond the party boundaries. Coppieters died on November 11, 2005.

Among other things, Coppieters was the author of: '*Het jaar van de Klaproos*'; '*Ik was een Europees Parlementslid*'; '*De Schone en het Beest*'. He was an honorary member of the EFA.

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