Rijksuniversiteit Groningen

Faculty of Spatial Sciences

Environmental and Infrastructure Planning
Master Degree Program (MSc)

Master Thesis

(Re-)Inventing Offshore Grid Planning

A Vision of Joint International Collaboration in the North Sea Towards a European Supergrid

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Groningen, August 30, 2015

Abstract

The European Commission published the desire for a competitive European offshore supergrid in 2007. This can be seen as one milestone towards the ambitious targets by the European Council with regard to climate change. This thesis researches the willingness of the stakeholders towards coordinative grid planning in the North Sea. This means joining the transmission system operators, governmental regulators and other stakeholders of all North Sea neighbouring countries to one coordinative approach. The willingness is investigated via a hybrid approach. Expert interviews give the practical background for the feasibility and literature review forms the scientific background. Additionally, reports and initiatives towards joint offshore grid planning are examined and contrasted. The question for a uniting steering institution will be discussed and a governance format is suggested based on an existing model. The findings show that broad initiatives mostly on a European level are set out to support the idea and to bring the stakeholders together. Unfortunately, very few investigations discuss the challenges coming along in regard to governance and feasibility. A combination of the findings from expert interviews and literature lead to the conclusion that a supergrid will not be realisable; at least not in one enormous grid project.

Bilateral offshore projects have already been accomplished. The greater scale of joining all North Sea neighbouring countries with all their stakeholders is large to succeed. However, small scale initiatives in borderlands could be the start towards a larger grid. This might be advised by an institution on a European level but the planning execution cannot be touched. Hence, it remains within the responsibility of nations and regions.

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List of Abbreviations

ACM	Autoriteit Consument & Markt
BNetzA	Bundesnetzagentur
CRE	Commission de Régulation de l'Énergie
CREG	Commission de Régulation de l'Electricité et du Gaz
DERA	Energitilsynet - Danish Energy Regulatory Authority
EDR	Ems Dollart Region
EEG	Erneuerbare-Energien-Gesetz (German Renewable Energy Act)
ENSEA	European North Sea Energy Alliance
ENTSOE	European Network of Transmission System Operators
EU	European Union
GIS	Geographic Information System
GW	Gigawatt
HVDC	High Voltage Direct Current Transmission
MW	Megawatt
NSCOGI	North Seas Countries' Offshore Grid Initiative
NVE	Norges vassdrags- og energidirektorat
Ofgem	Office of Gas and Electricity Markets
OFTO	Offshore Transmission Owners
OLEC	Oldenburger Energiecluster e.V.
OTEC	Ocean thermal energy conversion
TSO	Transmission System Operators

1. Renewable Energies and the North Sea

20 20 by 2020

The European Council set these targets in 2008 and paved the way for a climate change opportunity in Europe. A cut in greenhouse gas emissions by 20% and the shift towards 20% share of renewable energies should put the European Union (EU) into the position of being a pioneer for a more sustainable future (European Commission, 2008b). As a result, most member states of the EU came up with a renewable energy law or, if they had already, a reform in order to meet the given targets.
Germany initiated the first law regarding the support of renewable energies in 1991: the so called *Stromeinspeisungsgesetz* which guaranteed a purchase obligation for the grid provider. This was later merged up and replaced by the Renewable Energy Act (Erneuerbare-Energien-Gesetz, EEG) in 2000. Since the implementation of the EEG in Germany the renewable energy sector increased tremendously. Hydroelectric power stations, solar parks, biogas plants, photovoltaics, wind turbines and even geothermal power stations were installed. Due to geographical conditions, local potentials for the use of those energies vary a lot. Solar power installations for example are mainly set up in southern Germany. This is due to the fact that the average duration of sunshine is higher than in the north. Wind energy turbines are mainly installed in the north of Germany as the wind conditions at the coast and in the flat hinterland are much better than in the mountainous south (Schmidt & Mühlenhoff, 2010). The German example shows the dependence of renewable energies on geographical conditions. In fact, the best conditions for wind turbines are located on sea (Schmidt & Mühlenhoff, 2010; Constans, 1979). Additionally, space on land is often very limited in Western Europe and renewable energy tends to consume more space than power plants for fossil fuels (Brücher, 2008). Hence, it seems inevitable to come up with visions and ideas: The sea and the coastal waters offer a lot of space and are so far only used for fishery and transportation. This means, permanent use by offshore installations have a large potential. The two above mentioned reasons, lack of space and a higher potential for wind energy on sea, lead the way to be intelligible to install wind turbines and even wind parks off shore and in the territorial waters. In 2007, the European Commission argued in support of offshore projects on a larger scale. Including the idea of "a competitive European offshore supergrid" (European Commission, 2007, 2008a). This master thesis will discuss the possibilities and motivation for joint North Sea grid planning in order to come up with a common plan for one grid in the North Sea area.

1.1. Marine Renewable Energies

The North Sea region with the coastal waters of France, Belgium, the Netherlands, Germany, Denmark, Norway and Great Britain has a high potential for marine renewable energies (Woyte, De Decker, & Van Thong, 2008). Offshore wind energy is just one example of marine renewable energies. Tidal energy and energy from currents are other possibilities in the tidal North Sea and its estuaries to gain energy. Wave energy, osmosis and ocean thermal energy are rather new types of marine renewable energies but also give potential for conversion of renewable energy by the sea. The following section will give an overview of the potentials of the North Sea region for the various types of marine renewable energies.

1.1.1. Wind Energy

Nowadays, only offshore wind energy is implemented or planned on a larger scale in the North Sea. This is a result of the fact that wind energy is strongly supported as a renewable energy source which is state of the art and highly sophisticated. Additionally, the potential of this technology is higher on sea than on land, as mentioned above. A study on the North Sea revealed that "the mean wind speed increases with increasing distance from the coast." (Coelingh, van Wijk, & Holtslag, 1996) A tendency for expansion due to the fact is confirmed by Figure 1. The map shows the North Sea region and the offshore wind parks in their process of planning. It is clearly recognisable that only a small amount of planned parks are already operating. In fact, most of the zones are in the planning phase. In total, 36 offshore wind parks are installed and currently operating in the North Sea. Table 1 gives an overview of the distribution by country. This table includes exclusively the parks installed in the North Sea. Parks at the south and west coast of the United Kingdom and parks in the Baltic Sea are excluded. Relating the current amount of more than

Table 1: Operating Offshore Wind Parks in the North Sea (08.12.2014 (4C Offshore, 2014a))

Country	Count	Capacity
United Kingdom	14	2626.1 MW
Germany	6	870.9 MW
Belgium	6	712.2 MW
Denmark	3	386.5 MW
Netherlands	4	246.8 MW
Norway	3	2.3 MW
France	-	0 MW
Total	36	4.8 GW

4.8 gigawatt in Table 1 to the size and amount of operating wind parks in Figure 1 it is clear to see that the total potential of the constructed offshore wind parks within the next years will be far beyond the current energy level. This leads to the

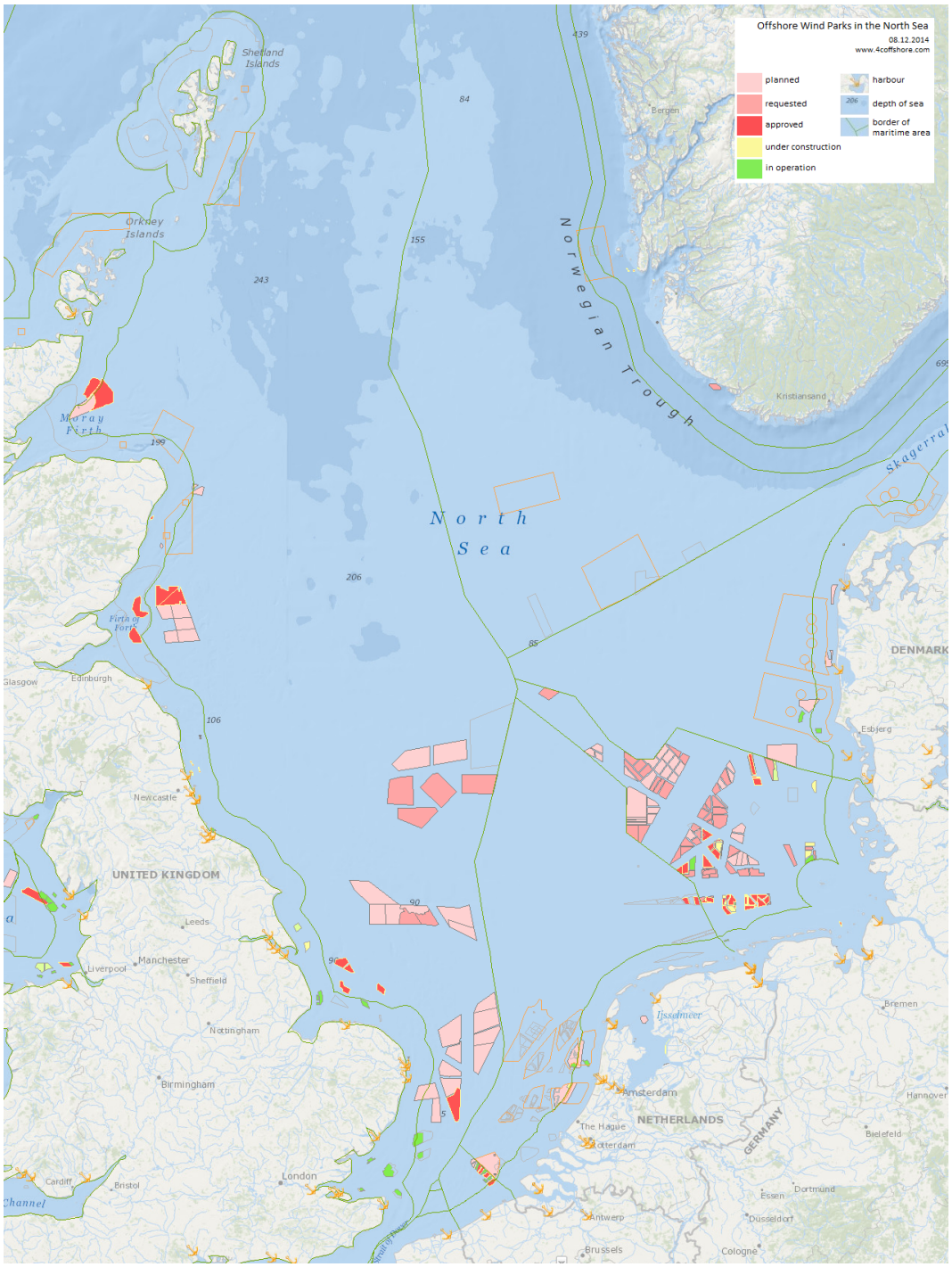
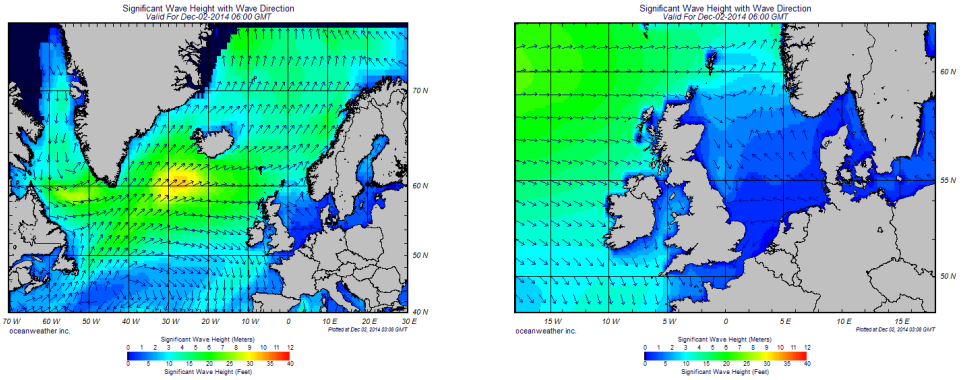


Figure 1: Wind Parks in the North Sea (08.12.2014 (4C Offshore, 2014a))



(a) Northern Atlantic (b) North Sea

Figure 2: Significant Wave Height with Wave Direction (Oceanweather Inc., 2014)

outlook for a strong offshore energy market as an important pillar in the upcoming European energy cluster.

1.1.2. Tidal Energy

Tidal energy and energy from other currents can be implemented in the tidal North Sea and its estuaries as well. In the North Sea neighbouring countries only Norway, the United Kingdom and the Netherlands are currently planning tidal energy projects. Norway has two projects (1.5 MW, decommissioned and 5 MW in planning process) outside the North Sea in the area of the Lofoten. The Netherlands have four projects in the phase of planning with a total potential of 4.3 MW. The United Kingdom has 54 tidal projects in planning or already installed. Most of those are also outside the North Sea at the west coast and feature up to 300 MW of energy generation. This high potential is due to higher currents at Atlantic Ocean's side (4C Offshore, 2014b).

1.1.3. Wave Energy

As mentioned, offshore wind energy is just one example for marine renewable energies. Wave energy plants are a possibility to convert energy for the market. Unfortunately only the northern part of the North Sea offers a high potential for wave energy generation (CRES, 2002). A wave height up to ten metres in the northern Atlantic Ocean provides a high potential and hence good conditions for the use of wave energy. Therefore, this is already utilized at the west coasts of Great Britain (Clément et al., 2002) and in the north of Denmark (RSE S.p.A., 2012). Unfortunately, this potential decreases tremendously down to five metres in the northern North Sea and around one metre in the southern North Sea (Figure 2b). Therefore, it is advisable for the United Kingdom and Norway rather to abstain from the implementation of wave energy plants in the North Sea. The focus should rather be on the west coasts. On the other hand, Beels et al. (2007) depict precisely this difference in aggressive-

ness of wave power in the North Sea as a potential to use wave energy conversion at distinct sites.

1.1.4. Osmotic Power

A osmotic power plant uses the technique of osmosis given by nature to generate energy by mixing salt and fresh water through membranes (Pattle, 1954). Therefore, this technology can be installed where rivers bring freshwater in their estuaries to the sea. In the end of 2009, the worlds first osmotic power plant was set up at the Oslo Fjord in Norway (IMechE, 2009). This prototype shall pave the way for a very young technology in the field of renewables. At current status, more research is needed, especially in the field of membrane-technologies (Thorsen & Holt, 2009), in order to get osmotic power plants market-ready (Loeb, 2002; Brauns, 2008). Brauns (2009) sees a high potential in this technology for future generations but also points out the higher potential for the lagoonal seas like the Black Sea. Lagoonal circulation leads to an increase of salinity in case if there is not enough exchange of water masses (Sverdrup, Johnson, & Fleming, 1942). Consequently, the Black Sea and Mediterranean Sea are known as very saline seas and have therefore higher potential for the use of osmotic power. Despite the higher potential of lagoonal seas, the North Sea region offers various spots, where rivers enter the sea. After progress in technology and therefore efficiency, various locations could serve for osmotic power plants, like the Afsluitdijk in the north of the Netherlands (Katia, 2014).

1.1.5. Ocean Thermal Energy

Ocean thermal energy conversion (OTEC) uses the existing temperature variations between surface water and deeper sea water alike geothermal power stations do. This technology requires two conditions: A preferably high gradient between the temperatures and a constant temperature of the surface water over the year. This leads to the fact that optimal conditions for OTEC are in the waters around the equator (Cavanagh, 1991). Therefore, the North Sea is unlikely to be considered for this type of marine renewable energy.

1.2. The North Sea

As pointed out in chapter 1.1, various technologies are feasible into implementation in the North Sea region with the aim to generate renewable energy. If technologies are in an earlier stage of development than for example wind energy, this does not mean they will not be installed within the next decades. Hence, the energy grid in the North Sea faces new tasks and constant changes in the upcoming years. Not least because of this, it is important to be open for future development while planning the grid for tomorrow. Every neighbouring country of the North Sea should face the challenge of a supergrid, as requested by the EU. A collaborative approach bridging the boarders

can contribute to every state, since the North Sea with it's central position (Figure 1) is ideal for the connection of the potential power plants and the main energy consumers. Earlier projects have already shown a successful cooperation between two countries (e.g. UK-France, NorNed, BritNed) for cable connections through the North Sea (Energy Valley, 2010; TenneT, 2014; Woyte et al., 2008).
A collaborative approach to plan the grid raises a challenge in two fields: Firstly, in order to take any action, a company needs any kind of motivation. This could be of financial benefits or others like the cooperation's image (Campbell, 1995). Hence, the transmission system operators (TSO) involved need a motivation or benefit to come together for joint grid planning. Secondly, it does not get easier to come to a mutual understanding, the more parties are involved. The more stakeholders involved in planning processes, the more complex the process gets (Lenferink, 2013).
Two general questions come up while discussing a possible offshore supergrid in the North Sea: Is it technically feasible? Is there a willingness to do so? The first question is already discussed broadly in literature (Woyte et al., 2008; Teixeira Pinto, 2014; Trötscher & Korpås, 2011, i.a.). The field of planning and international governance in the coastal regions is closely connected to the latter question. Hence, this study will investigate the second question:

Are the TSO in the North Sea neighbouring countries interested in a joint planning of a supergrid in the North Sea?

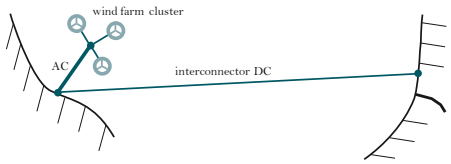
The TSO are the responsible stakeholders in grid planning. Additionally, it seems also relevant, if the governments or the governmental regulators are willing to do so as well. Furthermore, sub-questions emerge out of the above formulation, which have to be answered as well:

If the TSO need a stimulation to be interested, how could such stimulation look like?
Who are the actors in charge of planning the grid?
Which exactly are the involved countries?
Does a collaborative planning need an authority for supervision and management and how could such an authority look like?

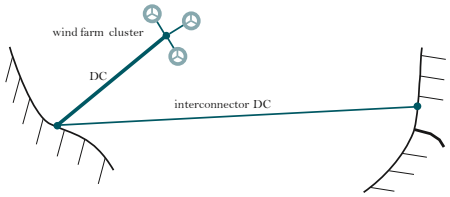
Other Questions regarding the design of the grid, technical feasibilities or locational planning are touched in this thesis but shall not be part of the investigation.

1.3. Current Status of Practise

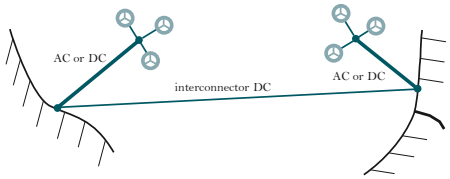
Due to recent developments and current state of the art at marine renewable energy the focus of this paragraph is on the development of offshore wind energy projects. Other marine renewable energies can be included into the grid but are mostly not yet ready for the market. At the current state of practise, most offshore energy projects are planned and built with an isolated grid connection. Due to various investors and



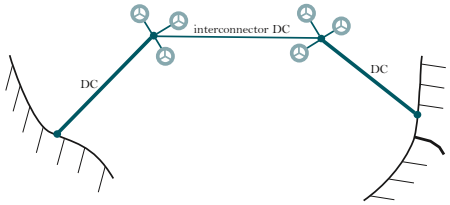
(a) Connection over Short Distance



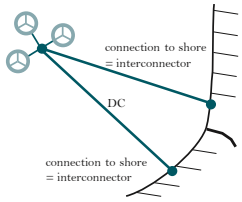
(b) Connection over Long Distance



(c) Interconnected Shorelines



(d) Interconnected Converter Stations



(e) Interconnected Shorelines via Converter Stations

Figure 3: Possible Interconnections of Wind Parks (Woyte et al., 2008)

a non-cooperative planning, only directly neighbouring wind parks are connected in a clustered design. This design provides one single connection to land over relatively long distances, as sketched in Figure 3a and 3b. Various offshore wind parks and other installed marine renewable energies give opportunity to interconnect the parks and to save cable routes and therefore lower the costs and environmental impact of such projects. Additionally, there are existing sub sea inter linkages between the North Sea's neighbouring countries (Ciupuliga, 2013; Ndreko, 2012; TenneT, 2014; Trötscher & Korpås, 2011). Those links could be used to connect marine renewable energy power stations on sea to the main grid via the landfalls of the cables (Figure 3c). Additionally, new links between countries do not have to be connected from shore to shore but could also be connected via each country's wind parks. This can be seen in Figure 3d. At last to mention is the connection of wind parks to more than one country (Figure 3e). This could compensate fluctuations in national grids due to variations in the consumption of energy.

This thesis will investigate the possibilities and motivation towards the target of a supergrid in the North Sea. Methods for this research form Chapter 2. This Chapter includes a discussion about interviews and how they were analysed. The conceptual framework of this research in form of a conceptual model is also included in this chapter. Besides the technical aspect, this thesis focuses on the political aspect and

the market's (TSO) motivation. Chapter 3 discusses the literature and the way it is going to be assessed. Furthermore, there is an additional section about theory in form of governance. The reflection on governance as well as a suggestion for an organisational structure (section 3.2-3.3) round out this chapter.
Chapter 4 will portray the data collected during the research process. This includes the information by the expert interviews and the relevant literature. It can be seen as elusive to get all interviews in the targeted group of interviewees. TSO and governmental regulators are both vast organisations. Hence, it can be expected that a number of enquiries come to nothing. This could be due to a responsibility of another then the contacted person. Or even due to a lack of motivation to take part in this interview. Additionally, the questions which are addressed in this research might touch upon sensitive information. A company could have a big interest in keeping their stance to oneself. Particularly, due to the fact that the those polled could be seen as competing firms on a international market and in the field of this research. This does apply to the TSO because they are private companies. The governmental regulators do not have an stake in market shares. The stand of the individual government is more relevant. If one countries government does not have a clear and public opinion on the topic, the governmental regulators are encouraged to keep any information. Therefore, a high rate of denials can be expected.
Additionally, to the information by interviews other practical sources exist. There are plenty of articles, reports and international initiatives dealing with the topic of offshore grid planning in the North Sea. These originate from the field of science as well as from institutions and companies. A broad and holistic overview of the topic can therefore only be offered if both sources are taken into account: Expert interviews and reports and initiatives. Hence, Chapter 4 also includes an analysis of reports and initiatives which will be later merged with the information from the conducted interviews.
The subsequent Chapter 5 adds up to the data and discusses it, for this field of research most important, in the practical field but also in a theoretical manner. This results in suggestions for further studies and ideas for further steps towards the North Sea supergrid. At last, Chapter 6 reflects on the success of the research process and indicates the issues as well as solutions for progress in context of this work.

2. Methodology

There is a broad range of methods in order to achieve an answer to the research question. Gaining knowledge through literature as well as the access to the same will be discussed in Chapter 3.1. Additionally, other means of achieving knowledge ought to be applied. Reinders (2005) points out the importance of inquiry connected to the assessment of the outcomes as well as the connection to literature and other means of information.

2.1. Interviews

This research takes place in a field which can be considered as mainly practical. Offshore grid planning combines parties from a public and private sector as well as theory in a general sense. Hence, theory and practice have to be merged. The theoretical objective of this research is mainly characterised if form of governance, international relations as well as the question of an organisational structure. The practical side of the research addresses the applicability and the willingness of the involved actors. Moser (2015) states it is often hard to combine this duality. Therefore, this research follows a twofold methodology. Besides literature in form of articles and theoretical reports, expert interviews offer a possibility to gain information through expertise. This collection of information of peoples' experience is valuable and can bridge the mentioned gap between the theoretical objective and the more practical question of this thesis. Hence, the selection of interviewees represents a vital and indicatory step for the topic (Reinders, 2005). The key personalities at stake within the field of international collaboration, grid planning, and governmental regulators are in focus. The aim of interviews is to get the expert's perception, opinion and interpretation to the given topic. Additionally, it is important to limit the number of interviewees to the most essential characters (Moser, 2015).
What kind of information is needed in order to answer the question if the TSO are interested in a joint planning of a supergrid in the North Sea? (Wagener, 2009) First of all it has to be investigated how international collaboration looks like in Europe and what kind of mechanisms play a role. In order to analyse this from a smaller scale the focus will be on the collaboration between Germany and the Netherlands. Both countries have a long tradition in planning and are both hierarchical. Regional plans as well as land use plans give basis for a plan oriented, comprehensive and integrated approach (Oxley et al., 2009). Hence, both countries are rather alike in planning. Given this condition, cross-border collaboration is more likely to succeed due to a strong and equal basis (CPB Netherlands Bureau for Economic Policy Analysis, 1997). The northernmost part of the border between the two countries is named the Ems Dollart Region. The eponymous organisation Ems Dollart Region (EDR) deals with the coordination and management of cross-border projects in the region. With its office in Bad Nieuweschans (NL), the EDR deals with projects in the dis-

tricts Emsland, Friesland and Cloppenburg in Germany and on the Dutch side of the border the provinces Groningen, Drenthe and Friesland (EDR, 2012). To see this regional cooperation on a smaller scale helps to understand the challenges coming along with cross border cooperation. Hence, the investigation is conducted on this level firstly. Besides regional initiatives, the EDR also realises various INTERREG programmes by the EU, since the beginning of the 1990s. These projects follow the aim to build links between the member states of the EU (Molema, 2013). This specified and long experience with cross-border projects signalises the first potential interviewee for this thesis: Hermann Wessels, executive director for INTERREG projects at the EDR (Appendix B).

2.1.1. Snowball Sampling

The research question faces a practical relevance and directly faces the field of (energy) markets, planning and governance. Based on this fact it seems obvious that the involvement of actors and stakeholders is very reasonable. Therefore, interviews are conducted to gain information to answer the question if there is an interest in joint planning. In this broad field of actors it is hard to find the most important and regulating organs. Some are obvious to be involved (TSO), some are even hidden and hard to point out. This paved the way for a method to distinguish the right interviewee: snowball sampling. Based on an initial expert interview with Hermann Wessels (EDR, Appendix B) the snowball sampling method will be applied. Cohen and Arieli (2011) point out the difficulties in identifying and accessing the subjects relevant for the study. The concept named snowball sampling can answer the challenges. It represents no random sampling but rather a calculated and studious selection of potential experts (Schnell, Hill, & Esser, 2013). Snowball sampling originates from sociological sciences in the 1940s (Handcock & Gile, 2011) and is seen as a widely used concept in that field. With one initial interviewee, referral chains are supposed to be built up as in Figure 4 (Biernacki & Waldorf, 1981). Based on a first initial entity, other following entities will be crystallised out (Figure 4). Based on latter, once more entities or even dead ends might be found. This method is to be followed until the requested information is gained (Goodman, 1961). In the studied literature only new entities for further investigation can be found with this theory. However, by interviewing entities, additional information comes up as well: Indicatory ideas for the upcoming work, interesting further literature and other hints can arise. Hence owball sampling presents a valuable concept to gain the information needed for studies. Based on this first interview, other experts will be selected and thoughts and drafts will be collected.
Hermann Wessels (EDR) suggests three separate groups of stakeholders, which may be important or relevant for this study: networks and organisations, the grid operators and the governmental side (Figure 5). First, he names Energy Valley, the district

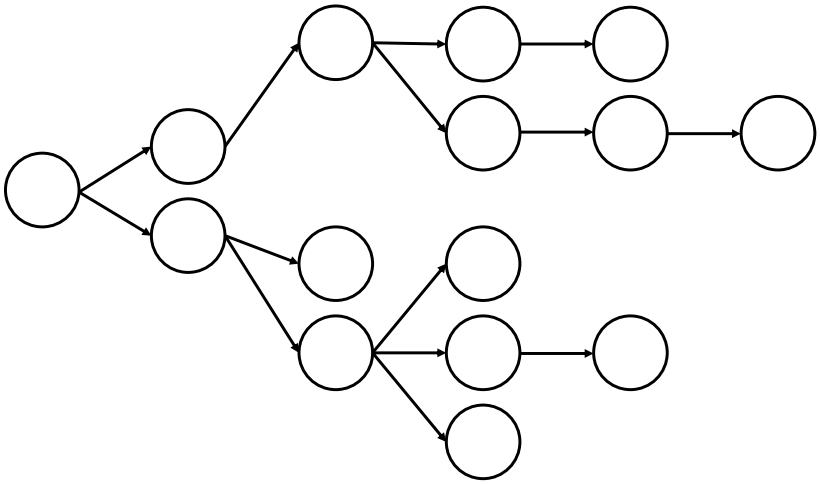


Figure 4: Snowball Sampling's Referral Chains

of Aurich and the Oldenburger Energiecluster e.V. (OLEC) as networks which deal with energy related tasks. These organisations offer a broad variety of publications in order to help to understand the complexity of international cooperation in the energy sector (ARSU GmbH, CIMA Institut für Regionalwirtschaft, & regio GmbH, 2013; Kooistra, Gawenat, Boshuizen, & Hentschel, 2014). Through the study of publications and information, other actors appeared like the European North Sea Energy Alliance (ENSEA) (Energy Valley, 2013) or the European Network of Transmission System Operators (ENTSOE) and the North Seas Countries' Offshore Grid Initiative (NSCOGI). These organisations all offer a broad variety of information. This refers to the applied model of snowball sampling in Figure 5. The figure shows a schematic analysis of the interview based on the snowball sampling method. In the upper part which is coloured in yellow, Hermann Wessels gives hints for networks and organisations, further studies and literature review. The green middle part stands for companies in the field of energy, hence TSO as well. Hermann Wessels suggests a closer look onto the projects by the EWE AG. As a distribution network operator, the EWE AG also supports and manages offshore energy projects. Since the offshore grid planning lays within the hands of the TSO instead of the distribution network operator, it seems also suitable to approach TSO (European Network of Transmission System Operators for Electricity, 2014). The blue area shows the recommendation for closer looks onto the governmental side. For the landfall, it is the district respectively the provinces at the coast (Figure 5). For the seaside it is the governmental regulating authorities listed in table 2.

The graphic shows the EDR as the first entity, the second column shows commonly the group, the later entities belong to. The third column lists literally the suggestions given by Hermann Wessels. The last column, listing the analysed and more specified interpretations of the given suggestions which fit into this thesis. It has

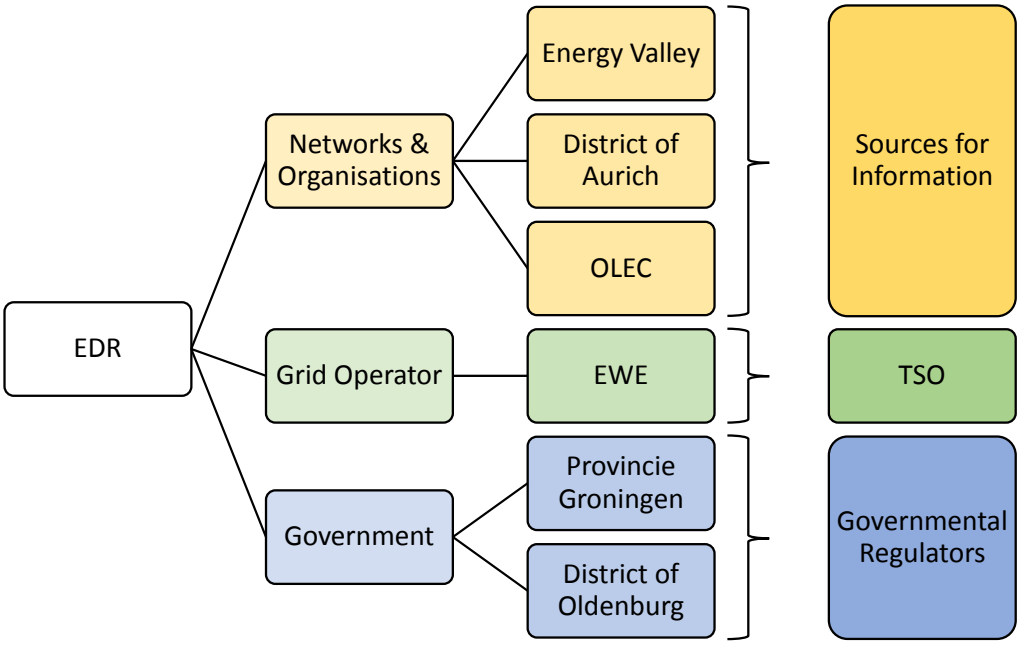


Figure 5: Referral Chain Based on EDR Interview (Appendix B)

no direct connection to the previous column and illustrates mere interpretation and conceptual bridges within the content. The coloured indication differentiates on the one hand the groups, named in column two. On the other hand, the emerging information clearance is represented as increasing colour intensity. Lines connecting the entities in the graphic show the causal relations to the Hermann Wessels and the EDR.

The lower two levels, shaded in blue and green, sum up the most important actors in grid planning. In green, the TSO which plan and construct the grid and in blue, the governmental supervisors for monitoring and intervening. The following subsection provides a closer look on these actors.

2.1.2. Actors

The research question if there is an interest in and possibilities for joint planning, automatically leads to the main actors involved: The TSO are responsible for the maintenance and expansion of the transmission network. Table 2 gives an overview of the TSO in each of the North Sea neighbouring countries. Those are relevant for this study, since they are also responsible for offshore projects originating from the specific country. Except for the United Kingdom, there is only one responsible TSO in the listed countries for the related coastal zones of the North Sea. In the United Kingdom, there is a list of three TSO on the east coast side of the Island. Other countries may also have a partition of the grid into a few TSO but the others do not affect the coastal waters of the North Sea (European Network of Transmission System Operators for Electricity, 2014). This authority shows the structure of the

TSO in Europe. They appear as monopolies on the market. Due to that fact, the European Parliament and the Council of the European Union adopted the Directive 2009/72/EC. It states in article 35 that "[e]ach Member State shall designate a single national regulatory authority at national level." (European Parliament & The Council of the European Union, 2009) This governmental authority shall be independent and has a supervising role in order to maintain the security of supply and observe the monopolistic TSO (European Parliament & The Council of the European Union, 2009). The corresponding governmental regulators are also listed in table 2. Hence, it gives an overview of the main relevant stakeholders in the field of grid planning in the North Sea. Based on the directive mentioned above, governmental regulators

Table 2: TSO (European Network of Transmission System Operators for Electricity, 2014) and Governmental Regulator (ACER, 2012; NVE, 2011) by Country

Country	TSO	Regulator
Belgium	Elia System Operator AS	Commission de Régulation de l'Electricité et du Gaz (CREG)
Denmark	Energinet.dk	Energitilsynet - Danish Energy Regulatory Authority (DERA)
France	Réseau de Transport d'Electricité	Commission de Régulation de l'Énergie (CRE)
Germany	TenneT TSO GmbH	Bundesnetzagentur (BNetzA)
Netherlands	TenneT TSO B.V.	Autoriteit Consument & Markt (ACM)
Norway	Statnett SF	Norges vassdrags- og energidirektorat (NVE)
United Kingdom	National Grid Electricity Transmission plc, Scottish Hydro Electric Transmission plc, Scottish Power Transmission plc	Office of Gas and Electricity Markets (Ofgem)

keep the power to intervene any projects by TSO, if concerns exist. Due to this fact, it is also essential to have a closer look on the aims of this authorities regarding offshore grid planning. Therefore, governmental regulators (Table 2) should also be involved in the interviews.

2.1.3. Questionnaire Design

When conducting an interview, the essential question of the interview design comes up (Reinders, 2005): should it be a quantitative or qualitative analysis? Quantitative and enumerative are of use if the outcome is countable. On the other hand, in order to answer the research question more precisely and with a higher practical relevance, it is important to distinguish between the ideas, thoughts and visions of the respondents. For this, a qualitative and partly standardised interview seems more appropriate since it is more of a analytical and partly standardised poll (Oppenheim,

1992; Mayring, 2000). Furthermore, the aim of this empirical study is to falsify or proof the hypothesis:

The relevant stakeholders are willing to join for a collaborative grid planning in the North Sea.

Additionally, the practical relevance of this topic asks for more details and the question of how could this joint planning look like. Hence, these factors drive the design of interview questions, a semi structured design is appropriate. The results of a qualitative approach by conducting semi structured expert interviews should provide explanatory information that proves or falsifies the hypothesis (Mayring, 2000; Oppenheim, 1992). The first interview, conducted with Hermann Wessels (EDR), is a qualitative one which is tailored to the respondent. In the next wave of interviews the TSO on the one hand and the regulating authorities on the other are targeted. Both groups need an individualised interview but within the group it should be standardised. This guarantees the comparability between the various parties in the different countries. In order to come to an answer and to estimate the feasibility of the research, a variety of questions are included in all questionnaires. The questions aim for sounding out the willingness of the stakeholders and at the same time the issues coming along with such broad approach.

2.2. Conceptual Framework

The structure of this thesis is described in the conceptual model in Figure 6. It provides on the one hand a theoretical concept and framework and on the other hand it guides through the research. Furthermore, a conceptual framework gives an organising structure and represents the "own particular study" (Bloomberg & Volpe, 2012).
Miles and Huberman (1994) explain the conceptual framework as "the current version of the researcher's map of the territory being investigated." This link to the term map refers to the conceptual model as a (flow) chart. Maps show the landscape and the neighbouring areas with their natural and man-made links. The flowchart in Figure 6 draws the two main areas of research methodology and theory in regard to this thesis. The "key factors, constructs or variables - and the presumed relationships among them" (Miles & Huberman, 1994) are displayed in form of bins, flow charts and (single- and two-way) arrows indicating directions. This design helps the researcher to identify the field of study, the questions of who? and how? and the paths leading towards an outcome of success.
This conceptual model is designed in a multiphase structure. Three phases divide the main part of the research. Interconnecting arrows indicate time flow in between the phases and the methods related to it. The concept of building this thesis and reaching an answer to the research question is build upon two aspects: Firstly, the

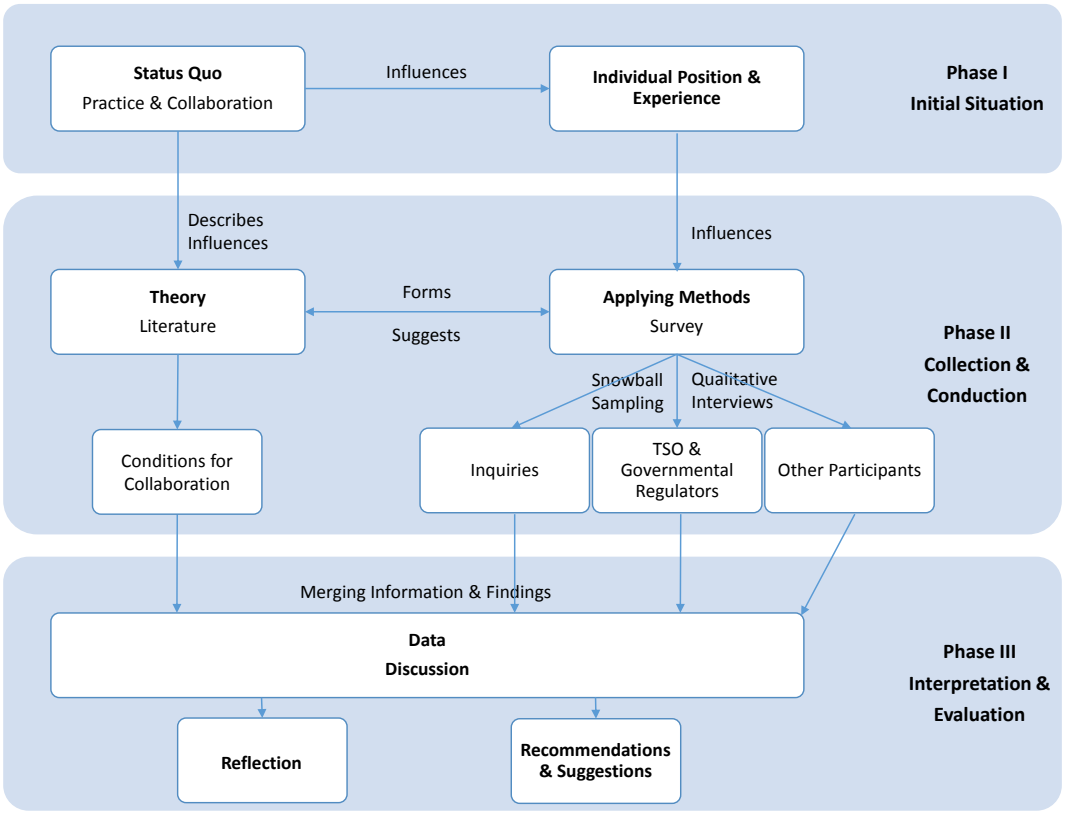


Figure 6: Conceptual Model

status quo. This stands for the technical, theoretical and governance related part at the same time:

- What kind of marine renewable energies are implemented in the North Sea and how is the grid distribution developed?
- What kind of theory exists and how is the scientific community dealing with the topic?
- What are the European Union and other governance and government levels doing in order to support the development towards a Noth Sea supergrid?

The second basis provides the authors experience and individual position referring to the topic and its broader context. Naturally, the status quo, including literature, politics and news, has an influence on an individual's position and experience to a certain topic. Summarising, this is the initial situation and basis in which this thesis has its origins. In Figure 8 it is labelled as Phase I.
Phase II gives the fundamental basis for the study and defines the theoretical design. It starts with the above given theoretical background and the broad variety of literature. The status quo is described by the literature. Theory further forms methods and provides relevant data for the interpretation and evaluation of this thesis. This includes the analysis of reports and initiatives as well as papers and articles.

Through this information, the conditions for a collaboration shall be determined.
The applying methods in the second greater white bin are influenced by the authors individual experience and hence preference. The form of a survey seems reasonable as already explained in Chapter 2.1. A snowball sampling oriented approach, based on the interview with Hermann Wessels (EDR) is an essential step forward. The interview does not only give the classical, expected outcome of a snowball sampling approach to gain more interviewees by name. Additionally, the interview provides new sources, estimations and opens new ways of thinking. Therefore, the first interview and the literature influence one another reciprocally. Furthermore, the initial interview leads to additional interviews and enquiries.
Data initiates phase III: The cumulation and sighting of collected data forms this chapter. The summary of the above mentioned information gained via the methodological path is merged with the theoretical information and literature in data in Chapter 4. In continuation it follows the resulting discussion of the findings. It stands for the interpretation and evaluation of the cumulated information from phase II. An additional bin for the reflection includes the reflection on the research process and also the success of the interviews will be discussed. The found results provide a response to the research question and will end up in recommendations for further studies and steps towards the achievement of the offshore supergrid suggested by the EU.

3. Theoretical Approaches and Governance

This chapter will show how theory is being used and assessed through the research. The relevant literature for this thesis as well as the way of assessing it are illustrated in subsection 3.1. Additionally, the subsections 3.2 and 3.3 discuss the management of international cooperation towards joint grid planning and suggest an organisational structure.
In order to answer the research question for a motivation towards an integrative grid, broad background knowledge is vital. Is a supergrid viable? Is it technically feasible? What actors are involved in order to plan a supergrid? To answer these questions, the review of literature is indispensable. Books, peer-reviewed papers, technical reports and publications by e.g. the European Commission are among the important sources. Cooperation's and network's websites also offer a broad amount of information, like web GIS (geographic information systems) and publications.
Information regarding the topic of offshore grid connection (in the North Sea) often touches the subjects of technical feasibility (Teixeira Pinto, 2014; Theisen, 2011; Ciupuliga, 2013), grid design (Feix & Hörchens, 2013; Woyte et al., 2008; European Network of Transmission System Operators for Electricity, 2012), governmental regulations, governance structures (Molema, 2013) and the potential for marine renewable energies generally (Bömer et al., 2010). It becomes apparent that the field of research features very specific and highly diversified information. Naturally, this provides numerous sources for research.

3.1. Research Strategy

The use of literature gives a strong basis for the thesis. Mostly online resources like PiCarta and Google Scholar were used for the review. Articles and cases already applied or currently in planning process are important to understand the complexity of the transnational vision of joint grid planning. Due to the topicality of renewables and offshore wind energy development, a large number of publications are available. Not only in articles, but also in technical reports, web sources and books. Books about renewable energies, collaboration management and other topics have also played a role in providing the necessary information for this thesis.
Owing to the circumstance of having a vast amount of literature available, it seems not possible to read and work through every source in detail with regards to the scope of this thesis. Therefore, it is advised to use a broad list of keywords to search for in every source. This list given in Table 3 not only eases the research but also provides a certain transparency in order to understand the process of research and therefore this thesis itself. The keywords in Table 3 are used to browse for necessary, revealing, helpful and interesting information. The relevant literature was either searched in English and German language. Furthermore, the use of two keywords combined (e.g. grid planning or international governance) form a new keyword and can reveal

Table 3: List of Keywords to Search in the Literature

Governance	Project
Transboundary	Grid
Cross border	Offshore
Policy	Joint
International	Planning
Management	Renewable
Cooperation	Vision
International	Energy
Economic	

a new spectrum of information. Additionally, it is very important to structure the reviewed sources well to keep an overview of them. Figure 7 shows that the sources can be divided into four groups: Project reports, technical reports, methods and theory. Each group is then divided into its parts. The first group is general reports. Publications by various organisations about the topic of transnational projects or large scale grid development fall under this category. The tag cloud shows the main sources (articles, publisher) graphically. The project reports are very important to assess the feasibility. Projects like the transnational electricity grid to be built in the Baltic Sea (Winter, 2010) will be important foundations for the possible transnational grid. The second group consists of technical reports. The majority deals with the technical aspects of a grid design which is able to transport the varying energies over large distances. Additionally, the possibilities of connecting and clustering wind farms offshore are important as well. The next smaller group of literature discusses marine renewable energies in general. This includes general reports about state of research, ecological impacts of marine renewable energies and project side descriptions. The rest deals with a certain type of marine renewable energies specifically. The focus on the technical reports is to gain a overview about the technical feasibility and potential in the North Sea and to get a feeling about the state of the art of the specific technologies.

The next group in Figure 7 is not really related to the others since it touches methods. This group of literature is not essentially addressing information to the topic but rather useful to understand the way of using methods and to decide which method is applicable. Hence, it is an essential part of literature as well but to illustrate a separation, the box is slightly smaller then the other three boxes. How to use scientific methods to approach a practical field is included in the area of practical research. Social research covers the methodological tools to do research in the society and investigate human interactions. The other two sectors including applied methods and questionnaires cover more practical approaches and tactics to gain information through interviews or polls. They discuss a broad spectrum from the selection of a interviewee to the conduction to the analysis and evaluation. The last quarter has the title governance. This section mainly consists of reports concerning initiatives

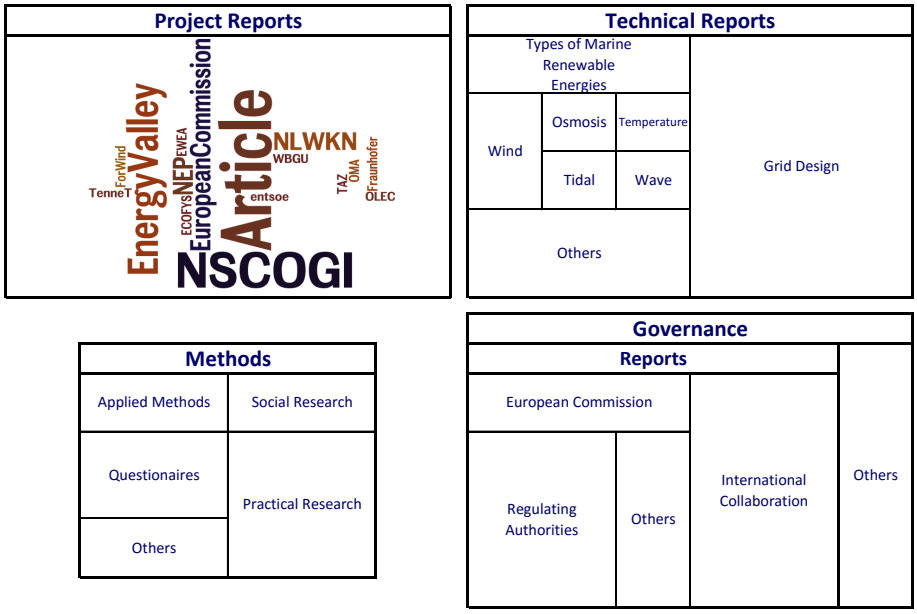


Figure 7: Portfolio of the used Literature

and governance on various political levels. Due to many proposals and directives, published by the European Commission and other transnational or national bodies, the predominant subgroups of the European Commission, regulating authorities and others are adequate. Those deal with the support of joint grid planning on European level and the responsibilities of national and regional authorities. Additionally, publications regarding international collaboration play a big role in order to oversee the possibilities and structure for a potential joint international planning. The focus was naturally within the context of this research. Hence, the addressed issues consist of shared governance in international context and international collaboration for grid connections.

This broad portfolio in Figure 7 covers most of the sources needed. Furthermore, it provides a useful separation of a huge amount of literature to provide the needed overview. This is a convenient method to deal with the collected sources, to stay on top of things.

3.2. Governance Format

Planning the interconnection of marine renewable energies in the North Sea and the North Sea's neighbouring countries at the same time is a far-reaching endeavour. TSO as well as governmental regulators from France, Belgium, the Netherlands, Germany, Denmark, Norway and Great Britain are the affected main stakeholders in this project. Not only due to the amount of stakeholders but also because of

the intercultural bridges like a country's language and discourse, problems will arise with regard to communication. In fact "in such multi-level setting governance is absolutely not a routine-like activity" (Hajer, 2006). Hajer (2006) is addressing the issues coming along in communication in meetings via discourse.
Consequently, efficient setting requires a certain framework, which provides the circumstances needed in order to bring above mentioned parties together and motivating them to be highly efficient. "Currently [there is] no regulatory regime in Europe which provides an explicit regulatory framework" (NSCOGI, 2012b) for a supergrid in the North Sea. Accompanied by the literature, the theoretical framework for a concept of joint international collaboration is essential. Teixeira Pinto (2014) points out the differences in regulations and policies and therefore asks for a common framework on EU level to overcome these obstacles.
Assuming relevant stakeholders are willing to cooperate in order to plan the grid in the North Sea, the question for the coordination comes up. Since collaboration in such setting does not come naturally, a framework is needed. The "specific framework of the [...] nations" (Faria & Schmidt, 2007) involved like laws, regulations, infrastructure in broadest sense and geographical conditions as well as an organisational structure affect transnational projects. Because of that an organisational structure for an efficient process flow should be provided (Interreg North Sea Programme Secretariat, 2008). The previous statements seem to foresee a need for central guidance. Land-use planning then again is a public duty and mostly rooted on regional level but can also be found on national level (Hooghe & Marks, 2001). Grid planning comes under the same jurisdictions (Bundesnetzagentur, 2009, 2014). It is often initiated by a public institution. Eventually, if publicly initiated or private, every grid project needs a permission by the public regulating authority. Hence, a public steering seems appropriate. However, there is no public sector entity with the authority to do so. However, due to the vast amount of stakeholders involved it can be helpful to assess a horizontal structure (Lenferink, 2013). Central guidance opposes a horizontal structure. Besides, there can be not always a tailor made structure for every governance configuration (Kreikebaum, Gilbert, & Reinhardt, 2003).
The question for the design of the framework, touched above shows the complexity. This is the reason for the search for a suitable and feasible governance format within this thesis. The construction of a strategy in pursuance of achieving advantages in know-how and expertise is therefore vital (Bronder, 1993). International settings as well as a vast amount of stakeholders form a complex and definitely no routine like setting. Hence, managerial skill and cooperative management plays an important role "in fields where there are advantages [to achieve] from the global integration" (Fayerweather, 1972). The following section introduce an option for a framework on a political and practical level at the same time.

3.3. Organisational Structure

The organisational structure of managing joint grid planning in the North Sea is highly complex due to twofold international linkages. Firstly, there are the grid connections in a technical sense. Each regulating authority has the interest in a stable national electricity grid and have the duty to supervise it. A connection between countries opens the grid for new variables, fluctuations and hence uncertainties. Secondly, the numerous involved institutions are spatially spread and naturally have individual interests and ambitions. The organisational structure should combine and manage such international linkages. Hence, it could be central for global ("zentral für global") (Fuchs & Apfelthaler, 2009). This style describes a structure with central coordination. It comes comes from a central office where the managing organisation is located. The subsidiaries are dependent on the head office and located in each country around the North Sea. The subsidiary would in this case be the agency or organisation managing the offshore grid planning jointly. TSO, governmental regulators and other possible stakeholders jointly step in for the subsidiaries. A continuous and brisk communication is intended. Additionally, the delegation of tasks into subunits and working groups can be helpful. Smaller working groups are able to work more efficiently in form of finding solutions and come to agreements (Kreikebaum et al., 2003). These thoughts for organisational structures are complementary to Hermann Wessels' experiences: He states, in most cases there is no external pressure needed to encourage transboundary cooperation (Appendix B). The interview with Hermann Wessels will be discussed in more detail in Chapter 4.2.2. Hence, the given main stakeholders can very well form the cooperation themselves. The structure for a governing agency for the transnational grid project, analysed in this thesis, shall be based on the opinions and experiences by experts. Experts cannot be considered as theoretical reference but experts can back up or challenge theory. In this case, Hermann Wessels backs up theory with his experiences considering cross boarder projects. There is no tailor-made structure for such a wide reaching and new theme of international cooperation. As Kreikebaum (2003) outlines, there is no universal organisational structure for all constellations possible. There is only a set of functional partial solutions. Hence, and based on the experiences by Fuchs & Apfelthaler (2009), Kreikebaum (2003) and Hermann Wessels, in this case it seems reasonable to design an organisational structure, with a broad division of tasks, strong communication and composed of the main stakeholders themselves.

Due to the above mentioned arguments, this work suggests an organisational structure for the governing association in form of a patchwork of expert's experiences, adapted for this specific use. Kreikebaum (2003) suggests to use a set of partial existing solutions instead of trying to find a universal solution. Hence, this thesis follows and suggests a structure which is a highly adapted version of an existing organisational structure.

The organisation of the adopted framework shall be alike to the project of this work. Thus, the main indicatory factors of this project are a broad amount of stakeholders, governmental as well as private actors, a high degree of internationality and preferably within the same territory. It means in effect to find a project or an organisation touching numerous interests and preferably those of government's, region's and private sector's. It deals with several country's interests and is if possible in the North Sea region. The Interreg IV B programme North Sea Region Programme 2007-2013 is one fitting example for an organisation of transnational management. It deals with the transnational cooperation of the North Sea greater area neighbouring countries, covers regional development and the connection of regions within the greater area. This happens in context of sustainable management as well as infrastructure (Interreg North Sea Programme Secretariat, 2008; European Commission, 2015). Hence, it handles the intersection of governmental, regional and private stakes. Summarising, the North Sea Region Programme covers all mentioned similarities. Therefore, due to the close relatedness of the programme's structure, it is worth a closer look.
The internal structure of the North Sea Region Programme 2007-2013 is particularised described in the "Flowchart of the Roles and Tasks". The internal designation of authorities as well as the roles and tasks are illustrated detailedly. It assesses themes where national boarders hinder solutions or where various levels of governance are needed (Interreg North Sea Programme Secretariat, 2008).
This research suggests a format for an organisational structure for the joint grid planning approach in the North Sea. As Kreikebaum (2003) suggests, it will be based on an existing governmental format. Due to the close relatedness of the above mentioned programme, that internal flowchart is chosen to base this format on. The diagram in Figure 8 illustrates the adapted version by this research. It describes a possible structure of an association for joint grid planning. The association itself is shaded in blue. All entities within this blue greater square stand for internal processes. On top of the figure stands the park operator. Planning and constructing marine renewable energies is the trigger for the entire process to be active. Since marine renewable energies have to be connected to the grid. Below this, all entities include three levels of text: The upper level in bold letters describe the entity. Beneath this, coloured in green, is the corresponding stakeholder deployed into the entity. The third level is a recommendation for a specific (e.g. federal) level where the process takes place. The changes in the flowchart occur mostly in specifying the entities of the diagram towards this specific case of joint offshore grid planning. The monitoring, steering and auditing system is adopted as efficient process optimisation and management entities. The two external entities below are adopted too. External beneficiaries exist in both cases and due to a close relatedness, both projects need a certifying authority. The national authorities responsible for the European Regional Development Fund are substituted with an internal finance department. The initiator of the entire process is in this case a park operator who requests a solution for grid connection as

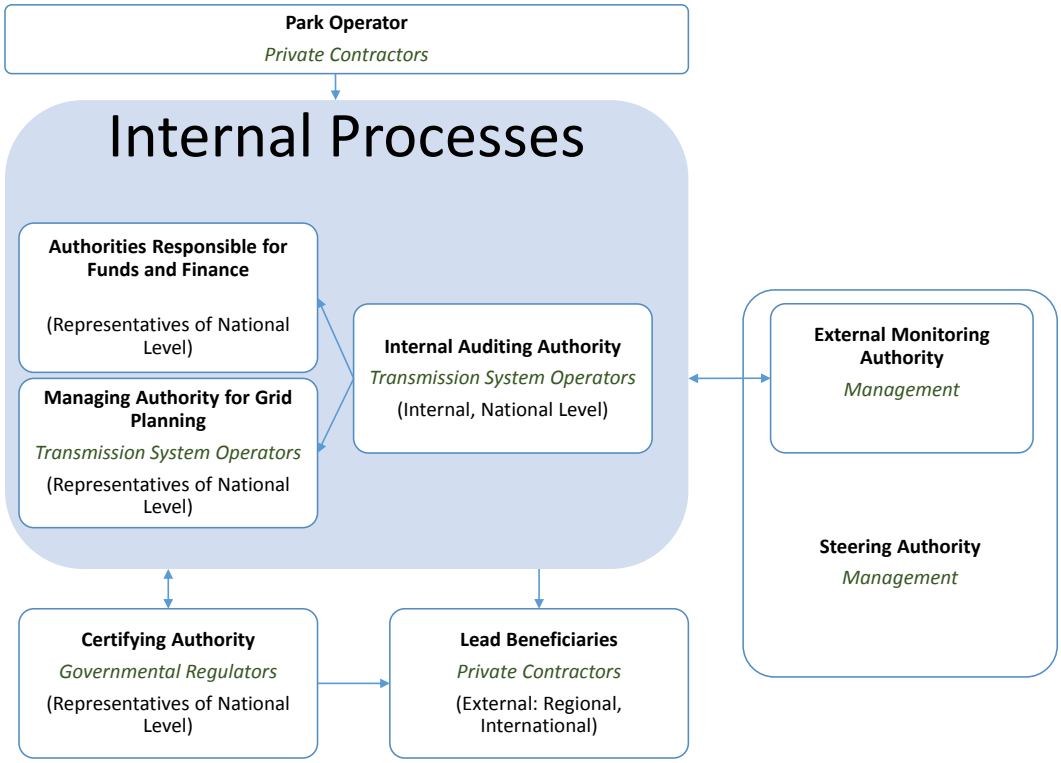


Figure 8: Structure of the Governing Association

a private contractor. This subsidises the entity standing for the communication with the European Commission in the outbound graphic (Interreg North Sea Programme Secretariat, 2008). Other changes occur in the deployment of specific stakeholders from the field of grid planning and governmental regulation in the same field. These are distributed in the flowchart and fill roles in the organisation.
Precisely because the foundational structure is a working and tested structure, changes should be kept to a minimum. But it should be taken for granted, if necessary adaptations will be made (Kreikebaum et al., 2003). Hence, the system can not be adopted entirely. These changes are necessary to adapt to the this specific case. Joint offshore grid planning comes with very specific constellations of actors and stakeholders. In the following, the exact roles of the authorities will be explained.

Managing Authority for Grid Planning

The managing authority for grid planning is the main driving entity in this association. It stands for the literal planning process. It consists of delegates of the TSO by every organisation. Since, they have the task of grid planning, they do so in this project too. Hence, the TSO plan individual projects as well as parts of the offshore grid. This working group should aim for common understandings of plans towards the joint grid.

Authorities Responsible for Funds and Finance

Above the managing authority stands the authority responsible for funds and finance. This small delegation is responsible for the allocation and exploration for funds in order to finance the project and the authority. This could be in form of subsidies by the EU, the countries or other financial sources like by those involved. Additionally, this entity is responsible for the internal finances and the lucrativeness of the association. The staff should be experts in the broader field of finance, European programmes or even accountants. It is not necessary to deploy delegates of TSO or other closely related stakeholders.

Internal Auditing Authority

Due to the fact that this association is a mutual subsidiary by the TSO, those should also take responsibility with their delegates in this position. Its main purpose is to optimise internal processes. Internal transactions, variables and data are monitored and supervised by the internal auditing authority as well (Verver, 2008). Additionally, internal process management and process optimisation are fields of practise. This controlling entity is specifically an internal process and has to be separated from the external monitoring.

Certifying Authority

The certifying authority represents the external position of the governmental regulators. They have the task to monitor, approve and even intervene projects and grid proposals. They also give regulations to the executive contractors who finally wire and construct. This tool is necessary within the process since it is as well in current practise: The governmental regulators have the responsibility to ensure a stable electricity grid. Hence, it is their task to monitor and certify plans for grid development. Eventually, this entity approves or refuses the work by the TSO in the managing authority.

Lead Beneficiaries

The lead beneficiaries are the external and private contractors who execute the planning. Those get the final plans and the permit for construction and other works from the certifying authority.

External Monitoring Authority

The external monitoring authority is part of the management and therefore directly connected to it. It monitors the effectiveness of the entire process. This entity is a reasonable implementation for the effectiveness of the organisation (Verver, 2008). The process optimisation is useful and may prevent from rising bureaucracy emerging

slowing of processes. Both, the external monitoring authority as well as the steering authority consist of delegates of the TSO.

Steering Authority

The steering authority is an external entity to watch over the association and represent the management itself. The tasks and rules of the working group are developed by this entity and the monitoring authority supervises and monitors the implementation. "In order to enable efficiency in decision making, the [Steering Authority] will have a limited number of representatives" (Interreg North Sea Programme Secretariat, 2008) of the management of the TSO.
This structure is a suggestion, visually and contextual closely connected to the "Flowchart of the Roles and Tasks" (Verver, 2008) as suggested by Kreikebaum (2003) and explained above. The high rate of interweaving (Bronder, 1993) as well as task sharing (International Energy Agency, 1999) between the stakeholders and the delegates of the countries are recommended. Governmental regulators, TSO and other private actors are involved in this structure. Hence, the interviewing of the public and private sector is high. The same applies to the internationality of the entire project. As discussed above, this structure involves a constellation of various actors, from each of the North Sea neighbouring countries.
The above suggested structure is supposed to manage the international cooperation and coordinate the grid planning in the North Sea. This design only functions, if all involved parties agree to the understanding and are willing to join the joint planning process. Furthermore, it might be relevant for the governing agency to gain the competence for the grid planning in the sea. This requires a invariably support of the nations and regions affected. The legitimacy of the entire process depends on this basis. Chapter 4 will introduce expert interviews as well as a broad analysis of initiatives and reports. These will be set in context with the above mentioned two conditions. Later, in Chapter 5, the overall applicability of the suggested structure will then be discussed in more detail.

4. Data and Findings

This section shows the investigated sources and data and discusses its relevance to the research question and the thesis, starting with the existing strategies targeting the offshore supergrid in the North Sea. A broad segmentation into the various fields will be clarified. Furthermore, conducted interviews will follow in order to get expert's opinions in context of the literature.
As already discussed in Chapter 1.1 there are plenty of marine renewable energies which offer a potential for gaining renewable energy from the North Sea. Wind energy shows a high availability in the region (Coelingh et al., 1996; Schmidt & Mühlenhoff, 2010). This is known for a longer time and the use of wind energy is common since years from now. Hence, the majority of installations are offshore wind turbines. Tidal and wave energy is possible in the North Sea. However, the North Sea offers much less potential compared to the north and north-west coast of Scotland (4C Offshore, 2014b; CRES, 2002; Clément et al., 2002; RSE S.p.A., 2012). Therefore, tidal and wave energy plants will most likely be installed in that region. Nevertheless, the lower potential of the central and southern North Sea could be used in future as well, due to product innovation and opportunities in grid connection. Osmotic power and ocean thermal energy both have to have specific conditions. Osmotic power can be used at a place where freshwater and saltwater meet. This is only possible at distinct sites like the estuaries (Brauns, 2008; Post, 2009; Post et al., 2007) and constructions like the Afsluitdijk in the Netherlands (Katia, 2014).
In order to use the potential efficiently, a common view on the North Sea is useful. The Sea is divided into the neighbouring countries' territories. Numerous direct connections from shore to the offshore installations would result in an enormous amount of cables installed and at the same time a large impact on the wadden sea as a designated natural world heritage site. To minimise the ecological impact and to lower the amount of connections, other connection types are possible. For this, the neighbouring countries should work together and plan the offshore grid jointly in form of cross boarder cooperations. This could lead to a more efficient grid design. However, this needs more communication and collaboration of neighbouring countries. In fact there are "approaches of several research projects to [...] increase cross-border connection capacities" (van der Meer et al., 2010). Although, there is a demand for smarter connections in form of a transnational supergrid in the North Sea (European Commission, 2007, 2008a), there is "currently no regulatory regime in Europe which provides an explicit regulatory framework" (NSCOGI, 2012b) for such a supergrid. Teixeira Pinto (2014) points out the differences in national regulations and asks for a common framework on EU level. This thesis suggests one possible regulatory framework. Chapter 3.3 introduces the possible format in detail. In the following section, literature and reports from academia and practice are presented. This puts the suggested concept in perspective. Later in Chapter 5 the question for

a common framework will be reviewed again.

4.1. Initiatives and Reports

During the research process numerous sources of information came up. As explained in Chapter 3.1, the sources are worked through and reviewed via keywords. The focus lays on the investigation how experts and the scientific community deal with the topic and how they estimate the feasibility. Additionally, it has to be pointed out how and where they seize the topic. The most important literature with regard to joint grid planning and governance is summed up in this section. The two important initiatives NSCOGI and ENSEA are introduced in Chapter 4.1.1-4.1.2. In Chapter 4.1.3 the given information is compared. This chapter starts with the introduction of individual articles.

Veal (2006) points out that a supergrid in the North Sea "is an answer to Europe's energy needs'". An important part of the overall European grid can form the supergrid in the North Sea. The report European Offshore Supergrid Proposal - Vision and Executive Summary shows the idea of such a supergrid in the North Sea in a visionary form. It depicts the technological capabilities as well as it criticises the risk of financing and capital for the vision. In the end, Veal suggests agreements between the "governments of the UK, Germany and the Netherlands", to come to a mutual understanding and therefore a support on national and European level.

The work by Pierik (2012) however, focusses on spatial analysis for offshore wind farm siting and overall design of the supergrid. The work suggests a high voltage direct current transmission (HVDC) network. This should be planned on the basis of already installed and currently planned wind farms.

Greenpeace demands the European Commission and the North Sea neighbouring countries to work together for a coordinated approach for the supergrid. The report A North Sea Electricity Grid [r]evolution suggests a grid designs for the entire North Sea as well as on a regional small-scale. This discussion is mainly technical and grid design related (Woyte et al., 2008).

Nutzung der Meeresenergie in Deutschland by Bömer et al. (2010) has its focus on giving an overview of the state of the art in marine renewable energies. Furthermore, the authors evaluate the potential of marine renewable energies in the German North Sea area. Unfortunately, they point out that the potential is relatively low on a comparison to the circumstances on the high seas. This outcome seems obvious as it was also explained in regard to the wave heights in Chapter 1.1.3. Hence, the report gives an energetic potential analysis but also emphasizes the synergies which could emerge due to an offshore super grid. These are based on the lagged electricity generation and the optimal energy mix for a broader region.

De Decker et al. (2009) see OffshoreGrid as an ambitious project. In 2009, the project started and it was designed for two and a half years. The aim was coming

to a mutual understanding of the stakeholders. The final report (De Decker et al., 2011) shows a scientific view on the supergrid design. The project groups analysed market conditions and costs on the basis of models and grid connection designs. In regard to governance of the supergrid they point out the importance of NSCOGI and suggest additionally EU regulations to be reviewed towards more coordination between TSO and the developers of wind farms. Finally, the report shows that the discrepancies between the support schemes like incentives and feed in tariffs do not necessarily have to be adapted. They should rather be compatible to one another (De Decker et al., 2011).

The Study of the Benefits of a Meshed Offshore Grid in Northern Seas Region by Cole et al. (2014) is a report for the European Commission which shows the economical advantages of the designated supergrid. An offshore supergrid in the North sea provides a high potential for better connections and optimal positions of offshore interconnectors. The estimated costs for different connection designs and estimated CO_2 emissions are calculated in form of scenarios. This report strongly supports the development of an offshore supergrid in the North Sea (Cole, Martinot, & Rapoport, 2014).

Müller investigates the legal regimes in the field of joint offshore grid planning in the North Sea deeply (Müller, Shariat Torbaghan, Gibescu, Roggenkamp, & van der Meijden, 2013; Müller, 2013b, 2013a; Müller & Roggenkamp, 2014). Targeted are the legal challenges for grid planning and offshore connections. The clustering of wind parks seems unlikely without more coordination between the TSO and other stakeholders. She asks for more measures to be implemented and hence suggests two possible approaches:

- One organisation holds the responsibility for the entire offshore grid, including the design, construction and operation. Here Müller sees the TSO in their responsibility.
- Organisations were separated and led by the market for split responsibilities for each project within a joint grid.

Nevertheless, both possibilities ask for more support and coordination between all actors involved. An additional and separated financing regime is important (Müller, 2013a). Generally, Müller does not see the legal framework as it exists in Europe right now to be designed for an integrated offshore grid. The European Union's policies shall not affect the nations sovereignty but rather support the member states in their projects. Working groups like NSCOGI or ENTSOE are important to be included into coordinated approaches to build a resilient grid in the North Sea. Unfortunately, legal differences make room for conflict which do not support the collaboration of actors (Müller, 2013b). Hence, a legal framework as implied above is necessary but with the lack of cooperation between the actors, she does not see coordinated projects in the near future (Müller, 2013a).

Woolley (2013) also addresses the necessity of a legal framework by referring to the outcomes of other studies (European Network of Transmission System Operators for Electricity, 2011; Williamson, 2011). She points out that there are three existing external affects which could strongly influence the expansion of offshore renewable energy planning:

- Joint planning of offshore projects is crucial for the grid design.
- In case of balkanisation the connection and combination of offshore infrastructure will be hardly possible. This happens in form of emerging infrastructure islands.
- The regulations on regional, national and international level have to be reconsidered.

For the joint planning approach Woolley discusses the legal framework and advises, that the sovereignty of each state shall not be touched by regulations on European level. A possibility would be a governance format and the development of frameworks by the EU. These regulations could then be adopted by the member states by choice. This could guarantee the sovereignty and at the same time offer an overall unification. These standards would then be combinable. The state should still have the lead in its territory for planning procedures. This work suggests various levels of governance integration and ends up with the call for a demand of a legal framework. This would strengthen the legal relationships between the states and open the path for more collaboration.

4.1.1. North Seas Countries' Offshore Grid Initiative

The NSCOGI covers the countries of Belgium, Denmark, France, Germany, Great Britain, Ireland, Luxembourg, the Netherlands, Norway and Sweden. This formation includes all North Sea neighbouring countries and their close neighbours which might be spatially affected as well. The collaboration consists of energy ministers, TSO, governmental regulators and the European Commission. The group signed the Memorandum of Understanding in 2010 (NSCOGI, 2010). The organisation is separated in three working groups:

- Working Group 1: Grid Configuration and Integration
- Working Group 2: Market and Regulatory Issues
- Working Group 3: Planning and Authorisation Procedures

Each group is arranged with members of the above mentioned shareholder groups of each two countries. Figure 9 shows the stakeholders, working groups and their structure. The time frame of the initiative is set from the signing of the Memorandum

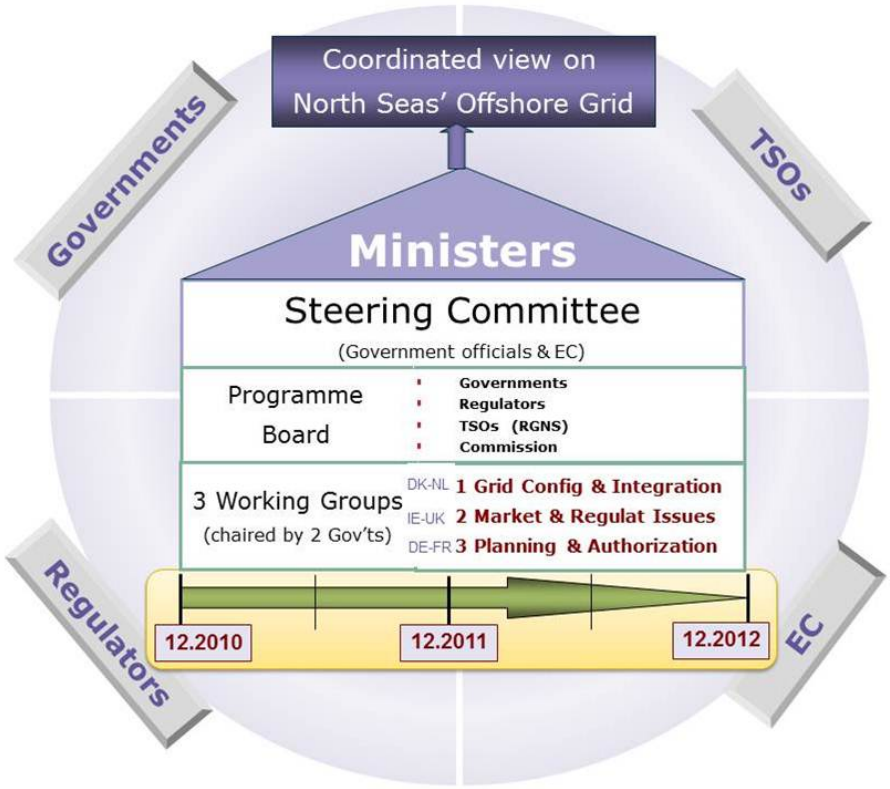


Figure 9: Structure of the NSCOGI (NSCOGI, 2012a)

of Understanding in 2010 until the end of 2012. The aim of the initiative is to get a coordinated view on the North Sea and the proposed supergrid.

The first group discusses the technical aspects of the connection and transportation of electricity. Working group two sees finances and the energy market as the target of work. These groups affect the overall feasibility of the project but do not touch this research specifically. The only relevant outcomes for this work are those of group three. This working group aims for the governance related barriers and incompatibilities. Recommendations towards the planning shall be the targeted outcome (NSCOGI, 2012a). Those are given by each of the stakeholders. This leads to a very broad range of standards which shall be noted at every particular planning event. The standards are then provided to the other participants which were not included in the particular activity. This reporting structure provides a strong exchange of information and hence supports process innovations.

The competences of the responsibility for an individual project lay within the hands of one national authority. This counts also for cross boarder projects where all affected stakeholders have to be identified very thoroughly. The steering authority is then also responsible for the reporting as described above (NSCOGI, 2012c).

Orths (2013) investigated the procedure of the NSCOGI and its benefits and tasks. She depicts the need for political decisions to finally move on with the supergrid which is for now still just a vision. The feasibility for the TSO depends on the costs

and benefits of such supergrid. But to take further steps they need regulations and statements from the governmental regulators and from governments. The task by the NSCOGI is to determine via market modelling and grid designs the benefits as well as the opportunities for a coordinated approach (Orths, 2013; Orths, Green, Fisher, Pelgrum, & Georges, 2013). Woolley (2013) summarises the work by the NSCOGI as follows: "The NSCOGI is currently operating under a non-binding Memorandum of Understanding in which the participating states have agreed to examine possibilities for developing a North Sea grid, but without making commitments to undertake such a project."

4.1.2. European North Sea Energy Alliance

The ENSEA is initiated and funded by the EU. Its aim is to cluster energy systems in the North Sea region. The shareholders are Scottish, Norwegian, German and Dutch organisations or initiatives. The targeted issues are from the fields of technology, policy, economy, regulation and social acceptance. Hence, it is a very holistic initiative with the aim of real implementation due to business cases. The basis for argumentation is the challenge of the energy in the North Sea. This includes not only marine renewable energies but also depleting oil and gas resources (ENSEA, 2014).
Besides the economic aspect, ENSEA addresses the research and development of local "universities, research centers, enterprises, regional authorities and other stakeholders across Europe." (Energy Valley Foundation, n.d.) With this networking knowledge and expertise will be collected and intensified. Based on the existing collaboration between north west Germany and the Netherlands, the network will be expanded to Scotland and Norway (ENSEA, 2013). The shareholders in this project are Energy Valley, Scottish region, Rogaland and the Ems Achse. The combination of those provides a holistic expertise from the fields of oil, gas, electricity and renewables (Energy Valley Foundation, n.d.). Figure 10 shows the allocation of tasks within the program and the areas of responsibility for each shareholder. The corresponding colours green and blue as interviewing lines and columns serve clarity and comprehensibility. They are of no further than of indicatory purpose. The column on the left illustrates the fields of practise whereas the topmost line confronts the fields with the possible challenges. The clusters shown in Figure 10 provide information on the feasibilities of each. The addressed fields again confirm a broad and holistic strategy. Additionally, since ENSEA is under persistent auditing, strengths and weaknesses between the clusters as well as in the clusters are investigated. Thereby, opportunities arise and the effectiveness of the entire project improves (Butler & Madeira, 2013).
Admittedly, it is hard to find any further information than given above. Reports about progress of the alliance as well as information about implementation or initiated approaches are lacking.

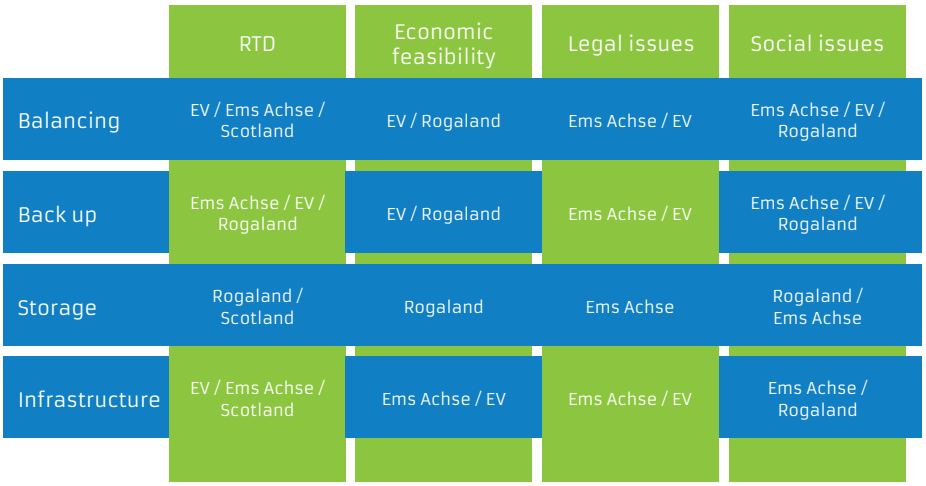


Figure 10: Allocation of Tasks Within ENSEA (ENSEA, 2014)

4.1.3. Comparison of Reports and Initiatives

The authors use various focuses and therefore different ways of touching the topic. Hence, Table 4 lists up all included reports to get a better understanding. The fields within the topic of offshore grid planning towards a supergrid are listed horizontally. Since this research focuses on the feasibility from a governance perspective, the topics are clustered into three superior groups. The first group Governance lists up all relevant topics for this thesis. The other two main groups may also contain subgroups, like grid design or technical feasibility in Technology. Any further division is not intended since it is not relevant for this research.

Table 4 shows that most of the sources reviewed have a focus either on monetary, technological issues or the feasibility in general. But all sources at least touch upon two categories at once and are rather hence broadly oriented. Reports discussing only specific topics like electrical engineering in offshore grid planning. Energy markets are left out because these are not relevant to the research. Generally, the reports see a relevance to do research in the field of offshore grid planning and to come up with grid designs. Most remarkable is the fact that the need for a change in offshore grid planning seems undoubted.

Unfortunately, two important issues are not sufficiently debated. The question of the ownership of the supergrid is nearly not discussed at all. Only Müller (Müller et al., 2013; Müller, 2013b, 2013a; Müller & Roggenkamp, 2014) questions and discusses it. The competence and who is going to plan and accomplish the supergrid is the

other neglected issue. This is only touched by Müller and Woolley (Woolley, 2013). In both cases, if any major hindrance appears in one of the fields or will not be discussed at all, the entire vision of a supergrid can founder. Investigations in regard to the ownership and competence are crucial for serious advance. The above listed reports and initiatives address the topic individually but do interlink with other reports. Mostly, the NSCOGI is named as a reference to address the progress of joint offshore grid planning. ENSEA is barely mentioned in other sources. Moreover, no competition of reports or even strong criticism is to find. Only Müller (Müller et al., 2013; Müller, 2013b; Müller & Roggenkamp, 2014) questions the meaning of other sources.

4.2. Interviews

The upcoming section summarises the conducted interviews for this research. The start will be the initiative interview with the Ems Dollart Region which was already introduced in Chapter 2.1. Based on the suggestions by Hermann Wessels, an interview with the District of Aurich and the Ems Achse will follow.

4.2.1. Ems Dollart Region

The interview with the EDR was conducted with Hermann Wessels as the manager for the INTERREG section.[1] In context of INTERREG programs various cross boarder projects were realised under the competence of the EDR. Those were mostly of general economic promotion or in one of the following sectors: tourism, culture, language education and even cross border spatial planning projects. The topic of energy transition and grid planning in general is also relevant for cross boarder projects by the EDR. Hermann Wessels depicts the existing differences between German and Dutch aims as obstacles, due to the different political circumstances like the EEG in Germany.
The example of the aluminium industry in the Netherlands emphasises the gaps between the objectives of nations. In Germany, energy-intensive industries are excepted by the EEG reallocation charge. This leads to low energy prices in specific industries. Therefore, Dutch companies thought about receiving energy directly from Germany via a connection under the Dollart. This project shows the barriers, questions and challenges, coming along with cross boarder connections. On the other hand, especially those ideas show the benefits emerging out of transnational cooperation. This could also be relevant for the connection of wind parks and grid planning. Any landfall comes along with an intrusion into the local ecosystem. The project site

[1] The interview is attached in Appendix B. The interview was executed on the 17th of November in 2014 at 10:00 a.m. Due to the invitation by Hermann Wessels it took place at the centre of the Ems Dollart Region in Bunderpoort 14, 9693 CJ Bad Nieuweschans, The Netherlands. The interview was recorded and later transcribed detailedly.

Table 4: Comparison of Reports and Initiatives

	Governance					**Finances & Economics**	**Technology**
	Ownership	Competence	Stakeholder's Interest	Country's Interest	Overall Feasibility		
Veal (2006)	−−	0	−−	−	−−	++	++
Pierik (2012)	−−	−−	−−	−−	−−	-	++
Woyte et al. (2008)	−−	−−	−−	−−	+	+	++
Bömer et al. (2010)	−−	−−	+	+	−−	+	++
De Decker et al. (2009)	−−	−−	−−	−−	+	++	++
Cole et al. (2014)	−−	−−	++	−−	+	++	++
Müller (multiple publications)	+	+	−−	−−	++	0	−−
Woolley (2013)	−	++	−−	+	++	−−	−−
NSCOGI (multiple publications)	−−	−−	++	++	+	++	++
ENSEA (multiple publications)	−−	−−	0	0	++	−−	0

++ = Focus of the Report
+ = Well Addressed
0 = Addressed
− = Introduced
−− = Not Included

of the North Sea is a designated natural world heritage site and hence, any impact should be kept at a minimum. Therefore, Hermann Wessels calls for further closer international collaboration for better coordination of projects.
International cooperation is one main point in this research. As a criterion, private companies do cooperate internationally if they benefit from it. Hermann Wessels has witnessed over time, that most companies have enough endogenous motivation and potential to act internationally and collaborative. Especially, companies with a similar focus or field of work are more likely to engage in international cooperation. However, international cooperation can also be difficult. Tennet for example is the responsible TSO in the Netherlands and at the German North Sea region as well. In Germany it is TenneT TSO GmbH and in the Netherlands TenneT TSO B.V. (Table 2). Both have the same origin but might have business objectives due to varieties in the German and Dutch market. Certainly, Hermann Wessels also depicts the importance for certain circumstances and parameters which affect transnational cooperation. Networks dealing with energy related issues can play a role in order to support cross boarder cooperation. In the EDR's sphere of activity is Energy Valley in the Netherlands and in Germany the OLEC, the district of Aurich and the Ems Achse. The latter is the leading association in the field of renewables in the region.
Regarding governance and political directives, the European Union has no competence in spatial planning nor in detail planning. Nevertheless, certain general framework conditions to the topic are set on European level. It is still doubtful how far the European influence and share will go. Currently, there is no direct connection between Europe and the fields of spatial planning and environmental impact assessment.
Summarising, Hermann Wessels sees a high demand for (international) cooperation if there is a benefit for the organisation. This endogenous interest does not necessarily need governance but it can be helpful to include experienced regional organisations from the particular sphere of knowledge or industry.

4.2.2. District of Aurich & Ems Achse

The District of Aurich is responsible in context of the energy sector within the Ems Achse.[2] Karl-Heinz Bakenhus is the head official for regional planning and the head of the economic team. Dr. Gabriele Krautheim is an expert in the field of energy with a scientific background and a participant and reference person in the ENSEA project. Ingo de Vries is a regional planner in the district of Aurich with experience in cross boarder planning projects in the Ems region.

[2]The interview with both was therefore conducted at the same time. The attendant interviewees were Karl-Heinz Bakenhus, Dr. Gabriele Krautheim and Ingo de Vries. The interview was executed on the 25th of June in 2015 at 09:30 a.m. Due to the invitation by Karl-Heinz Bakenhus it took place at the administrative district office at the Kreishaus Aurich, Fischteichweg 7-13, 26603 Aurich, Germany. A recording of the interview was not permitted. Hence, the transcript took place in form of notes.

Ingo de Vries sees the entire North Sea not as a feasible scope of planning. A project of joint grid planning only works with a maximum of two cooperating countries. Due to his experience with cross boarder projects in Germany and the Netherlands, he has experienced a lot of obstacles. Even on a bilateral level problems in planning projects emerge. There are always dissents between countries regarding planning guidelines, the spatial extend or even such simple things as language barriers. All in all, planning among countries leads to problems as soon as the country's territories are affected. In case of an implementation of a steering organisation like in Chapter 3.3, Dr. Gabriele Krautheim states that it can not have any authority. The conducting of planning is the responsibility of regions and nations. If this jurisdiction would be touched, the elected responsibility of the representative of the people and hence the democracy in it self is at stake. Therefore, a planning authority above national jurisdiction is not possible.
Karl-Heinz Bakenhus mentions two main sources for problems: The countries' above explained planning divergence and private companies with economic interests. Small scale approaches like the NorGer, a grid connection between Germany and Norway were perfectly feasible. Those individual measures however have their origin in the economy and not in planning. Hence, an economic interest is in foreground. Furthermore, energy prices also affect the feasibility of a supergrid. In such large-scale grid consolidation, an adjustment of the prices can be possible, sees Dr. Gabriele Krautheim. Norway for instance, has a strong interest in keeping the price level to protect the internal market.
Dr. Gabriele Krautheim adds to the discussion the technical feasability. At current technical state the construction and commissioning of a supergrid is not possible.
On the political level, the president of the European Commission addresses the supergrid in depth, whereas the European Commission has the task to enthuse the affected countries of the project. Hence, there is a strong interest on a political European level observable.
In case the supergrid is considered as one project it will not be realised. It seems only feasible to get towards a supergrid via very short targeted corridors. Hence, it is possible to begin on a small-scale. Then again, an initiative is essential. It has to come from one particular country or one single region. Summarising, the supergrid could only be accomplished under a comprehensive and advising organisation which then stimulates innovations. Eventually, it will be dependent on a potential economic interest.

5. Summary and Discussion

This chapter debates and discusses the content collected in the research process. Additionally, the information from the interviews and literature is summed up and set into context of the research question in Chapter 5.1-5.2. Furthermore, Chapter 5.3 concludes the thesis in order to take a step towards the proposed supergrid.

5.1. Governance and Initiatives

Chapter 3.2 shows the need for a governance format in order to manage and coordinate the multilevel setting of a joint grid approach. So far there is no governance or regime in order to do so. Therefore, the question for coordination and a format is raised. The high complexity underpins the experience of experts and the scientific community: there is no tailor made solution for a governance format. Hence, the Chapter 3.3 proposes a possible format. It is based on an existing structure and is adapted to the needs of a joint grid approach. Nevertheless, one fundamental condition exists for a successful performance of this suggestion: All involved parties have to be willing to join the approach and to cooperate.
In order to find out if this is the case, literature is investigated, enquiries are made and interviews are conducted. The literature and initiatives give a broad and detailed overview of the current state as well as the scientific community's point of view. To take up the question in Chapter 2.2: how is the scientific community dealing with the topic? Table 4 shows the list of literature and initiatives investigated within the scope of this study. Further reports and articles dealing solely with financial or technologic points of view in context of the offshore grid were left out in this comparison. This work focuses on the feasibility and motivation regarding the governance of the supergrid. Hence, the listed sources are of choice. The table shows an often appearing focus on the technological part which is mostly in context of the grid design. Only few address the broad topic of governance in detail. This is then mostly in the focus of the overall feasibility. Unfortunately, those rarely discuss the participation of stakeholders or the willingness. It is indispensable to see the importance of those who technically approach the planning and construction of the offshore grid. Furthermore, the competence as in the discussed governance format in Chapter 3.2 and 3.3 is barely debated. The last and least addressed topic is the question of the ownership. Who is in charge of the vast project?
The last two issues of the ownership and the competence are very important in regard to the overall feasibility of the offshore supergrid. Unfortunately, most of the literature and initiatives do not agree or do not dare to address this issues. Apparently, important facts like the grid design and financing are discussed and researched. But the governance level still lacks of substance. Who is really discussing the feasibility of the supergrid and who is discussing what needs to be done to take further steps?

The research process exposes only Müller and Woolley address the crucial barriers. Both point out two important points: Firstly, they ask for more coordination between the stakeholders. In this case the TSO, governmental regulators but also the states and the EU. Communication and certainly a willingness for coordination in the first place is crucial for the collaboration. Secondly, the governance format and the current political frameworks have to be revised. Without a clear commitment of the politics on European and national level, the supergrid is not feasible. Chapter 2.2 also points out the importance of the work by the European Union and other governance and government levels in order to support the development towards a North Sea supergrid. Since planning can not come from a European level, the member states have to do so individually. Without it, grid compatibility cannot be ensured. Hence, there has to be a commitment by the member states to cooperate and to join a planning guideline.

The two initiatives NSCOGI and ENSEA are the most important transnational initiatives in regard to the topic of this work. However the initiatives can be criticised in regard to their efficiency and meaningfulness. As Woolley (2013) sees it, the NSCOGI is not "making commitments to undertake such a project". This confirms the vagueness of the initiatives which emerged out of this research process as well. This does not only concern NSCOGI but also ENSEA. ENSEA seems to be a more implementation-oriented approach but the initiative also reveals two main critiques. First, the involved stakeholders are local initiatives from the field of energy and economics. Unfortunately, TSO and governmental regulators seem to be not directly included. Without these two main stakeholders in grid planning, the initiative lacks practice. Secondly, ENSEA bases its international cooperation on the existing cooperation between Germany and the Netherlands. Nevertheless, the scope of 13 countries is quite another matter. Naturally, it seems to be reasonable to base the transnational cooperation on an existing cooperation but the scope varies between the case of a bilateral cooperation and the cooperation of 13 countries. Hence, it can not be a strong foundation. It is a good start to base small scale or regional projects on such existing collaboration. But ENSEA intends to face the supergrid in the North Sea as one big project. On these grounds ENSEA should rather focus on finding a governance approach with the aim to unite all stakeholders from the beginning. ENSEA seems very optimistic, as every publication or initiative by the European Union. Unfortunately, it definitely lacks criticism and (again) the fields of ownership and competence. Additionally, it is to point out that the given information about the ENSEA is very limited. Therefore, the Chapter 4.1.2 does not include any information about succeeded projects or progress in implementation.

5.2. Interviews

Hermann Wessels makes a point by emphasising the importance of the economic interest. This is shared by Karl-Heinz Bakenhus and Dr. Gabriele Krautheim. If the TSO do not see a clear economic advantage of joint grid planning it is unlikely to happen. Unless, there will be a governmental regulation supporting the development like the EEG for renewables in general. Nevertheless, this has to happen in all North Sea neighbouring countries alike. Without a consistent political guidance, governance will be missing.
Hermann Wessels sees no issues regarding the transnational cooperation. However, the EDR is a local institution, only dealing with projects in the region. In that scope of planning, projects are much more likely to succeed then on a larger scope. The experiences by the interviewees of the District of Aurich are of wider scope and they collectively point out the difficulties coming along with such scope. They clearly state summarised in Chapter 4.2.2, that the supergrid will not succeed if it shall be approached on this broad level. The maximum possible planning extent is of two countries. Nevertheless, even on this scale problems occur. Despite the scope of planning, these transnational approaches always come along as a challange.
Added to this, the interviewees repeatedly emphasise strongly that one planning authority will not be possible since national jurisdictions will then be touched and restricted. Local projects however do not face this issue. Hence, as underpinned by Chapter 4.2.2 small-scale approaches are more likely to be successful. Hence, the scope of planning should be on small scale and bilateral projects within a larger perspective.
Due to a lack of response by the TSO and the governmental regulators, the research question is hard to answer. It seems, the TSO are not willing to cooperate if they do not clearly express it. Worse than expected in the beginning of the research process it turned out that not a single TSO or governmental regulator of the selected was willing to respond to the topic during the research process. This leads to the conclusion that the field of research might be of high relevance but turned out to be classified information unless further expressed. Therefore, the research question can not clearly be answered. It seems the TSO do not have an interest in joint grid planning in the North Sea. Even though there is a collaboration within the NSCOGI, it is still a non-binding initiative without any commitments by the participants.

5.3. Conclusion

Those initiatives like NSCOGI and ENSEA still play an important role. Even if they do not initiate the planning of a supergrid, they still present the topic itself and in all its facets. Accordingly, TSO and other stakeholder have the topic present. The idea only functions if all parties like TSO, governmental regulators, governments, European Union and private parties agree to one understanding. Most importantly,

the TSO have to join the international planning process independently.
Experiences prove that TSO are willing to join international projects if there is a financial benefit. Projects like NorNed and NorGer join TSO from different countries for grid planning. These projects have an economic origin and have a more overseeable scope than the entire supergrid region. Hence, if TSO have an interest, initiatives and practical research can prosper in small-scale projects. This trend is underpinned by serious obstacles coming along with planning projects on very large scales like the entire North Sea region.
This counts especially if the planning responsibility and sovereign territories are at stake. Therefore, an organisation cannot have a planning responsibility as explained above but might take on a role of a consulting and advising instance. So, the suggested organisational structure in Chapter 3.3 has to be reconsidered. The structure in itself is still relevant but can not have any authority. Therefore, this should be seen as a consulting organisation with the task to advise local planning initiatives. The plans can be collected and provided for others in order to provide a common ground and language. International transparency and consistency will be provided by the organisation but the country's sovereignty will not be touched. This comprehensive agency, may be based on the suggestion within this thesis, can support the development towards more local initiatives. Small scale projects in borderland regions have less potential to face conflicts and legal barriers. Thereby, this can help to close up on the idea of a supergrid. This opens up new possibilities and potential to come closer to the idea of a supergrid - even in a patchwork design. In the words of Trötscher & Korpås (2011), the "static nature of the model is unrealistic; a large meshed power grid will seldom be built in one step. The usual course is to develop the grid in steps."

6. Reflection

During the research, a lot of interesting and valuable information as well as struggles and obstacles came up. The willingness for interviews has to be highlighted. As it was questioned in Chapter 1 already, secrecy was expected. Interviews in general and especially in such international and highly complex setting often face rejections. Table 5 shows the number of enquiries for interviews sent and the number of responses

Table 5: Responses to Enquiries

Approached Institution	Number of Enquiries	Rejections	Positive Responses
TSO	9	2	0
Governmental Regulator	7	2	0
Others	5	0	2
Total	21	4	2

as well. The response rate is worse than expected. Not one TSO or governmental regulator was willing to take part in the study and only four of 16 responded to the enquiries. Due to the difficulties connected to the interviews, it is very useful to have another pillar to base the research on. The reports and initiatives discussed in Chapter 4 substantiate the research and the findings of this research. Nevertheless, it would have been useful to have more interviews to base the thesis on. Especially from the TSO in regard to answer the research question.
Unfortunately, the methods with regard to the interview design in Chapter 2.1.3 now lack relevance, since no comparison of multiple conducted interviews could take place. The extend of reticence was not foreseeable. However, the negative response rate underpins the findings in a way as well: The TSO are certainly not openly willing and publicly positive about a joint grid planning towards a North Sea supergrid. Otherwise, at least few responses would have been received.

References

4C Offshore. (2014a). *Global offshore wind farms database.* Web. Retrieved from `http://www.4coffshore.com/offshorewind,08.12.2014`

4C Offshore. (2014b). *Tidal projects.* Web. Retrieved from `http://www.4coffshore.com/windfarms/tidals.aspx,08.12.2014`

ACER. (2012). *Members of the board of regulators.* Web. Retrieved from `http://www.acer.europa.eu/The_agency/Organisation/Board_of_Regulators/Pages/BoR-Members.aspx,22.01.2015`

ARSU GmbH, CIMA Institut für Regionalwirtschaft, & regio GmbH. (2013). *Potenzialstudie energieregion nordwest* (Tech. Rep.). Oldenburger Energiecluster OLEC e.V.

Beels, C., Henriques, J., De Rouck, J., Pontes, M., De Backer, G., & Verhaeghe, H. (2007). Wave energy resource in the north sea. *Proceedings of the 7th European Wave and Tidal Energy Conference*.

Biernacki, P., & Waldorf, D. (1981). Snowball sampling. *Sociological Methods & Research*, *10*(2), 141-163.

Bloomberg, L. D., & Volpe, M. (2012). *Completing your qualitative dissertation: a road map from beginning to end.* Sage.

Bömer, J., Brodersen, N., Hunke, D., Schüler, V., Günther, H., Weisse, R., ... Gaßner, H. (2010). *Nutzung der meeresenergie in deutschland, endbericht.* Ecofys Germany GmbH.

Brauns, E. (2008). Towards a worldwide sustainable and simultaneous large-scale production of renewable energy and potable water through salinity gradient power by combining reversed electrodialysis and solar power? *Desalination*, *219*, 312-323.

Brauns, E. (2009). Salinity gradient power by reverse electrodialysis: effect of model parameters on electrical power output. *Desalination*, *237*, 378-391.

Brücher, W. (2008). Erneuerbare energien in der glglobal versorgung aus historisch-geographischer perspektive. *Geographische Rundschau*, *60*(1), 4-12.

Bronder, C. (1993). *Kooperationsmanagement: Unternehmensdynamik durch strategische allianzen.* Campus.

Bundesnetzagentur. (2009). *Positionspapier zur netzanbindungsverpflichtung* (Tech. Rep.). Author.

Bundesnetzagentur. (2014). *Verfahrenshandbuch zum planfeststellungsverfahren von vorhaben von gemeinsamem interesse (pci)* (Tech. Rep.). Author.

Butler, D., & Madeira, N. (2013). *Enseensea work package 2* (Tech. Rep.). European North Sea Energy Alliance.

Campbell, D. E. (1995). *Incentives: motivation and the economics of information.* Cambridge Univ. Press.

Cavanagh, J. (1991). Ocean thermal energy conversion. *Electricity and the Envi-*

ronment. Background papers for a Senior Expert Symposium held in Helsinki, 13-17 May 1991, 267-274.

Ciupuliga, A. R. (2013). *Transmission expansion planning under increased uncertainties. towards efficient and sustainable power systems* (Unpublished doctoral dissertation). TU Delft.

Clément, A., McCullen, P., Falão, A., Fiorentino, A., Gardner, F., Hammarlund, K., ... Thorpe, T. (2002). Wave energy in europe: current status and perspectives. *Renewable and Sustainable Energy Reviews*, *6*(5), 405 - 431.

Coelingh, J., van Wijk, A., & Holtslag, A. (1996). Analysis of wind speed observations over the north sea. *Journal of Wind Engineering and Industrial Aerodynamics*, *61*, 51-69.

Cohen, N., & Arieli, T. (2011). Field research in conflict environments: Methodological challenges and snowball sampling. *Journal of Peace Research*, *48*(4), 423-435.

Cole, S., Martinot, P., & Rapoport, S. (2014). *Study of the benefits of a meshed offshore grid in northern seas region* (Tech. Rep.). European Commission.

Constans, J. (1979). *Marine sources of energy.* Pergamon Policy Studies on Energy and Environment.

CPB Netherlands Bureau for Economic Policy Analysis. (1997). *Challenging neighbours: rethinking german and dutch economic institutions.* Springer.

CRES. (2002). *Wave energy utilization in europe. current status and perspectives* (Tech. Rep.). Centre for Renewable Energy Sources.

De Decker, J., Kreutzkamp, P., Joseph, P., Woyte, A., Cowdroy, S., McGarley, P., ... Caralis, G. (2011). *Offshore electricity grid infrastructure in europe* (Tech. Rep.). 3E, Senergy Econnect, SINTEF, dena, ForWind, IEO, NTUA.

De Decker, J., Woyte, A., Vu, V. T., Srikandam, C., Völker, J., Funk, C., ... Rodrifues, G. (2009). *The iee project offshoregrid: Objectives, approach and first results* (Tech. Rep.). 3E sa, Deutsche Energie-Agentur, ECBREC IEO, ForWind and EWEA.

EDR. (2012). *Wir über uns.* Web. Retrieved from `http://www.edr.eu/de/site/organisation,23.01.2015`

Energy Valley. (2010). *Energy valley works! investments in the northern netherlands for a clean and reliable european energy future* (Tech. Rep.). Energy Valley.

Energy Valley. (2013). *Current activities* (Tech. Rep.). Energy Valley.

Energy Valley Foundation. (n.d.). *Ensea – factsheet* (Tech. Rep.). European North Sea Energy Alliance.

ENSEA. (2013). *About the project.* Web. Retrieved from `http://www.ensea.biz/about-ensea,05.08.2015`

ENSEA. (2014). *Working together to create a sustainable and secure energy future* (Tech. Rep.). European North Sea Energy Alliance.

European Commission. (2007). An energy policy for europe.

European Commission. (2008a). An eu energy security and solidarity action plan.

European Commission. (2008b). Europe's climate change opportunity. 20 20 by 2020.

European Commission. (2015, 03). *Interreg iii: the strands a, b, c and the programmes.* Web. Retrieved from `http://ec.europa.eu/regional_policy/archive/interreg3/abc/abc_en.htm,11.06.2015`

European Network of Transmission System Operators for Electricity. (2011). *Offshore grid development in the north seas entso-e views* (Tech. Rep.). European Network of Transmission System Operators for Electricity.

European Network of Transmission System Operators for Electricity. (2012). *10-year network development plan 2012* (Tech. Rep.). European Network of Transmission System Operators for Electricity.

European Network of Transmission System Operators for Electricity. (2014). *Entso-e member companies.* Web. Retrieved from `https://www.entsoe.eu/about-entso-e/inside-entso-e/member-companies/Pages/default.aspx,20.01.2015`

European Parliament, & The Council of the European Union. (2009). Directive 2009/72/eg. *Official Journal of the European Union*, *211*(55).

Faria, P., & Schmidt, T. (2007). International cooperation on innovation: Empirical evidence for german and portuguese firms. *ZEW Discussion Paper*, *7*(60).

Fayerweather, J. (1972). The internationalization of business. *The ANNALS of the American Academy of Political and Social Science*, *403*(1), 1-11.

Feix, O., & Hörchens, U. (2013). *Offshore - netzentwicklungsplan 2013. zweiter entwurf der Übertragungsnetzbetreiber* (Tech. Rep.). 50Hertz Transmission GmbH, Amprion GmbH, TenneT TSO GmbH and TransnetBW GmbH.

Fuchs, M., & Apfelthaler, G. (2009). *Management internationaler geschäftstätigkeit.* Springer Vienna.

Goodman, L. A. (1961). Snowball sampling. *The Annals of Mathematical Statistics*, *32*(1), 148-170.

Hajer, M. A. (2006, May). The living institutions of the eu: Analysing governance as performance. *Perspectives on European Politics and Society*, *7*(1), 41-55.

Handcock, M. S., & Gile, K. J. (2011). On the concept of snowball sampling. *Sociological Methodology*, *41*, 367-371.

Hooghe, L., & Marks, G. (2001). *Multi-level governance and european integration.* Rowman & Littlefield Publishers, Inc.

IMechE. (2009). Osmotic power plant set to open in norway. *Professional Engineering*, *22*(18), 43.

International Energy Agency. (1999). *International collaboration in energy technology: A sampling of success stories* (Tech. Rep.). Author.

Interreg North Sea Programme Secretariat. (2008). *Interreg iv b: North sea region programme 2007-2013* (Tech. Rep.). Interreg North Sea Programme Secre-

tariat.

Katia, M. (2014, May). The white stuff. *Professional Engineering*, *27*, 59-62.

Kooistra, P., Gawenat, I., Boshuizen, J., & Hentschel, R. (2014). *Crossing borders in energy transition* (Tech. Rep.). Energy Valley, OLEC, Provincie Groningen, City of Oldenburg.

Kreikebaum, H., Gilbert, D. U., & Reinhardt, G. O. (2003). *Organisationsmanagement internationaler unternehmen: Grundlagen und moderne netzwerkstrukturen.* Gabler.

Lenferink, S. (2013). *Market involvement throughout the planning lifecycle: Public and private experiences with evolving approaches integrating the road infrastructure planning process* (Unpublished doctoral dissertation). Rijksuniversiteit Groningen.

Loeb, S. (2002). Large-scale power production by pressure-retarded osmosis, using river water and sea water passing through spiral modules. *Desalination*, *143*, 115-122.

Mayring, P. (2000). *Qualitative inhaltsanalyse : Grundlagen und techniken.* Beltz. Deutscher Studien Verlag.

Miles, M. B., & Huberman, A. M. (1994). *Qualitative data analysis: an expanded sourcebook.* Sage.

Müller, H. K. (2013a). The coordinated development of offshore energy infrastructure: Legal challenges and possible solutions. *Competition and Regulation in Network Industries*, *14*(3), 291-313.

Müller, H. K. (2013b). Legal bases for offshore grid development under international and eu law: Why national regimes remain the determining factor. *European Law Review*, *5*, 618-637.

Müller, H. K., & Roggenkamp, M. M. (2014). Regulating offshore energy sources in the north sea - reinventing the wheel or a need for more coordination? *The International Journal of Marine and Coastal Law*, *29*, 716-737.

Müller, H. K., Shariat Torbaghan, S., Gibescu, M., Roggenkamp, M. M., & van der Meijden, M. A. M. M. (2013). The need for a common standard for voltage levels of hvdc vsc technology. *Energy Policy*, *63*, 244-251.

Molema, M. (2013). *Regionale stärke. wirtschaftspolitik im norden der niederlande und in nordwestdeutschland, 1945-2000.* Verlag der Emsländischen Landschaft e.V.

Moser, H. (2015). *Instrumentenkoffer für die praxisforschung.* Lambertus-Verlag.

Ndreko, M. V. (2012). *Offshore wind power connected to the dutch transmission system by vsc-hvdc networks: Modeling and stability analysis* (Unpublished master's thesis). TU Delft.

NSCOGI. (2010). *Memorandum of understanding* (Tech. Rep.). North Seas Countries' Offshore Grid Initiative.

NSCOGI. (2012a). *Initial findings* (Tech. Rep.). North Seas Countries' Offshore

Grid Initiative.

NSCOGI. (2012b). *Recommendations for guiding principles for the development of integrated offshore cross border infrastructure. deliverable 2 - final report* (Tech. Rep.). North Seas Countries' Offshore Grid Initiative.

NSCOGI. (2012c). *Wg 3: Procedural guidelines* (Tech. Rep.). North Seas Countries' Offshore Grid Initiative.

NVE. (2011). *Annual report 2010. the norwegian energy regulator* (Tech. Rep.). Norges vassdrags- og energidirektorat.

Oceanweather Inc. (2014). *Current marine data.* Web. Retrieved from `http://www.oceanweather.com/data,01.12.2014`

Oppenheim, A. (1992). *Questionnaire design, interviewing and attitude measurement.* Continuum.

Orths, A. (2013). *A european north-seas offshore grid - results from a joint 10 countries' analysis* (Tech. Rep.). Energinet.dk, Internationaler ETG-Kongress.

Orths, A., Green, D., Fisher, L., Pelgrum, E., & Georges, F. (2013). A european north-seas offshore grid - results from a joint 10 countries' analysis. *Internationaler ETG-Kongress 2013*(139), 5.

Oxley, M., Brown, T., Nadin, V., Qu, L., Tummers, L., & Fernández-Maldonado, A. M. (2009). *Review of european planning systems* (Tech. Rep.). Centre for Comparative Housing Research.

Pattle, R. E. (1954). Production of electric power by mixing fresh and salt water in the hydroelectric pile. *Nature*, *174*(4431), 660.

Pierik, J. (2012). *North sea transnational grid. wind farm locations and development (wp2)* (Tech. Rep.). ECN Wind Energy.

Post, J. W. (2009). *Blue energy: electricity production from salinity gradients by reverse electrodialysis* (Unpublished doctoral dissertation). Wageningen University.

Post, J. W., Veerman, J., Hamelers, H. V., Euverink, G. J., Metz, S. J., Nymeijer, K., & Buisman, C. J. (2007). Salinity-gradient power : Evaluation of pressure-retarded osmosis and reverse electrodialysis. *Journal of membrane science*, *288*(1), 218-230.

Reinders, H. (2005). *Qualitative interviews mit jugendlichen führen.* Oldenbourg Wissenschaftsverlag GmbH.

RSE S.p.A. (2012). *Orecca webgis. off-shore renewable energy conversion platforms - coordinated action.* Web. Retrieved from `http://map.rse-web.it/orecca/map.phtml,09.02.2015`

Schmidt, J., & Mühlenhoff, J. (2010). *Erneuerbare energien 2020. potenzialatlas deutschland* (Tech. Rep.). Agentur für Erneuerbare Energien e.V.

Schnell, R., Hill, P. B., & Esser, E. (2013). *Methoden der empirischen sozialforschung* (10th ed.). Oldenbourg Wissenschaftsverlag GmbH.

Sverdrup, H. U., Johnson, M. W., & Fleming, R. H. (1942). *The oceans their physics, chemistry, and general biology.* Prentice-Hall, Inc.

Teixeira Pinto, R. (2014). *Multi-terminal dc networks. system integration, dynamics and control* (Unpublished doctoral dissertation). TU Delft.

TenneT. (2014, November). *About the electricity grid.* Web. Retrieved from `http://www.tennet.eu/nl/grid-projects/gridmap.html,14.11.2014`

Theisen, M. E. (2011). *Offshore-grid* (Unpublished master's thesis). NTNU.

Thorsen, T., & Holt, T. (2009). The potential for power production from salinity gradients by pressure retarded osmosis. *Journal of Membrane Science*, *335*, 103-110.

Trötscher, T., & Korpås, M. (2011). A framework to determine optimal offshore grid structures for wind power integration and power exchange. *Wind Energy*, *14*, 977-992.

van der Meer, A. A., Teixeira Pinto, M., Rodrigo Gibescu, Bauer, P., Pierik, J. T. G., Nieuwenhout, F. D. J., Hendriks, R. L., ... van Kuik, G. A. M. (2010, 10). Offshore transnational grids in europe: The north sea transnational grid research project in relation to other research initiatives. *Proceedings of the 9th International Workshop on Large-Scale Integration of Wind Power Into Power Systems As Well As On Transmission Networks For Offshore Wind Power Plants*, *1*, 1-8.

Veal, C. (2006). *European offshore supergrid proposal. vision and executive summary* (Tech. Rep.). Airtricity.

Verver, J. (2008). *Continuous monitoring and audaudit: What is the difference?* (Tech. Rep.). Protiviti Inc.

Wagener, U. (2009). Was tun wir, wenn wir daten erheben? In *Methoden-reader zur oldenburger teamforschung.* Oldenburger VorDrucke.

Williamson, K. (2011). Long and windy road: What is the glue that will hold the pieces together as we plan for 40 gw of offshore wind in and around the north sea region in 2020? *Renewable Energy Focus*, *12*(6e), 60–64.

Winter, W. (2010). *European wind integration study. towards a successful integration of large scale wind power into european electricity grids* (Tech. Rep.). ENTSOE.

Woolley, O. A. (2013). Governing a north sea grid development: The need for a regional framework treaty. *Competition and Regulation in Network Industries*, *14*, 73-97.

Woyte, A., De Decker, J., & Van Thong, V. (2008). *A north sea electricity grid [r]evolution* (Tech. Rep.). Greenpeace Belgium and 3E.

A. Acknowledgement

At the end of this work and at the same time at the end of my time as a student I would like to appreciate the support I received during this time. First of all I thank my supervisor Dr. Christian Zuidema for the support and a lot of helpful and trend-setting advices and ideas. Additionally, my second supervisor apl. Prof. Dr. Ulrich Scheele as well as Prof. Dr. Frank Schüssler for helpful and inspiring ideas.
Especially in the context of this thesis I really appreciate the cooperation with Hermann Wessels, Karl-Heinz Bakenhus, Dr. Gabriele Krautheim and Ingo de Vries. Their willingness to communicate was an important pillar for this work and allowed me to see the research topic from the eyes of experts in the field.
I appreciate my private sphere and all who supported me especially during the research phase. I thank Hilke Menzel for being at my side. Not least because just since lately, I am looking forward for even more time to come. Thank you, Dr. Nils H. Müllner, Kristof Plewka, Micha Lundbeck, Isabelle Lange for professional backing, for great times and even more to come.
Eventually, I thank my family for being my family! Nantje and Sebastian Fuhrmann, it is great to have you both so close; as family and as friends. Felizitas, Bianca, and Gerold Fuhrmann, thank you for being there for me any time. I would not be what I am now without all you on my side. Naturally, special thanks to my parents for enabling all possibilities I could imagine for my life.
At last, I thank the entire team of BIWAK Outdoor Equipment OHG for a great time over the last seven years.

B. Interview with Hermann Wessels

Name of Interviewee	Hermann Wessels
Location	Ems Dollart Region Bunderpoort 14 9693 CJ Bad Nieuweschans The Netherlands
Date and Time	17.11.2014, 10:00

(HW=Hermann Wessels, CF=Christian Fuhrmann)

HW: Zur Person: Mein Name ist Hermann Wessels und ich arbeite hier bei der Ems Dollart Region insbesondere im Bereich des Programmmanagements INTERREG. Im Wesentlichen beinhaltet das die Vorbereitung, Koordinierung und Durchführung grenzübergreifender Programme. Die INTERREG Programme gibt es hier in der Region schon relativ lange, seit Beginn der 90er Jahre. Im Rahmen dieser Programme sind natürlich auch schon sehr viele grenzübergreifende Projekte im Bereich der Wirtschaftsförderung ganz allgemein, der touristischen Entwicklung, der Zusammenarbeit in den Bereichen Kultur, Ausbildung, Sprache aber auch im Hinblick auf grenzübergreifende Planungen durchgeführt worden. In den letzten Jahren konzentriert sich die Kooperation insbesondere in wirtschaftlicher Hinsicht auf Innovation und Technologieentwicklung. Dafür wird ein Großteil der finanziellen Mittel eingesetzt, die für diese Programme von der EU zur Verfügung gestellt werden. Auf der anderen Seite werden Themen der nachhaltigen regionalen Entwicklung behandelt, wobei unterschiedliche Projekte z.B. der Umwelt und der Landschaft hier in der Region verwirklicht werden. Darüber hinaus steht die Kooperation der unterschiedlichen Institutionen und Partner an deutscher und niederländischer Seite im Fokus. Zu dem Hintergrund bzw. dem Ansatz in der Masterarbeit lassen sich auch Ansätze und Anknüpfungspunkte erkennen, die innerhalb der Arbeitsfelder der EDR auf der Tagesordnung stehen. Die EDR befasst sich inhaltlich nur am Rande mit Projekten, sondern koordiniert mehr die Vorbereitung und Organisation von derartigen Projekten und Programmen. Dennoch kommt diese Thematik, die Sie in der Masterarbeit ansprechen wollen, natürlich in verschiedenen Projekten im Zusammenhang grenzübergreifender Kooperation auf die Tagesordnung. Dabei spielen diese insbesondere in der Diskussion der letzten Jahre eine große Rolle. Vor dem Hintergrund der in Deutschland unter dem Stichwort Energiewende aktuellen Themen wird das auch noch zunehmen. In den Niederlanden spricht man von "Energietransitie". Wobei die schwerpunktmäßige Ausrichtung der einzelnen Themen, die dabei jeweils in Nordwestdeutschland und dem Norden der Niederlande eine Rolle spielen, teilweise durchaus unterschiedlich sein können. Das hängt im Wesentlichen aus unserer Sicht mit unterschiedlichen Rahmenbedingungen zusammen, die z.B. durch die Politik gesetzt werden. Stichwort in Deutschland: das EEG. Auf der anderen Seite sind teilweise unterschiedliche Interessen zu berücksichtigen z.B. die im Norden der

Niederlande vorhandenen Ressourcen. Zu nennen ist hier das Stichwort Gas bzw. die Gasvorkommen. Daraus leitet sich natürlich zum Teil eine andere Lösungsorientierung im Hinblick auf die Energiewende ab. Wobei wir feststellen, dass sich gerade in der grenzübergreifenden Kooperation diese unterschiedlichen Herangehensweisen auch durchaus ergänzen können und interessante Ansätze für gemeinsame Kooperationen bilden. Auf diesem Wege und vor dem Hintergrund auch unterschiedlicher Interessen können dennoch Kompetenzen und Lösungswege zusammengebracht werden, bei denen Partner in beiden Ländern durchaus für sich und insgesamt einen Mehrwert erzielen können. Soweit zu der Thematik und zur Fragestellung, ob zu den Projekten Hinweise bzw. Anknüpfungspunkte zu einigen konkreten Fragestellungen vorhanden sind.

CF: Gut. Glauben Sie generell, dass eine Vision möglich ist, nach der sich mehrere Unternehmen, Netzbetreiber aus den entsprechenden Ländern zusammentun, um gemeinsam diese Problematik in einem grenzübergreifenden Vorhaben anzugehen?

HW: Uns ist durchaus bewusst, dass unterschiedliche Rahmenbedingungen in Deutschland und in den Niederlanden in Bezug auf eine derartige Fragestellung sehr differenziert zu betrachten sind. Außerdem sind sie eventuell nicht so einfach in Kooperation zu lösen. Das lässt sich an einem aktuellen Beispiel verdeutlichen, bei dem die Partner gemeinsam an einer Lösung arbeiten, aber noch viele Fragen vor einer Realisierung zu bearbeiten sind. Im Eemshaven ist eine sehr energieintensive Industrie angesiedelt. Stichwort: Aluminium zum Beispiel. Und diese ist in der Produktion beziehungsweise in ihrem Wirtschaften sehr von Energiepreisen und der Verfügbarkeit der Energie abhängig. Dann gab es in Deutschland die Diskussion im Zusammenhang mit dem Energieeinspeisegesetz, dass große Unternehmen, die viel Energie brauchen, von der im Gesetz geregelten Abgabe befreit werden und die entsprechende Umlage auf die Energie, die sie für ihre Produktion nutzen, nicht zahlen müssen. Das hat in den Niederlanden, den Anstoß zu der Fragestellung gegeben, ob es für energieintensive Unternehmen nicht wirtschaftlicher sei, direkt aus Deutschland Energie zu beziehen, um gerade diesen Vorteil auch in Anspruch zu nehmen. Dazu ist ein Kabel bzw. eine Verbindung unter dem Dollart hindurch zwischen Emden und Delfzijl zu schaffen. Dadurch soll die energieintensive Industrie im Eemshaven mit deutscher, möglicherweise auch zum Teil überschüssiger Energie, zum Beispiel aus Offshore Windparks versorgt werden. Verschiedene Partner sind jetzt dabei, die Voraussetzungen dafür zu schaffen. An einem derartigen Projekt werden natürlich die Barrieren, Fragestellungen und Herausforderungen deutlich, die eine grenzübergreifende Verbindung hinsichtlich den erforderlichen Abstimmungen mit sich bringt. Aber auf der anderen Seite zeigt das Beispiel deutlich auf, dass es sich auf jeden Fall "lohnt", an vergleichbaren Projekten und Kooperationen zu arbeiten, um tatsächlich Vorteile gemeinsam nutzen zu können. Das setzt sich fort auch in vielen Diskussionen beim Thema Offshore / Offshore Windparks und bei den notwendigen Verbindungen und Trassen, die dazu erforderlich sind, um den dort

produzierten Strom an Land zu bringen. Bisher gibt es schon Überlegungen zum Beispiel im Norden der Niederlande mit dem skandinavischen Raum zu gemeinsamen Trassennutzungen und ähnlichen Lösungen, während die deutsch-niederländische Abstimmung da noch nicht so weit vorangeschritten ist. Da sind die Partner gefragt, die sich z.B. im Bereich Offshorewind engagieren, hier gemeinsame Kooperationsansätze zu finden. Wobei dort auch realistisch immer zu berücksichtigen ist, dass dieser Markt natürlich ein noch sehr national organisierter Markt ist. Das Thema Energie ist in den Niederlanden etwas anders strukturiert als in Deutschland, obwohl wahrscheinlich alle sich an der gleichen Börse um den Strom bemühen, den sie zu Verfügung stellen wollen. Aber dennoch gibt es da natürlich unterschiedliche Interessen und es erfolgen bereits heute Stromlieferungen in die Niederlande aus Windenergie und das wiederrum zeigt, ein Austausch und eine Kooperation ist durchaus möglich. Aus unserer Sicht wäre das natürlich gerade im Zusammenhang mit den Offshore Windparks angebracht. Gerade die Auflagen, die dieses Gebiet, die Nordsee und das Weltnaturerbe Wattenmeer, mit sich bringt, geben Anlass, gemeinsam Planungen zu betreiben, da natürlich jede Trasse für sich wiederum Eingriffe in das Weltnaturerbe nach sich ziehen und diese Eingriffe sollten zukünftig noch enger auch grenzübergreifend miteinander abgestimmt werden.

CF: Ja, das stimmt. Sie sagten gerade, dass es Kooperationen zwischen den Niederlanden und Skandinavien gibt, was das Netz angeht, aber weniger zwischen den Niederlanden und Deutschland. Das finde ich persönlich eher verwunderlich, weil ich sagen würde, dass es eher einfacher wäre, einmal weil die Länder direkt nebeneinander liegen und zum anderen weil dieselben Netzbetreiber für das Stromnetz im Grenzgebiet zuständig sind. Das ist die Firma Tennet, soweit ich informiert bin. Deshalb hätte ich gedacht, dass es da eher zu Kooperationen kommen kann beziehungsweise unbürokratischer, einfacher. Deshalb ist meine Frage, welche Institutionen spielen da die Rolle, was die Kooperation oder das Management von diesen Geschichten angeht.

HW: Diese Vorstellung im Hinblick auf einen gemeinsamen Betreiber Tennet sind ja nachvollziehbar. Dennoch muss man berücksichtigen, dass ein Betreiber Tennet sich natürlich im Niederländischen Markt in einer anderen Situation befindet, als im deutschen Markt. Und sicherlich ist auch sehr genau zu betrachten, welche Funktionen er in dem jeweiligen System hat. Wichtig ist wahrscheinlich auch, die finanziellen Rahmenbedingungen nicht zu unterschätzen, in denen ein derartiges Unternehmen in den Niederlanden oder in Deutschland arbeitet oder sich bewegt. Eine Kooperation mit weiter entfernten Partnern in diesem Thema kann aus unterschiedlichen Gründen leichter zu realisieren sein. Das kann auch mit den entsprechenden nationalen Rahmenbedingungen zusammenhängen. Weiterhin können unterschiedliche Interessenslagen eine Rolle spielen. Auch in Deutschland wird im Bereich der Energie mit Skandinavien über Kooperationen nachgedacht, da es zum Beispiel in Skandinavien mehr und vielleicht auch nachhaltigere Ressourcen gibt, um Energie zu speichern.

Und diese Rahmenbedingungen sind natürlich im Einzelnen zu berücksichtigen. Dennoch ist der Hinweis richtig, dass Akteure in diesem Themengebiet schon jetzt auch grenzübergreifend arbeiten. Sie haben den Netzbetreiber Tennet genannt. Es gibt natürlich auch andere Unternehmen, die schon Kooperationen haben, z.B. RWE oder EWE. Das sind Unternehmen, die sich im europäischen Markt und vor allem auch im deutschen und niederländischen Markt engagieren und insofern bietet sich da natürlich auch eine Zusammenarbeit an.

CF: Ja und wie wäre es denn am sinnvollsten realisierbar? Ist es so, dass die Unternehmen, wenn sie zusammen arbeiten aus inneren Beweggründen, innerer Motivation es schaffen, das selbst quasi zu koordinieren oder gibt es da Arbeitsgruppen oder eventuell eigenständige, kleine Vereine, Organisationen, die geschaffen werden, um solche großen Projekte zu koordinieren?

HW: Es gibt sehr viele Möglichkeiten auf unterschiedlichen Ebenen zur Kooperationen. Wenn Unternehmen sich engagieren und investieren wollen, dann ist zunächst festzustellen, dass bereits heute international und global gearbeitet wird. Die Investitionsentscheidungen erfolgen auf der Basis von Standortauswahl, Rahmenbedingungen, finanziellen Möglichkeiten, Förderungen und ähnlichen Kriterien. Unternehmen brauchen daher keine besondere Unterstützung oder besondere Rahmenbedingungen, um grenzübergreifend kooperieren zu können. Die Frage im Zusammenhang mit der hier relevanten Thematik besteht darin, wie Rahmenbedingungen geschaffen werden können, dass die Überlegungen im Zusammenhang mit dem Anschluss der Offshore Windparks auch berücksichtigt werden. Wie kann man da auch die Unternehmen zur Kooperation anregen? Und da kommen verschiedene Institutionen ins Spiel. Zum einen gibt es hier beispielsweise im Norden der Niederlande und im Nordwesten Niedersachsens schon jetzt Netzwerke, die sich mit Energiefragen befassen und diese Thematik schon auf der Tagesordnung haben. Wie weit sich das wirklich realisieren lässt, beziehungsweise wie weit dort die Planungen schon vorangekommen sind, sollte direkt mit diesen Partnern erörtert werden. Für den Norden der Niederlande könnte Energy Valley als Ansprechpartner dienen. Im Rahmen der Vorbereitungen der Masterarbeit sollte der Kontakt zu Energy Valley gesucht werden. In dem Zusammenhang sollte an deutscher Seite mit zwei Partnern gesprochen werden. Das eine ist der Landkreis Aurich, der im Rahmen der Ems Achse für das Thema Energie verantwortlich und federführend ist und der diese Thematik auch aufgrund der beteiligten Küstenregion natürlich auf der Agenda hat. Und darüber hinaus wäre es vielleicht das Oldenburger Energiecluster - auch ein Zusammenschluss von energieorientierten Unternehmen, für die diese Thematik sicherlich eine große Rolle spielt. Weiterhin ist die EWE ein wesentlicher Ansprechpartner, da sie selbst bereits als Offshore Windparkbetreiber aktiv ist. Diese Fragestellungen werden dort sicher schon bearbeitet und entsprechende Kooperationen sind dort sicher auch ein Thema.

CF: Okay, gut. Und haben Sie Tipps oder Hinweise worauf ich achten sollte, was die Befragung oder beziehungsweise der Kontakt mit diesen Organisationen angeht?

HW: Bei den Kontakten mit diesen Institutionen werden Sie sicherlich erfahren, wie in den Unternehmen und in den Institutionen der aktuelle Sachstand ist. Die Frage der gesetzlichen Rahmenbedingungen ist bei einigen Unternehmen bereits in der Bearbeitung. Die Unternehmen wie die EWE haben das Knowhow im Hause, um auf diese Fragen einzugehen, weil sie als Akteur auch grenzübergreifend schon im Markt sind. Darüber hinaus wäre es aber vielleicht sinnvoll, nochmal mit der "staatlichen Seite" diese Thematik anzusprechen beziehungsweise zu fragen, wer über Informationen verfügt und Auskünfte erteilen kann. Da könnte man sich an die Provinz Groningen wenden, die für Fragen der Raumordnung an niederländischer Seite zuständig ist. An deutscher Seite wäre das Amt für regionale Landesentwicklung in Oldenburg zu Themen der Raumordnung in Weser-Ems zu befragen. Dann ergibt sich neben der Bewertung und Einschätzung von Netzwerken und Unternehmen, auch eine Betrachtung der staatlichen Stellen. Insgesamt könnte so ein Gesamtbild entstehen, bei dem folgende Fragen bearbeitet werden: Was ist tatsächlich möglich? Welche Wege beschreiten die Unternehmen oder die Akteure in der Thematik? Was wird auch aufgrund unterschiedlicher Rahmenbedingungen bewusst nicht getan oder wo wird eine Kooperation gesucht.

CF: Ja. Und was die politische Ebene angeht, ist es da sinnvoll auf der regionalen beziehungsweise auf der Landesebene zu bleiben oder sollte man auch die europäische Gesetzgebung, europäische Ebene mit einbeziehen?

HW: Da ist entscheidend, wie weit man gehen will und soll. Auf europäischer Ebene gibt es in der Raumordnung beziehungsweise in der dazu notwendigen Detailplanung keine Zuständigkeit. Dennoch werden natürlich politische Rahmenbedingungen gesetzt, die auch auf europäischer Ebene zu diesen Thematiken festgelegt werden. Es ist aber parallel schwer, alles zu leisten und daher sollte eventuell eine Reihenfolge festgelegt werden: Also zunächst mit der Raumplanung auf der staatlichen Seite hier in der Region, bei den Provinzen und dem Land beginnen. Danach könnten eventuell noch weitere Detailinformationen über die Rolle Europas in dem Zusammenhang einfließen. Fraglich ist, wie weit die europäische Beteiligung in dem Zusammenhang geht. Ein direktes Zusammenspiel beim Thema Raumplanung, Planungsverfahren und Umweltverträglichkeitsprüfungen mit Europa besteht nicht. Ob es z.B. eine europäische Richtlinie im Hinblick auf die Nutzung gemeinsamer Trassen gibt, ist bei den Raumordnungsbehörden zu erfahren. Vor diesem Hintergrund sollte die Arbeit bei den regionalen Stellen ansetzen und je nach Bedarf weiter ausgedehnt werden.

C. Interview with the District of Aurich

Names of Interviewees	Karl-Heinz Bakenhus Dr. Gabriele Krautheim Ingo de Vries
Location	Kreishaus Aurich Fischteichweg 7-13 26603 Aurich Germany
Date and Time	25.06.2015, 09:30

(KHB=Karl-Heinz Bakenhus, GK=Dr. Gabriele Krautheim, IdV=Ingo de Vries, CF=Christian Fuhrmann)

KHB Die Aussagen der Beteiligten sind stets auf den Standpunkt des Landkreises Aurich bzw. eines Landkreises an sich zu beziehen.

GK & IdV: Es gibt stets Probleme zwischen den Ländern bezüglich der Planungsrichtlinien.

GK ENTSEA wurde letzte Woche unterzeichnet.

Generell ist es schwierig ein Projekt zu planen, sobald die Hoheitsgebiete eines Staates betroffen sind.

CF Ist so eine große Planungsinstanz realistisch?

IdV Das ist eher nicht realistisch. Wenn so etwas realisierbar wäre, dann nur in kleineren Gruppen. Das heißt in Kooperation von zwei Ländern beispielsweise. Es kommt allerdings bereits zu Problemen, bei Planungsprojekten, die nur Deutschland und die Niederlande betreffen.

KHB Es gibt generell zwei Hauptproblemquellen: 1. Die Länder mit unterschiedlichen Planungsgrundsätzen und Interessen und 2. die privaten Unternehmen, welche stets wirtschaftliche Interessen verfolgen.

IdV Kleinere Ansätze wie beispielsweise das NorGer, eine Leitungsverbindung zwischen Norwegen und Deutschland, sind realistisch. Sogenannte Einzelmaßnahmen haben allerdings stets ihren Ursprung in der Wirtschaft und nicht in der Planung. Das heißt, es stehen die wirtschaftlichen Interessen im Vordergrund. Sollte das Supergrid als ein geschlossenes Projekt betrachtet werden, ist es nicht realistisch, es zu realisieren. Es könnte aber im Kleinen begonnen werden.

GK Das Thema der Energiepreise ist ebenfalls ein relevanter Faktor. Bei einem so großräumigen Netzzusammenschluss könnte es dazu kommen, dass die Energiepreise angepasst würden. Norwegen hat allerdings ein großes Interesse daran, das Preisniveau zu halten – Stichwort Binnenmarkt schützen. Es ist wichtig, dass die Initiative für ein solches Projekt stets von einem einzelnen Land oder einer einzelnen Region (Bundesland) kommt.

KHB Der Präsident der Europäischen Kommission (EC) befasst sich mit dem Thema des Supergrids. Wobei die EC die Aufgabe innehält, die Länder von der Idee zu

begeistern.

CF Wie könnte die Struktur einer steuernden Organisation aussehen?

GK Es darf definitiv keine Autorität im eigentlichen Wortsinne vorliegen. Eine Planungsinstanz über der Nationalstaatlichkeit ist nicht möglich. Zusätzlich ist die Machbarkeit des Supergrids anzusprechen. Zu dem jetzigen Technischen Zeitpunkt wären der Bau und die Inbetriebnahme noch nicht machbar.

CF Sehen Sie einen Nutzen für die Übertragungsnetzbetreiber oder andere Beteiligte an dieser Idee eines gemeinsamen Netzplanes?

IdV Es ist lediglich möglich über kürzere Planungskorridore und Einzelmaßnahmen dem Projekt näher zu kommen. So wäre eine Planung einfacher, allerdings ist die Planung noch immer Nationalsache. Es sollten immer isolierte Planungskorridore betrachtet werden, wie beispielsweise in der Grenzregion zwischen Deutschland und den Niederlanden. Als ein Gesamtprojekt ist es zu unsicher und daher eher nicht machbar.

GK Letztendlich wird diese gesamte Idee ausschließlich von wirtschaftlichem Interesse abhängen. Große Probleme wird es geben, was die nationalstaatlichen Unterschiede angeht. Hierzu gehören unter anderem die Wirtschaft, die Kultur und die Sprache. Wenn ein solches Projekt gelingen könnte, dann nur unter einer beratenden Instanz, welche zu Innovation anregen kann. Allerdings berät eine solche Instanz letztendlich stets jenen, der sie bezahlt. Das heißt, eine Unbefangenheit kann nie gänzlich ausgeschlossen sein. Die Gemeinschaftsidee ist gut, jedoch nur, wenn auch ein gemeinsamer Nutzen vorliegt.

D. Declaration of Authorship

I hereby certify that this thesis has been composed by me and is based on my own work, unless stated otherwise. No other person's work has been used without due acknowledgement in this thesis. All references and sources of information, including graphs and data sets have been quoted.

Date *Signature*