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# Norstrat

## Nordic power road map 2050: Strategic choices towards carbon neutrality

### D4.1.R Institutional grid review

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# Executive Summary

This report focuses on two topics that are essential for a future European electricity market, namely high voltage grids and grid connections to and from offshore wind farms. Despite ambitious goals, one in three high voltage projects in Europe currently is delayed. Considering that a high voltage power grid project all in all can take up to 15 years to build serious delays seem to be unavoidable (Entso-E, 2012c). Also, the reality is that Europe still could be described as a collection of national electricity systems rather than a joint electricity market. This report addresses some of these issues in the context of the Nordic countries<sup>1</sup>. The focus is on the institutional setup when it comes to high voltage grid concession regimes as well as the offshore wind farm related institutional grid issues. Doing so, differences between the countries and interesting patterns have been revealed.

From the perspective of the European Union and the Council's goal of establishing an integrated electricity market by 2014, it is obvious that there is a stark contrast between the vision for increased Europeanization of the grid and the actual local and national regulation in place. To begin with, there is a clear difference in the importance of local interests vs. national energy goals as well as the political legitimacy in the grid concession process across the Nordic countries. In Sweden municipalities with their planning monopoly and their detailed planning competence have considerable weight in the grid concession process. Even if national energy goals are upheld by the regional government authority, they are not easily implemented in municipal detailed plans. This results in the phenomenon that national or European energy goals are deprioritized as well as the fact that the concession process might differ substantially depending on the municipalities involved (Pettersson et al., 2010; Söderholm & Pettersson, 2011).

In contrast to the Swedish example the grid concession process in Norway is dominated mostly by national actors like the Norwegian Water Resources and Energy Directorate (NVE) and the transmissions system operator (TSO) Statnett. Furthermore is the process in Norway highly expert driven and the definition of needs is decided upon beforehand by expert groups that are not subject to political debate and are hence less politically legitimate. In Finland, as in Sweden, municipalities have considerable planning power and local master plans are considered as law. However, national energy goals more strongly supersede local plans compared to Sweden. Denmark's grid concession process is clearly hierarchical and national energy goals have a lot of weight. However, the majority of the procedures are coordinated from below in Regional Environment Centres and much of the investment intensive grid decisions have been pushed for by a broad political coalition as well as decisions in the parliament. As such one can argue that hierarchical, national governance does not mean that the concession process has to

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<sup>1</sup> Denmark, Norway, Sweden & Finland

be less legitimate on the different governance levels if a broader consensus has been reached beforehand.

It is also interesting who facilitates and organises the process to get a grid concession, particularly during the Environmental Impact Assessment (EIA) phase as this can be a sign of the local embeddedness of the whole process. In Sweden most of the process is directly run and organised by the grid developer whereas in Norway the concession process is facilitated very much by the national regulator. In Finland and Denmark the regional government authority plays a larger role and is partly also organising the relevant hearings. The possibilities and relevance of public participation in the grid concession process are also crucial. In both Sweden and Denmark from very early on there is room for negotiations and consultations. Negotiating and consulting is encouraged *before* applications are fully developed and sent to the government. In Finland not all consultation take place before the government decision is being made, but most ambivalent is the Norwegian concession process as it incorporates somewhat of a paradox of participation: The longer involved parties wait to participate, the greater the effectiveness of participation.

The procedures in the offshore wind farm context and connected grid issues are somewhat similar across the Nordics with Denmark being the exception. In Sweden, Norway and Finland the developers themselves have to pay for getting connected to the nearest TSO substation on land. As such they are also responsible for obtaining all the required permits and the EIA for such connections including the transformer stations. In Denmark all connections to the offshore wind farms, including the transformer station near the wind farm, are considered part of the realm of the Danish TSO. This removes a large part of the initial investment from the private developer's budget and reduces the uncertainty of being able to get grid connection. This however is only made possible through predefined development zones to which a clear time schedule is attached and where the necessary EIAs have been done by the Danish TSO before the private developer applies. This also removes much of the uncertainty TSO's are facing in the other Nordic countries about where exactly offshore wind farms will be located and hence where the grid will need to be strengthened in the long term (T. Johansson & Nilsson, 2009). When looking at cross border high voltage grid connections in all countries this remains a government decision and it is only in the realm of the TSO to build such a line after government consent. In the future, it appears that meshed setups of offshore wind farms, which at the same time will be cross border links, will increase but currently such setups are a particular example of how institutional alignment around a European grid vision is missing in particularly Sweden, Norway and Finland.

Ultimately, one can only acknowledge some of the inherent conflicts and institutional barriers that the concession processes have to overcome. This applies not only to national energy goals vs. local planning power, but also to the European vision of supergrids and offshore grids vs. actual laws, rules and norms in the nation states. Even the Nordic countries which have a joint electricity spot market and hence have

come longest in electricity market integration in the EU are characterised by many differences, e.g. in the policy experience when it comes to a coordinated transformation towards more renewables. Paradoxically, these differences persist while at the same time a Nordification (green certificate system between Norway and Sweden as well as the Nordic electricity market) and an Europeanization (Third Energy Package) takes place.

**Keywords:** high voltage grid, offshore wind, concession, consent, Nordics

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*List of Abbreviations*

AC	Alternating current
ACER	Agency for the Cooperation of Energy Regulators
CEER	Council of European Energy Regulators
DC	Direct current
DEA	Danish Energy Agency
DG	Directorates-General
DKK	Danish krone
EC	European Commission
EEZ	Exclusive economic zone
EI	Swedish Energy Markets Inspectorate
EIA	Environmental Impact Assessment
EMV	Finnish Energy Market Authority
ENTSO-E	European Network of Transmission System Operators for Electricity
ERGEG	European Regulators Group for Electricity and Gas
ETSO	European transmission system operators
EU	European Union
FOSG	Friends of the supergrid
GDR	Grid development regime
HVAC	High voltage alternating current
HVDC	High voltage direct current
HVDC VSC	High voltage direct current voltage source converters
kVA	Kilo volt-ampere
LRF	Federation of Swedish Farmers
MEE	Finnish Ministry of Employment and the Economy
MW	Megawatt
MWh	Megawatt hour
NGO	Nongovernmental organisation
NSCOGI	North Seas Countries Offshore Grid Initiative
NVE	Norwegian Water Resources and Energy Directorate
OED	Norwegian Ministry of Petroleum and Energy
R&D	Research and development
REC	Finnish Regional Environment Centre
SVK	Svenska Kraftnät
TSO	Transmission System Operator
TWh	Terawatt hour

## 1. Introduction

Over the last couple of years there has been an intensification in the attempts to foster the creation of an integrated European electricity market. The number of initiatives to nurture this market includes concepts such as the supergrid, electricity highways or several regional initiatives such as in the Baltic Sea or North Sea region. In general these initiatives aim at increasing the cross border high voltage transmission capacity within the European Union (EU). Despite high policy pressure due to fast growth in renewables, risk of outages, decreasing network stability, transmission congestion and reinforced through the German Energy Transformation (“Energiewende”), the reality is that Europe still could be described as a collection of national electricity systems rather than a joint electricity market (Balaguer, 2011, p. 4711; Geden & Dröge, 2010, p. 6; Sattich, 2012a, 2012b). The further development of cross border grid extensions is slow and only a small fraction of around 5% of total electricity generated is traded across borders. In general transmission is heavily congested at the borders due to limited capacity (Sattich, 2012a, p. 1, 2012b, p. 7). At the same time much of the ambitious supergrid goals get stuck in the individual national energy policy debate, the national particular market and electricity tariff structure as well as the institutional set up and planning procedures around high voltage grid extension of each member state (Battaglini, Komendantova, Brtnik, & Patt, 2012, p. 255). One in three high voltage projects in Europe currently are delayed. Considering that a high voltage power grid project all in all can take up to 15 years to build serious delays seem to be unavoidable (Entso-E, 2012c). In stark contrast to that is the goal of achieving an internal electricity market by 2014 which has been adopted by the European Council (Sattich, 2012a).

This report addresses some of these issues in the context of the Nordic region (Denmark, Finland, Norway and Sweden). It focuses on the institutional conditions of high voltage grid concession regimes as well as the offshore wind farm related institutional grid issues. Compared to the rest of Europe the Nordic region is already fairly integrated due to historically close collaborations between the TSOs since 1963 and through the Nord Pool Spot market which organically grew since 1996 (Balaguer, 2011, p. 4704; Pollitt, 2009, p. 14). However, in line with the NORSTRAT project in the future the Nordic region can become a major exporter of electricity on a European wide electricity market or be a more modest exporter with a focus on achieving a balance within the Nordic countries. In any case more transmission capacity is needed to overcome bottlenecks in the Nordic electricity system (e.g. the South Western Link project between Sweden and Norway). Also in the Nordics, high voltage grid extension projects face several obstacles that delay project plans and in some cases the projects have caused substantial public resistance (“Gräv ner Sydvästlänken!” 2012; Hardangeraksjonen, 2012). The following research question is being addressed in this report:

*What institutional differences can be found across the Nordic countries when it comes to high voltage grid projects?*

The report will be based upon an institutional analysis with institutions being defined as laws, regulation, rules and norms. While the electricity grid is not anymore a technological innovation per se, the electricity grid essentially depicts the dominant technological regime. In the electricity regime's early development phase this often has been a centrally organised national system with large power production units at its core. During the last decades however this regime slowly has moved to more decentralised production, a deregulated electricity market and increased regionalisation or Europeanization of the grid (see also section below on European level policy drivers). As such electricity grids are strongly socio-technical and sensitive to technological innovation (Hughes, 1993; Högselius & Kaijser, 2007). This is also the reason why in this report we will present the analysis according to the system structure of innovation systems, namely the most important actors, actor networks, institutions (e.g. the concession processes) and technology in the sense of the present physical infrastructure (Jacobsson & Bergek, 2011, p. 45).

This report unfolds as follows in the first section we are reviewing policy drivers on different levels of governance, namely on EU level, a Nordic level as well as the four Nordic countries. The second and last section will compare and discuss the institutional setup among the Nordic countries.

## **2. Policy drivers, existing policies and targets**

From a multi-level governance perspective one can find multiple policy drivers on EU, Nordic and national level when it comes to the institutional setup of the grid development regime (GDR).

### **European Level**

#### **Grid overview and technology**

During the last decades one can see an increasing Europeanization of the European grid, meaning that the EU agencies pushed for a centrally integrated grid with central governance and planning. This development has been met with a lot of resistance in the past as many actors in the power sector were and partly still are convinced that a decentralised power system with decentralised governance offers advantages in terms of system reliability (Van der Vleuten & Lagendijk, 2010a). Much of this debate comes down to the question of grid technology. The argument is that a centralised grid with synchronised AC or HVAC lines without the necessary smart technology and enforcement of the n-1 criterion can lead to large power outages through cascading failure. This is why synchronised, large and centrally integrated AC networks are seen as being relatively vulnerable because a failure has potential consequences for all synchronised areas. If however the future European supergrid were made up mostly of HVDC technology such cascading failure could be prevented by HVDC acting as a firebreak between AC networks (Ahmed, Haider, Van Hertem, Zhang, & Nee, 2011; Kemp, 2012). Within that debate also the benefits



of underground as well as the conversion of existing AC lines to DC lines are being discussed. In reality a complex mixture of overhead and underground AC and DC technologies as well as smart technology for better grid monitoring and control can be expected.

From a European perspective the cross border high voltage grid has not changed much during the last decade. Despite the goal of an internal market for electricity, not a lot of such capacity has been added (Sattich, 2012a).

## Actors and networks

The European Union and its agencies did not play a major role as an actor in the European electricity sector until the Single European Act was passed in December 1985 (Van der Vleuten & Lagendijk, 2010a, p. 2059). The act established the goal of a joint European electricity market and the Treaty on the European Union which followed in 1992 also added the competence of Trans-European Network planning and financing. As a result in 1994 the first interconnection lists were presented which included some transnational power lines. Historically this is connected to the ongoing debate between national actors and EU organisations about whether or not centralising the electricity market would increase security of supply and decrease the risk of blackouts (Van der Vleuten & Lagendijk, 2010a; van der Vleuten & Lagendijk, 2010b). Today one major actor within the Brussels agencies is the DG Energy currently headed by Commissioner Oettinger. Among other instruments they are responsible for the “Connecting Europe Facility” which will be co-financing transmission infrastructure projects between 2014 – 2020 as part of a total energy budget of 9.1 billion Euros (European Union, 2011a, 2011b). This however is only a fraction of the needed 140 billion Euros in total investment. Apart from the European Commission and the European Parliament also the European Council, representing the governments of the member states, is a central actor. The Council set the goal of achieving an internal energy market by 2014.

One important actor from the transmission system operator (TSO) side was first the association European Transmission System Operators (ETSO) which was established in July 1999 (Van der Vleuten & Lagendijk, 2010a, p. 2059). ETSO existed until 2009 when all the operations were taken over by the new European Network of Transmission System Operators for Electricity (ENTSO-E) (Entso-E, 2012a). ENTSO-E’s goal is to harmonise network access as well as to facilitate international electricity trade within the EU. According to the EU’s Third Energy Package which went into force in 2011, ENTSO-E is e.g. responsible for developing non-binding 10 year grid development plans every second year, drafting network codes and also has subcommittees that develop such plans for specific regions, like e.g. the Baltic Sea and North Sea area (Entso-E, 2011, 2012b; Svenska Kraftnät, 2012a).

In 2003 the European Commission also saw to it that the European Regulators Group for Electricity and Gas (ERGEG) got established (Van der Vleuten & Legendijk, 2010a, p. 2059). The ERGEG was a network of independent regulators that had among others tasks the responsibility of assisting member states to implement EU directives. In 2011 ERGEG got replaced by the Agency for the Cooperation of Energy Regulators (ACER) which had been established through the Third Energy Package. ACER is supposed to guarantee the compatibility of regulatory regimes between the different member states (DG Energy, 2011). Later, cooperation between the independent energy regulatory authorities of different countries was also organised through the independent Council of European Energy Regulators (CEER). The CEER acts as a preparatory body and works closely with ACER and ENTSO-E.

An important network between countries that was formed to foster regional electricity market integration as well as the development of offshore wind power is called the North Seas Countries Offshore Grid Initiative (NSCOGI). It got established in December 2009 through a joint statement by ministry signatories of Belgium, Denmark, France, Germany, Ireland, Luxembourg, the Netherlands, Sweden and the United Kingdom (NSCOGI, 2009). A similarly important initiative for the Baltic sea is the Baltic Energy Market Interconnection Plan (BEMIP) (BEMIP, 2011; Lang, 2010, p. 8).

Another actor to mention is the interest organisation and NGO “Friends of the Supergrid” (FOSG) (FOSG, 2012). The organisation is actively supporting the development of HVDC transmission infrastructure and consists of several companies that are involved in realising such high voltage lines. As such it constitutes an important network.

## Institutions

With the introduction of the “First Legislative Package” on the Internal Energy Market (Directive 96/92) in 1996, the EU officially initiated a process toward electricity integration between national markets based on establishing common rules for the generation, transmission and distribution of electricity. (Balaguer, 2011; Talus, Guimaraes-Purokoski, & Rajala, 2010, p. 27). The second step was the adoption of the second package which included the Electricity Directive 2003/54/EC and the Regulation 1228/2003/EC (Balaguer, 2011; Pollitt, 2009; Talus et al., 2010, p. 27). The package dealt with eliminating obstacles in cross-border trading of electricity and regulates the terms under which access to cross-border networks takes place. Other goals were greater transparency in the whole sale market, non-discriminatory access, the establishment of compensation mechanisms between different national operators. In 2007 the European Commission identified several obstacles on the way towards an integrated electricity market namely among others continued discriminatory practices when it comes to market access and active limitation of cross border transmissions in order to protect domestic electricity generators

(European Commission, 2007). As such transmission congestion is used to control who and which energy source has access to an electricity market (Balaguer, 2011, p. 4711).

Today, the most central piece of European legislation for the functioning of Europe's internal electricity market is the third energy package which was passed by the European parliament in 2009 (Bjørnebye & Alvik, 2012, p. 9). The package consists of three elements that are of relevance for the European electricity market, namely the ACER regulation 713/2009, the Electricity regulation 714/2009 as well as the Electricity directive 72/2009 (European Union, 2009a, 2009b, 2009c). Through that the Agency for the Cooperation of Energy Regulators (ACER) got established (European Union, 2009b). Other highly relevant directives for the European electricity market arguably include the Security of Electricity Supply Directive (2005/89/EC), the Renewables Directive (2009/28/EC) and the Directive on establishing the ETS system (2003/87/EC) (Bjørnebye & Alvik, 2012, p. 10). It has to be mentioned here that Norway is not obliged to implement this legislation as it is not a member of the EU.

The Electricity Directive was required to be implemented by member states into national law by the 3<sup>rd</sup> of March 2011. The Directive sets common rules for the generation, transmission, distribution and supply of electricity, all with the aim of integrating electricity markets within the EU. Among other demands it requires the member states unbundle transmissions systems and transmission operators by 3<sup>rd</sup> of March 2012 (DG Energy, 2011). The member states shall also define technical safety requirements for the further integration into regions and hence encourages first closer regional integration. In several passages it stresses and defines non-discriminatory requirements as a central element of the internal market (e.g. non-discriminatory on the basis of nationality, equal treatment of suppliers) (Bjørnebye & Alvik, 2012, p. 11). The Directive also defines the responsibilities of the transmission system operator and asks for the establishment of a national regulatory authority. This authority e.g. monitors the investment plans of the TSO and cooperates with regards to cross border issues.

The Electricity Regulation in turn is dealing with cross-border issues and the functioning of a whole sale market. It also deals with the establishment of network codes in which both ACER and ENTSO-E are to be involved (Bjørnebye & Alvik, 2012, p. 13).

## **Nordics**

### **Grid overview and technology**

Overall the Nordic countries have quite a varied mixture of electricity production which gives it the opportunity to balance each other's strengths and weaknesses (e.g.

dependency of hydro power on water level, dependency on wind etc.) (please see Figure 1 and Figure 2).

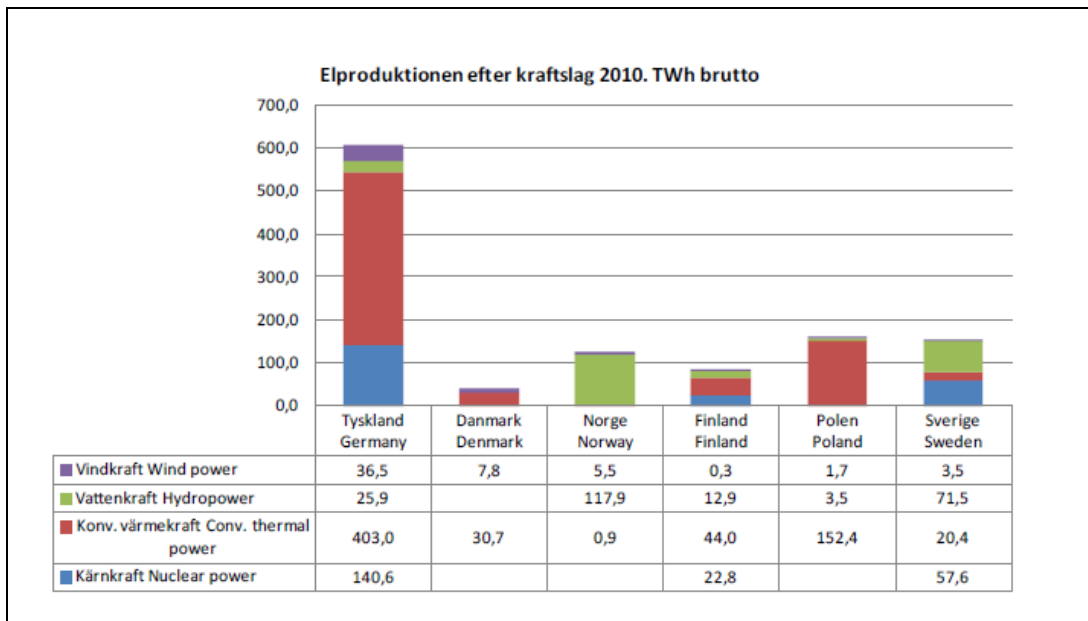


Figure 1 Nordic electricity generation (SCB, 2012, p. 52)

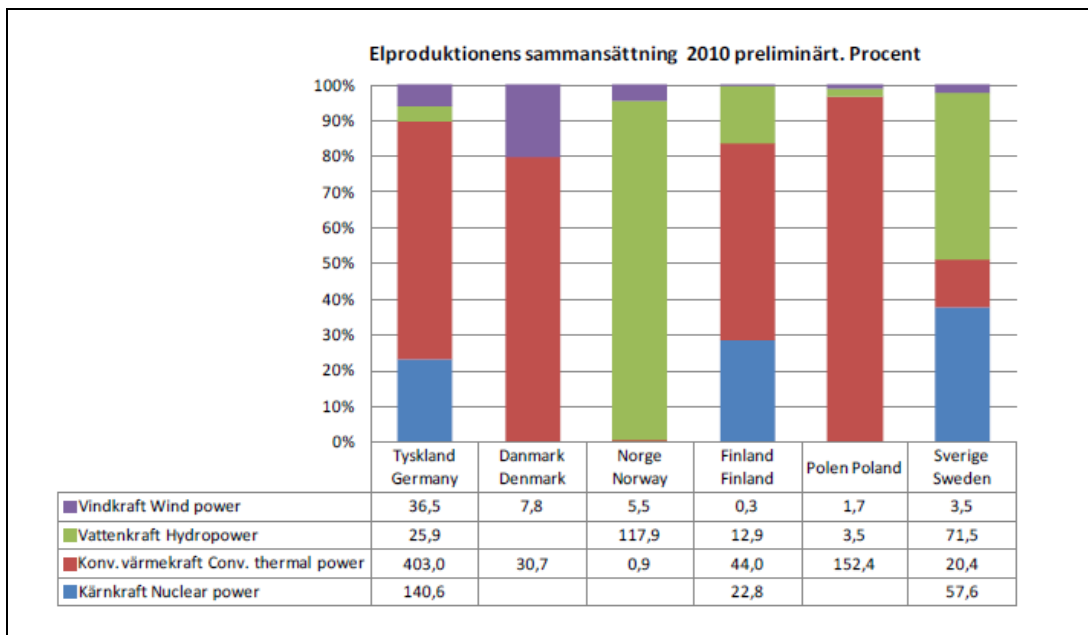


Figure 2 Relative electricity generation in the Nordics (SCB, 2012, p. 52)

The Nordic electricity market is already relatively integrated and historically has close collaboration, e.g. between Norway and Sweden (Högselius & Kaijser, 2007).

## Actors and networks

Central actors in the Nordics are the TSOs as well as the electricity regulators in the given country. The TSOs already started collaborating through a network called Nordel which existed in the Nordic countries since 1963. The Nordic TSOs first joined ETSO and eventually ENTSO-E after it was established and as a result Nordel as a separate network discontinued.

An important actor is the organisation NordReg which is an organisation for the Nordic energy regulators (NordREG, 2012). They seek to promote legal and institutional framework and conditions necessary for developing the Nordic and European electricity market.

In a larger scheme the Nordic Ministry Council is facilitating cooperation among the Nordic countries.

## Institutions

While there is no harmonised procedure for concessions of high voltage power lines the Nordic TSOs have previously developed Nordic Grid Master Plans which aligned some of the regulatory as well as planning procedures. In the context of ENTSO-E the Nordic TSOs continue that tradition through developing Nordic Grid Development Plans (Statnett, Energinet.dk, Svenska Kraftnät, & Fingrid, 2012). Another institutional integrator is the Nord Pool Spot market which accounts for more than 70% of Nordic electricity generation (Nord Pool, 2012). It got established in 1996 and eventually all Nordic countries joined (Pollitt, 2009).

Another speciality of the Nordic electricity market is the existence of a Green certificate market (Bergek & Jacobsson, 2010). The scheme has been established in 2004 and since January 2012 also Norway has joined which at least partially reminds of the historic development of the Nord Pool spot market. The green certificates create an artificial market in which demand is generated by quotas of green certificates (or renewable energy) that have to be fulfilled by the utilities. The supply of the green certificates comes from renewable energy electricity producers. As a result supply and demand meet accordingly. The green certificate market does not favour any particular technology but favours the cheapest and hence often the most mature renewable technology option.

## Finland

### Grid overview and technology

The Finish electricity system originally consisted of two separate national high voltage grids, namely one for energy intensive industrial purposes and one for the remaining sectors (Talus et al., 2010, p. 31).

## Actors and networks

The relevant actors in the Finnish case are the by the transmission line affected property owners, local municipalities as well as regional government authorities. The main TSO in Finland is called Fingrid and got established in 1996 (Talus et al., 2010, p. 31). Under the authority of Fingrid the two former separate grid systems were merged into one. The TSO in turn is overseen by the regulatory network authority called Energy Market authority (EMV) which got established in 1995 (Talus et al., 2010, p. 23). Fingrid is controlling 14,000 km worth of transmission line including 104 connection and transformation stations (Fingrid, 2012). This includes usually lines above 220kV but can also include strategically important 110kV lines (Talus et al., 2010, p. 31). Interestingly, Fingrid's ownership structure is split up between the state, the country's two largest utilities (Fortum and Pohjolan Voima) and independent investors. The ability of the state and the two largest Finnish utilities to sell their shares is restricted by law. As other Nordic TSOs, Fingrid owns 20 % of Nord Pool Spot AS.

The relevant regional government body that oversees the environmental impact assessment (EIA) is the regional environmental centre (REC). Apart from that the national government authorities involved in the concession and utility easement are the newly founded Ministry of Employment and the Economy (MEE) as well as the central government.

## Institutions

In the case of Finland the Finnish EMV is responsible to grant concessions for lines over 110 kV and longer than 15 km (Energimarknadsverket, 2012; Fingrid, 1999, p. 4; Ministry of Trade and Industry Finland, 2005, sec. 18; NordREG, 2010, pp. 16–17). The concession process is run in accordance with the Electricity Market Act which got established in 1995 (Talus et al., 2010, p. 23). The application for the concession has to include information about the TSO, the main specifications and route of the transmission line, cost estimates and construction times as well as several assessments with regards to the necessity of the line and the environmental effects caused. Also the viewpoints of the network operator as well as distribution system operator have to be included in the application.

The concession application process starts with the setting up of an EIA program or work plan initiated by the applying TSO who in turn engages with the affected stakeholders like e.g. municipalities, government units as well as interest groups (Fingrid, 1999, p. 6; NordREG, 2010, p. 18). Such an EIA is necessary for all lines over 110 kV and longer than 15 km and has to be performed for all power line alternatives that exist in the EIA program. The consultation period usually lasts 1 month, sometimes also 2 months. After the other stakeholders have declared their viewpoints, the REC is condensing those statements and is also reviewing the EIA program. This results in a statement made by the REC and finishes the first consultation round.

After those consultation steps the EIA report is formally prepared by the TSO and sent to the REC. After being sent the official report the REC is doing an EIA evaluation and eventually is giving their final official statement to the TSO (NordREG, 2010, p. 19). The EIA evaluation period usually lasts between 30 and 60 days and during that time viewpoints by stakeholders can be raised (Fingrid, 1999, p. 6; Finish Parliament, 1995). The REC is organising those EIA hearings but the cost has to be covered by the grid developer. After receiving the final statement by the REC the TSO will choose which power line route they will go forward with. At this stage the TSO can apply for a concession at the EMV by handing in the connected EIA documents as well as a detailed line route. The whole EIA process can take between 1 and 1,5 years (Fingrid, 1999, p. 6).

The final decision for granting the concession is hence made by the EMV. Only after that a detailed planning of the transmission line commences. Hence, granting the concession does not yet include detailed plans or permissions of where the power line will actually be built or how the construction process will look like (NordREG, 2010, p. 18). As such the previous EIA cannot take into account the exact position of the future line (Talus et al., 2010, p. 37). After the concession decision has been made by the EMV, the TSO has to seek the consent of the local municipalities affected in order to be able to go further in the process (Ministry of Trade and Industry Finland, 2005, sec. 18). However the possibilities of the municipalities to refuse this are limited. They can withhold consent based on planned use of areas, environmental considerations or on other aspects. The consent however shall not be refused if that endangers the security of electricity transmission or causes unreasonable inconvenience for the applicant (Ministry of Trade and Industry Finland, 2005, sec. 20). Furthermore section 20 of the Electricity act requires the municipality and the grid developer to cooperate in the process. How relevant a line is for the “security of electricity transmission” has however already been somewhat indicated by the fact that the line has already been granted by the EMV (Talus et al., 2010, para. 79).

During the detailed planning process the soil conditions in the area of the line location are being examined with the permission of regional government authorities (Fingrid, 1999, p. 8). After the soil conditions have been examined the final line route will be determined. During this planning process property and land owners can still raise their viewpoints.

The next step is the utility easement process which is managed by the Ministry of Employment and the Economy (MEE). Before leaving the process to the MEE the TSO can also try to find pre-arrangements with the property and land owners (Fingrid, 1999, p. 9; NordREG, 2010, p. 19). In the end the final decision about the utility easement is being decided on ministry level. The whole easement procedure usually takes between 0,5 and 1 year. The decision made by the government will then be sent to and implemented by the case specific local cadastral office. The cadastral office then also carries out the valuation and compensation procedures. Fingrid

however are not represented in the process initiated by the cadastral office. The amount of the compensation among other factors depends on the size and form of the area that can't be used anymore as well as how intensive the cultivation is in the area (Fingrid, 1999, p. 10). On request 75 per cent of the compensation can be paid in advance before the construction is finished. The full amount can however not be paid until the line is finished. Compensation for damages as a result of the construction is negotiated separately. With regards to the timber on the property Fingrid and the property owner make a separate arrangement, but the property owner will ultimately decide how e.g. the timber will be sold (Fingrid, 1999, p. 11).

The final concession decision that was made by EMV with regards to the concession as well as the easement decisions can be appealed first at a regional administrative court and at a later stage at the Supreme administrative court (NordREG, 2010, p. 18).

### **Offshore wind farms and the grid**

Similar to the grid concession process an offshore wind farm requires an EIA as substantial environmental damage can be expected (Finlands Havsvind, 2010; Finnish Wind Energy Association, 2013; Finnish Wind Power Association, 2013; Invest in Finland, 2012; NordVind, 2011; Pohjolan Voima, 2010; Tepp, Schachtschneider, & Brueckmann, 2012). The EIA is mandatory for projects with more than 10 turbines or a higher capacity than 30 MW. The whole EIA process has the EIA Act as its basis and will be administered by the REC. Due to its marine activity and the necessity of marine cables also a permit according to the Water Act is necessary which can be obtained from the Regional Administration Authority (the EIA has to be attached). The necessary building permits have to be obtained from the municipalities involved after the EIA is complete. The building permit also requires the previous approval by the national aviation authority as some wind mills may be over 30 meters high. In order to be legal the offshore wind farm has to be included in the national land use guidelines, the regional land use plan, the local master plan and the local detailed plan. Chances of the project's success will increase if the area is set for wind power usage in the national land use guidelines. The national land use guidelines are a national hierarchical instrument to influence the detailed plans of the regions and municipalities. If changes in the land use guidelines are necessary the Ministry of Environment has to be applied to. The necessary grid connections require a contract with Fingrid (TSO) and a concession from the Energy Market Authority (EMV) - much in the same way already described above. The developers have to pay themselves for connection to the next Fingrid substation. For closer studies of the seabed and in order to get access to third party property, permits will be needed which can be obtained from the regional administration authority and the expropriation agency.

The current regime for offshore wind power is characterised by a feed in tariff system which was introduced in March 2011. The feed in tariff is based on the



difference between the spot price market and a target price of 83,5 Euros per MWh for wind power. This is upon condition that the park has to be larger than 500 kVA. This tariff will be paid for 12 years. Later on the Finnish government might switch to a tendering procedure instead. Additionally, the Finnish government has used a 20 million Euro tender process as a one-time tender mechanism in addition to the existing feed in tariff system (Tien, 2012). However, critics indicate that the feed-in-tariff is too low to make offshore wind farms attractive enough (Fagerholm, 2012).

## **Sweden**

### **Grid overview and technology**

The Swedish electricity system can be divided into three major voltage categories: the transmission grid with high level voltage, medium voltage and low voltage. The high voltage transmission grid is owned and operated by the Svenska Kraftnät (SVK) which operates all transmission lines over 220 kV (NordREG, 2010, p. 21; Svenska Kraftnät, 2012e). This accumulates to 15000 km length of grid and 150 transformation and connection stations. The concession period for such lines is 40 years. The medium voltage and low voltage categories are owned by private companies but overseen by state agencies e.g. the Swedish Energy Markets Inspectorate (EI).

The power generation in Sweden is dominated by hydro power (45,65%) and nuclear power (38,35%) which together in 2010 accounted for 84 per cent of the total power generation or the equivalent of 121,8 TWh. The other production sources are thermal with 13,1% (19,7 TWh) and wind power with 2,41% (3,5 TWh) (163 MW installed offshore wind capacity in 2010). The thermal part can be split into fossil with 7,8 TWh and renewable with 11,9 TWh. Often the renewable content is the result of the combined combustion of fossil and renewable in a thermal plants.

When it comes to future development goals for the Swedish electricity system one relevant one is that Sweden wants to create the planning prerequisites in order to produce 30 TWh wind energy by 2020 (of which 10 TWh are planned to be offshore wind) (Svenska Kraftnät, 2012b). Also, Sweden has the goal to achieve a fossil fuel independent transport sector by 2030 which almost by definition requires a somewhat electrified vehicle fleet. Nuclear power has also been much debated in Sweden, especially since the Fukushima catastrophe in Japan 2011. Recently, the government decided it would allow new reactors if they would be built on the same location and if the investor would bear all costs involved (Nordlander & Rosén, 2010).

Due to those new demands to the grid in terms of national demand, intermittent energy sources and European market integration, SVK has identified a huge need for investment and as such has predicted the highest investments during its history in the coming years (Svenska Kraftnät, 2012b). This is also being undertaken to reduce the

bottlenecks that currently make full European market integration impossible. The budget plans of SVK have to be approved by the Swedish parliament.

An important aspect of Sweden's electricity system is the Nordic spot electricity market called Nordpool of which Sweden is a member since 1996 (Nord Pool, 2012). The spot market was then supposed to be a new method of coordinating the deregulated electricity market and today 70% of electricity in the Nordics is traded there. The other fraction is comprised of fixed deals with industry customers, crowd funded electricity etc. However, the electricity price has not developed as was hoped when the electricity market was deregulated and the price since 1996 has in fact tripled in Sweden.

The country has a strong north south axis between production and consumption of electricity. When the Swedish SVK introduced its new four price regions on the 1st of November 2011 there were soon different prices in the most southern price region due to bottlenecks towards the north of Sweden and Norway (Energinyheter.se, 2011; Svenska Kraftnät, 2011). As a result Southern Sweden currently is much closer to Danish electricity prices compared to the rest of Sweden meaning that the electricity is more expensive and even more so if the wind is not blowing in Denmark (vindkraftsnytt.se, 2011). The price regions were introduced because of demands for a single European electricity market formulated by the European Commission. The new price regions were established to make the bottlenecks more transparent and hence possibly be an incentive to overcome those bottlenecks through high voltage transmission grid projects like the South Western Link.

When it comes to renewable electricity production Sweden has, as already stated in the general Nordic section, introduced a Green certificate market (Bergek & Jacobsson, 2010).

## Actors and Networks

The actors involved in Sweden's GDR are governmental authorities, interest organisations and other private organisations on the different governance levels.

On a local level the central actor is often the property owners of the land on which the transmission line is going to be build. Usually the government does not own that land and hence has to deal with the concerns and compensation demands this group has. The different municipalities that are involved in the transmission grid project by being situated near it are also an important local actor since they have a local detailed planning monopoly which grid developers have to take into account.

On a regional level the prime mover is the regional government authority (Länsstyrelsen) that investigates whether the transmission projects leads to a major environmental impact (in which case it can order an extended, more time consuming

review), has harmful cultural aspects and is overseeing the general regional and national interests in the municipalities decisions.

There are several actors on the national level that are involved in a high voltage transmission project. First of all there is the Energy Markets Inspectorate (EI) that in general is overseeing the electricity market and to which applications for all concessions are to be made. However in the case of high voltage transmission grid concessions and connections to foreign countries, it is the Ministry of Enterprise, Energy and Communication that has the final say whether the concession is being granted. In the case of high voltage lines it is SVK which is the TSO and is responsible for making those concession applications and also the connected consultations and planning procedures. If SVK and the property owner on the local level don't agree on a suitable compensation it is the Cadastral authority that has to resolve the disputes on compensation. During the concession process there are many dimensions in which it is possible to make appeals which eventually would end up in the national courts (environmental, national, property). However those courts only allow the investigation of the correct administrative process. An important actor on the national level is also the LRF which is the national interest organisation of the Swedish farmers that tries to influence the process in the farmers favour. Depending on the location of the transmission grid it can also happen that the Swedish army has to be involved in the planning procedures since there might be security concerns. A similar discussion can be found with regards to the army and new wind farms.

## Institutions

The main focus here is on the planning procedure for a new high voltage transmission line during which several institutional aspects come into play. When planning a new transmission line, SVK as the TSO building the line has to follow an established procedure that can be found in the electricity law as well as the electric law procedures ("ellagen" & "elförordningen") (Svenska Kraftnät, 2012c). According to SVK the whole procedure takes on average between 5 and 10 years' time, but there have also been cases where such projects have taken longer than 10 years.

The first step in this established process is a preliminary study which includes different proposals where the transmission line could be located and also includes various impact assessments with regards to landscape, housing, natural and cultural environment, outdoor life and natural resources (Svenska Kraftnät, 2012c). According to SVK, after this preliminary study, consultations take place in which e.g. property owners, people living nearby, interest organisation as well as the local and regional government authorities take part. It must be stressed that Swedish municipalities have a local planning monopoly and if the planned route contradicts with local detailed plans the concession will not be granted (can be found in the "plan & bygglagen") (A. Johansson & Pihlgren, 2005, pp. 31–32). Sometimes also the Swedish armed forces are included in these consultation processes. These consultations can be physical meetings but can also be viewpoints exchanged via post

or originally initiated by placing advertisements. After the consultations have been initiated they have to be finished within a set time frame. Everybody can participate in these consultations and the viewpoints or opinions that are raised in these consultations will also be documented and made available.

In light of the consultations connected to the preliminary study, SVK is choosing one of the suggested locations of the transmission line. However this does not necessarily mean that the consultation input has significantly impacted the choice by SVK. After having made its choice, the company is further analysing the proposal by researching the soil conditions, performing measuring tasks, investigating the species and wildlife in the area, and getting information for the property valuation etc. Also the exact location of the transmission line can be determined more accurately in that step. In order to do those investigations SVK is asking the property owners for permission. Granting permission to these investigations however does not mean that the property owners have agreed on a transmission line being built on their property (Svenska Kraftnät, 2012c).

Building on that information is the EIA which is done according to the EIA law (“Miljöbalken”) (EI, 2011, pp. 11–13; NordREG, 2010, p. 21). The EIA is a central piece of regulation that not only applies to grid extension projects but to all infrastructure projects like e.g. wind power development (Pettersson, Ek, Söderholm, & Söderholm, 2010; Söderholm & Pettersson, 2011). The EIA is describing the location of the transmission line in more detail and explains the direct and indirect impacts on humans, animals, plants, soil, water, air, climate, landscape, cultural environment, usage of soil, water and the physical environment, usage of material, raw materials and energy (A. Johansson & Pihlgren, 2005, p. 24; Swedish Government, 1998). It also should describe measures how to reduce those impacts and should provide alternatives to the suggested line route (A. Johansson & Pihlgren, 2005, p. 26).

After the EIA has been submitted another consultation round will be started, similar to the one during the preliminary study with the same actors involved. During that stage Länsstyrelsen can effectively order an extended EIA if it sees potential for high environmental impact and this decision cannot be appealed. This makes the agency an important actor in the concession process (A. Johansson & Pihlgren, 2005, p. 25; Swedish Government, 1998). Länsstyrelsen can also themselves suggest alternative routes if it sees a high potential for environmental damage (Swedish Government, 1998). The EIA can also be brought to the environmental court (“Miljödömsstolen”). After the preliminary study and the EIA as well as the documented consultation rounds, SVK is applying for a concession in order to build and operate the transmission line. But it is again necessary to stress that SVK does not necessarily need to comply with the viewpoints raised in the consultation rounds. This application is made to the Swedish Energy Markets Inspectorate (EI) which functions as the national electricity network authority (NordREG, 2010, p. 21).

The EI in turn is sending out inquiries (“remiss”) to the affected property owners as well as the local and regional government authorities in order to get their viewpoints about the detailed concession proposal (EI, 2011, p. 9). In high voltage cases and international connections the EI leaves the final decision up to the Ministry of Enterprise, Energy and Communications which performs another round of hearing and inquiries (“remiss”) before finally deciding (EI, 2011, p. 6; NordREG, 2010, p. 22; Svenska Kraftnät, 2012c). For their part of the process the EI has a maximum of 3 years (Swedish Government, 1994).

SVK, the EI and the government also have to take into account the socioeconomic usefulness of the line, the overall rational development of the grid (good quality and security of supply) as well as the so called n-1 criterion.

Once the Ministry has reached a final decision the possibilities to appeal are very limited and in practise it does not happen often (NordREG, 2010, p. 22). After that, it is only possible to appeal to the national administrative court which can be made on the ground that the procedure to reach the decision has not been done according to the law (A. Johansson & Pihlgren, 2005, p. 20). It does however not change the content of the concession. Apart from the concession a number of other permissions possibly need to be secured depending on the case at hand (Svenska Kraftnät, 2012c). There are for example demands with regards to coastal protection and biotope protection. Also there can be permissions needed from the water authority.

When the concession is granted all affected property owners and local as well as regional government authorities will be contacted. The next step is an agreement between the property owners and SVK which will allow SVK to build the transmission line on the property owners land (“markupplåtelseavtal”). This agreement is then converted into transmission line law (“ledningsrätt”). This allows the owner of the transmission lines to operate, maintain and build transmission lines on other party’s property if it is for the public good. Such cases of the transmission line law (“ledningsrätt”) are being examined and decided by the Swedish mapping, cadastral and land registration authority (“Lantmäteriet”) (Lantmaeteriet, 2012a).

In the cases where the property owner and SVK cannot agree on such an agreement the case will go through a formal cadastral procedure (“ledningsrättsförättningen”) in which the Swedish mapping, cadastral and land registration authority will formally decide on a so called utility easement (Lantmaeteriet, 2012a, 2012b). However this happens after the transmission line has been build and is operating. This decision can afterwards be challenged within 4 weeks at the “Mark miljödomstol” court (Lantmaeteriet, 2012c, 2012d).

The agreement (“markupplåtelseavtal”) between the property owner and SVK comes also with a one-time compensation (Svenska Kraftnät, 2012c, 2012d). This compensation is being set according to the expropriation law (“expropriationslagen”). This compensation includes the equivalent value of the reduction of the property’s value due to the expropriation, possible damages due to

the construction of the transmission lines as well as a 25 % on top lump sum of the total value reduction of the property. If the transmission line is going through forest areas agreements have to be negotiated with regards to the value of the timber.

Before the construction of the transmission line begins SVK is inviting all the property owners that are affected. During this information meeting the upcoming work will be described in more detail and SVK is also assigning a project manager that is responsible for the project. During the construction period information on the current status will be passed on to the property owners, authorities and people living nearby (Svenska Kraftnät, 2012c). This information can be spread through information meetings, SVK's website or through news pamphlets.

### **Offshore wind farms and the grid**

Although Sweden has no official wind offshore development zones, the Swedish Energy Agency has established 25 national areas of interest for offshore wind energy, which however legally is only one aspect when an application is weighed against other national interests (Swedish Energy Agency, 2012a). The regional authorities have the task to make sure those national areas of interest will be implemented in municipal detailed plans (Swedish Energy Agency, 2012b). Furthermore, the concession procedures will be impacted by the location of the offshore farm, namely if the project will be in Swedish territorial waters or in the Swedish Exclusive Economic Zone outside the Swedish territory (Söderholm & Pettersson, 2011, p. 523).

Firstly, within Swedish territorial waters a permit for environmental hazardous activity, a permit for water related operations and an EIA are necessary. The water related operations permit can be obtained from the national land and environmental court and the permit for environmental hazardous activity will normally be obtained from the regional government authority that is closest to the offshore farm (Swedish Energy Agency, 2012d). However, these two permits can be pursued in a coordinated fashion from the national land and environmental court. To get the permit for water related operations the developer has to proof that the social or public benefits of the farm outweigh its cost. Within the territorial waters the municipalities are responsible for overview planning in the shore area (E.ON & Sweco, 2012, p. 7). This means the developer has to get the allowance from the municipalities to set up the wind farm. Additionally, within the Swedish waters government approval is needed according to the Law on the Swedish Continental Shelf. The application is made with the Ministry of Enterprise, Energy and Communications and for that approval also an EIA has to be attached. This approval will allow the necessary studies on the seabed and will also allow pursuing seabed cabling around the offshore wind farm site and to land. Any cabling or electricity lines within Swedish territorial waters will be subject to the same concession process as already described above for grid concessions. Depending on the project also the Law on Cultural Heritage, and the Law of Expropriation applies. Once all these permits and the approval have been secured there is no additional

building permit necessary, but a public notification according to the planning and building procedures.

Secondly, if the offshore wind farm is to be located outside the territory but in the Swedish Exclusive Economic Zone, territorial planning procedures do not apply. Then only one permit which is obtained directly from the Swedish government (Ministry of Enterprise, Energy and Communications) and an EIA will be necessary (Swedish Energy Agency, 2012c). The permit is being pursued according to the Law on the Swedish Continental Shelf as well as the Law on the Swedish Exclusive Economic Zone (EEZ). For both approvals an EIA has to be attached. This will allow the necessary studies and cabling to land. As such fewer permits are necessary in the EEZ as opposed to Swedish territorial waters. A conflicting societal interest could be the Nature 2000 defined areas which also apply in the EEZ. The nearest regional government authority will investigate such cases. As soon as the electricity cables reach Swedish water territories the described procedures for grid concession as well as expropriation apply.

The general problem in the Swedish offshore wind industry is that policy support in the form of the current technology neutral green certificate market as well as pilot program R&D is too weak as an economic signal to make offshore wind projects a reality in Sweden in the coming years (Bergek & Jacobsson, 2010; Deloitte & GL Garrad Hassan, 2011, p. 79; Söderholm & Pettersson, 2011, pp. 524–525). In Sweden the electricity connection from the offshore farm to the nearest SVK substation on land as well as the necessary offshore transformer station have to be paid for and are owned by the developer (SVK, 2009). SVK in their turn have the duty to connect to the high voltage grid. Connecting to the high voltage grid is subject to a connection fee that the developer will be charged with.

## **Denmark**

### **Grid overview and technology**

Since November 2008 Denmark has decided that all new transmission lines above 100 kV shall be underground cables (NordREG, 2010, p. 16). Also according to the “Cable Action Plan” the already existing 132 and 150 kV grids shall be put underground until approximately 2030 (Energinet.dk, 2008).

### **Actors and Networks**

The relevant actors are primarily property owners, the TSO Energinet, the regional environmental authorities as well as the Energy Agency, the Danish Environment Agency and the Ministry for Transport and Energy. A special Danish case is that the compensation negotiations are done or supported by interest organisation, namely grid interest organisations and framers interest organisations.

## Institutions

In Denmark ownership and the operation of the grid as well as concessions are regulated according to the Danish Electricity Act (NordREG, 2010, p. 14). Different from e.g. Sweden a concession for a transmission line is only valid for 20 years in Denmark. The TSO in Denmark is called Energinet and is responsible for long term grid planning and has its own separate legislation.

According to the Danish Electricity Act transmission lines over 100 kV require a concession by the Ministry of Climate, Energy and Building which however usually acts through the Danish Energy Agency (DEA). Among other criteria the new transmission line has to be a necessary investment and satisfy socioeconomic demands (NordREG, 2010, p. 14).

In detail the application process for a concession starts by the initial drafting of an EIA. This is done collaboratively by Energinet and the regional environmental government authorities together with external stakeholders. After gathering first ideas, this process is opened up for public hearing for 8 weeks in order to get more viewpoints and relevant criticism from e.g. property owners (Scott & Ngoran, 2003, p. 68). After receiving this input the regional environmental authority will help in scoping the EIA and different transmission line routes will be worked upon. After this official draft has been finished 8 weeks of public hearing are available to raise viewpoints. After considering all this input the TSO is ready to submit an official EIA. Eventually the EIA will be approved by the regional environmental authority. In the case of a very large project the Ministry of Environment through the Danish Nature Agency will be involved in approving the EIA.

After securing the EIA the TSO can official apply for a concession at the DEA. Here the TSO needs to justify the need for the line but also is asked to show the socioeconomic benefits connected. The DEA in turn will send the application to all the government authorities involved in order to get feedback. Lastly the concession is granted by the DEA while however projects worth more than 100 million DKK have to be approved by the Ministry of Climate, Energy and Building (Danish parliament, 2005; NordREG, 2010, p. 15).

In parallel to this process once a line routing has been decided upon, the TSO can engage into negotiations about utility easement and compensation. The acquisition of the land required to build the line is primarily in the hands of the TSO. In the Danish case the compensation or utility easement is primarily negotiated between interest organisations and the TSO according to standard rates (NordREG, 2010, p. 15). Usually there are grid developer organisations on one side and the farmers associations on the other. Presumably most of these utility easement cases are settled voluntarily through that process.



## Offshore wind farms and the grid

In Denmark the right to exploit wind resources in territorial waters and the EEZ belongs to the Danish state (Danish parliament, 2005). As a result the concession system for offshore wind farms and the necessary grid connections are somewhat different from the shown grid concession procedure. For all wind offshore procedures including the grid procedures the Danish Energy Agency (DEA) is a so called “one stop shop” for the developer and coordinates with other authorities in the background. *For offshore wind farms three licenses are necessary, namely a license to carry out preliminary investigations in the area, then a licence to establish the offshore wind turbines and finally a licence to exploit wind power for a given number of years as well as an approval for electricity production.* As most offshore wind farms will impact the environment an EIA must be carried out which also includes all the cables to land (according to the Executive Order no. 815 of 28. August 2000). The EIA will be carried out after the license for preliminary studies has been obtained from the DEA (DEA, 2006, p. 12). After having conducted preliminary studies and the EIA the developer sends in an application to the DEA which then starts a process of public consultation with e.g. other authorities, the general public or any other concerned organisation. The public consultation will take place for at least 8 weeks. Only after that period a building permit can be obtained which however comes with extensive specifications as a result of the EIA and the public consultations (Dong Energy, Vattenfall, DEA, & Danish Forest and Nature Agency, 2006, p. 130). Appeals to that decision can be registered with the Energy Appeal Board. Building the offshore farm cannot begin before the developer documents how the specified conditions in the building permit will be met. The production of electricity in turn cannot begin before it is documented how all the conditions stated in the building permit have been met during the construction.

When it comes to obtaining the mentioned three licenses there are two paths available to developers (DEA, 2012). Firstly, there is the approach of using government specified development zones for which open tenders are performed. These six development zones were decided upon by the Danish parliament (Danish parliament, 2012). Through establishing these development zones the government beforehand has already been made responsible to organise first public consultations, preliminary environmental, economic and technical studies that established certain general and local requirements that are part of applying for a specific development zone in the tendering process (DEA, 2005, p. 8; Energinet.dk, 2012). During such a tender the applicants will mainly compete for a fixed feed in tariff or in other words the assumed electricity price for a specified amount of electricity produced (specified in full load hours). This approach takes into account the different circumstances of each offshore project since wind speeds, water depth, distance from the shore etc. can vary greatly which affects the economics of each offshore wind farm (Kaldellis & Kapsali, 2013). Other application criteria apart from the price are the applicants’ technical, financial and legal qualifications as well as the presentation of a credible schedule for the project (DEA, 2005, p. 7). In the case of government tender projects the government owned TSO Energinet will construct, own and maintain the

transformer station and the underwater cable that connects the offshore farm to the transmission grid on land. On land the farm will avoid the distribution grid and directly connect to the high voltage transmission grid via a first cable substation near the coast and finally to the nearest high voltage substation. All the cabling to the final high voltage substation will be underground in the seabed or underground on land which will reduce the extent of the EIA procedures for the grid that have to be secured by Energinet beforehand (DEA, 2005, p. 16). The developer is only responsible for the internal offshore wind farm grid to the transformer station (Dong Energy et al., 2006, p. 132). The developer will also receive a sales guarantee from Energinet which protects the developer from shortcomings or bottlenecks in the grid caused by Energinet. This in turn will be an incentive for Energinet to invest in the reinforcement of the high voltage transmission grid long term.

Secondly, there is the so called open door approach in which the developers themselves choose the area for the offshore wind farm (DEA, 2012). The application for preliminary studies is also made with DEA, but unlike the specified development zones the DEA now first has to see if there are conflicts with other societal interests in that area. The application has to include a description of the project, the likely scope of the preliminary studies that need to be carried out, the capacity and number of turbines as well as the geographical area. To establish the potential for societal conflict the DEA will have a hearing process with other government bodies to clarify the public interest. If the DEA allows the application to go ahead it will make the application public to offer other interested parties a chance to apply and to increase competition (Dong Energy et al., 2006, p. 128). As opposed to the tendering process in development zones, in the case of open door projects the developer has to pay for all grid connections to land as well as the transformer station (Deloitte & GL Garrad Hassan, 2011, p. 66). Open door procedures cannot be initiated in areas that are part of the government specified development zones. The revenue for the wind farm in this case is based upon wind onshore rules and ownership must be 20% local (Deloitte & GL Garrad Hassan, 2011, pp. 63–64).

A special wind offshore case is the development zone in Kriegers Flak which is an area of interest for Denmark, Sweden and Germany. The combined area is estimated to have a capacity of 1600 MW in offshore wind power. The Danish TSO Energinet and the German TSO 50Hertz have decided to together optimise their plans and also to enable cross country electricity trade between Denmark and Germany and through that establish the very first piece of an European offshore supergrid (Energinet.dk, 2012b). The Swedish TSO SVK has withdrawn from the project in January 2010 after initial talks, a joint pre-feasibility study and a joint feasibility study, due to currently uneconomic conditions for offshore wind power as well as the unclear regulatory role of combined or meshed offshore and cross border connections in Sweden (Energinet.dk, SVK, & Vattenfall Europe Transmission, 2009; SVK, Energinet.dk, & 50Hertz, 2010, p. 15; Söderholm & Pettersson, 2011, p. 521; Vattenfall, 2012). The project was initially started by the Berlin declaration in which the responsible ministries of all three countries issued a positive statement. The total project's budget is estimated to be around 900 million Euros (European Union, 2012). The project is supported by the European Recovery Program with a budget of 150 million Euros. The transformer station near Kriegers Flak will connect both Denmark and Germany with two HVDC cables (the AC systems in Germany and Denmark are not synchronous). Technically, a later connection to Sweden via future Swedish offshore wind farms will be made possible. On the Danish side, due to the cross country nature of the project the Ministry for Climate, Energy and Building had to approve the project before Energinet could carry out the existing initial environmental studies. Only later the usual tender procedures will commence with another extensive EIA and public hearing procedures on the Danish side. In both Sweden and Germany developers have been chosen and received concessions (Vattenfall and EnBW respectively). Apart from the technical issues, the actual market issue is also interesting as the Nordic countries and Germany have different market systems for electricity trade. The Danish offshore wind park is scheduled to be operational at the beginning of 2018 (DEA, 2013).

Figure 3 Case Study Kriegers Flak

## Norway

### Grid overview and technology

Almost 99 % of the Norwegian energy-use stems from hydropower and the power plants are spread out over most of the country. This has also affected the system for grid development in Norway, where the need for long distance central grid historically has been of minor importance and most demand in the municipalities and local industry could be met with local supplies. As such there is a relatively strong local embeddedness and decentralisation of the grid development regime (Angell & Brekke, 2011; Skjold & Thue, 2007; Thue, 1995). Today, Statnett owns 87 % of the central grid. Aggregated, the Norwegian central grid has capacity for further

electricity production, and Statnett estimates that the grid still stands 5000 MW new production (NVE, 2009a). However, bottlenecks are a challenge in certain regions.

## Actors and Networks

Similar to all countries the main actors are the property owners as well as the TSOs (in the Norwegian case that is Statnett). The involved governmental authorities are Norwegian Water Resources and Energy Directorate (NVE) as well as the Ministry of Petroleum and Energy (OED).

## Institutions

In Norway according to the Norwegian Energy Act, a concession is required for all grid development projects over 22 kV. According to the act the concession-process has to take place in a social appropriate and rational manner, including considerations regarding private interests and the general public (The Norwegian Energy act, §1-2). The responsible network authority is the NVE which accordingly is granting the concessions for new power lines (NordREG, 2010, p. 19). Similar to the other Nordic countries also in Norway an EIA has to be performed which applies to power lines longer than 20 km and with a higher voltage than 132 kV. This is regulated according to the Norwegian Environmental Impact Assessment Regulations.

The concession process starts with a pre-notification that is submitted by Statnett to the NVE and includes a first proposal for an EIA program or work plan (NordREG, 2010, p. 19). After this initial step the NVE is arranging consultations and hearings with local and regional government authorities. Later on the directorate presents the EIA programme to the Ministry of the Environment. Taking the feedback they received into account the NVE puts together a programme for consequential analysis which includes the EIA programme. The NVE also compares the current proposal with similar previous proposals. Hence, the Norwegian GDR is characterized by the fact that the whole process is very much facilitated by the authorities (in this case the NVE).

After having taken into account the previous feedback by NVE and the previously defined programme for consequential analysis, the TSO can officially apply and submit a complete EIA (NordREG, 2010, p. 19). Usually this also is connected with an application for the compulsory acquisition of land or property or in other words utility easement. After having received the official application, the NVE is holding another round of consultation and hearings with the general public but also with the relevant government authorities. While deciding upon a concession the NVE also has to apply the assessment criteria as stated in the Norwegian Energy Act (NordREG, 2010, p. 20).

If the NVE agrees with the application, the concession is granted in the first instance. Granting the project includes the demand for a feedback on the exact transmission line route as well as the technical specifications of the line. Also more detailed planning requests are included with e.g. specifications for the construction work, mitigating measures and information on how the line is negotiated against the interests of memorial protections and landowners. The necessary acquisition of land and property usually also comes with a building and operating permission.

After the decision has been made it can be appealed through addressing objections to the OED. In Norway, most projects within the central grid are actually appealed upon. The case then will be sent through the NVE which is examining the appeal first. This examination often takes the form of a new investigation, including new inspection and new consultations. The result of this examination together with the objections are finally being sent to the OED which then comes up with a final decision. This practice, where most cases are appealed and where the government has to conduct new investigations and inspections, is a lengthening factor for the concession process in Norway.

### **Offshore wind farms and the grid**

In Norway only few practical examples of offshore wind farms are existent which makes it somewhat difficult to assess the institutional regime around such projects. In accordance with the Norwegian Energy Act, the Norwegian Planning and Building Act, the Sea and Water Act and the Act concerning Relics and Ancient Culture, offshore wind farms in Norwegian Waters will require an installation concession (Norwea & EnergiNorge, 2013; NVE, 2008, 2009b, 2012a; Ravlo, Kaldahl, Ingebrigtsen, Ringstad, & Atland, 2011; Siragrunnen AS, 2007, p. 7, 2012; Söderholm & Pettersson, 2011, p. 524). Similar to the grid concession process already described the application for concession will be done with the NVE and can be appealed to the OED. The same applies for any grid related activities that are necessary due to the wind farm installation. After sending a first notice to the NVE, the agency will organise the hearings and the other procedures as already described for the grid concessions above. After having received the feedback, the developer can apply for those concessions and has to accompany the application with the EIA. Similar to the described grid concession the same expropriation procedures apply according to the Expropriation law (also application to NVE necessary). When it comes to the grid connections, all costs up to the nearest on land substation have to be covered by the developer.

Apart from the described institutional elements the Norwegian parliament in 2010 has passed an Offshore Energy Act which in the future will regulate any further offshore wind farm activity. In the law it is stated that any resource extracted offshore belongs to the state and that concession for extraction in principle can only be given in pre-specified areas (Norwegian Directorate for Nature Management, Directorate of Fisheries, Norwegian Coastal Administration, NVE, & Norwegian

Petroleum Directorate, 2010, p. 14). Since 2008 a committee consisting of several authorities but under the leadership of NVE studied the possible consequences of 15 possible development zones for offshore wind power which could get priority in the concession process in the future. The committee finished their work at the end of 2012 and handed the report over to the OED which opened up a hearing process that will last until 4th of March 2013 (NVE, 2012b; OED, 2013). In the report NVE prioritised the 15 areas in categories which likely will impact project timetables. Until that screening process is finished many concession applications are practically on hold.

Similar to Sweden, a central problem in the Norwegian offshore wind industry is that often wind farms are not economic in the current policy climate (NTB, 2012; Vidhammer, 2012). The existing joint Norwegian-Swedish green certificate market is not enough as an economic instrument to make many of the planned projects economically viable. Apart from R&D support by Enova for pilot projects also tax exemption similar to the oil and gas industry are being discussed as incentives.

### **3. Discussion and conclusion**

After having reviewed the institutional set up around high voltage transmission grids and offshore wind farms in the Nordics, there are some interesting patterns that can be discussed.

To begin with, there is a clear difference in the importance of the local interests vs. national energy goals as well as the political legitimacy in the grid concession process across the Nordic countries. In Sweden municipalities have a planning monopoly and their detailed planning competence has considerable weight in the process. Even if the regional government authority (“Länsstyrelsen”) represents the national energy goals in the concession process, it will be almost impossible to overrun detailed plans established by the affected municipality. This results in two aspects, namely the fact that national or European energy goals are deprioritized as well as the fact that the concession process might differ substantially depending on the municipalities involved along the grid project (Pettersson et al., 2010; Söderholm & Pettersson, 2011). This will make it difficult to standardise the concession process, as each application will require the developer’s adaption to new local circumstances.

Norway historically has a strong local embeddedness of electricity production and consumption through their tradition in hydro power across the country. As opposed to this tradition, in the grid concession process mostly national legislation and national actors like the NVE and Statnett are of main importance. Apart from that the process in Norway is highly expert driven and the definition of needs is decided upon beforehand by expert groups that are not subject to political debate and hence less politically legitimate.

In Finland the local dimension is historically close to the Swedish planning tradition. As in Sweden municipalities also have considerable planning power and local master

plans are considered as law. However, they are asked to cooperate with the grid developer and to not withhold consent if the government ministry has decided a project is important for the electricity security of supply. As such the national energy goals more strongly supersede local plans compared to Sweden.

Denmark's grid concession process is clearly hierarchical and national energy goals have a lot of weight. However much of the procedures are coordinated from below in Regional Environment Centres. Only at a later stage national actors play a role for the grid concession. It is also important to emphasise that in Denmark's case the "undergrounding" policy that the Danish TSO has to follow, as well as the national energy goals all have been created by a broad political agreement as well as decisions in the parliament. As such one can argue that hierarchical, national governance does not mean that the concession process has to be less legitimate on the different governance levels.

It is also interesting who facilitates and organises the process to get a grid concession, particularly during the EIA phase. In Sweden most of the process is directly run and organised by the grid developer. In Norway the concession process is facilitated very much by the NVE as opposed to the grid developer or a regional governmental authority. In Finland and Denmark however the regional government authority plays a larger role and is partly also organising the relevant hearings. It is also interesting how larger interest organisations, like farmer associations, facilitate the process in the name of affected property owners. This seems to be common practice in Sweden and Denmark, but not as much in Finland and Norway.

The next aspect concerns the possibilities of public participation in the grid concession process. In terms of public participation there are also differences to be seen. In both Sweden and Denmark from very early on there is room for negotiations and consultations. As such those processes encourage negotiating and consulting *before* applications are fully developed and sent to the government. In Finland not all consultation take place before the government decision is being made, as e.g. the EIA does not yet specify exact line location. The Norwegian licensing process incorporates somewhat of a paradox of participation: The longer involved parties wait to participate, the greater the effectiveness of participation. This is due to the practice that most cases are appealed and as a result new investigations and inspections are being conducted. This is a lengthening factor for the concession process in Norway. As such taking part in the early stages of a grid project is time-consuming, while the benefits of participation are highly uncertain. It is often first when the grids have begun to materialize in the form of lines on the map that potential stakeholders can be identified and mobilized.

The procedures in the offshore wind farm context and connected grid issues are even more different among the Nordic countries as when compared to just looking at the high voltage grid. In Sweden, Norway and Finland the developers themselves have to pay for getting connected to the nearest TSO substation on land. As such they are also responsible for obtaining all the related permits and perform an EIA for

such connections including the transformer stations. In Denmark all connections to the offshore wind farms, including the transformer station near the wind farm, are considered part of the realm of the Danish TSO and are hence eventually paid for by all final consumers. This removes a large part of the initial investment from the private developer's budget and reduces the uncertainty of grid connection. This however is only possible in Denmark as most future offshore wind farm projects will take place in predefined development zones to which a clear time schedule is attached and where the necessary EIAs have been done before the private developer applies. This also removes much of the uncertainty TSO's are facing in the other Nordic countries about where exactly offshore wind farms will be located and hence where the grid will need to be strengthened in the long term (T. Johansson & Nilsson, 2009). Also Norway is currently in the process of setting up specific development zones for offshore wind farms, but they have not yet specified the economic and political instruments that are necessary to make this an effective and predictable policy environment. In both Sweden and Finland national wind plans instead of development zones have been implemented, but so far they fail to be effective instruments. This is exemplified by cases where wind farms did not get concession despite their location being in such wind zones. One of the largest problems in Norway, Sweden and partly Finland is however that offshore wind farms are not economic. This is partly because of the mentioned grid connection issue, but also because the technology neutral green certificate system in Norway and Sweden is not sufficient enough. In Finland the experiences with the recent introduction of a feed in tariff are so far too limited to assess if the instrument is effective, but critics say the tariff is not high enough and that it is not sufficiently adapted to offshore wind energy. All the three countries instruments fail to take into account that each offshore wind project is somewhat different when it comes to the distance to land, water depth and wind resources. The Danish tendering process takes the individuality of each offshore project into account. All in all this leads to the fact that most actual offshore wind construction actually takes place in Denmark (please also see Figure 4).



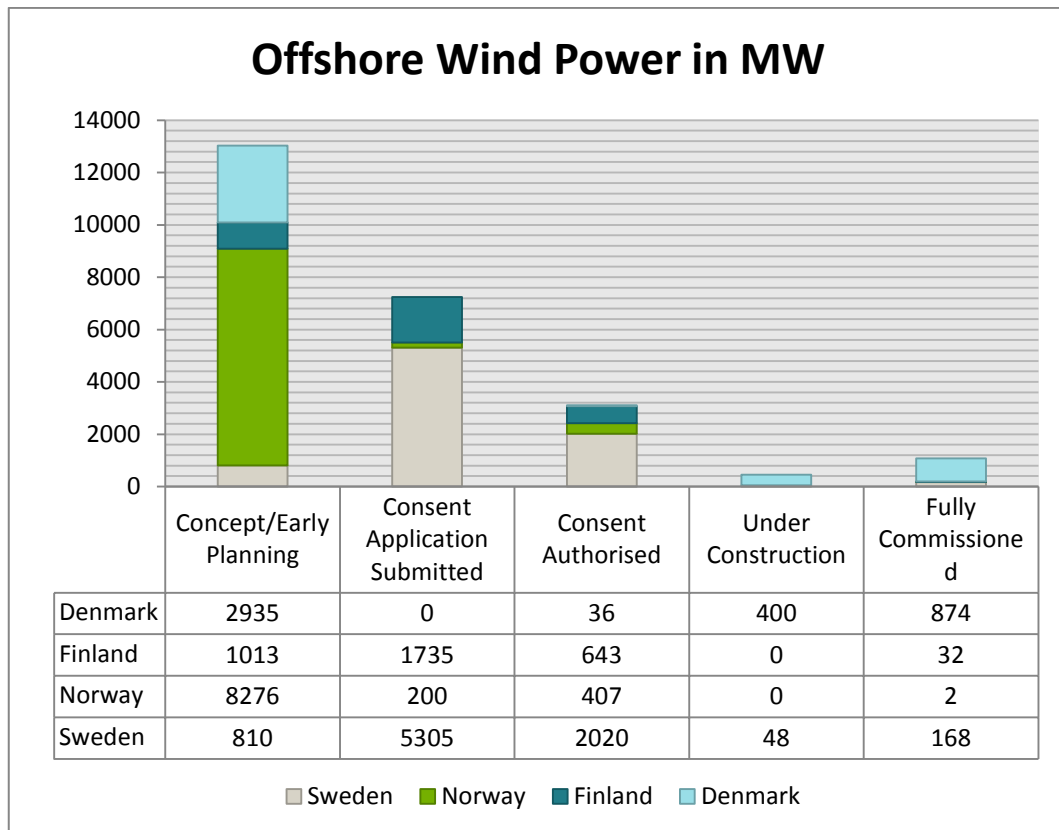


Figure 4 Offshore Wind Power in the Nordics (4C, 2013)

When looking at cross border high voltage grid connections in all countries this remains a government decision and it is only in the realm of the TSO to build such a line after government consent. This has been somewhat of a paradox in the Kriegers Flak case example, at least on the Swedish side (see also Figure 3). Due to the fact that in the Swedish case offshore grid connections have to be owned and paid for by the developer, one of the obstacles for Swedish participation also was that the meshed grid characteristics in Kriegers Flak would have been illegal to own for the developer as it also constituted a cross border link. Due to the fact that the Danish TSO anyway also has to own and operate offshore wind farm connections, no such conflict appeared. It appears however that meshed setups of offshore wind farms which at the same time will be cross border links, will increase in the vision of the European supergrid and that this is a particular example of how institutional alignment around that European vision is missing.

When it comes to the TSO themselves, a noteworthy aspect is that the state owned Swedish TSO has to get its investment plan and budget approved by parliament which exposes it to political scrutiny. In Norway however the state owned TSO is not required to get direct parliamentary approval and operates more independently from political control. In Finland the ownership structure is also much more mixed between public and private owners compared to other Nordic TSOs which likely results in stronger independence but also limitations in terms of its political

rootedness. The state owned Danish TSO has a separate budget from the Danish state but its annual report and the yearly investment plan have to be approved by the Danish Climate, Energy and Building Ministry and if loans need to be taken the finance committee of the Danish parliament needs to approve it (Danish parliament, 2009). Having a direct link to legislative power increases the political legitimacy of a TSO and also allows for perhaps “normative” decisions such as the cable undergrounding policy and the offshore wind farm grid connection policy passed by the Danish parliament.

Concluding one can only acknowledge some of the inherent conflicts and institutional barriers that the concession processes have to overcome. This applies not only to national energy goals vs. local planning power, but also to the European vision of supergrids and offshore grids vs. actual laws, rules and norms in the nation states. Even the Nordic countries which have a joint electricity spot market and hence have come longest in electricity market integration in the EU are characterised by many differences. In this report this has been shown when it comes to the high voltage grid concession and offshore wind farm concession processes as well as the political legitimacy and the level of policy incentives used in energy policy. There are clear differences in the policy experience when it comes to a coordinated transformation towards more renewables in the Nordics. Paradoxically, these differences persist while at the same time a Nordification (green certificate system between Norway and Sweden as well as the Nordic electricity market) and an Europeanization (Third Energy Package) takes place.

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