
The creation of the pan-Nordic electricity market

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Abstract

Europe has the potential to satisfy its entire electricity need from renewable sources if the European electricity policy scope is internationalised. However, the opposition against opening and unifying the national power markets is strong, and today only one international electricity market exists: the pan-Nordic power market. Seemingly, the circumstances in the Nordic countries were different than in continental Europe, diminishing opposition and leading to an increased will to liberalise and unify the markets. In this thesis, the main driving forces and factors for the successful creation of the open Nordic market during the 1990s are identified. The following conclusions are drawn:

The main driving force for the liberalisation of the markets was an ideological conviction to liberalise with the goal to increase the efficiency of the power system and to decrease prices. The liberalisation wish was founded in a general paradigm shift in the early 1990s, but was also a backlash reaction to the old, heavily regulated power systems. The successful Norwegian liberalisation and the decreasing price there - which however were largely decoupled - were of major importance for the liberalisation processes in Sweden and Finland. Almost all actors in all countries supported the liberalisations, although opposition in Denmark was initially very strong.

The main driving forces for the market unification were market power dilution and the strong advantages of unifying the Norwegian and Swedish hydro-based with the Finnish and Danish thermal-based power systems. All national markets were heavily concentrated which was seen as a threat to the proper functioning of the liberalised markets. By unifying the markets, this market power was to be diluted. The optimised use of Norwegian and Swedish hydro power was expected to decrease prices in the entire Nordic region and reduce the total Nordic power-related emissions. In return, the Finnish and Danish thermal power would secure the Nordic supply during dry years. The unification was expected to lead to increased economic efficiency, higher security of supply and an improved environmental performance of the Nordic power system. This pan-Nordic energy policy scope arose in 1993 after a Swedish study which strongly supported a Nordic power market was published, and became even stronger after the decision of the Nordic Council of Ministers in 1995, the Louisiana Declaration, to unify the Nordic power markets. There was no significant opposition against the unification.

The profound, over-the-blocks political will to liberalise and unify the Nordic power markets, due to ideological conviction and macroeconomic advantages were the key success factors for the creation of the pan-Nordic power market.

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1 Introduction

The energy future Europe is facing today, based on projections of current trends, is dirty, insecure and expensive. However, new government policies can create an alternative energy future, which is clean, clever and competitive. For this to happen, old thinking patterns have to be abandoned and a new energy policy paradigm has to arise.

The rapidly increasing European energy import dependency and the increasing knowledge and awareness about climate change have a large impact on the possible European energy options of the future [European Commission 2006b:3ff; EurActiv 2006a]. Both the problem of energy supply security and the climate crisis must be solved – it is not possible to choose only one. At the same time energy prices must be minimised to ensure Europe's competitiveness which calls for the cheapest resources in Europe to be used first. However, enormous costs may arise if the supply is not secured and if the climate crisis is allowed to escalate [see e.g. LogicaCMD 2006; Stern 2007]. Energy security benefits from the increased use of domestic energy resources which, in the case of Europe, first and foremost mean coal and renewable energy. Climate security requires the increased use of carbon-neutral energies, which places a strict constraint on the supply security options by banning the carbon-intensive coal. These two problem areas may therefore have contradicting solutions, like the coal option, but may also have common, symbiotic solutions, as is the case for the renewable option. In any way, climate protection and security of supply are two issues which obviously have to be approached and solved simultaneously and the renewable energy technologies are the only today existing technologies which can solve both problems at the same time [see Matthes, Gores, Graichen 2006:3f].

If Europe wants to sustain its position as leader in the global climate process and to prevail on an ever tougher world market to secure its access to abundant and fairly priced energy, it cannot afford to speak with 27 different voices. However, European energy policy still has a narrow national scope. The nationalistic approach, which may have been justified during the cold war, is no longer suitable for the unified Europe and it is often counterproductive at the European and international levels. The current European energy policy allows Germany to make gas deals with Russia without asking the transit country Poland and France to actively support nuclear power while many other Member States have decided to phase it out. This creates tensions within the European Union, decreases European reliability internationally and is therefore neither beneficial for the European security of supply nor for its leadership role in

the international climate process [see e.g. Spiegel 2007]. A fragmented energy policy also diminishes Europe's capacity to make use of its great resources for renewable electricity.

If the energy policy paradigm is changed, Europe has the technical and economical potential to satisfy its entire electricity need completely from renewable sources [BMU 2005:56; 2006:5; 43; Eurostat 2006:22]. However, the resources and the consumption are unevenly distributed over the continent. The central, densely populated Member States like France, Germany, Italy, Belgium and Holland have the large load centres and cannot support their own electricity needs entirely from renewable sources, even if the consumption does not increase from present levels. Instead, the large potential surplus for renewable electricity is found in the peripheral regions with lower consumption like the Iberian Peninsula and the Nordic region [BMU 2005:56; 2006:43; Eurostat 2006:22; see also Czisch 2001; 2004]. These regions may be the power houses of Europe in the 21st century. For this to happen a high-performance Europe-wide power grid to transport the electricity from the production sites to the load centres has to be constructed [EurActiv 2006b]. Such a pan-European power grid will be beneficial for European security of supply regardless of which kind of power is fed in – it will be possible to feed in coal or nuclear power just as well as renewable power. This will enlarge the power base and reduce the risk of blackouts due to power plant or grid failures. It may also increase the overall efficiency of the European electricity system, thus minimising the costs. From an economic perspective, a pan-European grid is clearly beneficial [Brunshagen et al 1995:257f; Helm 2005:3f]. For a massive expansion of the cheapest renewable electricity production, however, the pan-European supergrid is not only beneficial, but a prerequisite. For the construction and operation of the supergrid, the nationalistic energy policy paradigm has to be replaced by a policy in which some Member States are entrusted with supplying the others with renewable electricity on a pan-European electricity market.

Today, only one international electricity market exists¹: the NordPool area consisting of Norway, Sweden, Finland and Denmark [ERGEG 2007; NordPool 2007a:13]. According to the European Commission, the Nordic market is, besides the UK market, the first and only electricity market in Europe with complete competition and the only integrated international electricity market world-wide [European Commission 2004:2]. In continental Europe, the opposition against the deregulation and unification of power markets and the reinforcing intercon-

¹ There is also another initiative which is still in the process of market unification: The *tri-market coupling* between France, Belgium and Holland (and from 2009 also Luxemburg and Germany), which exists since November 2006. This still only includes day-ahead trading and can therefore not yet be seen a complete unified market but will possibly be truly unified in the coming years [EurActiv 2007a].

nections is large. This opposition is mainly due to market actor opposition and different political interests of the Member States [Czada, Lütz 2004:119f; EurActiv 2007d; e]. Due to the traditionally close bonds between the state and the large, mono- or oligopolistic, often state-owned, power companies, the large market actors have a channel to the politics and often succeed in getting their will; often the political and market will seem to be the same. The political fear of giving up control over the national electricity system to other countries has significantly slowed the unification process [Czada, Lütz 2004:119f]. This has led to a slower expansion of the interconnections and to weaker liberalisations than in the Nordic countries, leaving the old national champions largely undisturbed on their former monopolistic home markets [Matthes, Grashof, Gores 2007:19].

For the goal of creating a pan-European power grid the opposition against the liberalisation and unification of the national power markets has to be overcome. In the Nordic countries, this has already happened, which raises the question why these markets could be unified when it has not been possible to unify the markets in continental Europe. The Nordic market only encompasses about 25 million citizens but electricity consumption is nonetheless high: about 400 TWh/a, which can be compared with the German electricity consumption of about 500 TWh/a [Nordel 2007:3; Eurostat 2006:22]. The sheer size of the Nordic market also makes it interesting for lesson-drawing for a pan-European power grid: Its area is about one-third of the entire European continent and the distance from the North Cape to Slesvig in southern Denmark is roughly the same as from Slesvig to Sicily [Alestalo, Kuhnle 1987:3]. During the process of deregulating and unifying the Nordic markets in the 1990s, the Nordic interconnection capacity and electricity trade increased by about 100%, which makes it an interesting example of how inter-European interconnections can be reinforced and expanded through deepened cooperation and unification. The unification of the Nordic markets has to be seen as an integral part of the liberalisations: although a liberalisation is theoretically not necessarily a prerequisite for market unification, this has practically been the case in the Nordic countries. Therefore, the processes of liberalising and unifying the Nordic markets must be considered together and cannot be investigated separately. The liberalised Nordic market was gradually extended to all four Nordic countries between 1996 and 2000, and is today a strongly interconnected, fully integrated electricity wholesale market with plans to internationalise the retail market as well [von der Fehr, Amundsen, Bergman 2004:1; NordReg 2006:8; 2007:7; Nordel 1986-2006 Statistics chapter].

1.1 Research questions

Although it seems clear that great economic and ecologic gains can be achieved by restructuring and unifying the European electricity markets, only one international power market exists – the Nordic market. This thesis therefore aims to investigate the process of liberalising and unifying the Nordic electricity markets. The main research question of this thesis is: *What were the key factors for the successful liberalisations and unification of the Norwegian, Swedish, Finnish and Danish electricity markets?*

In order to answer this question, a number of sub-questions, roughly following the stages of the policy cycle (see chapter 2) are defined:

- a. *What was the problem structure in the different countries?*
- b. *Which were the main actors? Who wanted what?*
- c. *What was the proposed solution? What were the expected advantages of the proposed solution?*
- d. *Why were the markets unified instead of kept national?*
- e. *What were the outcomes of the liberalisations and market unifications?*

The results of this thesis will be used to discuss why the power markets in the Nordic countries were unified and liberalised to a higher degree than the other EU Member States' markets.

1.2 Previous research

Whereas the literature about the functioning of the liberalised and unified Nordic power market is rather plentiful, there has been very little research done about the liberalisation and unification processes. For this thesis, only one study directly concerning the unification process has been found and used – an article by Atle Midttun, who in 1996 investigated why the liberalisation and unification processes in Norway and Sweden got such broad support [Midttun 1996]. Midttun points out that the goals of different actors were sometimes directly opposed – politicians and consumers wanted lower prices, which cannot have been the goal of the electricity generating companies – but nonetheless most actors supported the reforms. He concludes that one main reason for the broad support, from the political as well as from market

actors, was “*cognitive limitations*” – the actors did not fully understand the consequences of the deregulations and the unification. All actors believed they would gain from the reforms and consequently they supported them. Midttun also sees the Swedish liberalisation as a mean for the large producers and “*political elite*” to effectively put the nuclear phase-out to a halt [Midttun 1996:63f].

The perhaps most protruding research about the functioning and potential problems on the unified Nordic market has been conducted by Eirik Amundsen at the University of Bergen and Lars Bergman at Stockholm School of Economics and a group of researchers around them. In 2005, they concluded that “*the general opinion among power industry representatives and electricity market analysts is that the Nordic electricity market has worked well*”, a statement that is used as a starting point for this thesis [Amundsen, Bergman 2005:2; Amundsen, Bergman 2007:3393, see also Nordic competition authorities 2003:6]. They also conclude that the low market concentration, which was achieved through the market power diluting effect of unifying the four markets, may have been the most important factor for this successful implementation of the Nordic market [von der Fehr, Amundsen, Bergman 2004:26; Amundsen, Bergman 2007:3393]. Also NordPool states that this market dilution was the main reason for the unification and the proper functioning of today’s Nordic electricity market [NordPool 2004a:7].

Concerning the vision of an electricity grid covering all of Europe and its neighbour regions, which this thesis should be seen as part of, mainly the work of the German Aerospace Center DLR (commissioned by the German Ministry of Environment, BMU) and Gregor Czisch at ISET (Institute for solar energy technology) should be mentioned. The DLR/BMU studies show that the potential for renewable electricity in Europe is sufficient to cover the entire electricity need, but also that the resources are very unevenly distributed across the continent. The by far largest and cheapest potential for renewable electricity is found outside Europe, in the deserts of Northern Africa, and has the theoretical potential to supply the entire world with energy [BMU 2005; 2006]. An important conclusion is that renewable energy from the Sahara is the least-cost energy option not only for energy security in North Africa, but also for supplying in the European Union with renewable electricity [BMU 2005:6]. However, the energy, preferably in the form of electricity, has to be transported to as well as within Europe. For this, a new and reinforced grid is needed [BMU 2005:7].

Gregor Czisch concludes that all the fundamentals, such as the economic and energetic potential, for covering Europe’s need for electricity completely from renewable sources are given

and that the extra cost for restructuring the electricity system compared to maintaining the old are negligible [Czisch 2001:51ff]. Therefore, he does not see the main obstacle to converting the electricity system and interconnecting the Member States with each other and Europe with its neighbours in the technical or financial aspects, but almost exclusively in the political hesitation and reluctance to implement the idea of a pan-European electricity grid and market [Czisch 2004:14].

1.3 Scope

The time frame of the thesis is roughly from the end of the 1980s until today. The first steps toward deregulating and eventually unifying the Nordic power markets were taken in the end of the 1980s which makes this a logical starting point. The focus lies on the early and mid-1990s and, for the Danish case, the end of the 1990s. Almost all new interconnection capacity was built during the 1990s. Since 2000, the Nordic market is unified, so that the time after 2000 only the outcomes of the reforms are considered. Although this thesis does not primarily aim at investigating how the Nordic market functions today, much of this has to be described in order to understand the accession processes of Finland and Denmark to the Norwegian-Swedish market, and whether the creation of the Nordic market has been positive at all. In general, readers who are interested in how the Nordic market functions today are recommended to read the work of Amundsen and Bergman (see above in chapter 1.2).

The geographical scope, except the last part of the discussion, is limited to the four Nordic countries Norway, Sweden, Finland and Denmark.

1.4 Definitions

This thesis focuses on the four Nordic countries Denmark, Finland, Norway and Sweden. Usually, the term *Nordic* encompasses these countries and Iceland; the term *Scandinavia* comprises Sweden, Norway and Denmark. In this study the terms *Nordic* or *Nordic countries* comprises only Norway, Sweden, Finland and Denmark.

The terms *Jutland* and *Zealand* are used synonymously to the two Danish grid areas Denmark-West and Denmark-East, respectively, even though this is not a perfect geographical distinction. In reality, all Danish islands and the main land west of the Great Belt is connected to the Denmark-West area and everything east thereof is part of Denmark-East.

The terms *continent* or *continental Europe* are common in the Nordic countries and in the literature for the parts of Europe that are not Norway, Denmark, Sweden, Finland, nor the British Isles. This nomenclature is used also in this thesis, but is narrowed down to comprise the EU Member States which are not Sweden, Finland or Denmark.

Throughout the thesis the terms *unification* and *liberalisation* are used. Unification refers to the process of unifying different national markets whereas liberalisation refers to the process of opening the market and introducing competition in the production, wholesale and retail sectors. The term *deregulation* is used synonymously to *liberalisation*.

The term *national champion*, which is common in the literature, is used to indicate the size and historical importance of the often state-owned large energy companies. In the Nordic countries these companies are Statkraft in Norway, Vattenfall in Sweden, IVO/Fortum in Finland (all three are state-owned) and Elsam and Elkraft in Denmark.

Throughout the thesis, the terms *market power*, *market concentration* and *market dilution* are used. The market power of a company is its ability to increase the prices without losing all its customers to competitors, usually because it is the dominant actor in its market segment. Market concentration denotes this market power: a highly concentrated market has few but powerful large actors. Consequentially, market dilution describes the decrease of the market concentration, for example when two markets are unified.

The cross-border electricity transmission capacity is throughout the thesis referred to as *interconnection capacity* or simply *interconnections*. Increased interconnections and market unification is not the same thing, although the interconnection capacity is an important indicator of how integrated two power markets are. However, two markets can be interconnected without being unified.

The distinction between high-voltage long-distance transport in the main grid and low-voltage transport to the customers through the regional and local grids is shown by the use of the two terms *transmission* and *distribution*, respectively.

In the Nordic countries, two different grid tariff systems have been used during the investigated time period: a *point-to-point tariff system* and a *point tariff system*. In a point-to-point system, the tariff is mainly dependent on the feed-in time, the geographical feed-in location of the producer as well as on the location of the feed-out point of the customer. In a point tariff system, the fee for using the grid is mainly dependent on the geographical feed-in location and the feed-in time. The point-to-point tariff system is therefore distance-dependent, whereas the point tariff system is not.

A distinction between *hydro-based system*, a power system dominated by hydro power, and *thermal-based system*, which is a power system based on nuclear power and the combustion of fossil fuels.

To a large extent abbreviations have been avoided throughout the thesis. In some places, the term *TSO* has been used for *Transmission System Operator*. The TSO is the entity responsible for the frequency regulation and balancing of a power grid and is usually, though not necessarily, the owner of the main grid.

The abbreviation *TPA* is used for *Third Party Access*, the rule about how actors who are independent of the grid owner can connect to the grid and transmit electricity, although they do not own the grid themselves. The TPA is therefore crucial to any liberalised electricity market; without it only the grid owner would be able to transport and distribute electricity. There are two main kinds of TPA: *Regulated* and *Negotiated Third Party Access* (*R-TPA* and *N-TPA*, respectively). R-TPA means that the access is regulated in the legislation and that all actors have access to the grid to equal and pre-defined conditions. N-TPA means that access to the grid has to be negotiated separately for each actor. In an N-TPA system, the conditions for grid access for different actors may differ, whereas all actors in an R-TPA system have the same conditions.

Further, the abbreviations *HVAC* and *HVDC* denote the different ways to transmit electricity over long distances *high-voltage alternating current* or *high-voltage direct current*. The terms *power* and *electricity* are used synonymously.

This thesis does not aim at giving economical data or expressing costs or benefits in a quantitative way. Nonetheless, economic data is often helpful to understand the different Nordic power systems and to understand the outcome of the processes. This economical data is in the literature usually given in the national currency without correcting for inflation and must therefore be considered with care. For the sake of comparison, the data is converted from Norwegian, Danish and Swedish kroner to Euro using the following exchange rates, which roughly correspond to the nominal, mean exchange rate since 1999: 1 €=8,1 NOK=7,5 DKK=9,2 SEK [ECB 2007a; b; c]. This converted data must be considered with the utmost care and are not to be seen as accurate but only as a mean to a very rough comparison. Data for Finland is only given in Euro.

1.5 Structure

In chapters 2 and 3, an overview about the method and material used for the thesis is given.

In the 4th chapter, the liberalisation and unification processes of the four countries are described. Chapter 4.1 briefly describes the background of Nordic business and political cooperation as well as the for the creation of the Nordic power market important institutions Nordic Council, Nordic Council of Ministers and Nordel.

The chapters 4.2-4.5 give an overview of the main political and market actors as well as the political perception of the power market problem structure before the liberalisations. Due to the different paces in the deregulation processes, this cannot be done for one single year for all countries. Instead, the Norwegian power market situation in the late 1980s is described, as are the Swedish and Finnish power markets of the early 1990s. For Denmark, the relevant pre-deregulation situation of the mid-1990s is presented.

The developments in the deregulation and unification processes as well as the outputs and outcomes of the reforms are described for each country are described in the chapters 4.6 to 4.9. This is done in a quasi-chronological way, following the stages of the policy cycle, but as the processes in the four countries are parallel this description cannot be done strictly chronological. In general, the structure of this chapter is Liberalisation process (Policy cycle: agenda setting and formulation) – Output – Outcome. In order to make the text easier to read, this chapter is split into subsections where appropriate. In chapter 4.10, the process of deregulating and unifying the four Nordic markets is summarised.

Chapter 5 discusses the results of the thesis and has a focus on what can be learnt from the Nordic case and what this means for the creation of a similar, pan-European market.

2 Method

This thesis systematically describes the historic events at national and international levels that lead to the liberalisations and the unification of the four electricity markets in Norway, Sweden, Finland and Denmark. Based on this systematic description hypotheses about the success factors of the opening and unification of the Nordic markets are formulated. These hypotheses, again, are used to discuss what can be learned from the Nordic case for the creation of a pan-European electricity market. Therefore, the thesis should be seen as a qualitative case-study of the process of deregulating and unifying the Nordic electricity market [von Prittwitz 1994:199ff].

The work with this thesis, as well as the report itself, has been structured by using the *policy cycle* model. This is one of the most common models for describing the policy process and dates back to the 1950s and the American political scientists Harold Lasswell and Daniel Lerner [Windhoff-Héretier 1987:10ff; Jann, Wegrich 2003:75]. The characterisation of the single stages and the number of stages of the policy cycle differ in the literature, but is more a formal issue than a matter of substance [Jann, Wegrich 2003:77; cp. Jänicke, Kunig, Stitzel 2003:53; Jann, Wegrich 2003:82; 95]. In this thesis, a seven stage model is used, whereof five stages are explicitly considered: *problem perception*, *agenda setting*, *policy formulation*, *policy output* and *policy outcome*. The process of liberalising und unifying the Nordic electricity markets is seen as five parallel and interlinked cycles (four national processes and one Nordic) which are run through only once, up to the outcome stage. After the creation of the Nordic market, no large changes have been done but the original system has been kept more or less intact. Due to the insignificance of these changes, the stages of *evaluation* and *reformulation/termination* are not explicitly considered although, strictly speaking, these small changes are the result of the running-through of these two stages.

The following description of the stages of the policy cycle is based on the policy cycle chapters of Windhoff-Héretier [1987:64-114], Jann, Wegrich [2003:71-99] and Jänicke, Kunig, Stitzel [2003:53-66]. The first stage, *problem perception*, is the initiation of every political process, although the sheer perception of a problem is no guarantee for a problem to be politically addressed. In this thesis, the problem perception is outlined from a political perspective. In the Nordic electricity systems this is quite much the only perspective available since almost all actors were politically controlled. Due to the traditionally state-centred nature of electricity politics and the continuous presence of electricity policy on the political agenda, the second stage, *agenda setting*, is already implied in the problem perception stage and does not have a

chapter of its own. Instead, it is addressed as the beginning of the third stage, *policy formulation*. The policy formulation stage describes the discussions and debates about the political goals and the instruments to reach these. It is in this thesis followed by the *output* stage, which is the result of the discussions and debates: the new legislation and regulations. After the output stage comes the *outcome* stage, the description of what effects and impacts the new power market situation and the implementation of the new legislation have had. This is the final stage of this thesis; the political evaluation processes and minor re-formulations of single regulations are not explicitly considered, since the market regulations have not changed significantly since the creation of the Nordic power market.

3 Material

In order to make the picture of the creation of the Nordic power market as complete as possible an extensive literature research has been done. A prerequisite for this has been that the author, being a Swedish citizen, can read and understand Swedish as well as Norwegian and Danish. During this process, most important and relevant studies, surveys, bills and other documents have been used in original, since they were available in these languages. As far as possible, national documents have been used to draw the general picture of the processes in each country.

The most important sources used for this thesis came from political institutions, mainly the Nordic governments, parliaments, ministries or energy authorities. Other important sources were surveys and studies from the national TSOs or Nordel. All of these institutions have strong connections to the governments, or are indeed the governments, which gives a state-centred perspective. This should be noted, but is not necessarily unfavourable to the thesis. The aim of the thesis is to investigate political deregulation and unification aspects within the Nordic countries and the international cooperation between them, thus making a state-centred perspective necessary anyway.

Most of all, the liberalisation bills have been invaluable sources, since they described not only what the new regulations but also the old and why these were changed. The bills also referred to surveys and other documents relevant to the reform processes. All relevant bills from all four countries were available in Norwegian, Swedish or Danish.

Other important sources have been the surveys, usually conducted by the responsible Ministries, the national TSOs or a Nordic cooperation organisation, of the future power markets. All such surveys from Norway, Sweden and Denmark were available, whereas some of the earliest surveys from Finland were only available in Finnish and could not be evaluated. The missing Finnish surveys were however summarised in the Swedish deregulations surveys. All legislation from all countries immediately concerning the electricity market was available in Norwegian, Swedish or Danish.

Generally, the material about Finland was not as rich as for the other countries, mainly due to language problems. The relevant Finnish legislation was available in Swedish and some studies were written in English which made it possible to create a general overview of the liberalisation in Finland and its accession to NordPool with mainly original Finnish documents. In order to make the picture of the liberalisation and unification processes as complete, docu-

ments from the other three Nordic countries had to be used since no Finnish national source for that information was available. No interviews have been conducted.

Only very little research about the process of creating the Nordic power market has been done. Therefore, only one academic study considering the process of creating the integrated Nordic power market was available as source to this thesis (see above chapter 1.2) [Midttun 1996]. Instead, studies considering other aspects of the Nordic market, such as the effects of the liberalisations of the single markets or the functioning of the unified Nordic market, have been used as sources, since they often implicitly or as a by-product consider matters of importance to the processes of liberalising and unifying the markets. A very important source for such studies has been the journal *Energy Policy*, which is one of the leading journals in the energy policy field. Also the annual reports of the Nordic electricity cooperation organisation Nordel, which summarise the events on the power markets every year and publish a vast amount of key statistics, have been invaluable sources.

For the sake of transparency of the sources used for the thesis, the title and publisher of all non-English entries in the bibliography have been translated. This is, just as the references throughout the text, indicated by the use of square brackets.

4 Results

4.1 *Nordic cooperation*

The Nordic countries have a long common history which today can be seen in deep cooperation between the countries in many different areas and great similarities in the political development. For example, the social politics of the four countries is very similar with extensive redistribution effects and social security systems. Although Sweden is often used as an example for this kind of social market economy, many analysts rather talk about a *Scandinavian model* for this kind of welfare states [Erikson et al 1987:viif]. Also the political systems are very similar, at least in the Norwegian, Swedish and Danish monarchies. Even the party structures in the parliaments are similar, with a dominant Social democratic party with about 30-50% of the mandates, a conservative party with typically about 20%, an agrarian party (traditionally called Centre party) with 10-20%, at least one liberal and leftist party, respectively [Alestalo, Kuhnle 1987:32].

The common historical bonds become clear when looking at the territorial history of the Nordic: Denmark, Sweden and Norway had a currency union until 1914; large parts of southern Sweden used to be Danish; Finland was Swedish until 1809; Norway was a part of Denmark until 1814; after that Norway and Sweden was in a union until 1905. Except for the former Danish areas in Sweden, which were taken by force 1658, no territorial exchanges are the result of wars between the Nordic countries. Also the dissolution of the Swedish-Norwegian union in 1905 was peaceful [Nordic Council 2006].

Further, there is a feeling of mutual understanding and trust among Nordic citizens, although almost no one identifies him- or herself as “Nordic citizen” [Nilsson 2007:10]. In a study by the Swedish national board of psychological defence, 61% of the interviewed Swedes stated that they trust other Nordic citizens, which was a higher number than the trust for working colleagues, the legal system and “normal people” [Österman 2004:20]. These feelings are much supported by the fact that the Nordic languages, except Finnish, are similar and that most Swedes, Danes and Norwegians can speak to each other in their mother tongues. The Finnish are due to their language not included in this fellowship, but on the other hand they have a very strong historical connection to Sweden. Swedish is still an official language in Finland and is the mother tongue of about 6% of the population [Tilastokeskus 2007a].

The Nordic fellowship has led to the emergence of numerous Nordic companies, of which many are partly state-owned such as the Swedish-Danish-Norwegian Scandinavian Airlines

and the Finnish-Swedish telephone operator TeliaSonera² [SAS 2007:11; TeliaSonera 2007:3]. There also have been numerous Nordic mergers with private companies, such as the Finnish-Swedish paper company StoraEnso and the Danish brewery Carlsberg, which merged with and bought all the largest Norwegian and Swedish breweries [Ringnes 2004; Carlsberg 2005; StoraEnso 2006].

The Nordic governments have close contact and cooperate directly in many issues but historically, most of the Nordic political cooperation has been formalised in the *Nordic Council* and the *Nordic Council of Ministers*. These councils have, amongst many other things, often treated questions of electricity trading and exchange between the countries. The technical electricity cooperation, which dates back to the 1960s is handled by *Nordel*. These forums for cooperation are briefly presented below.

4.1.1 The Nordic Council and the Nordic Council of Ministers

Since it was founded in 1952, the Nordic Council has been the central forum for Nordic political cooperation [Nordic Council 2007a:1f]. The Nordic Council is not a supranational institution and is not another governmental layer above the Nordic governments but the cooperation forum of the Nordic parliaments, including Iceland and the autonomous areas Greenland, Åland and the Faroe islands. The scope of the Council is to “*maintain and develop further cooperation between the Nordic countries in the legal, cultural, social and economic fields as well as in those of transport and communications, and environmental protection*” [Nordic council 1962 Art. 1]. The countries of the Nordic council shall work to “*promote, to the greatest extent possible, cooperation between their countries concerning production and investment*” [Nordic council 1962, Art. 19]. Further, “*the regulations governing Nordic cross-border trade shall be so formulated as to cause a minimum of inconvenience*” [Nordic council 1962, Art. 24]. The most prominent examples of the work of the Nordic Council are the exemption from passport requirements when travelling between the Nordic countries which was introduced in 1957 and the free Nordic labour market [Nordic Council 1957:1; 1983:1; Nordic Council of Ministers 2002:3; 9]. In many cases, the Nordic cooperation goes further than most other international cooperation: for example, all Nordic citizens living in another Nordic

² However, there are also a number of examples when the Nordic fellowship has not worked: Before Telia and Sonera merged, Telia and the Norwegian company Telenor wanted to merge. The merger was cancelled after the Swedish Minister of Enterprise, frustrated with the way the Norwegians negotiated, said to a journalist (whose tape recorder he thought was shut off, but it was not) that “Norway is the last Soviet republic. They are so extremely nationalistic...everything is politics” [Aftonbladet 1999].

country have the same access to the social welfare systems as the citizens of that country [Nordic Council of Ministers 2002:11].

Besides the Nordic Council there is also the Nordic Council of Ministers, which is a cooperation body for the Nordic governments, including the governments of the autonomous areas, since 1971 [Nordic council 2007a:1]. The Nordic Council of Ministers is really 20 different councils, treating different areas. Among these are for example energy, environment and consumer rights. All decisions taken by the Council of Ministers must be unanimous, since they are binding for all Nordic states [Nordic Council of Ministers 2002:7; Nordic Council 2004:2].

The Nordic Council of Ministers has taken several decisions about the Nordic power market, including the Louisiana Declaration in which the creation of a pan-Nordic power market was officially decided [Nordic Council of Ministers 1995]. The role of the Nordic Council of Ministers and its impact on the development of the Nordic power market and transmission grid are described and discussed below. After the Swedish and Finnish EU accessions, many, but not all, of these functions are treated by the EU and the EEA which has considerably diminished the importance of the Nordic Council and the Nordic Council of Ministers.

4.1.2 Nordel

The Nordic countries have, as described above, a long history of cooperation in different areas, also in the energy and electricity sectors. The first international power line in the world was built by Sydkraft already in 1915 between Sweden and Zealand [E.ON 2007a:1].

As a consequence of the first HVAC interconnections between Sweden and Norway in the early 1960s, the two power systems needed to be made synchronous. Therefore, Nordel was founded in 1963 as an electricity system cooperation organisation of all five Nordic countries Denmark³, Finland, Iceland, Norway and Sweden [OED 1998:88; Nordel 1986:2]. It has been, and still is, an important forum for the Nordic TSOs and power sector actors.

In the beginning, Nordel's tasks were relatively limited and concerned compiling and publishing of statistics and the grid and production plans of the Nordic countries [Nordel 1986:2; 2006:3]. Each year an annual report was published which described the relevant developments in the Nordic market and the individual countries. In 1993, Nordel's mandate was ex-

³ Denmark-West (Jutland) is also a member of UCTE [RWE 2007b].

panded to include the technical coordination and the creation of a common framework for the entire Nordic power system [Nordel 1993:4]. The unification of the Norwegian and Swedish power markets in 1996 and the accession of Finland to the Norwegian-Swedish power market in 1998 created a need for a closer cooperation between the Nordic TSOs in order to guarantee the equal and impartial treatment of all market actors in all countries. This need became even more urgent when western and eastern Denmark joined the Nordic market in 1999 and 2000, respectively [Nordel 2001:4f; NordPool 2007a]. Until 2000, when Nordel became the primary cooperation body for the Nordic TSOs, it was an association of “*leading individuals in the power supply industry*” in the Nordic countries. However, Nordel has remained an advisory and recommendatory organisation leaving the system responsibility and the actual decision making to the national TSOs [Nordel 1986:30; 1993:4; 2000b; 2001:3].

The Nordic interconnection capacity is traditionally through the Nordel cooperation rather high: in the late 1980s, the total capacity was slightly more than 4000 MW, which corresponds to about 8% of the 1989 maximum Nordic load of 49000 MW [Nordel 1990:83]. During the 1990s, the interconnections were reinforced, especially the Swedish-Norwegian and Swedish-Danish interconnections, and the interconnection capacity more than doubled to about 10000 MW in 2001, see Figure 4-1, which corresponds to about 16% of the 2001 maximum load of 64000 MW [Nordel 2002a:4]. Obviously, the importance of the interconnections grew considerably during this time period as the power markets became more integrated. About half of the total Nordic interconnection capacity is between Norway and Sweden, which is not very remarkable considering the long Norwegian-Swedish border and the fact that Finland only has land borders to Sweden and Norway in the sparsely populated Lapland and Finnmark and Denmark does not have any land border with any of its Nordic neighbours. About one fourth of the interconnection capacity is between Sweden and Denmark, mainly Zealand [Nordel 1986-2006 Statistics chapter].

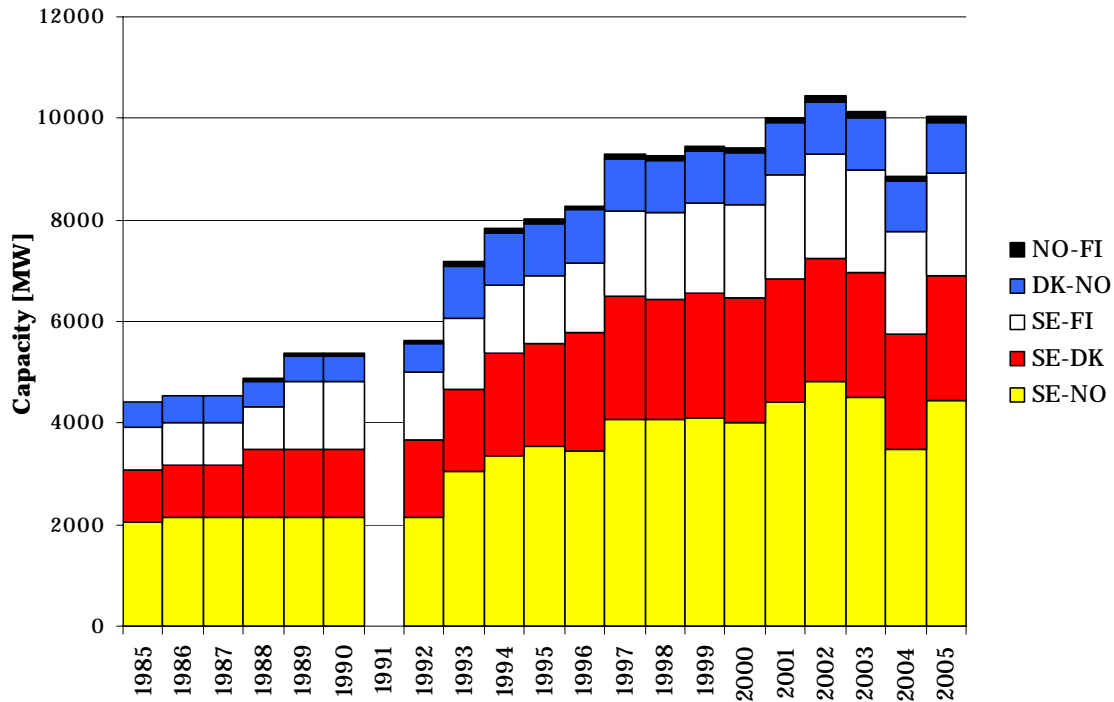


Figure 4-1: The mean Nordic interconnection capacity 1985-2005.

Data for 1991 is missing. The values are the mean values of the import and export capacities to/from each country and therefore differ slightly from the stated values for transmission in one direction in the Nordel statistics [Nordel 1986-2006 Statistics chapter].

4.2 Norway

4.2.1 Power market characteristics

More than 99% of the Norwegian power in the late 1980s was produced in hydro power plants which throughout the 20th century have provided Norway with cheap electricity [SSB 2007a; b]. The Norwegian electricity prices to households were between 1,9 and 2,5 €/kWh (15-20 øre/kWh), taxes and grid fees excluded [SSB 2007b]. Most of the Norwegian hydro power was produced in the south, relatively close to the load centres which reduced the need for long-distance transmissions. Therefore, Norway had relatively weak connections between different parts of the country, which however usually were sufficient. The dominant electricity transportation pattern was from the south-western and central parts toward the Oslo region and Sweden. Northern Norway was not at all connected to the Norwegian high-voltage grid until 1993 [Nordel 1991:89; 1993:26; SVK 1993:64; Bråten 1997:220f].

The Norwegian electricity consumption was, measured per citizen, the highest in the world, partly due to electric heating of houses [NVE 1998:8; Bergman 2001:2]. At the end of the 1980s, the Norwegian power consumption was about 100 TWh/a, which is equivalent to about 25000 kWh/person and year. During the 1990s, the consumption grew slowly to about 110 TWh/a around the turn of the millennium, a level that has been constant until today [SSB 2007a]. More than half of the Norwegian energy consumption was electricity [OED 1998:81]. Thus, the electricity policy has always been very important, also in the eyes of the public [Diesen 2003:1ff]. The Minister for Energy, and later Prime Minister, Jens Stoltenberg once stated that “*Electricity is for a Norwegian what gasoline is for an American*” [Stoltenberg 1996:5].

The large amount of hydro power in the power system had, however, made Norway highly dependent on the stochastic nature of the hydrological conditions [SVK 1993:64]. Due to this supply induced vulnerability, and other reasons (see below), Norway had built up a considerable production over-capacity, which made Norway a net exporter of electricity in all but 2 years between 1950 and 1990, albeit to very different extents: the net exports range from just a few GWh in some years to 15 TWh in 1989 [SSB 2007c]. Due to the very large share of hydro power, the electricity production did not have any significant impact on the Norwegian greenhouse gas emissions [SSB 2007e].

4.2.2 Main actors

4.2.2.1 Market actors

In 1990, the state authority and electricity producer *Statkraft* produced about 30% of the Norwegian power. The by far largest part, more than 60%, of the power generation capacity was owned by about 70 small companies which were operated or owned by the municipalities. Many of these public utilities were vertically integrated and also operated the distribution grid in the municipality in question [Bonde 2002:177]. Only about 10% of the production capacity was in private ownership and mainly used for customer generation [Bråten 1997:221; Bye, Hope 2005:4; 25; Gronheit, Skytte, Wolffsen 1998:43f; Bonde 2002:178]. Today, Statkraft is the third largest generator on the Nordic market with about 10% of the total Nordic electricity production [Energimarknadsinspektionen 2007].

Before the liberalisation Statkraft was the TSO and owned the largest part (~80%) of the national grid as well as the interconnections to Sweden, Denmark and Russia. The remaining

20% were leased by Statkraft but owned by about 40 different companies [Rutledal et al 2000:11]. The access to the main grid had to be negotiated with Statkraft in an N-TPA system. Since Statkraft also was the by far largest generator, it totally dominated the Norwegian power market. The lower voltage grid levels were owned by 230 different small companies owned by the municipalities [Midttun, Summerton 1998:146; Bye, Hope 2005:4]. Since its construction in 1994, Statkraft is the majority owner in the Swedish-German HVDC Baltic cable interconnection [Baltic cable 2007].

Another relevant actor on the Norwegian pre-liberalisation market is *Samkjøringen*, a spot-based power exchange for temporary power. The exchange was open only to producers with a production exceeding 100 GWh/a and was the main optimisation instrument on the Norwegian power market between 1972 and 1993 [SVK 1993:32; Bye, Hope 2005:2; NordPool 2007a].

4.2.2.2 Political actors

Between 1986 and 1989, Norway had a Social democratic government. This government lost the elections in 1989 to a conservative coalition of *Høyre* (Conservative party), *Kristelig Folkeparti* (Christian democrats), and *Senterpartiet* (Centre party). This government fell in 1990, due to internal disagreement about the EC membership and the Social democratic government was re-elected. The Social democrats remained in the government until 1997 when a coalition of the Christian democrats, the Centre party and *Venstre* (Liberal) [SSB 2000; Regjeringen 2007].

In general, the Norwegian parties followed the normal European left-to-right scale, with a clear left-right distinction in the parliament. In the energy market liberalisation question, however, this left-right distinction was not so obvious, as the Centre party, which was represented in the liberalisation-positive conservative government, was rather liberalisation sceptical (see below in chapter 4.6.1) [Diesen 2003:2ff].

4.2.3 Problem perception

In the 1980s, inefficiency in different areas was considered the major problem of the electricity sector by more or less all actors [Bye, Hope 2005:4; see also OED 1985]. The Norwegian Ministry of Petroleum and Energy (OED, Olje- og energidepartementet) stated that the first

reason for this was the large number of small actors on the market, a total of 410 units in 1989 [OED 1990a:3]. This in its turn could lead to two other problems: First, small companies would have larger problems in attracting qualified workers than larger companies which, especially when the problem occurs in the distribution sector, could jeopardise the security of electricity supply. Secondly, small companies do not have the advantage of economies of scale, which could make the electricity more expensive compared to a market with fewer large actors [OED 1985:1].

A second main problem in the electricity sector was the inefficiencies in production and the market [OED 1985:1ff; Bye, Hope 2005:6f]. Toward the end of the 1980s a considerable production over-capacity had been built up, leading to an increasing inefficiency of the fragmented power system. The Norwegian power pricing was in practice regulated by the government to guarantee cost reimbursement for new hydro power plants, a system the NVE director Diesen called “*power socialism*” [Diesen 2003:1; Bye, Hope 2005:5]. Once each year, the parliament decided the Statkraft electricity price, which functioned as a price signal to the other companies. The municipalities, which owned almost all the rest production capacity, adjusted their prices to the Statkraft price, allowing the government to effectively influence the electricity price for most customers [Bye, Hope 2005:4f]. In this way, prices were artificially pushed up to stimulate the construction of more capacity, even though the capacity was sufficient for a normal year. By creating an over-capacity, Norway could be self-providing with electricity also in dry years. The artificially high prices dramatically reduced economic risk and led to the construction of costly new hydro power plants and rising power prices [NUTEK 1995:31; Rothwell, Gómez 2003:168; Bye, Hope 2005:6f]. Construction of new hydro power plants was not only an energy political matter, but also a matter of employment and regional policies. Therefore, the cheapest alternatives were not always chosen, adding further to the inefficiency of the system [SVK 1993:32].

It had also led to a situation where over 5% of the water had to be spilt from the dams without producing any electricity in order to maintain the price level for the electricity that was exported to Sweden and Denmark [Stoltenberg 1996:4; Hope 2002:3]. Despite the spilling, the exported electricity was sold at clearly lower prices than the electricity that was sold within Norway [OED 1990b:359; SSB 2007d; Hope 2002:3].

4.3 Sweden

4.3.1 Power market characteristics

Sweden has a tradition of cheap and abundant electricity. In 1990, the electricity price for households was 3,5 €/kWh and for industry customers 2,6 €/kWh, including grid fees but taxes excluded (32 öre/kWh and 24 öre/kWh, respectively) [Energimyndigheten 2006a:31]. The Swedish electricity consumption was high: in 1990, it was 140 TWh or some 17000 kWh per citizen [Energimyndigheten 2006a:17]. The electricity consumption had increased dramatically during the nuclear power expansion years 1972-1985, from 72 TWh/a to 131 TWh/a. Two thirds of this increase took place in the households, and was used mainly for electric heating. During the 1990s, the Swedish energy consumption increased only slightly from 140 TWh in 1990 to 147 TWh in 2005 [Energimyndigheten 2006a:17; 12, 31].

In the early 1990s, the Swedish electricity was mainly produced in hydro and nuclear power plants (50% and 45% of total production, respectively). About 85% of the hydro power was produced in the northern parts of Sweden which created a need for massive long-distance transmission capacities to the load centres in the central and southern parts of the country. The transmission capacity from the north to mid-Sweden in 1993 was 7000 MW, whereas the capacity from mid- to southern Sweden, where most nuclear reactors are located, was only 2700 MW [SVK 1993:15]. Due to the power production structure, changes in electricity consumption have very little impact on the Swedish CO₂ emissions which were constant during the 1990s [EEA 2006:106].

Due to its large share of hydro power, about 50% in a normal year, Sweden is highly dependent on the hydrological conditions, which may vary dramatically from year to year. For example, the hydro power production in 1993 was 74 TWh, whereas it in 1994 was only 58 TWh [Energimyndigheten 2006a:17]. Much of these fluctuations can be compensated by changing the production in the nuclear power plants, making Sweden slightly less dependent on the rainfall than Norway. Nonetheless, Sweden had to rely on power imports from its neighbour countries during some few, extremely dry years, even though it normally was a net power exporter [SVK 1993:64]. The net export/import was rather low until 1996, the year of the unification with the Norwegian market, normally between ± 3 TWh/a which corresponds to only a few percent of the total usage [Energimyndigheten 2006a:17].

A characteristic feature of the Swedish electricity policy is the uncertainty about the future of nuclear power. During the nuclear expansion period, the nuclear issue even led to the fall of

the conservative government in 1978 [Riksdagen 2006]. In 1980, a referendum about the future of nuclear power in Sweden was held but due to the unclear result⁴ of this referendum, the uncertainty about the phasing-out of nuclear power has been a restraint for Swedish energy policy and still is an infected controversy in Sweden [Regeringen 2005; 2007b; Prop. 1994/95:222:23; Prop. 2001/02:143:16]. The nuclear issue is a covert element of the Swedish energy policy that is often not mentioned but often plays a major role for the decisions made [see Midttun 1996:62f]. For example, the nuclear phase-out and the uncertainties associated with it is not mentioned in any bill during the entire liberalisation process until 1995, when the government stated that the formalities and the time of the phase-out must be further investigated and instated a commission to investigate the matter [Prop. 1991/92:133; Prop. 1993/94:162; Prop. 1994/95:222:23]. The commission concluded that the market could be liberalised without diminishing the possibilities to phase out the nuclear power, and that “*no date for the decommissioning of the last reactor should be fixed*” [Nordel 1996a:27]. Until today, two reactors have been closed [Barsebäck 2005]. The public opinion about nuclear power has changed dramatically since the referendum and with increasing distance to the Chernobyl accident: in 1986, 72% of the Swedes wanted to abolish nuclear power, whereas only 12% wanted to keep it; in 2005 only 33% wanted to abolish and 50% wanted to keep it. This is the second strongest support for nuclear power in the EU25 [Holmberg 2006:2ff].

4.3.2 Main actors

4.3.2.1 Market actors

The Swedish pre-liberalisation electricity production sector was highly concentrated: the ten largest companies controlled more than 95% of the total production [Lindblom, Andersson 1998:2]. The state authority *Statens Vattenfallsverk* owned about 50% of the production capacity and also controlled the main grid [Näringsdepartementet 2005:160]. Most of the rest capacity, about 45%, was owned by ten other companies, most prominently the privately owned *Sydkraft*⁵ (about 25% market share). Other important actors were the municipally

⁴ In the referendum there were three alternatives, which all basically meant the phasing-out of nuclear power, but at different paces. The two most cautious alternatives together got a majority of the votes, and a phasing-out in a “reasonable tempo” was decided. The interpretation was that all reactors should be closed until 2010, but this goal was abandoned in 1997 and was not replaced by a new quantified goal. Until 2007, only 2 of the 12 reactors have been closed and no more will be closed before 2010 [Regeringen 2007b].

⁵ Sydkraft was bought in 2001 by the German company E.ON and is today called E.ON Sverige [E.ON 2007b:3].

owned *Gräninge* (bought 2004 by Sydkraft), *Gullspång* and *Stockholm energi*⁶ [Bonde 2002:184; KKV 2006:15, E.ON 2007b:3]. The remaining 5% were produced by small companies in private or municipal ownership. Today, Vattenfall is the largest generator on the Nordic market with about 18% of the total Nordic electricity production [Energimarknadsinspektionen 2007].

In 1988, Statens vattenfallsverk was made an independent, state-owned company by an almost unanimous parliament *Riksdagen*. The new company *Vattenfall* was kept vertically integrated until 1992, when it was split into two separate, state-owned companies: the generator *Vattenfall* and the transmission grid operator and owner *Svenska kraftnät* [Nordel 1992:28]. Svenska kraftnät also was made owner of the Nordic interconnections previously owned by Vattenfall [SFS 1988:851; 1991:2013; Vattenfall 2007a]. Svenska kraftnät also is the majority owner of the SwePol HVDC link to Poland, which was constructed in 1998 [SwePol 2005]. The HVDC interconnection between Sweden and Germany, Baltic cable, which was commissioned in 1994, is owned by Statkraft (2/3 of the shares) and Sydkraft (1/3 of the shares) [Baltic cable 2007]. Before the liberalisation, access to the main grid was regulated by the Main Grid Treaty (“*stamnätsavtalet*”) between the ten largest actors and Vattenfall in an N-TPA manner. Other actors were effectively shut out from the main grid. The cost of transmitting electricity was subject to negotiations between the actor and Vattenfall and was primarily dependent on the geographical locations of the in- and output points [SVK 1993:25]. Any actor affected by the Main Grid Treaty who wished to transport electricity through the main grid had to apply to Vattenfall 5 years in advance, giving Vattenfall the time to construct new power lines if necessary [SVK 1996:5].

There were about 280 distribution companies active on the Swedish electricity market in 1993, of which 160 were owned by municipalities. The municipal distributors delivered electricity to about 2/3 of all electricity customers, making the municipalities a major player in the reform process. The municipally owned companies were not allowed to make profit and had to make all their cost calculations public [SVK 1993:23].

⁶ Stockholm energi was owned by the city of Stockholm and the Finnish national champion IVO/Fortum (50% each) and merged with Gullspång in 1998 and changed name to Birka. In 2002, Fortum became 100% owner of Birka, see also chapter 4.4.2 [Nordic competition authorities 2003:23; Fortum 2007a].

4.3.2.2 Political actors

Until 1991, Sweden had a Social democratic government. In the elections 1991, the Social democrats lost power to a conservative four-party coalition with the parties *Moderaterna* (Conservative party), *Folkpartiet* (Liberal party), *Centerpartiet* (Centre party) and *Kristdemokraterna* (Christian democrats) [Regeringen 2007a]. This new, market liberal government had liberalisations and privatisations of the state-owned companies high on the agenda which resulted in the opening of many former monopoly markets as well as the privatisation of many companies [e.g. Midttun 1996:54; Näringsdepartementet 2005:150]. In 1994, the Social democrats won the elections and stayed in government position until 2006, with parliamentary support of *Vänsterpartiet* (Left party) and *Miljöpartiet* (the Greens), which however were not represented in the strictly Social democratic government [Regeringen 2007a].

Sweden has a tradition of rather weak governments and a parliament split into a left (Social democrats, Left party) and a right block (the Conservative, Christian democratic, Liberal and Centre parties). Between 1978 and 2006, all governments were minority governments, also the coalitions [Regeringen 2007a; SCB 2007a]. The governments therefore have had to seek support from other, non-government parties in the parliament.

The left-right distinction, which is clear in most questions, is broken in the nuclear issue; the conservative coalition of 1978 even broke due to the plans to commission more nuclear power plants [Regeringen 2007b]. The nuclear-critical Centre party in 1997 made an across-the-blocks energy deal with the Social democrats and the Left party to close the two reactors in Barsebäck and increase the amount of renewable energy in the energy system [Prop. 1996/97:84]. In general, and at least partly due to the weak governments, the power market deregulation reforms were characterised by broad consensus in the parliament, as all large parties agreed that more competition was needed in the power sector [Prop. 1994/95:84:4f].

4.3.3 Problem perception

The Swedish pre-liberalisation power market was not directly controlled by the state but was regulated by “clubs”, voluntary and to a large extent self-assumed associations between the major power producers. The government hardly intervened on the power market directly, but indirectly through Statens Vattenfallsverk which always acted as chairman in these clubs. [Näringsdepartementet 2005:157; Hjalmarsson 1993:1ff]. The major companies set the requirements for admission to the clubs so high that smaller companies were effectively shut

out of the decision making. This was a major conflict between large and small companies and was an increasingly pressing issue toward the end of the 1980s [Näringsdepartementet 2005:157ff].

Access to the main grid was practically determined in the Main Grid Treaty, which was the result of negotiations in the *Transmission Grid Club*, to which only the largest producers were admitted. Small producers were excluded from the main grid, which denied them access to the national market [Näringsdepartementet 2005:157ff].

The electricity pricing was also determined in such a club. Indirectly, however, the state's yield requirements for Vattenfall practically decided the electricity price [Näringsdepartementet 2005:158; Hjalmarsson 1993:5ff]. The electricity price, which was determined not through supply and demand but through the profit demand of the company owners (in most cases either the government or the municipalities), was the most important political issue before the deregulation [Prop. 1993/94:162:27]. Different studies have shown that the pricing on the high voltage market, to the large customers, was indeed higher than the marginal costs for generation and transmission but considerably lower than they would have been if the companies had made full use of the monopoly positions [Hjalmarsson 1993:7]. The pricing for small customers in the low voltage market, however, was not as efficient, since many companies, having monopoly in their concession area, cross-subsidized less profitable activities, such as district heating, by raising the electricity prices [Näringsdepartementet 2005:159]. During the economic crisis in the beginning of the 1990s, a major goal for the Swedish government was to decrease end-customer prices [see Midttun 1996; Kaijser, Högselius 2007].

During the 1960s, the Swedish electricity demand had increased dramatically, leading to shortages and even power rationing. This led to an overestimation in the demand projections and a too much new capacity was built. Over the 1970s and 1980s, a considerable over-capacity had been built up in Sweden by a forced nuclear power expansion [Midttun, Summerton 1998:146]. This over-capacity problem was somewhat reduced by a parallel forced expansion of electric heating of dwellings. Further, the existing Nordic interconnections were not considered, so that the reserve capacity was determined strictly from a national perspective, which increased the need for excess production capacity to secure the supply in dry years. One main goal of the Swedish energy policy of the early 1990s was to increase the efficiency of the market and to decrease the price by diminishing the production over-capacity [Näringsdepartementet 2005:160].

Also, the new competition legislation that entered into force in July 1993 was expected to make the price and main grid cartels illegal, which increased the pressure to reform the power sector. However, the dominant positions of Vattenfall and Sydkraft had to be considered, since these two companies together totally dominated the power market, a market power that would threaten the functioning of a deregulated, competitive market [SVK 1993:21].

4.4 Finland

4.4.1 Power market characteristics

The Finnish power system was quite different from the Swedish and Norwegian. The Finnish pre-liberalisation electricity system was based on fossil and nuclear power: About 50% of the Finnish electricity came from nuclear power; approximately 15% were produced in coal-fired plants and 10% in gas-, oil- or peat-fired power plants; and about 10% in hydro power stations. The shares of the different generation technologies have remained fairly constant since 1990, with a slight increase of the use of coal and gas [KTM 2003:23; 2005:2]. Finland was dependent on electricity imports, mainly from Russia. The amounts of electricity imported from Russia were steadily increasing from about 4,5 TWh in 1990 to 11,3 TWh in 2005. The direction of the quite low electricity trade with Sweden and Norway before the market unification was mainly dependent on the hydrological conditions: When Sweden and Norway experienced dry years Finland exported some electricity to its Nordic neighbours, whereas it in wet years was a net importer [Nordel 1986-2006, Statistics chapter].

The Finnish per-capita consumption in the early 1990s was roughly the same as the Swedish, about 17000 kWh/a, but unlike its neighbour countries, the electricity consumption in Finland was increasing rapidly and had been doing so for decades. The consumption increased from about 50 TWh/a in 1985 to 87 TWh/a in 2004. The increase was due to massive consumption increases in the household and industry sectors [KTM 2003:23; Energiategollisuus 2007a]. Due to the high electricity consumption and the dependency on fossil fuels for power production, the Finnish per-capita CO₂ emissions were almost twice as high as the Swedish. During the 1990s, the total Finnish greenhouse gas emissions were approximately constant [EEA 2006:106].

As in Norway and Sweden, many Finnish homes were heated with electricity, but in contrast to these countries the number of electricity heated dwellings in Finland was increasing. In 1990, 481 000 households had electric heating, compared to 632 000 in 2004 [Energiategol-

lisuus 2007b]. This makes the citizens aware and sensitive to changes in price and, just like in Norway and Sweden, makes electricity policy a matter of large public interest. Electricity in Finland was rather cheap compared to other European countries, but high compared to Sweden or Norway. The electricity price in Finland for households⁷ in 1992, excluding taxes and grid fees, was about 6,7 €/kWh, whereas it for a medium-sized industry⁸ was 4 €/kWh [Energiamarkkinavirasto 2004:3f].

Just as in Sweden, the Finnish policy about nuclear power is somewhat confusing and an important characteristic of the power system. Although the parliament in 1992 made a non-binding statement that “*nuclear power is not included in Finland’s energy strategy*” [Nordel 1993:16], the government in February 1993 agreed in principle to the construction of a new, fifth nuclear reactor [Nordel 1994:16]. The construction of this reactor started in 2005; making Finland one of the few Western countries that today are constructing new reactors [KTM 2005:8f; 2007; TVO 2007c].

4.4.2 Main actors

4.4.2.1 Market actors

The Finnish pre-deregulation power market was dominated by two large players: *IVO*⁹ (Imatran Voima) and *PVO* (Pohjalan Voima). The third large power company, *TVO* (Teollisuuden Voima), was owned by PVO (majority owner) as well as some other energy other companies and industries. About 40% of the Finnish production capacity was owned by different industries (20%) as well as municipalities (20%) [Nordel 1994:33; PVO 1999:9; Sener 2000:10; Lemström 2001:4; TVO 2007a].

IVO was the by far largest company on the Finnish power market, with a share of total production of about 40% [Lemström 2001:4; Nordic competition authorities 2003:30]. Before the liberalisation, *IVO* was only active on the wholesale market [SVK 1993:59]. The Finnish state was and still is majority shareholder of *IVO/Fortum*, even though the state has sold much of its shares [SVK 1993:60; Fortum 1999:6; 2007b:35]. *IVO/Fortum* has been expanding aggressively before as well as after the liberalisation and the unification, especially on the

⁷ Household without electric heating and a consumption of 2000 kWh/a.

⁸ Industry with consumption of 10 GWh/a.

⁹ *IVO* changed name to *Fortum* after the merger with the state-owned gas and oil company *Neste* in 1998 [Fortum 2007a].

Swedish market (see chapter 4.3.2). Today, Fortum is the second largest generator on the Nordic market, controlling about 13% of the combined Nordic production [Energimarknadsinspektionen 2007].

PVO was traditionally an industry-owned company which provided energy for its shareholders. The largest stockholders in PVO were the paper and forest companies UPM-Kymmene and StoraEnso [PVO 1999:4; 2006:4]. PVO owned about 20% of the Finnish electricity production [Lemström 2001:4; Nordic competition authorities 2003:30]. PVO also owned the majority of the shares in TVO, which amongst other owned the Olkilouto nuclear power plant and the grid company TVS [TVO 2007a; b].

Before the liberalisation, there were two high-voltage grid owners and operators in Finland, operating partially parallel and competing grids: the public IVO Transmission Services, which was diverted from IVO into a separate company in 1992, and the private TVS which was controlled by TVO. In 1991, the IVO grid was about 10400 km, whereas the TVS grid was about 5000 km [SVK 1993:58]. The objective of the TVS grid operations was to minimise the costs of transmission for the owners was not open to third parties but was used by the electricity intensive industry to avoid the IVO grid. Access to the IVO grid was difficult and subject to negotiations between the producer and IVO in an N-TPA system. The tariffs were distance-dependent and theoretically unlimited. In practice, however, the IVO grid tariffs were naturally kept low, due to the fear of losing customers to the competing TVS grid [Pineau, Hämäläinen 2000:184f].

4.4.2.2 Political actors

In Finland, the executive is split between the government and the president. The president determined the Finnish foreign policy, appointed the Ministers, had to approve all laws and could call a new election without any restrictions [Nousiainen 2000:4]. These powers were removed or weakened in the new constitution of 2000, but the president is still in charge of the foreign policy. In practice, foreign policy has since 1982 been done in cooperation between parliament and president [Nousiainen 2000:7ff; 17ff, see also President.fi 2007]. Between 1982 and today, Finland has had three Social democratic presidents [President.fi 2007]. The presidents have not played any significant role in the liberalisation and unification processes, although they concerned foreign policy.

Finnish politics is not as divided into blocks as the Swedish, but has had many different party constellations in the governments during the last years [Statsrådet 2005]. All governments since 1977 have been majority governments [Valtioneuvosto 2007]. Between 1987 and 1991, the Finnish government was a coalition between the Social democrats and the three conservative parties *Kansallinen Kokoomus* (National coalition party, KOK), *Ruotsalainen kansanpuolue* (the Swedish People's party, RKP) and *Suomen Maaseudun Puolue* (The Finnish countryside party). In 1991, the sitting government lost the election to a conservative coalition of the *Suomen Keskusta* (Centre party), KOK, RKP and the *Kristillisdemokraatit* (Christian Democrats). This conservative government lost the next elections in 1996 to a coalition of the Social democrats, the Greens and the conservative KOK and RKP, which stayed in the government until 2003 [Valtioneuvosto 2007].

4.4.3 Problem perception

In general most actors were satisfied with the functioning of the Finnish electricity market. The government in 1994 stated that “*the Finnish electricity market already functions efficiently*” [RP 138/1994b:1]. The Finnish power market of the early 1990s was one of the least regulated power markets in Europe [Gronheit, Skytte, Wolffsen 1998:53]. For example, anyone who wished so could build a power line, as long as the voltage did not exceed 110 kV or the constructor was the concession holder for that particular area. Except for nuclear and hydro power plants, anyone could construct a power plant with a capacity up to 250 MW without applying for a construction permit [Pineau, Hämäläinen 2000:184f; IEA 2003:9].

In other areas, the Finnish electricity market was heavily regulated and state-controlled in an almost socialistic manner. Every third year, each of the 20 power cooperation areas (“*samarbetsområden*”) had to issue a power supply plan. In this plan, the regional consumption and production for the coming five years had to be estimated. The plan had to be approved by the Ministry of Trade and Industry which could demand that the plans were to be changed. However, it never made use of this option but approved all submitted plans [RP 138/1994a:4]. Further, the government had to give concession to any company that wished to import or export electricity. However, concessions were given to all utilities and companies that applied for it [RP 138/1994a:5].

The general political wish was to abandon the regulations on foreign trade and the five-year-plans, since they were never used and therefore obviously unnecessary, and enable free trade and competition where this was possible [RP 138/1994a:11; 138/1994b:1]. The new competi-

tion legislation, which entered into force in 1992, forced the Finnish electricity sector to change since some parts of the optimisation cooperation were incompatible with it [SVK 1993:59].

4.5 Denmark

4.5.1 Power market characteristics

The Danish electricity production in 1994 was dominated by coal power (82%), gas power (7%) and oil power (6%). This had changed dramatically to the liberalisation in 2000. Although the production still was based on coal (46%), a shift toward gas (24%), oil and wind power (both 12%, respectively) had occurred [ENS 2006:9]. Just before the liberalisation, about half of the Danish electricity was produced in CHP (combined heat and power) plants [Folketinget 1999b:2]. Wind power has been massively supported since 1985, since it is the only renewable, domestic energy resource in Denmark [Energiministeriet 1985]. Its share of the total Danish electricity production has risen from 0% in 1985 to about 3% in 1995 and to 12% in 2000 [ENS 2006:7ff]. Due to the high usage of fossil fuels and the renunciation of nuclear power, the Danish per-capita CO₂ emissions are considerably higher than the emissions in Norway and Sweden and at approximately the same level as the Finnish emissions. The Danish emissions were increasing slowly during the 1990s [EEA 2006:106; Folketinget 1985; European Commission 2005a:4f].

Due to the production structure, the Danish electricity prices were, for a Nordic country, rather high. In 1997, the electricity price in Denmark, taxes and grid fees excluded, was 6,4 €/kWh (0,48 DKK/kWh) [ENS 2006:38]. Before the deregulation, the main pricing principle was cost recovery, in order to protect the customers against monopolist abuse of market power [Larsen et al 2004:25]. The Danish electricity consumption was much lower than in the other Nordic countries, partly due to the absence of electric heating of dwellings. In 1990, the electricity consumption was 29 TWh (about 5400 kWh per capita), which had risen continuously to 33 TWh (6700 kWh per capita) in 2000 [ENS 2006:8].

The Danish electricity production was highly dependent on the hydrological conditions in Sweden and Norway. After a phase of massive interconnection expansions before the liberalisation, Denmark had in 2000 had a total interconnection capacity of about 4000 MW (to be compared with the average Danish electricity consumption of 4000 MW) [Helby 2005:2; Larsen et al 2004:21]. Denmark had a net import of electricity in the wet years 1989 and 1990 of

about 9 and 7 TWh, respectively (or approximately 25-30% of the total domestic consumption), whereas it in the dry year 1996 exported 15 TWh [ENS 2006:8]. The difference between the highest registered export and the highest import is approximately 24 TWh, or over 80% of the consumption in 1990. This also has implications for the Danish climate policy, since the dirtiest power plants are the plants on the margin, thus dramatically increasing the Danish CO₂ emissions during export years. An example of this are the emissions in the dry year 1996, when Danish CO₂ emissions increased with 23% compared to 1995 [OED 1998:154; EEA 2006:106]. In 1990, the CO₂ emissions of the Danish power sector were about 50% of the aggregated CO₂ emissions of the Nordic power system [Amundsen, Nesse, Tjøtta 1999:419].

Denmark was, and still is, organised in two electricity grid areas: one east and one west of the Great Belt. The eastern part, Zealand, was a part of the Nordel frequency area, whereas the western part, Jutland, was connected to the continental European UCTE frequency area [Gronheit, Skytte, Wolffsen 1998:82f; Larsen et al 2004:10; RWE 2007b]. Even though the Danish parliament in 1992 decided that a HVDC connection over the Great Belt should be built, it was never constructed since the two TSOs considered it as not economical - it was cheaper to trade electricity with Norway, Sweden or Germany instead of constructing an intra-Danish interconnection. In 2005, due to the wind power expansion in Jutland and the shutting-down of two nuclear reactors in southern Sweden, the united Danish national TSO Energinet.dk started constructing the Great Belt electricity connection [Nordel 1993:14; MEM 1996:33; Energinet.dk 2005; 2007].

4.5.2 Actors

4.5.2.1 Market actors

The Danish power markets before the liberalisation were highly concentrated. The municipalities owned the distribution grid companies which in their turn owned the production companies. The production companies, again, owned the two power cooperations, *Elsam* on Jutland and *Elkraft* on Zealand. This core principle of the Danish power system was called “*forbrugereje*” (“consumer ownership”). Together, these two organisations controlled 90% of the Danish power production as well as the main grids. Only 10% of the total production capacity was not affected by this constellation but were largely independent. Most of this capacity was

owned by municipalities [OED 1998:157; Folketinget 1999b:3; Larsen et al 2004:10f; Olsen 2006:10].

In 1997, before the Danish liberalisation, Elsam was split into two companies: the generator Elsam and the grid operator Eltra. A year later, a grid operator subunit to Elkraft was created, but Elkraft was not split into two different companies [Nordel 1998:13; Folketinget 1999b:4]. The interconnections were owned by Eltra and Elkraft, respectively, together with a producer or the TSO in the foreign country. The HVDC connections to Sweden were owned by Elkraft and Svenska kraftnät, the Skagerrak interconnections by Elsam and Statkraft and the interconnections to Germany by E.ON and Elsam or Elkraft, respectively [Olsen 2006:9].

4.5.2.2 Political actors

Denmark has during the 1990s had two governments. From 1990 to 1993 a conservative-liberal government with the parties *Venstre* (Liberal party) and *Konservative Folkeparti* (Conservative party) was in power, but it fell in 1993 due to an immigration politics scandal. From 1993 to 2001 a coalition of the *Social democrats* and *Det radikale venstre* (Social-liberal party). Until 1994, also *Kristelig Folkeparti* (Christian Democrats) and *Centrum-Demokraterne* (Centre party), were part of the coalition. The Centre party stayed in the government until 1998. Since 2001, Denmark has had a conservative-liberal government with *Venstre* and *Konservative Folkeparti* [Statsministeriet 2005; Folketinget 2006:2f].

4.5.3 Problem perception

The wish to liberalise the Danish market did not arise due to internal, Danish problems with the functioning of the market, but rather as a result of pressure from outside. For example, the politically regulated energy prices which were controlled by the Danish Competition Authority according to the Energy Price Laws (“*energiprislove*”) were seen as something positive, since they protected the customers from too high prices and at the same time enabled construction of new power plants [KS 1998:3].

The EU process toward an internal electricity market which started in 1988 and resulted in the Directive on an internal electricity market in 1996 however forced Denmark to start opening its power market [European Commission 1988; Directive 96/92/EC]. The successful liberalisations and the unification of the three other Nordic power markets in 1996-1998 had led to an expectation in the power market of a Danish deregulation [Skytte, Wolffsen 1997:49].

With these developments in the background the Danish Competition Authority stated that “*the political choice is not about whether the energy supply should be liberalised. However, a decision about the speed of the liberalisation must be taken*”¹⁰ [KS 1998:10].

The traditional Nordel cooperation and the experiences from Norway, Sweden and Finland also led to an expectation among power market actors that Denmark would liberalise the power market and unify it with the NordPool area [Larsen et al 2004:15]. Toward the end of the 1990s, many Danish actors on their own initiative prepared to join the Nordic market, which also increased the pressure on the government to take measures to join the Danish power market with the Nordic [KS 1998:9f].

4.6 The Norwegian liberalisation

4.6.1 Policy formulation and the Norwegian liberalisation process

4.6.1.1 Pre-liberalisation development

In the beginning of the 1980s, the inefficiency problems of the power market were accepted by all actors and became an issue of general debate. An Energy Act Commission, “*Energilovutvalget*”, was founded by the Ministry of Petroleum and Energy to investigate how to solve the problems with the small companies and the production over-capacity. In its report in 1985 the commission recommended that the number of public actors on the electricity markets was to be reduced to 20 by stimulating or, if that was a too slow way, force companies to vertically integrate the power generation and distribution into one company [OED 1985; Bergman et al 1999:125; Diesen 2003:2]. In this way, the price differences between different parts of the country should be aligned. The possibility to join all municipal energy companies into one national unit, “*Norgesdriften*”, was investigated but rejected as too complicated [OED 1985:1; Midttun 1996:60].

The plan economic ideas of the report encountered severe resistance from the municipalities and the power industry which did not at all want to be merged [Diesen 2003:2]. In 1986, the Social democratic government prepared a bill for a new energy law based on the recommendations of the Energy Act Commission. The government presented a draft bill but, as a result of “policy reorientation”, immediately revoked it before it was considered by the parliament

¹⁰ “Det politiske valg handler defor ikke om, hvorvidt energiforsyningen skal konkurrenceudsættes. Der skal derimod træffes beslutning om liberaliseringstempoet”.

[Midttun 1996:56]. In 1988, civil servants within the Ministries of Finance as well as Petroleum and Energy commissioned researchers at the Norwegian School of Economics and Business Administration to pursue a study of a future, more market-based electricity system [Midttun 1996:54; 56]. Along the lines of this study, the Social democrats refurbished their old bill, introduced some market elements and proposed it to the parliament in September 1989. This second Energy Bill, which was supported by the Social democrats, the Socialists and parts of the Centre party, was however never considered by the parliament due to the short time before the elections [OED 1990a:1; Midttun 1996:57; Diesen 2003:2, see also OED 1990b], which the social democrats lost to a conservative coalition [Regjeringen 2007]. The new government considered the Energy Act Bill too little market oriented and immediately withdrew it. Shortly after its inauguration, the conservative government presented a third Energy Bill to the parliament [OED 1990b:362].

4.6.1.2 The power market liberalisation bill

The third Energy Bill was in many perspectives diametrically different than the old Social democrat bill. Most importantly, the new bill was clearly liberal and very market oriented, in contrast to the old bill which had several socialistic elements. It did not contain the goal to vertically integrate distribution and production companies nor the possibility to force companies to merge in order to reduce the number of utilities on the market [OED 1990b:358f]. Instead, the problems in the Norwegian power sector were to be solved by deregulating and minimising the interference of the state in the market [OED 1990a; b; Diesen 2003]. No intention to deepen the cooperation with the Nordic neighbours can be found in the bill, the parliament debates or the different ex-ante reports about the liberalisation. The word “Sweden” occurs only twice, both times in negative contexts when discussing negative effects for Norway due to the interconnections to Sweden [OED 1985; 1990a; b].

The third bill encountered weak opposition from the Social democrats and the Socialists, but was supported by the conservative government parties in the parliament and most market actors [OED 1990a:1ff; b; Midttun 1996:60; Diesen 2003:1ff]. Despite internal resistance against the liberal bill within the Centre party, which is traditionally a somewhat market sceptical party, it supported the bill, since it did not want to vote against the government it was self in. Further - and perhaps most importantly - the Centre party could not vote against a bill from a Centre party Minister of Energy [Midttun 1996:60; Diesen 2003:2f]. This turnabout seems to have confused, and to some extent stunned, the Social democrats and Socialists, who

only made half-hearted opposition [OED 1990b; Midttun 1996:54]. The Socialist MP Aasland-Houg stated in the parliament debate after the Minister presented the bill “*I have to rub my eyes as well as my ears and think about whether this speech really came from a Centre party politician*”¹¹ [OED 1990b:371].

The support for the liberalisation from the market actors, of which many were municipalities, seems to originate in a solid opposition to the Social democrat proposition to force companies to merge. They did not mainly support the liberalisation because of its own qualities but because the alternative was worse [Midttun 1996:60; Eikeland 1998:920; Diesen 2003].

All in all, the liberalisation bill encountered very weak opposition and was supported by almost all actors [Bonde 2002:188]. The liberalisation bill was accepted by the parliament just a few months before the fall of the conservative government in autumn 1990 [OED 1990a:1ff; Diesen 2003:1ff]. The Social democrats did neither vote against the electricity liberalisation in parliament nor stop the new Energy Act from entering into force after they were reinstated in the government a few month after the bill passed, which clearly shows how weak the Social democratic opposition was [see also Midttun 1996:53ff]. The new Energy Act, “*Energiloven*”, entered into force on the 1. January 1991 [Energiloven 1990].

4.6.2 Policy output of the Norwegian liberalisation: The Energy Act

With the new Energy Act, the Norwegian power market was immediately 100% opened; “*everyone now has the right to purchase electric power from anyone and to have it delivered on the grid*” [Nordel 1993:23]. Nonetheless, the state still had considerable influence over the market and its actors. Concessions were needed for any activity in the market, such as constructing or operating high-voltage facilities for production, transformation, transmission and distribution of electricity, just as for low-voltage distribution [Energiloven 1990 §3-1; §3-2]. The company that achieved the distribution concession for an area was obliged to deliver electricity to all customers within that area. The state decided who got concession for delivering electricity in a specific area and could also decide on pricing of the distribution service, the specific distribution conditions or the expropriation of a distribution facility, as well as it was empowered to decide whether an electric facility had to be built, expanded or abandoned [Energiloven 1990 Kap. 3].

¹¹ “Jeg må nesten gni meg enten i øynene eller i ørene, og lure på om dette var en senterpartipolitiker som talte”

The new Energy Act had two key elements. Firstly, the political goal of vertical integration of the public utilities was abandoned [OED 1990a:2; b:358]. Instead, large vertically integrated companies were forced to legally unbundle its grid activities from its production and/or retail activities into independent legal entities. This was only effective for TSO and vertically integrated companies with more than 100 000 grid customers; smaller companies only had to keep separate accounts and managements [Energiloven 1990 §4-6; §4-7]. As a consequence, the dominant, vertically integrated state authority Statkraft was in 1992 split into two separate, state-owned companies: the generator Statkraft and the transmission grid operator *Statnett* [Nordel 1992:24; NUTEK 1995:32; Rothwell, Gomez 2003:169; Statnett 2007; Statkraft 2007; AAD 2003:62]. Statnett owned about 80% of the main grid; the rest was owned by about 40 different companies [Rutledal et al 2000:11].

The second key element of the reform was the non-discriminatory Regulated Third Party Access (R-TPA) which was introduced at all grid levels: all companies with grid concessions had to connect anyone who wished to their grid in a neutral way, with objective conditions and fair tariffs [Energiloven 1990 Kap. 4]. In 1992, the old distance-dependent cost recovery based point-to-point tariffs were abandoned and a system with point tariffs was introduced. In this system, a connection tariff, which was dependent on the geographical feed-in point and the feed-in time, was paid giving the producer he right to use the entire Norwegian transmission system [Energiloven 1990 Kap. 4; Nordel 1992:23; Bråten 1997:221]. Therefore, the grid fee was independent of the geographical location of the customer [Bergman et al 1999:132; OED 2004:71ff].

An independent regulatory authority was instated at the *Norwegian water resource and energy directorate (NVE)*. A main task of the NVE was to control the grid monopolies and the functioning of the Norwegian power market [NVE 2007]. The NVE also determined how much a distribution or transmission company was allowed to charge for distribution or transmission services [Rutledal et al 2000:12]. Through this division the state wished to avoid bias, as it otherwise would be both grid owner and grid regulator [Bonde 2002:183].

The state monopoly on long-term exports of electricity was maintained in the Energy Act. The state could issue concessions to others for exporting or importing electricity [Energiloven 1990 §4-2; OED 1985:3]. The maximum long-term export quota was limited to 5 MW and was split among the power plant owners in a way that was advantageous for owners of new power plants [SVK 1993:38; NUTEK 1995:32f; OED 1998:82; Nordel 1992:21]. Short-term

export contracts for less than 6 months were not affected by the export quota but were only restricted by the available interconnection capacity [SVK 1993:38].

4.6.3 Policy outcome of the Norwegian liberalisation

A characteristic of the Norwegian liberalisation was the power exchange. The already existing power exchange for temporary power Samkjøringen was extended to a spot market. Samkjøringen was taken over by Statnett in 1993 and was made an independent company, *Statnett Marked*, in 1993 [NordPool 2007a]. For the traded electricity a system price was calculated as a function of supply and demand at a given time. This price was the main price of the exchange at times when the transmission capacity between different areas was sufficient. When the transmission capacity was insufficient due to higher load, Norway was divided into several price zones. The price was reduced in the surplus area and increased in the deficit area until the power flow no longer exceeded the transmission capacity [Bye, Hope 2005:13]. The trade via the exchange was not mandatory and most of the electricity trading was done by bilateral contracts outside of the exchange [Bonde 2002:181]

The years after the liberalisation were in Norway extremely wet, leading to a very large electricity surplus. Combined with the mild winters and the economic recession in the beginning of the 1990s this led to dramatically decreasing electricity prices, especially for high-voltage customers. This was positive for the consumers, which consequently saw the deregulation as a success, but disastrous for the producers. Many producers tried to solve their economic problems by exporting electricity, but were stopped by the government which feared that the future power balance could be jeopardised if exports were increased. In the summer of 1992 the government was nonetheless forced, amongst others by the municipalities which in many cases were owners or creditors to the threatened producers, to increase the long-term export contingent by another 5 TWh/a [SVK 1993:44f; 47; NUTEK 1995:32ff]. At the same time Statkraft decided not to sell electricity at prices lower than 100 NOK/MWh (approximately 27 €/MWh) [Hira, Amaya 2003:198]. However, the electricity price did not increase and in autumn 1992 the Social democrats proposed to the parliament that small customers should not be allowed to change supplier anymore in order to increase prices and protect the producers. This bill was rejected since it did not get support from the Centre party [SVK 1993:45; Bonde 2002:188].

Due to the extremely low electricity prices, the investments in new power plants ceased completely after the deregulation and the over-capacity started to diminish [NUTEK 1995:32; Woo, Lloyd, Tishler 2003:1114]. This was one of the goals of the deregulation (see above in chapter 4.2.3). Despite, or perhaps due to, the sinking electricity prices, almost no Norwegian households had changed electricity supplier in the years following the liberalisation [Bråten 1997:221].

4.7 The Swedish liberalisation and the creation of NordPool

4.7.1 Policy formulation and the Swedish liberalisation process

The most important driving force for getting the power market liberalisation onto the Swedish political agenda was the across-the-blocks will to liberalise and, which is valid at least for the conservative government, to privatise state enterprises [Näringsdepartementet 2005:161]. Further influential factors were the Norwegian liberalisation, which was considered “*largely successful*”, mainly because of the sinking wholesale prices, and the Finnish liberalisation process [Bonde 2002:191]. In 1991, Sweden had applied for EC membership¹², and the adaptation to EC/EU regulations was another very influential driving force for opening the power market [SVK 1993:v; Betänkande 1995/96:NU1:12; Prop. 1994/95:222:21; Näringsdepartementet 2005:161; Regeringen 2006]. The market concentration and the market power of especially Vattenfall and Sydkraft were the major identified obstacles for the liberalisation of the Swedish power market [SVK 1993:66; Lindblom, Andersson 1998:2]. Despite this, there was no interest in deepening the Nordel cooperation or joining the power market with a neighbour market. In the first Swedish electricity reform bill of 1992, the government stated that there were several interconnections to the other Nordic countries which were mainly used for regulating power and that the Norwegian market has been liberalised. However, the government did not consider market unification for the further liberalisation process [Prop. 1991/92:133:5; 48].

It was recognised by all political parties that the key to a successful liberalisation of the power market was to unbundle transmission on the one hand and production and distribution on the other in order to guarantee a non-discriminatory grid access for all actors, along the lines of the Norwegian liberalisation. As a first step toward liberalisation the Social democrat government decided that the main grid was to be operated independently from the production by

¹² Sweden joined the EU in 1995 together with Finland and Austria [European Commission 2007].

a state owned company. For this reason, Vattenfall, which in 1992 was transformed into a state owned company (see above in chapter 4.3.2), was split into two companies, both still under state ownership: the generator and distributor Vattenfall and the national grid owner and TSO Svenska kraftnät (SVK; “*Swedish power grids*”). At the same time, three conservative parties demanded that Vattenfall was to be privatised [Prop. 1990/91:87; Prop. 1991/92:49; Betänkande 1995/96:NU1:5f]. The social democratic government in 1991 stated that Vattenfall may be privatised in the future, an idea that was supported and pushed by the conservative parties after they came to power [Prop. 1990/91:49; Prop. 1993/94:162:217]. This energy policy objective was revoked by the new Social democrat government in 1995 and today, Vattenfall is still in 100% state ownership [Prop. 1994/95:222:23; Vattenfall 2007b:2]. The ownership of the state owned international interconnections was also transferred to Svenska kraftnät as they were regarded as a part of the main grid [Prop. 1990/91:87:1f].

The conservative government in 1992 recognised that “*the Swedish power market functions well in an international perspective*”¹³ [Prop. 1991/92:133:1], but that a liberalisation was necessary in order to achieve a more efficient use of the resources and lower prices and to “*abolish growth retarding regulations* Näringsdepartementet 1993”¹⁴ since “*the Swedish efficiency problems [...] are caused by the disabling of the market mechanisms*”¹⁵ [Prop. 1993/94:162:19; 22]. Besides from deregulating the market Vattenfall was to be privatised, despite opposition from most market actors [Betänkande 1993/94:NU22:12; Prop. 1993/94:162:217; Näringsdepartementet 1993]. In order to investigate how a Swedish deregulation should look and how it was to be implemented, the government commissioned Svenska kraftnät to conduct an ex ante study on this matter.

4.7.1.1 Swedish investigation of the future power market

In 1993, Svenska kraftnät published its report on how a deregulated Swedish market should be organised [SVK 1993]. It concluded that the efficiency of the deregulated power sector would be maximised if a power exchange was created. It also stated that “*The development of an open Swedish electricity market and a power exchange should be developed in such a way*

¹³ “I ett internationellt perspektiv anses den svenska elmarknaden fungera väl”

¹⁴ “avskaffa tillväxthämmande regleringar”

¹⁵ “Sveriges effektivitetsproblem [...] beror på att marknadsmekanismerna satts ur spel”

*that cooperation with the Nordic countries, especially Norway, is enabled*¹⁶ [SVK 1993:vii]. For this, the interconnection capacities to Norway would have to be massively reinforced, but in the end it would be very advantageous for both Sweden and Norway to join their power markets [SVK 1993:66].

According to the Svenska kraftnät study, there would be large efficiency and environmental advantages of uniting the markets. The need for new production capacity would decrease, since countries with a common power market could share peak load and reserve capacities. A market including Finland and Denmark would also lead to lower emissions, since the fossil fuelled power plants in these countries would have a lower load [SVK 1993:83; 102]. Nordel in 1993 calculated the combined Nordic emission reductions of CO₂ and SO₂ during 1990-1992 to about 36 million tonnes and 144000 tonnes, respectively, or about 20-25% of the total power system emissions [Nordel 1993:55]. Already due to these reasons, Svenska kraftnät favoured a direct merger of the Norwegian and Swedish electricity markets [SVK 1993:83; 102; Prop. 1993/94:162:31f].

The most important reason, however, was the strong concentration on the Swedish power market. It was feared, not only by Svenska kraftnät but also by many politicians, public servants and small market actors, that the two largest companies, Vattenfall and Sydkraft (50% and 25% market share, respectively), could exert their market power on a liberalised, strictly Swedish market and distort the functioning of the competitive market. A power exchange could decrease the market power of the large companies, but would still leave them with considerable market power. Therefore, Svenska kraftnät once again suggested that the Swedish market should be unified with the Norwegian market in order to dilute the market power of these two companies [SVK 1993:vi; 66; Prop. 1993/94:162:217ff]. This suggestion was supported by most actors, especially distributors, municipalities, state authorities and the power-intensive industry, which hoped to see decreasing prices like in Norway. The large power producers, namely Vattenfall, Sydkraft and the Swedish power plant association, opposed the liberalisation as well as a unification with Norway [SVK 1993:61; 66; Prop. 1993/94:162:81; 209; 219ff; Bonde 2002:192]. Vattenfall and Sydkraft instead stressed that cooperation between power producers is a prerequisite for the efficient functioning of a power system and that a liberalised Norwegian-Swedish power market would jeopardise this old system [SVK 1993:61]. Vattenfall's opposition against a Nordic power exchange was in sharp contrast to

¹⁶ "Utvecklingen av en open svensk elmarknad och en elbörs bör ske så att det blir en samverkan med övriga nordiska länder, särskilt Norge"

the opinion of the owner, the Swedish state, which may be one reason for its weakening opposition during 1994. In 1995, all consultees were positive to the unification of the Swedish and Norwegian power markets [Prop. 1993/1994:162; Prop. 1994/95:222:29; SVK 1996:11]. In general, there was no serious opposition against the liberalisation from any Swedish actor, political or market actor, except for Vattenfall and Sydkraft [Bonde 2002:193]. However, how the opinions of Vattenfall and Sydkraft developed is difficult to know, since they are not expressed in the bills and reform ex ante studies after 1994 [see Prop. 1994/95:222]. Possibly, they were not asked at all.

Shortly after the publishing of the Svenska kraftnät study, the Norwegian parliament debated and accepted a bill that stated that Norway would have considerable advantages of further increasing the interconnections to other hydro power based electricity systems, i.e. Sweden. Such a development was expected to lower the price fluctuations downward in wet years, which would be good for the producers, and the fluctuations upward in dry years, which would be advantageous for consumers. The bill also stated that Norway was positive to enter contracts or treaties with neighbouring thermal-based systems, i.e. Denmark and Finland, due to the environmental and economical benefits to all parts [Nordel 1994:23].

4.7.1.2 The first Swedish bill for a new Electricity Law

In February 1994, a bill for the new power market legislation was presented to the Riksdagen which accepted it despite the opposition of Social democrats and Left party. In most issues, the bill was concordant with the Norwegian Energy Act and was highly liberal. The new Electricity Law was to enter into force on the January 1st 1995 [Prop. 1993/94:162:246; Betänkande 1993/94:NU22].

A general expectation of the liberalisation was sinking electricity prices due to increasing efficiency [Prop. 1991/92:133:14; Prop. 1993/94:162:20]. Even though it was not spoken out loud, except for the Svenska kraftnät study of 1993 (where this is only written as a parenthesis), a major incentive among politicians as well as market actors to connect Sweden to Norway was to buy cheap Norwegian electricity [SVK 1993:92; Kaijser, Högselius 2007]. During the economic crisis in Sweden in the beginning of the 1990s, this was a key issue and a key driver for the liberalisation and the issue communicated to the public [Midttun 1996:57; 62; Kaijser, Högselius 2007]. Between 1990 and 1995 the Swedish electricity prices increased with more than 25%, making this issue even more urgent [Energimyndigheten 2006a:31]. In

this light, the sinking Norwegian electricity prices and the resulting Swedish view that the liberalisation there had been successful may have been a direct prerequisite for the unification of the Swedish and Norwegian markets and consequently the creation of the entire Nordic market.

In the bill the government stressed the economical and environmental advantages to all Nordic countries of the Nordel cooperation but did not mention the advantages for Sweden to be able to buy the cheap Norwegian electricity. Most of all, two Nordic advantages are pointed out: Firstly, the Norwegian hydro power export, as well as the Swedish nuclear and hydro power exports, may considerably reduce the use of fossil fuelled power plants in Denmark and Finland, thus reducing the total Nordic emissions. Secondly, the government states that the different national production structures and consumption patterns reduce the need for national peak load and regulatory power, thus also diminishing the national production overcapacity, which leads to lower total electricity costs [Prop 1993/94:162:31f]. However, the bill did not foresee power market unification with Norway but only a continuation of the Nordel cooperation.

As the conservative government lost the elections in 1994, the power market reform was stopped since the new Social democrat government saw the new legislation more as an attempt to as soon as possible privatise Vattenfall than to make the power market more efficient¹⁷. Instead of implementing the bill, the new government instated a commission to investigate the potential impacts of the liberalisation bill. The results of the investigation were expected in the second half of 1995 [Prop. 1994/95:84:4f].

4.7.1.3 Further studies about a Nordic power market and the Louisiana Declaration

Following the Svenska kraftnät study, Nordel and the large Nordic producers in 1994 started a study about a future Swedish-Norwegian or pan-Nordic power exchange and joint Nordic market. Statnett and Svenska kraftnät, which already in 1994 had agreed in principle to cooperate with the aim to create a Nordic power exchange started investigating if and how this could be done [SVK 1996:6]. These three studies, which were conducted by representatives

¹⁷ However, in the liberalisation bill of 1994, the conservative government does not, at least not overtly, express any intention to privatise Vattenfall. On the contrary, the only statement about privatisation in the bill is negative: the government states that all consultees are either indifferent to the privatisation of Vattenfall or against it [prop. 1993/94:162:210].

from all four Nordic countries, were published in spring 1995 and came to the same result as the Svenska kraftnät study of 1993: It is technically possible and very beneficial for all four Nordic countries to join their power markets and trade the electricity at one common marketplace [Statnett, SVK 1995:7ff; Nordel 1995b; SVK 1996:11]. A year later, after the Norwegian-Swedish market was already established, a Nordel working group published yet another study with the same conclusions [Nordel 1996b]. All in all, there was a great Nordic consensus in 1995, possibly with the exemption of the large Swedish producers, that market unification would be beneficial to all countries.

The results of the Svenska kraftnät study and the studies published in 1995 were discussed at the meeting of the Nordic Ministers of Energy at the Louisiana Museum of modern art in Humlebæk, Denmark in June 1995. At the end of the meeting, the Ministers issued the *Louisiana Declaration*, stating that a pan-Nordic free trade electricity market was beneficial to all countries, economically as well as environmentally, and that such a market should be created as soon as possible [Nordic Council of Ministers 1995]. This declaration marks the formal beginning of the unification of the Nordic power market.

4.7.1.4 The final liberalisation bill

After the results from the liberalisation impact assessment commission were presented, the Social democrat government presented its own liberalisation bill. This bill was in almost all points identical with the previous bill [Betänkande 1995/96:NU1]. However, in the new bill, the Swedish government expressed its wish for a joint Nordic power market instead of a strictly Swedish market in order to decrease market concentration in all countries, to enable a more efficient use of the Nordic production resources than could be achieved on a strictly national market and to aid the Nordic governments to achieve their environmental goals [Prop. 1994/95:222:29]. At the same time it established that the Nordic electricity trade was advantageous with respect to the Swedish phase-out of nuclear power [Prop. 1994/95:222:25].

4.7.2 Policy output of the Swedish liberalisation: the Electricity Law

The new Electricity Law, “*ellagen*”, which in all relevant aspects was the same as the one proposed by the conservative government, entered into force on the 1st of January 1996 [SFS 1994:618; Betänkande 1995/96:NU1]. It was consistent with the Norwegian Energy Act in almost all points. In 1998, all electricity laws were integrated into one electricity law. The

many different old electricity laws were summarised into one law with practically the same contents as of the old laws [Prop. 1996/97:136:1; SFS 1997:857; Nordel 1999:31].

The key issue of the liberalisation was the unbundling of transmission and distribution, respectively, and production in vertically integrated companies. The first step had already been taken in 1992 by introducing ownership unbundling and separating the main grid from the production and the creation of Svenska kraftnät. To avoid cross-subsidies between distribution and production or trading the new law required legal vertical unbundling from all power companies regardless of their size or status – all companies were prohibited to produce or trade electricity in the same legal entity as the distribution [Prop. 1993/94:162:9ff; SFS 1902:71 s.1 §1; SFS 1994:618 §1]. This regulation is somewhat stricter than the Norwegian legislation, which only requires accounts unbundling unless the company in question is the TSO or has more than 100000 customers (see chapter 4.6.2).

A slightly modified R-TPA system was introduced by the new Electricity Law. The juridical person having the grid concession for a line or an area was obliged to connect any facility to its grid and to transmit electricity from any producer through its grid. In addition, he had to purchase all electricity from production facilities with a capacity lower than 1500 kW within his concession area [SFS 1902:71 §2; 1994:618 9§]. The concession holder had to connect any “normal” consumer within his concession area [SFS 1994:618 9§]. The grid tariffs had to be fair and the grid owner had to publicly account for the cost. In 1995, already before the actual liberalisation, Svenska kraftnät introduced point tariffs, only dependent on the feed-in time and feed-in location, for accessing the grid [NordPool 2004a:8]. Any actor who had paid the grid tariff had the right to transmit electricity through the entire main grid to any point within the country, the interconnections excluded [SFS 1994:618 §2 7mom].

An independent regulatory authority, “*Nätmyndigheten*” (“Grid Authority”), was established to supervise the monopoly sectors (i.e. the grid activities) and that access to the grids and the tariffs were fair to all actors. Concessions were given by the Grid Authority, except for the international interconnection concessions which were given only by the government [Prop. 1993/94:162:5]. Also in these respects, the similarities to the Norwegian legislation are striking.

The interconnections to Norway are also affected by the R-TPA, albeit with light restrictions. The interconnections could be used by anyone who wished so and entered a contract with a foreign company and the interconnection concession holder, which had to be the TSO. If the contract was valid for more than six months, price, amount and counterpart of the contract

had to be registered at the Grid Authority, but no special authorisation for foreign trade was required. There was no limitation for foreign trade. For the interconnections, a point-to-point tariff was used and the cost was dependent on the feed-in and feed-out locations [SFS 1994:618 §2; Betänkande 1995/96:NU1:18; SVK 1996:7]. This is a laxer regulation than what was the case in Norway until 1996, when Norway however abandoned its restrictions on electricity trade with Sweden (see below).

Any consumer who wished to change electricity provider had to install an electricity meter and measure the consumption on an hourly basis. This regulation affected approximately 99,5% of all Swedish consumers and practically kept the supply monopoly since the costs of installing such an electricity meter were very high. The metering requirements were dropped in 1999 and were replaced by customer type specific load curve billing system like the one already in use in Norway [SFS 1902:71 §10; Nordel 2000a:31; Näringsdepartementet 2005:161ff].

4.7.3 Policy outcome of the Swedish liberalisation: Unification with the Norwegian power market and creation of NordPool

Perhaps the most remarkable feature of the Swedish liberalisation was the unification of the Swedish and Norwegian power markets, the creation of the world's first international power market, and the establishment of the Nordic electricity exchange NordPool [NordPool 2007a]. Electricity buyers or seller were not obliged to do their trading at NordPool, which in contrast to the British power exchange was and still is a voluntary trading place. Although all electricity could be traded between the countries, the balancing power was still traded nationally [Skytte, Wolffsen 1997:21; Gronheit, Skytte, Wolffsen 1998:12].

At the same time as the Electricity Law entered into force the Swedish border tariffs for trade with Norway were abolished. In December 1995, the Norwegian parliament removed the quantitative export restrictions for electricity trade with Sweden and after the border tariffs were abolished, the two power markets were unified [Bråten 1997:221; Nordel 1996a:23; 1997:35]. The Norwegian-Swedish electricity trading started on the 1st of January 1996. Only the wholesale was affected by the unification. Until today, Nordic households cannot choose an electricity supplier from another country [von der Fehr, Amundsen, Bergman 2004:1; NordReg 2006:14]. During 1996, half of the shares of Statnett Marked were acquired by Svenska kraftnät and the marketplace changed its name to *NordPool* [SVK 1996:12; Nordel

1997:35]. On this marketplace, also Danish and Finnish actors were allowed to trade, although the markets were not yet unified and the border tariffs still in place [Bråten 1997:221]. The ultimate goal of NordPool and the acceptance of the Louisiana Declaration are shown by the fact that NordPool since its beginning as a Norwegian-Swedish power exchange presented itself as “the Nordic power exchange”, with all four Nordic flags in its logo [Gronheit, Skytte, Wolffsen 1998:53].

In theory, the Norwegian and Swedish markets were truly unified already from the very beginning. By paying the grid tariffs in both countries, an actor had access to the entire Swedish-Norwegian grid and there were no limitations on trade between the countries, as long as the balance and frequency, which were both nationally regulated, were guaranteed [Bergman et al 1999:138; Hira, Amaya 2003:197; Energimyndigheten 2004:14].

In practice, however, the markets were not 100% integrated, even though much international trade occurred. Firstly, Norwegian companies still needed to get a concession from the government for long-term trading with foreign companies, a procedure that could take up to 6 months. Therefore, many Norwegian actors refrained from participating in trade with Swedish actors. The concession system for trade with other NordPool countries was abandoned in 1998. Secondly, the limitations in the interconnection capacity led to unpredictable congestion problems which discouraged many actors from participating in international trade [KKV 1996:8]. In times of congestion the NordPool area was split in different price areas: Sweden was one large price area at all times, whereas Norway could be split into several different price areas [Bigatto 2000:121ff]. In the five years following the unification the Norwegian-Swedish interconnection capacity was increased with about 60%, from 3000 MW to more than 5000 MW, which diminished this problem considerably [Nordel 1997-2002, Statistics chapter].

Immediately after the markets were unified, the electricity prices at NordPool soared. This was mainly due to the hydrological conditions and a severe water shortage in the hydro power plants and was not immediately connected to the liberalisation or unification issues. The combined Swedish and Norwegian hydro power production in 1996 was 36 TWh lower than in 1995 [Nordel 1997:5; Bergman 2001:8; Bonde 2002:189]. Nonetheless voices were heard, especially in Norway, that the liberalisations were to be taken back and regulations to protect the customers from increasing prices were to be re-introduced. The water storages in Norway in July 1996 were as low as 36% of the normal capacity and power shortages were feared. The electricity imports to Norway and Sweden from Denmark and Finland kept the water

storages from being completely exhausted. This gave the Norwegian and Swedish governments a good argument to keep the reforms already introduced and to further deepen the Nordic electricity cooperation toward a pan-Nordic market [Stoltenberg 1996:2f]. In early autumn heavy rainfalls restored the water storages, the price normalised and the calls for re-regulation faded [Stoltenberg 1996; Nordel 1996a:23; 1997:27; Aam, Wangensteen 1998:5; Hope 2002:4; SSB 2007b]. The development in the Nordel area in during 1996 clearly showed that the Nordic countries all benefit from the cooperation and that the studies from Svenska kraftnät, Statnett and Nordel were right in their conclusions concerning this.

4.8 The Finnish liberalisation und unification with NordPool

4.8.1 Policy formulation and the Finnish liberalisation process

In the early 1990s, the general liberalisation and deregulation wave had reached Finland. The application for the EC membership was submitted to the Commission in 1992¹⁸ [European Commission 2007], and the preparations for the membership and the adaptation to the European legislation were therefore further important driving forces for the Finnish deregulation. There was also the general wish for increased power system efficiency and lower prices. The Swedish liberalisation process and the at least for the consumers positive experiences of the deregulation of the Norwegian power market were very important factors for pushing the liberalisation further up on the Finnish political agenda [RP 138/1994a:11; Pineau, Hämäläinen 2000:186]. Despite the statement of the Finnish government that “*the Finnish electricity market already functions efficiently*”, there was a general political wish to reform the electricity sector [RP 138/1994a:12; RP 138/1994b:1].

In 1992, a commission, the Electric Utility Committee, was appointed by the government to study the possibility to reform the Finnish electricity market and increase the efficiency further. The Electric Utility Committee published its report in 1993, after the Svenska kraftnät study, recommending that the problems in the power market were to be solved by deregulating and opening the grids at all voltage levels. Further, it recommended that grid activities should be unbundled from production and retailing along the lines of the Norwegian liberalisation. The Electric Utility Committee stated that an electricity exchange, regardless of whether it is Nordic or strictly Finnish, is not necessary, but may anyway be a good option for

¹⁸ Finland joined the EU in 1995 together with Sweden and Austria [European Commission 2007].

the future [SVK 1993:59; Nordel 1993:16; Pineau, Hämäläinen 2000:186; Sener 2000:6]. After the Svenska kraftnät study was published in 1993 and the initiation of the subsequent studies on a Nordic level during 1994 about the benefits and possibilities for a common Nordic power market, an increasing wish to participate in a future Nordic power market and exchange became an important driving force in the Finnish power market reform process [RP 138/1994a:12; Pineau, Hämäläinen 2000:186]. It was feared, mainly from the Ministry of Trade and Industry, that a strictly Finnish power exchange would have liquidity problems due to the small size of the market [Skytte, Wolffsen 1997:18; Nordel 1997:35f]. Therefore, the government stressed the need for the power market reform to be conform with the Norwegian and Swedish electricity legislations [RP 138/1994a:12; Sener 2000:6f; Pineau, Hämäläinen 2000:186].

The power market reform in Finland was relatively uncontroversial [Nordel 1993:32]. It encountered no serious political resistance and only weak resistance from some small producers is documented. The Finnish Power Plant Association supported the reform, but wanted a long period of transition and the postponement of the reform until at least mid-1995 [SVK 1993:60]. Both these demands were granted [Elmarknadslag 1995]. Due to the high import dependency and the lack of domestic low-cost large scale hydro power, the Finnish producers would hardly have to face sinking prices like their Norwegian counterparts, which may have increased their willingness to accept the liberalisation [SVK 1993:60]. However, the high Finnish import dependency was not mentioned as a driving force for the development on the Finnish power market in any study nor official document used for this thesis.

4.8.2 Policy output of the Finnish liberalisation: the Electricity Market Law

The liberalisation bill was presented to the parliament and was accepted just before the national elections in March 1995 and entered into force on the 1st of June 1995. In most relevant issues, the new Finnish Electricity Market Law was concordant with the recommendations of the Electric Utility Committee, and had a period of transition for smaller customers until 1997. It also greatly resembled the Norwegian Energy Act and the draft for a new Swedish Electricity Law, in order to enable market unification in the future [Elmarknadslag 1995; Nordel 1996a:16; Sener 2000:8; Pineau, Hira, Froschauer 2004:1460].

A system with area concessions for distributors was introduced. Within their concession areas all distributors had to connect any production unit that wished so and to transfer electricity for

any other company, in accordance with the R-TPA principle [Elmarknadslag 1995 9-10 §]. The former distance-dependent point-to-point tariffs were abandoned and distance-independent tariffs were introduced which, just like in Norway and Sweden, gave access to the entire national grid independently of the location of the consumer [Elmarknadslag 1995 Kap. 3; Nordel 1995a:18; Pineau, Hämäläinen 2000:188]. The grid access tariffs had to be fair; the fairness of the tariffs and the access to the grid was supervised by an independent authority, the *Energiemarkkinavirasto*¹⁹ (“Electricity Market Authority”) [Energiemarkkinavirasto 2002]. The interconnections were also affected by the R-TPA, but the cost of using the interconnections had to be negotiated separately, since they were exempted from the point-tariff system [Elmarknadslag 1995 16§]. Since 2003, the interconnections underlie the same pricing as the national grid [Elmarknadslag 2003 14a§].

The central element of the law was the unbundling. Companies active in distribution as well as production or trading with a dominant position on the market had to legally separate the distribution and transmission sectors from each other and from the production or retailing sectors [Elmarknadslag 1995 11§; 12§]. Companies which were mainly active in only distribution or production/retailing with only a minor involvement in the secondary sector only had to keep separate accounts for the different sectors but did not have to sell off one of business units [Elmarknadslag 1995 29§]. This regulation was practically the same as in Norway; but weaker than in Sweden where all vertically companies had to be unbundled, regardless of their size (see chapters 4.6.2 and 4.7.2) The operation of the national main grid was separated from all other activities and a new company, the national TSO *Fingrid* (until 1999: *Finnish power grid*), was founded to operate it [Elmarknadsförordning 1995 11§; Fingrid 2007]. In 1997, the two competing main grids were united and the ownership of both grids transferred to Fingrid [NordPool 2004a:8; Fingrid 2007]. Most interconnections were owned by IVO and were also transferred to Fingrid. Fingrid was, and still is, owned by Fortum/IVO and PVO (both 25%); the Finnish state (12%) as well as private insurance companies without other interests in the electricity sector (38%) [Pineau, Hämäläinen 2000:187; Sener 2000:10; Fingrid 2007].

During a transition period until 1997, only customers with a consumption exceeding 500kW were allowed to change electricity supplier [Elmarknadsförordning 1995 6§]. After this, all customers were in theory allowed to change supplier, but were, just like in Sweden, in prac-

¹⁹ In a way, this was a step toward more regulation since Finland did not have a regulatory authority before the liberalisation [see also Pineau, Hämäläinen 2000:190].

tice hindered to do so by the hourly metering demands. The meters were so expensive that it did not pay off for households to change supplier [Nordel 1998:18]. The metering demand was abandoned in 1998 and replaced by a system of load type curves, just like in Norway and, eventually, Sweden [Nordel 1999:20].

4.8.3 Policy outcome of the Finnish liberalisation: EL-EX and the Finnish accession to NordPool

In June 1996, the Finnish power exchange *EL-EX* was founded by the clearing house SOM. This was a national exchange, albeit with some, about ¼ of all members, Swedish actors active in the trading already from the beginning. Six of the 42 Finnish EL-EX members were also active on the Norwegian-Swedish NordPool [Gronheit, Skytte, Wolffsen 1998:54]. The Finnish Ministry of Trade and Industry feared that this national exchange would have liquidity problems due to the small size of the Finnish market. The expressed goal of the Ministry as well as EL-EX itself was to merge with NordPool in order to secure both the advantages of the Norwegian and Swedish power systems and the liquidity of the exchange [Skytte, Wolffsen 1997:18; Nordel 1997:35f].

In January 1998, EL-EX was taken over by Fingrid and in April Finland abandoned the border tariffs to Sweden and Norway and became a NordPool price area [Nordel 1998:19; NordPool 2007a; Gronheit, Skytte, Wolffsen 1997:53]. Since 1999, access to the entire Nordic grid (except Denmark, which was not yet a part of the Nordic market) is granted along the same lines as the access to the national grids, with only insignificant restrictions, when the grid tariffs are paid [Prop. 1997/98:159:12; 23; 40ff; SFS 1997:857 4 Kap. 2§; Energimyndigheten 2000:1f].

In times of congestion, Finland was one separate NordPool price area, just like Sweden. Norway was still divided into several areas when transmission capacity was scarce [NordPool 2007b]. The balancing power was still traded on an hourly Finnish EL-EX market, but was in 1999 replaced by the Swedish-Finnish Elbas balancing service which was handled by NordPool [Nordel 2000a:10]. In 2002, EL-EX merged with NordPool AS and 20% of the shares in NordPool were sold to Fingrid [Nordel 2002a:13; NordPool 2004a:9; Fingrid 2007].

In the five years following the liberalisations in Finland and Sweden the interconnection capacity from Sweden to Finland was expanded with about 800 MW to a total of 2230 MW.

Almost all of this increase took place before Finland joined NordPool in 1998, enabling Finland to fully participate in the Nordic trading [Nordel 1990-2002 Statistics chapters].

The electricity prices in Norway, Sweden and Finland were already in a decreasing trend after the price and supply shock in 1996 at the time Finland joined NordPool in 1998. This decreasing trend was continued until summer 2001, with converging price levels in the three countries [Energimyndigheten 2004:25ff; Eurostat 2007a]. Electricity was during 1998 and 1999 traded at the same price in all three countries in 44% of the time [Energimyndigheten 2004:12]. The price convergence shows that the interconnection reinforcements were quite sufficient. However, congestion did occur at some point of the system at about 4000 hours per year, albeit on points and times which normally did not have a great influence on the price so that the price differences between price areas were moderate [Energimyndigheten 2004:26f].

4.9 The Danish liberalisation and unification with NordPool

4.9.1 Policy formulation and the Danish liberalisation process

Most Danish actors, political as well as market actors, were relatively satisfied with the pre-liberalisation power market system and were reluctant to change it. Many actors wanted to wait and see before any power market reforms were initiated, because of the “*many reasons to hesitate before one changes a system that has worked fairly well over many years*”²⁰, [Gronheit, Skytte, Wolffsen 1998:112].

Many leading Danish politicians feared that the successful system with consumer ownership would be threatened by reforming the power market. The environmental concern of many political parties also led to the reluctant attitude toward a liberalisation. Even though a power market liberalisation was on the political agenda after the liberalisations in the neighbour countries and, most of all, because of the requirements of the EU, no clear political will to actually deregulate could be seen. This lack of political will to push the liberalisation forward, which had been present in Norway, Sweden and Finland, was considerably slowing the process, and largely explains why the Danish power market was not opened until almost 10 years after the Norwegian market [Larsen et al 2004:15; Olsen 2006:10]. The unwillingness to liberalise was spread across many influential institutions. Most importantly, the Ministry of Environment and Energy as well as in the Danish Energy Authority opposed a deregulation.

²⁰ “Der kan være god grund til at være afventende før man reformere et system, der har fungeret rimelig godt i lang tid”

Most, if not all, electricity producers were against a liberalisation in the mid-1990s. Among the protagonists, the Confederation of Danish Industries, the Ministry of Finance as well as the Danish Competition Authority were the most important [Olsen 2006:10]. The Danish Minister of Environment and Energy Svend Auken stated in spring 1998: “*I understand that the Norwegians [...] used the market to prevent an excess construction of hydro power. In Denmark, however, the power system works well with a high efficiency, low prices and a strong environmental performance*”^{21, 22} [Gronheit, Skytte, Wolffsen 1998:55]. The scepticism toward the liberalisation seems to have been present in the population as well. Even today, after the liberalisation in Denmark, only 68% of the Danes think it is important to be able to choose electricity supplier, the lowest number in Europe [Eurobarometer 2007:21].

4.9.1.1 The first liberalisation step

Regardless of any national opposition, Denmark had to open at least some of its power market to competition in accordance with the Electricity Directive of the European Commission [Directive 96/92/EC]. In May 1996, the first step was taken as the electricity law was changed to allow competition for customers with a consumption exceeding 100 GWh/a [Folketinget 1998a Kap. 8]. This law entered into force in the beginning of 1998, after a dispute with the European Commission over the support scheme for renewable energy introduced by the law [Folketinget 1999b:13].

However, a weaker sort of TPA than in the other Nordic countries was introduced: N-TPA. All customers had to negotiate with the grid operator about access to the grid [Folketinget 1998a §14; Gronheit, Skytte, Wolffsen 1998:78]. Some few electricity intensive industries were affected by the new regulation as were all large distribution companies, including Elkraft and Elsam. Therefore, Denmark had achieved a 90% market opening already in 1998, although no low voltage customers were allowed to change supplier, and was not obliged by its EU commitments to liberalise further for many years [Folketinget 1998a; b:1; Gronheit, Skytte, Wolffsen 1998:88; Nordel 1999:15].

²¹ “Jeg forstår godt at man i Norge [...] tok i bruk markedskrefter for å hindre kommunal overudbygning av vannkraft till høye priser. I Danmark, derimot, har vi et velfungerende elsystem med høy effektivitet, lave priser og sterk miljøprofil”.

²² It should be noted that the Danish electricity prices were more than twice as high as the prices at the NordPool exchange and the emissions from the Danish power sector was many times higher than the Norwegian.

4.9.1.2 Expectations of an accession to NordPool

In its energy plan of 1996 for the next decade the Danish government expressed its commitment to the Louisiana Declaration and pointed out the mutual advantages: Denmark would provide Norway and Sweden with electricity in dry years and cold winters, and in return Denmark would be able to buy cheap hydro power in wet years and in the summer [MEM 1996:21]. The largest actors, namely Elkraft and Elsam as well as some other producers, began to fear that they would be locked out from the large and in their view successful power market in Norway and Sweden if Denmark did not also liberalise. This successive change of opinion at Elkraft and Elsam is a critical development in explaining the development of the Danish liberalisation process in the late 1990s [Olsen 2006:10].

Many political as well as market actors also feared that a strictly Danish market, which would practically be two very small markets east and west of the Great Belt, would be too small to ensure an adequate degree of competition. This problem was expected to be solved by joining the other Nordic countries in NordPool [Larsen et al 2004:20f; Olsen 2006:6f].

During 1997 and 1998, a series of studies about the future Danish power market and a possible power exchange were conducted by the Risø National Laboratory in Roskilde. These studies conclude, amongst other things, that an international power market is beneficial for Denmark as a wind power nation and the European environment in general and that Denmark with its very large interconnection capacities is suited to join either the Nordic or the German market. The studies showed a broad support among market actors for abandoning the old monopoly market system in favour of an international power market and exchange. No actors supported an exclusively Danish liberalised power market and the overwhelming majority of actors did not support market unification with Germany. Instead, almost all market actors wanted a common Nordic market and the Danish accession to NordPool [Skytte, Wolffsen 1997:2]. This opinion change among the market actors increased the pressure on the government to take the necessary steps toward a NordPool accession.

4.9.1.3 The Danish power market liberalisation bill

In March 1999, the Danish government made an agreement, “*elreformen*”, with the other four large parties of the parliament, *Folketinget*, to reform the Danish power system and the support for renewable energy, as well as how to reach Denmark’s CO₂ commitments [Folketinget 1999b Bilag 1]. The most important result of the agreement is the Electricity Supply Act, “*lov*

om elforsyning”, of 1999, in a way the logical consequence of the Electricity Law of 1996, which deregulates the Danish power market.

The reform is justified in a very different way than the Norwegian, Swedish and Finnish reforms, not mainly with the wish for increased efficiency, internal market problems or a general ideological wish to liberalise, but solely with external influences: *“The need to implement a reform for the electricity sector arises due to two important external conditions. [...] In 1996, the Directive concerning the internal electricity market was adopted and the far-reaching changes in the Nordic power cooperation due to the liberalisations in the other Nordic countries”*²³ [Folketinget 1999b:1].

The political hesitation toward the power market liberalisation is clearly recognisable in the Danish Electricity Supply Act. The fears of Danish politicians to threaten their success stories with the new electricity law is reflected in the fact that there are more paragraphs concerning the consumer ownership and the environmental electricity policy than market liberalisation issues [Folketinget 1999a; see also Olsen 2006:10].

4.9.2 Policy output of the Danish liberalisation: the Electricity Supply Act

The main strokes of the Danish liberalisation were the same as in the other Nordic countries. According to the Electricity Supply Act, the market was to be opened successively to smaller customers, reaching the complete opening for all customers at all voltage levels in 2003 [Folketinget 1999a §7].

In the Electricity Supply Act the same form of unbundling as in Sweden was found. Vertically integrated companies, regardless of their size, had to separate the monopoly sectors (i.e. distribution and transmission) from the competition sectors (trade and production) into separate legal units. Companies controlling the transmission grid as well as a distribution grid had to be split into at least two separate legal units; one for transmission and one for distribution. Distribution companies owning only a small part of the transmission grid could be allowed to keep the company intact by implementing accounts unbundling between the transmission and distribution sectors [Folketinget 1999a §47, 1999b:32].

²³ “Behovet for at gennemføre den lovreform for elsektoren skyldes særligt to væsentlige forhold. [...] I 1996 blev der vedtaget et direktiv om det indre marked for electricitet, og det nordiske elsamarbejde er undergået store ændringer op grund af den vidtgående liberalisering, der allerede har fundet sted i de øvrige nordiske lande”.

The R-TPA principle was introduced, just like in the other Nordic countries, which gave all actors the possibility to use the main grid for transmitting electricity on pre-defined and fair conditions [Folketinget 1999a §28, §29]. The costs for access to the main grid were determined by the TSOs and had to be adequate, transparent and fair. The two Danish TSOs were obliged to establish similar principles, for example a point-tariff systems, for grid access as the TSOs in other interconnected countries in order to make full use of the advantages of the interconnections between the systems [Folketinget 1999a §28].

The use of the interconnections was not regulated by the Electricity Supply Act, but in a separate regulation. The use of the Nordic interconnections was practically unlimited since they were seen as a part of the common Nordic transmission grid [Larsen et al 2004:20f; Olsen 2006:8].

An independent regulation authority was instated, “*Energitilsynet*”. The main tasks of the authority were to investigate the adequacy and transparency of the connection tariffs and conditions for third parties’ access to the grid [Folketinget 1999a §78, §82].

4.9.3 Policy outcome of the Danish liberalisation: the full integration of the pan- Nordic electricity market

In July 1999, the border tariffs between Jutland and Norway were abandoned as Jutland became a separate price area at NordPool. Zealand followed as a separate price area in the beginning of 2000, making the Nordic market fully integrated. The border tariffs between Zealand and Jutland, respectively, and Sweden prevailed until 2002 [Nordel 2000a:16; 2001:16; 2002a:13; NordPool 2007a]. In the NordPool area Sweden and Finland constituted one price area each²⁴, whereas Jutland and Zealand were two separate Danish price areas. Norway was split into up to 6 different price areas²⁵ [NordPool 2007b]. Balancing power trade was kept national to begin with, except the Swedish-Finnish Elbas trading system. In 2004, Zealand joined the Elbas cooperation and Jutland as well as eastern Germany followed in 2007. Norway is still outside the Elbas system but is due to join in the near future [NordPool 2004b;

²⁴ Within each price area the congestion management is done by a counter-trade system, where production is increased in the deficit area and decreased in the surplus area [Amundsen, Bergman 2007:3384].

²⁵ In 2005, also the Vattenfall transmission area in eastern Germany became a NordPool price area. In eastern Germany, Vattenfall is the TSO and the totally dominant producer. However, trade between the Nordic countries and eastern Germany is still severely limited due to the low interconnection capacity. Only the Kontek cable from Zealand to Germany, with a capacity of 550 MW to Germany and 200 MW from Germany, can be used for trading [NordPool 2005a].

Nordel 2007:4]. Since 2000, R-TPA to the entire Nordic grid was granted, with only insignificant regulatory restrictions, when the grid tariffs are paid and interconnection capacity was sufficient [Prop. 1997/98:159:12; 23; 40ff; SFS 1997:857 4 Kap. 2§; Energimyndigheten 2000:1f].

In 2002, NordPool Spot was founded to handle the spot market transactions on the Nordic market. NordPool Spot is to 80% owned by the TSOs in equal shares (the two Danish TSOs have 10% each) and to 20% by NordPool AS, which in its turn is owned by Statnett and Svenska kraftnät (each 50%) [NordPool 2007a].

The interconnection capacity between Denmark and Norway is today about 1000 MW and has been so since 1993. The Danish-Swedish interconnections are 2500 MW and have constant since 1998 after a rapid expansion phase between 1993 and 1998 [Nordel 1986-2006 Statistics chapter]. This means that the Danish-Nordic interconnection capacity was expanded to its current level already before the Danish liberalisation and accession to NordPool. Since 2000, the total Nordic interconnection capacity has been fluctuating between 9000 and 10000 MW [Nordel 2001-2006 Statistics chapter].

The market concentration, which was seen as a major problem in Finland and Sweden and which was very high in Denmark, although it was not perceived as a problem there, was strongly diluted on the common Nordic market. For example, Vattenfall in 2000 had a share of 53% of the Swedish national market, Statkraft controlled 27% of the Norwegian market and Elsam controlled 62% of the Danish market. In a Nordic perspective, these companies controlled only 21%, 9% and 6%, respectively, which significantly diminished their possibilities to exert market power and distort competition [Bergman 2001:6]. From this perspective the Nordic competition authorities claim that the creation of the Nordic market has been “*largely successful*” [Nordic competition authorities 2003:6]. However, they also state that the bottlenecks between the countries and within Norway distorted the functioning of the common market since the markets at times of congestion become “re-nationalised” with different prices in different price areas. In 2001, congestion occurred somewhere in the Nordic electricity system at just below 50 percent of the time. Most frequently, the Jutland and the central/northern Norwegian (both about 19% of the time) price areas were separated from the general Nordic system price [Nordic competition authorities 2003:8]. During these times the former national champions totally dominate the secluded price areas and can also exert considerable market power and push prices up. The competition authorities therefore in 2003 urged the TSOs to increase the interconnection capacity, but so far most projects are only at

the planning stage. Many of the suggested Nordic grid reinforcements have are priority infrastructure projects of the EU [Nordic competition authorities 2003:6; Statnett 2005:3ff; DG-TREN 2005:6f; 20f; SvD 2007].

The NordPool electricity price remained rather constant in all countries in the years following Denmark's accession. In general, the price development was similar in the different price areas [Energimyndigheten 2006a:31; SSB 2007b]. The Zealand price has been the same as the Swedish area price at almost all times, whereas the Jutland area has had a price development correlating to the Swedish development, but at a level between the Swedish and German prices [Nordel 2005:13]. Since 2002, the Nordic electricity prices have increased rapidly (in Sweden with about 70% between 2001 and 2004; in Norway even 160% between 2000 and 2003) before the electricity prices fell somewhat during late 2004 and 2005. Over the entire period from before the liberalisations and unifications until today, the nominal electricity prices, including grid fees, have increased with between 22% (Finland) and 54% (Sweden)²⁶. [SSB 2007a; b; Energimyndigheten 2006a:31; Energiarkknavirasto 2004:3f; ENS 2006:38].

During spring 2002, the water reservoirs in Sweden and Norway were higher than normal which led to an increased export to countries outside the continent. Between July and December the precipitation was much lower than normal, leaving the water reservoirs with approximately 35 TWh less water than in a normal precipitation year [Amundsen, Bergman 2005:6]. During the coldest days in the winter 2002/2003 the Norwegian and Swedish TSOs even feared a power shortage although the Nordic interconnections transported vast amounts of electricity to Norway and Sweden. The TSOs issued a power shortage warning and urged the citizens to save electricity, a situation that had never happened before. Following this, Norwegian and Swedish electricity prices soared and increased with more than 700% to the all-time-high of 114 €/MWh in January 2003. Due to voluntary consumption cuts in the Norwegian electricity intensive industry, the system balance was kept and no power shortage occurred [Nordel 2003:4; 7; 2004:6; von der Fehr, Amundsen, Bergman 2004:2]. Just as in 1996, as the dry year led to skyrocketing electricity prices, voices were heard, especially in Norway, that the governments should intervene on the market. All over the Nordic countries the electricity market was front-page news. However, the governments and the competition

²⁶ However, it should be noted that the inflation in Finland has been almost 17% since 1995, the year of the liberalisation. In Sweden, it has been about 10% since the liberalisation in 1996 [Tilastokeskus 2007b; SCB 2007b].

authorities in all countries abstained from intervening and eventually the electricity price decreased [von der Fehr, Amundsen, Bergman 2004:26; Amundsen, Bergman 2005:7]. Even though the prices decreased from the price spike in winter 2002/2003, the Nordic electricity prices have never been as low as in spring 2002 [Amundsen, Bergman 2005:7; Energimyndigheten 2004:26ff].

During the supply shock of 2002/2003, the hydro power based electricity systems in Sweden and Norway had to rely on electricity supply from the thermal based systems in Finland and Denmark. Finland and Denmark in their turn had to increase imports from Russia and Germany. A power shortage in Sweden and Norway could only be averted by relying on imports of large quantities of electricity from the neighbour countries [Nordel 2003-2004 Statistics chapter].

The near-shortage in 2002/2003 was however to a large extent not only caused by the hydrological fluctuations but also to the liberalisations of the markets. One of the goals of the Norwegian as well as the Swedish liberalisations was to make the production system more efficient and to lower the production over-capacity (see above in chapters 4.2.3, 4.3.3, 4.6.1 and 4.7.1). In both countries, construction of new production capacity has practically come to a stop and the production has slowly decreased while the consumption had been growing steadily [NVE 2005; Energimyndigheten 2006b:7]. At the same time, the Finnish and Danish production capacities have been increased to keep up with the entire Nordic consumption increase [Nordel 2002b:3; Statnett 2005:10]. The production capacity buffer in the system had therefore been deliberately reduced, and the risk of power shortage and the dependency on the interconnections had increased. On the other hand, production and interconnection capacity was obviously enough – no power shortage occurred. The capacity reduction has led to the expectation that the dominating electricity flux will be reversed in the near future from the traditional flow from north to south and from west to east to increased exports from Denmark, which now has a significant production over-capacity in a national perspective, to Sweden and Norway [Nordel 2002b:3; 6; Energimyndigheten 2006b:6f].

This can be seen as a sign of a broadened energy policy scope, which has gone from a strictly national approach toward the power balance to a pan-Nordic approach [Nordel 2002b:3]. Today, as the supply shock of 2002/2003 shows, the reserve capacities of the neighbour countries can be used to secure the supply during extreme events [Energimyndigheten 2006b:6f]. The increased mutual dependency on the interconnections and the neighbours can be seen in the example Norway: in the 40 years preceding the liberalisation Norway had been a net ex-

porter during 2 years, and not exceeding a few TWh/a. During 4 of the 9 years following the unification with the Swedish market Norway has been a net importer, importing up to 12 TWh in 2004, or 9% of the total consumption [SSB 2007c]. The fluctuations have also been large: in 2004 Norway had a net import of 12 TWh, followed by a net export of the same amount in 2005 [SSB 2007c].

The common Nordic electricity market has also had an impact on the environmental and climate policies of the Nordic countries. A change in Norwegian and Swedish hydro power production has to be followed by an analogue, but opposed, change of thermal power production in Denmark and Finland in order to keep the system balanced. The investments in new hydro power production capacity in Sweden and Norway, or the absence thereof, has therefore an impact on the possibilities for Denmark and Finland to reach their future climate targets [Eikeland 1998:921] Neither Finland nor Denmark is likely to reach their current Kyoto targets [European Commission 2005a:4f; EEA 2006:106]. Due to this increased interdependency, and due to efficiency reasons, Norway and Sweden planned to introduce a joint support scheme for renewable electricity, which eventually could be extended to the other Nordic countries. The system was never introduced since the countries could not agree on the burden sharing of the combined target and the planning was abandoned at an advanced stage in 2006 [Prop. 2005/06:154:61; OED 2006; Hegg Gundersen 2007:10ff]. Today, the Swedish Green certificates are traded at NordPool and voices within the Nordic council are still heard that a common Nordic market for Green certificates should be created despite the problems in the past [NordPool 2007c; Nordic Council of Ministers 2007b]. Although NordPool is the central trading place for carbon emission allowances in the Nordic region and some climate policy is discussed within the framework of the Nordic Council of Ministers, all four Nordic countries still have their own national climate policies, targets and strategies [NordPool 2005b].

4.10 Summary

The starting point of the process of creating a liberalised pan-Nordic power market was the liberalisation in Norway in 1990. The Norwegian power market of the late 1980s was totally dominated by hydro power, which had led to a large production over-capacity in order to secure the electricity supply in dry years. The power market was very fragmented with a large number of municipally owned small actors. The political consensus was that these problems led to inefficiencies in the power system. After years of confusion and conflicts with several failed or withdrawn attempts to reform the power market in order to increase the efficiency,

the newly elected conservative government presented a power market liberalisation bill to the parliament. The bill was supported, or at least not opposed, by all government parties, even though the internal opposition in one government party was strong, and the bill passed. Most market actors supported the liberalisation, since they saw it as a lesser evil compared to the earlier reform propositions. 1990 was a very wet year and was followed by several years with high precipitation. Due to the full dams the Norwegian electricity prices started to fall rapidly and became so low that many producers got severe liquidity problems. For the consumers, however, this was very positive.

In the elections in 1991, both Sweden and Finland changed governments to conservative coalitions. Both these governments had liberalisations and privatisation of state-controlled monopoly markets and state enterprises high on their agendas. This ideological conviction to liberalise was, especially in Sweden, very important for the initiation of the power market reforms in the two countries. The main goal in both countries was to lower consumer prices, which made a deregulation of a Norwegian model seductive, considering the sinking prices there. This argument gained much importance in the light of the severe economic crisis of the early 1990s. Also the requirements of the EU, to which Sweden and Finland both wished to ascend, played a significant role in initiating the reforms. In both countries, studies about a future power market were initiated by the governments. The Swedish study, conducted by the TSO Svenska kraftnät in 1993, concluded that there would be considerable environmental and economical advantages to all parts by deepening the Nordel cooperation to a Swedish-Norwegian, and eventually a pan-Nordic, strongly interconnected power market, mainly by optimising the use of the Nordic hydro power resources and diluting the market power of the largest companies.

Before the Svenska kraftnät study was published, a deeper Nordel cooperation was hardly considered at all. In Norway it was only mentioned to point out adverse economic effects of the Norwegian electricity trade with Sweden. Also in Sweden the interest of internationalising the power market was low. In the Swedish electricity reform bill of 1992, the government only stated that there were several interconnections to the other Nordic countries which were mainly used for balancing power and that the Norwegian market had been liberalised; but a deepened Nordel cooperation or market unification were not further considered. This was quite similar in Finland, as well. After the Svenska kraftnät study, the creation of a Nordic market was on the agenda and appeared as a political goal in official documents in all three countries.

The liberalisations in Sweden and Finland encountered only little opposition, and the unifications were hardly opposed at all. The market actor liberalisation opposition was limited to some Swedish large producers, most prominently Vattenfall, which stated that the current cartel power system was a guarantee for an efficient power supply. Vattenfall was however state-owned and eventually it had to subdue to the political will of the government. In Finland, all market actors supported or did at least not actively oppose the reforms. Also in the parliaments there was little opposition and the bills were accepted in 1994 and 1995, respectively, in Sweden and Finland. In none of the bills, market unification with a neighbour market was foreseen, although the legislations were made very similar to the Norwegian in order to enable market unification some time in the future. Shortly after the Swedish bill passed parliament, the conservative government lost the elections to a Social democrat government, which postponed the liberalisation one year.

During this delay, in June 1995, the Nordic Ministers of Energy agreed at their meeting at Louisiana outside Copenhagen that the Nordic electricity markets were to be unified as soon as possible, starting with the unification of the Norwegian and Swedish markets in 1996. This decision, the Louisiana Declaration, is the formal political beginning of the unification of the Nordic power markets. In January 1996, when the Swedish liberalisation bill was finally implemented, the Swedish and Norwegian markets were unified and the joint power exchange NordPool was founded. The Finnish market was opened before the Louisiana Declaration and was, although many Swedish actors were active on the Finnish power exchange from the start, not unified with the NordPool area until 1998.

After a brief period of very high prices in 1996, mainly due to low precipitation, the electricity prices at NordPool showed a decreasing trend between 1996 and 2002.

At the same time as the liberalisations in Sweden and Finland were implemented in 1995 and 1996, Denmark started to open its markets to competition. This was however not due to ideological or economical reasons, but mainly due to the EU requirements. The internal Danish wish for power market reforms was very weak and the opposition against a market opening was quite strong. Most Danish actors were content with the power market system, despite higher consumer prices and higher emissions than in the other Nordic countries. Due to the EU liberalisation requirements, the Danish power market was partially liberalised with weaker regulations than in the other Nordic countries. During the mid-1990s, after the Louisiana Declaration in 1995, the creation of NordPool in 1996, the partial liberalisation of the Danish power market and the Finnish accession to NordPool in 1998 the Danish opposition

against a liberalisation gradually weakened and the expectations of the Danish power sector to join NordPool grew. Consequently, the pressure on the government to take the necessary steps and fulfil its commitments from the Louisiana Declaration increased as well. In 2000, the Danish power market was liberalised and the Nordic market became fully integrated.

After the creation of NordPool, the Norwegian and Swedish investments in new production capacity had more or less stopped. This was one of the means toward the goal of increasing the efficiency of the power systems, and has erased the former Nordic production over-capacity. After a long period of decreasing prices the prices at NordPool soared in autumn 2002, since the autumn rainfalls were extremely low. During the winter 2002/2003, rolling blackouts were feared in Norway and Sweden due to the reduced production margins, but the system capacity was just barely enough, due to massive imports from Finland and Denmark, and blackouts were evaded. Even though the prices eventually normalised, the low prices of 2000 and 2001 were not reached and the prices today are considerably higher than the pre-liberalisation and pre-unification prices.

The most important actors, the power system structure and the main driving forces for the liberalisations and unifications are summarised below in Table 4-1.

Table 4-1: Production structure, governments and market actors, and main driving forces for the liberalisations and unifications in the Nordic countries.

	Year	Production structure	Government	Market actors	Main driving forces for liberalisation	Main driving forces for unification
Norway	1990 (lib.)	Hydro (99%)	-1990 Social democrat 1990 Conservative 91-97 Social democrat 97- Conservative	Production: Statkraft (30%) [State owned] Municipalities (60%) Grid: Statkraft [State owned]	Inefficiency Over-capacity Neoliberal ideology	Security of supply Keep prices up in wet and down in dry years Louisiana Declaration
Sweden	1994/1996 (lib.) 1996 (unif. with Norway)	Hydro (50%) Nuclear (45%)	-1991 Social democrat 91-94 Conservative 94- Social democrat	Production: Vattenfall (50%) [State owned] Statkraft (25%) Municipalities (20%) Grid: Vattenfall [State owned] (since 1992: Svenska kraftnät) [State owned]	Neoliberal ideology Liberalisation in Norway Reduce prices Economic crisis Over-capacity	Security of supply Reduce prices Louisiana Declaration
Finland	1995 (lib.) 1998 (unif. with Norway/Sweden)	Nuclear (50%) Coal (15%) Gas/oil/peat (10%) Hydro (10%) Imports (7%)	-1996 Conservative 1996- Conservative + Social democrat	Production: IVO (40%) [State owned] PVO (20%) Industries (20%) Grid: IVO (67%) [State owned] PVO (33%)	Liberalisations in Norway, Sweden Neoliberal ideology Unnecessary regulations Reduce prices	Reduce prices Finnish national market too small Louisiana Declaration
Denmark	2000 (lib.) 1999/2000 (unif. Jutland/Zealand)	Coal (42%) Gas (24%) Oil (12%) Wind (12%)	1993-2001 Social democrat + liberal 2001- Conservative + liberal	Production: Elsam (DK-West), Elkraft (DK-East) (90%) Grid: Elsam + Elkraft	EU requirements Liberalisations in Norway, Sweden, Finland Louisiana Declaration	Danish national markets too small Louisiana Declaration Expectation of NordPool accession

5 Discussion

The liberalisation and unification processes of the power markets in Norway, Sweden and Finland show great similarities, whereas the Danish case is different in many aspects. Therefore, the Danish liberalisation is considered somewhat at the side in the following discussion, which has a focus on the experiences from the Norwegian, Swedish and Finnish cases.

5.1 The creation of the Nordic power market

The most important factor for the successful creation of the Nordic electricity market was political will to liberalise and unify the markets and the decisive action in order to achieve this goal. To a large extent, this will came from an ideological conviction that liberalisations are, per se, beneficial. This becomes very clear when looking at the cases of the reforms in Norway, Sweden and Finland. In Norway, this will arose due to the problem structure on the electricity market and as a backlash reaction to the failed attempts to reform the power system in a socialistic way. In Finland and Sweden it was more or less self-evident that the electricity markets should be liberalised, much due to the successful liberalisation with decreasing prices in Norway but the general policy paradigm change toward more market liberalism also played an important role. The liberalisations encountered only little opposition, but a right-left distinction could be seen in the political attitude toward the liberalisation; the leftist parties were more negative to the liberalisation than the conservative or liberal parties. There was almost no political resistance against the unification at all. The unifications were usually not discussed as a separate matter, but were overshadowed by or seen as an integral part of the liberalisations. The little opposition against the unification that was documented came mainly from the Swedish national champion Vattenfall. All national champions, Statkraft in Norway, Vattenfall in Sweden and IVO in Finland, were state-owned, as were the main grids. Therefore, the states could control the markets and to a very large extent also suppress any opposition from these companies and enforce its own will on the major market players.

The “success” of the Norwegian liberalisation was a key issue for the continuation of the processes, most of all in Sweden and Finland. With the experience of falling electricity prices in Norway in the background, it was of course tempting for Swedish and Finnish politicians to glance at the Norwegian example and to pursue with a similar reform at home. This ought to have been even more tempting during the deep economic crisis in the entire Nordic area in the beginning of the 1990s. However, the falling prices in Norway were to a large extent the result of sheer luck – the liberalisation was followed by several wet years, which was the actual

main reason for the falling prices. During the first dry year in Norway after the liberalisation, 1996, voices were immediately heard that the reform should be taken back, but the reform was already settled and no such action was taken. Had the years immediately after the liberalisation been dry years, resulting in increasing prices, the public support in Norway would probably have been erased and the liberalisation might have been revoked or at least weakened. In any case, it would not have been considered a success in the neighbour countries which may have been more reluctant to implement a similar reform. Much of the incentives to join the markets with Norway would have been destroyed and market unification, also the unification between Sweden and Finland, would have been rather improbable.

The Norwegian liberalisation was however considered a success by most, except the Norwegian producers, and the Norwegian liberalisation model, which is today rather known as the *Nordic model*, was exported to the neighbour countries. The combination of strict unbundling requirements, which make the TSO independent of any other electricity market actor, and R-TPA is obviously a potent recipe for creating a well-functioning and competitive electricity market. Without the market power diluting effect of the unification, however, it is questionable whether even these measures would have been enough to guarantee a success. At times of congestion, when some markets are isolated from the rest of the NordPool area, there still are signs of abuse of market power in these smaller market areas [see Nordic competition authorities 2003]. This problem is however much smaller than it would be if the four markets would have been kept national, in which case the Nordic markets would probably face similar problems as many of the continental Member States are doing today. The problems with market power on strictly national markets were anticipated by all governments, and were one main reason for the unification.

The creation of independent regulation authorities is also crucial for the political credibility of the reform – the objectivity of the state as regulator could otherwise easily be compromised, since the state also is the owner of the main grids as well as the national champions.

5.1.1 Micro-level

On a micro-level, the advantages of the liberalisations and the unifications for the single companies are quite straightforward – the possibilities to expand are larger on a larger market – but the risks are also obvious. At the time of the liberalisations, the old protected oligopoly structures were abandoned, new networks created and new contestants were let in to the former monopoly markets. This is one main reason for the two largest Swedish companies, Vat-

tenfall and Sydkraft, to oppose the liberalisation as well as the unification and for the smaller companies to support them: these large companies simply had much to lose, whereas the smaller companies rather saw the possibility to expand. Still, the question remains why most companies, including the national champions in Norway, Finland and Denmark, supported the liberalisations. Perhaps Midttun's hypothesis, that the actors just did not understand what was happening and what to expect from the reforms (see above in chapter 1.2), is correct also in a Nordic perspective.

In any case, it is quite striking that the first international power market in the world was a market at the side of the main markets, protected from the large markets by geographical barriers. It is much more improbable that the small Benelux energy companies would agree to be liberalisation and unification pioneers with the giant companies of Germany and France lurking on the other side of the border. Perhaps the smaller Nordic companies felt protected from the "predator" energy giants on the continent, although they had at least two – Vattenfall and IVO/Fortum – at home.

5.1.2 Macro-level

One important reason for the strong support for the unification was the "objective" macroeconomic benefits of interconnecting the Norwegian and Swedish hydro-based electricity systems to the thermal-based systems in Finland and Denmark. These benefits had of course existed all along, but the publishing of a number of studies in 1993-1996 clearly showed politicians and market actors the full extent of the benefits.

Due to the dependency of the hydrological conditions, a hydro-based system can increase its security of supply in two ways: either it can create a significant over-capacity or it can connect to other electricity systems with a different energy mix which can replace the missing hydro power in dry years. Norway and Sweden had both chosen the over-capacity path, but with the liberalisation they both needed to divert from it. Therefore, only the unification option was left to secure the electricity supply. A hydro-based system connected to a thermal-based system can also expect to be able to sell its, normally cheaper, electricity to customers in that system in wet years with excess production. A thermal-based system normally has no problems with security of supply (as long as fuel deliveries from other countries are reliable, which they until now have been), but rather a problem with the costs. In general, thermal power is more expensive than large-scale hydro power. The interest for a country with a thermal-based system to unify its market with a hydro-based power system is quite straight-

forward: it can import cheap electricity in wet years and export expensive electricity when precipitation is low. Therefore, the unification of the Nordic markets was a win-win situation for all countries, at least on a macroeconomic level: the neighbour countries had the solutions for the national problems.

The actual *publication* of the Svenska kraftnät study (see chapter 4.7.1) was a very important factor for putting the idea of unification on the political agendas. Anyone who would have performed a theoretical study of the advantages of unifying a hydro-based with a thermal-based power system would have reached similar conclusions as the Svenska kraftnät study, and the studies following it (like the line of thinking above). This theoretical knowledge was most definitely present at many institutions, including the governments, before the publication of the studies. Therefore, the results cannot have been that much of a surprise for anyone, but the fact that these results were non-ambiguous and published by such an important actor as Svenska kraftnät obviously had a large impact on the continued reforms. Before the publication of this study, unification was not on the agenda in any country, after the publication unification was a political goal in all countries.

5.1.3 Nordic political tradition and cooperation

The consensus orientation of Nordic politics in general can be clearly seen in the electricity market reform process and is one further issue to help explain why the markets could be liberalised and unified without much opposition. In Norway, Sweden and Finland the liberalisations were engineered and decided by conservative governments with liberalisations of monopoly markets as chief ideology. In all three countries, these conservative governments fell or lost elections more or less immediately after the liberalisations were decided in parliament, but the new Social democrat governments did not revoke the liberalisations but implemented them as they were and kept the reforms more or less intact until today. The liberalisation wave had obviously penetrated most political parties and institutions. In Denmark, the liberalisation wave had in the mid-1990s not yet reached the energy politics, but after this general reluctance to liberalise at all was overcome, the power market deregulation was even an agreement between almost all political parties in the parliament. This consensus orientation ensures that the reforms are kept the way they were decided and are not watered down or even revoked after a new government comes to power. It also ensures a reform that is accepted by a large majority of political actors and with them probably also a large share of the market actors.

Also the Nordic institutions and the tradition of cooperation were pivotal in the unification process. The impact of the work of the Nordic Council of Ministers is quite straightforward, with the Louisiana Declaration as the most striking example (see chapter 4.7.1 above). Nordel was an important force in unifying the markets and coordinating the new Nordic market and an important forum for the main actors. Without these two institutions the development on the Nordic markets had most definitely been different and perhaps the unification would not have taken place at all. That, however, is only a question of academic interest, since the Nordic Council and Nordel are not only bodies of cooperation in different areas but an institutionalisation and a manifestation of trust and willingness to cooperate between the Nordic countries and citizens.

This general feeling of trust between the Nordic countries and citizens is a “soft” issue that is hard to grasp and it has not been addressed explicitly in this thesis. Nonetheless it has played an important role in the unification process. It may also help to explain why the “*outsider country Norway*”²⁷ without much discussion joined an international cooperation. The importance of trust between countries and its institutional manifestations becomes clear when one looks at what power system cooperation and power market unification really mean. A country’s electricity supply is a key part of the infrastructure and critical to all parts of the society. Disruptions in the electricity supply or strongly increasing prices have severe consequences for many functions on which the modern society relies and which today are taken for granted. By deregulating the electricity market, the state gives away large parts of its control of it to diverse market actors²⁸. In a strictly national power system, the state can keep some the control over the system, mainly through control over the grid which is a natural monopoly and a prerequisite for any electricity system²⁹. By unifying the power market with another country, parts of that control is given away to the neighbouring country. Practically, both countries have control over the power system in the other country. This inter-dependency becomes clear when the blackouts in recent years on the comparatively weakly interconnected continent, or the blackout in southern Sweden and Zealand in 2003, are considered [see IEA 2005]. Politicians in the countries which are about to unify their power systems have to trust each other, as do the industries, the power market actors and also the citizens, or the unification is likely to

²⁷ “*utenforlandet Norge*” [Diesen 2003:2]. Norway often stands at the side of international cooperation and has for example had two referendums about EU membership, both with negative results.

²⁸ However, it cannot have full control over a liberalised power market, as the example of California shows. The flawed regulations on the liberalised Californian market led to a massive abuse of market power, which in its turn led to a long period of rolling blackouts due to power shortages [see FERC 2003; EFET 2001].

²⁹ However, it must be highlighted that no Nordic control institution has been created so that each Nordic country still has the regulatory and legislative control over its own power market

encounter opposition and may not take place at all. The Nordic trust has been built up over a very long time and can not be explained with only rational, objective reasons.

5.2 Is the Nordic market a success?

All in all, the statements of Amundsen and Bergman and the Nordic competition authorities which were the starting point of the work with this thesis, saying that the Nordic power market has been largely successful, must be regarded as correct. However, there are problems and questions which should be highlighted; not least shown by the recently published article from Kaijser and Högselius, stating that “*the electricity market deregulation is a shocking example*”³⁰ of a failed reform [Kaijser, Högselius 2007]. Therefore, the question whether the Nordic market has been a success is discussed below.

5.2.1 Economy

Economically, the creation of the pan-Nordic market has been a fairly successful, with increased competition and efficiency. The prices have increased, but this is hardly mainly due to the reforms but rather to other, external factors.

Due to the possibilities to share peak and reserve capacities, the efficiency of the system has probably increased; however, no data measuring the benefits of this is available. In any case, the production over-capacity has been clearly reduced, due to the increasing consumption and the ceased construction of new power plants in Norway and Sweden. This has most definitely increased the efficiency of the market, but the cost for this has been reduced margins during extreme events and an arising import dependency (see chapter 5.2.2 below). In four years between 2000 and 2005, the NordPool countries were net importers of electricity; the general trend is a rapidly increasing dependency on electricity imports from other countries, mainly Russia [Nordel 1986-2006 Statistics chapter].

Despite the increased efficiency of the system, the prices have, after an initial decline, increased since the unification. This price increase has not been as strong as sometimes stated in the debate (see for example Kaijser, Högselius [2007]), but nonetheless it has been a significant increase also in real prices. This price increase is, however, not as often stated primarily due to the market power of the national champions, but due to other reasons [sees Nordic

³⁰ “*elavregleringen ett skräckexempel*”

competition authorities 2003]. Instead, the unification has effectively diluted the market power of the national champions and *reduced* their possibilities to distort the market. Therefore, the unification has rather decreased the price, since the national champions would be able to exert much more market power on strictly national markets, which would push prices up. This market dilution is a direct prerequisite for the, at least in international comparison, competitive Nordic market.

Instead of blaming the high electricity prices on the liberalisations and the unification, one should consider the world energy prices in general. The Nordic electricity price increase has occurred at a time of general price increases in the entire energy sector: between 2000 and 2006, the European hard coal price has increased with 60%; the natural gas price with 100%; the oil price has increased with more than 400% since 1998 [Schwarz, Lang 2006:14; Eurostat 2007b; IEA 2007]. In continental Europe, this has led to strong increases in electricity prices, even stronger than the Nordic price increase: the German electricity price, for example, increased with 80% between 2003 and 2005 [Schwarz, Lang 2006:16; 21]. Due to the interconnections from the Nordic countries to the continent, the increasing continental electricity prices create a demand for imports of the cheaper Nordic electricity, which in its turn pushes the Nordic prices up [Energimyndigheten 2006b:7]. With increased interconnection capacity from the Nordic countries to the continent, the Nordic prices can be expected to continue this increase until they are balanced with the continental prices. Norway, Sweden and Finland all have a large energy intensive industry and much electric heating of dwellings, both of which only have fossil fuels as substitute products for electricity. Therefore, the general fossil fuel price increase has a direct impact on the Nordic electricity price, even though the dependency on fossil fuels for electricity production is lower than on the continent.

In this light, the Nordic nominal price increase of between 22% and 54% is rather modest and is not necessarily a sign that the liberalisations and the unification have failed, like Kaijser and Högselius state. The more efficient use of the production capacity may have restrained the price increase, which has been lower than on the continent, but it is not possible to answer the question how the Nordic price development would have been without the unification.

5.2.2 Security of supply

From a security of supply viewpoint, the unification has been positive, albeit with some negative aspects. The Nordic power system as a whole has become less sensitive to disturbances, due to the increased total power generation base and the reinforced interconnections. Due to

the different types of electricity generation in the different countries, each country has effectively experienced a fuel diversification, which has made the Nordic system less dependent on rainfall, fossil fuel price or supply shocks.

On the other hand, the NordPool area has gone from being a net exporter to a net importer of electricity in the few years after the unification. Most of these imports come from Russia and transported through Finland to Sweden, which in its turn exports electricity to Norway (see for example Nordel 2005:46). The increased dependency on direct electricity imports is surely a negative effect of the Nordic reforms, and is the result of the ceased construction of new production capacity in Norway and Sweden. This, again, is a consequence of the liberalisations, which in these two countries had the explicit goal to reduce the production overcapacity. During the dry years 2001-2004, Norway and Sweden therefore had to rely on the Nordic and European neighbours for securing their supply. There has at all times been enough power in the system, even during the supply shock in winter 2002/2003, which impressively shows the benefits of the Nordic power market unification and the reinforced interconnections between the Nordic countries.

Therefore, it can be concluded that the *liberalisation* of the markets has not necessarily been positive for security of supply, but the *unification* has been very positive and at times even essential for the Nordic power balance.

5.2.3 Environment

Also environmentally, the creation of the Nordic market must be considered to have been successful, at least until today. Unfortunately, there is no data for the time after the unification describing the emission reductions due to the more efficient utilisation of Norwegian and Swedish hydro power in the entire Nordic power system. It seems clear, however, that this has led to a reduced use of Finnish and Danish coal power plants, which in its turn has reduced the total Nordic emissions of CO₂ and other pollutants. The most recent data on emission reductions due to the Nordel cooperation are from 1992, as the Nordic electricity trade was very limited compared to the present day. This data shows that the Nordel cooperation reduced the total Nordic electricity-related CO₂ emissions with about 25% [Nordel 1993:55]. There is no reason why this performance should have deteriorated since. It can rather be expected to have increased, due to the much increased trade, aiding Finland and Denmark to improve their climate performance.

However, since most of the Nordic production capacity increase is taking place in Finland and Denmark, much of this with fossil fuels, the long-term effects of the unification and the outsourcing of the Norwegian-Swedish electricity production to the neighbour countries may actually be a decreased environmental performance of the Nordic power system. This may in the future increase the Nordic emissions in general and the Finnish and Danish emissions in particular.

The phase-out of the Swedish nuclear power has also been enabled through the unification, since it has made it possible to rely on the neighbours to supply the missing Swedish electricity. This energy gap is mainly closed with direct imports from Finnish and Danish fossil-fired power plants and from Russian nuclear power plants. It is of course from an environmental point of view questionable whether it is reasonable to close down Swedish nuclear reactors and instead increase the electricity import from Russia and the Chernobyl-type nuclear reactors in Sosnovyj Bor outside St. Petersburg, which is the actual starting-point of most Finnish-Russian interconnections.

5.3 What Nordic experiences can be transferred to continental Europe?

The main success factor for the successful liberalisations and the unification of the Nordic markets was the strong political will to consequently and radically reform the markets. Today, the EU Member States can no longer choose whether they want to liberalise or not since the Electricity Directive forces them to do so, just like was the case with the Danish liberalisation. Further, the liberalisation paradigm has prevailed and is today a dominant policy paradigm in European policy.

Even though most Member States comply with the Electricity Directive, or only fail to fulfil the minor requirements, the will to go beyond the Directive or to unify national markets seems very limited. Also, most Member States have implemented half-hearted regulations, most of all concerning unbundling and TPA, which however still fulfil the watered-down requirements of the Electricity Directive. This is effectively preserving the monopoly or oligopoly situations and keeping smaller actors outside the market [European Commission 2006a:6; see also Turmes 2002 and www.eu-energy.com]. The general picture among analysts is that the liberalisations in continental Europe have not been very successful; a lot remains to do before the markets really deserve to be called liberalised and competitive, not to mention how far away Europe is from one single internal electricity market [EREC 2005:18f; European

Commission 2005b:9; Haas et al 2006:12ff]. In 2006, the Commission stated that “*it is highly questionable that gas and electricity prices are the result of a truly competitive process rather being the direct result of decision of companies with market power*” [European Commission 2006a:3]. Only the Nordic and the UK market are today considered fully liberalised [European Commission 2005b:9].

The main micro- and macro-level differences, as well as issues of political cooperation and trust, with impact on the political will and the acceptance and viability of reforms similar to the Nordic reforms between the Nordic and the continental markets are discussed below.

5.3.1 Micro-level

Looking at the micro-level, a number of reasons for the lack of political will to unify the power markets in continental Europe can be identified. At a first glance, the micro-level situation on the continent today is quite similar to the one in the Nordic countries at the time of the beginning reforms there. There are a few totally dominant companies and a large number of small companies active on most European markets. The structure of possibilities and threats to the companies is similar to the Nordic: an enlargement of the market will bring opportunities for all companies to expand, but will also bring more competitors. The large companies, often the national champions, will lose their monopoly areas when the market is totally liberalised and will lose market power if the national market is unified to other markets. If the grid sectors have to be separated from the production or retail sectors, as would be the case with the strong Nordic unbundling requirements, they would not only lose their monopolies but also a lot of the influence over the power market. Therefore, the large companies may be more reluctant toward a liberalisation than smaller companies.

Apparently, this fear has taken the upper hand, leading the national champions to use their close connections to the state to slow the process down as much as possible and to get the politicians to implement weak forms of unbundling and TPA³¹. This connection between energy giants and states is a major restraint for the full liberalisation and unification of the EU

³¹ All Nordic countries have ownership unbundling for transmission, which effectively separates the interests of the transmission and production companies, and legal unbundling for distribution. In 2005, Germany had legal and accounts unbundling for transmission and distribution, respectively, Italy had ownership and management unbundling and France had chosen legal and management unbundling [Eurostat 2006:29]. The Commission states that a strict transmission unbundling is the single most important variable to ensure that a market functions properly. The weak unbundling must be seen as one of the main reason to the problems on the continental power markets [European Commission 2005b:40].

electricity market, perhaps even the largest and hardest obstacle to overcome. The competition problems due to the weak unbundling are recognised by many politicians and the EU has recently been pushing to split the grid and production sectors of the large companies, which continue to grow larger and increase their market power, but has encountered harsh opposition from different sides, mainly the large energy companies and the national governments of France and Germany [Matthes, Grashof, Gores 2007:3; Financial Times 2007; EurActiv 2007b; c; Handelsblatt 2007]. Although Germany and France at the moment, in August 2007, seem to have the upper hand, the European Commission still seems to be determined to force the Member States to implement stricter regulations regarding unbundling. It remains to see who wins this fight.

One key to overcoming the tradition of power supply oligopolies in the Nordic countries was that the national champions, except the Danish, are all state-owned, allowing the governments to force their companies to accept the reforms. On the continent most large companies and national champions, like RWE and E.ON in Germany or Enel in Italy, are not state-owned (significant exception: Electricité de France, EdF). In some cases, state-owned companies are active on foreign markets, like Vattenfall [EdF 2007:12; Enel 2007; E.ON 2007c:152; RWE 2007a; Vattenfall 2007b:2], where they can act quite differently compared to how they need to act on their home markets. For example, Vattenfall is active as an oligopoly actor on the German market and is acting quite differently on this foreign market than in Sweden, most of all with respect to environmental concerns but also with respect to economical and cartel aspects. This non-state ownership makes it harder for the governments on the continent to enforce their will to liberalise and unify the power markets. It can therefore aid to explain why the pace in continental Europe is slower than in the Nordic countries and why the implemented regulations on the continent are weaker. This difference also weakens the possibilities to draw lessons from the Nordic example for the creation of a pan-European power market.

5.3.2 Macro-level

The fuel mixes in the electricity systems of continental Europe and the Nordic region are completely different, which has a large impact on the macro-level advantages of interconnecting power systems and unifying markets. The continental European electricity generation mix is totally dominated by thermal power and is very different from the hydro-based Norwegian-Swedish power system [Eurostat 2006:36]. There still are economic advantages of unifying two thermal-based systems, and to some extent also environmental and security of supply

advantages, but these are considerably lower than the advantages of uniting a thermal-based with a hydro-based system. The direct economic advantages mainly originate from increased efficiency due to the shared peak load and reserve capacities and also a possible change in the merit order. Due to the lower degree of production diversification – the power plants are of the same types in both systems – these advantages will be diminished. In a larger system, the more expensive power plants will indeed be used at a later load level, thus reducing the total cost and increasing the overall efficiency.

There are benefits for security of supply of unifying two thermal-based electricity systems, since a larger system can easier absorb technical failures and therefore is less dependent on each single production, transmission or distribution unit. However, if the two thermal systems are based on the same fuels – coal and gas, and perhaps nuclear – which to a large extent have to be imported, the security of fuel supply, and consequentially the security of electricity supply, is hardly increased.

The environmental benefits of unifying two thermal-based systems are clearly smaller than is the case when connecting a hydro system to a thermal system. Often, the more expensive power plants which get pushed further down in the merit order when connecting the two systems are the most inefficient power plants. Thus, the increased economic efficiency by running these power plants less frequently can also be an environmental advantage. However, the unification can also result in decreased environmental performance if it leads to an increased use of coal power in base load generation and a degradation of the more environmentally friendly gas-fired power plants to mere peak load capacity.

If and when the continental energy mix shifts toward renewable energies the advantages of interconnecting the markets will increase. Due to the intermittency of wind and solar electricity the need for reserve and balancing power will increase when the renewable energy sources achieve higher market shares. A larger power system will be able to share these regulatory capacities, thus increasing the overall efficiency. Further, the total need for regulatory power will decrease since the total stochastic variability of renewable electricity input will be lowered: the probability that the sun is shining or the wind is blowing somewhere is larger in a large system than in a small system. This stochastic smoothing will increase both the efficiency and the security of supply in the system. Keeping the lights on and minimising the costs are two of the keys to an expansion of renewable electricity and this can be achieved by uniting markets and interconnecting power systems.

An interesting problem that may be more accentuated in the future is the climate change impact on the power sector. The climate change and increasing temperatures may cause increased problems with the cooling for many power plants, especially for those not located at the sea, since the water supply may be insufficient or the water too warm. This has already happened once: in 2003, several French nuclear reactors were on the verge of having to shut down due to the high water temperatures [Roche 2005:23]. If these events become more frequent in the future and power plants have to lower or stop production during warm periods, potentially leading to electricity shortage and blackouts to a tremendous cost to society. Enlarging the power system may however decrease the vulnerability to such events, since it is improbable that such a heat wave will cover the entire continent. If they are strongly interconnected, one region may increase its electricity generation to compensate the losses in another, thus increasing security of supply for the entire interconnected area. A common energy policy and a common electricity market would make this production optimisation more efficient.

All in all, the macro-level economical, environmental and security of supply advantages for unifying the current power markets on the continent are considerable, but not as large as they were in the Nordic countries. This is most definitely an important reason for the lower political will and the slower market integration on the continent. If the advantages are smaller, of course the pace of a process will be lower since the actors are not as keen to implement the new regulations as they would have been if the advantages were larger. The protagonists of unification of the continental European power markets have had fewer and not as strong arguments as their Nordic counterparts. This will however change in the future as climate change becomes present in the everyday life, perhaps even making cooling of conventional power plants impossible during hot summers, and renewable electricity market shares increase. A visionary but also a play-it-safe approach would therefore be to unify the markets and increase the interconnection capacities already today.

5.3.3 Political cooperation and trust

The importance of the Nordic cooperation organisations Nordic Council and Nordel for the unification of the Nordic market is quite obvious and can hardly be overstated. On the continent, similar organisations are present. All continental EU Member State TSOs are members of the cooperation organisation UCTE (Union for the Co-ordination of Transmission of Electricity) and the entire continental EU, except the Baltic former Soviet republics, is one synchronous frequency area [UCTE 2007; RWE 2007b]. Therefore, the countries are already

inter-dependent on each other for maintaining the stability of the system, albeit to a smaller extent than the Nordic countries due to the weaker continental interconnections, but the markets are still kept national. This situation is very similar to the Nordel cooperation in the beginning of the 1990s, before the Nordic markets were unified. The main institution for political cooperation on the continent is of course the European Union. The work of the EU is in many areas similar to the work of the Nordic Council in the past, like the exemption from passport requirements or the common labour market, but is even deeper in many areas, like environmental policy. The institutional landscape of cooperation on the continent is very similar or even deeper integrated than was the case in the Nordic region at the time of the liberalisations and the unification, but still continental electricity market progress is 15 years behind.

The trust and feeling of understanding between the Nordic countries is based on a mutual history and similar languages which have led to a feeling that “they are not so different from us”. The countries on the continent also have a mutual history, but this history is to a large extent characterised by conflicts and wars, which has led to mistrust and prejudice, for example between Germans on the one side and Poles, Dutch or English on the other. Almost all countries have another language which immediately makes clear that “they are different from us”. On the highest political level, many of these problems have already been overcome and trust and understanding is increasing and the conflicts of the past are more and more disappearing from the political arena, except for the occasional blooper by populist prime ministers or presidents³². This is to a large extent happening because of the ever deeper political cooperation in the EU. It remains to see whether the top-down elitist political project that is the European Union will lead to a “europeanisation” and increased trust also among lower-level politicians, companies and citizens.

5.3.4 Outlook

This thesis has showed that it is not impossible to fundamentally reform a power system and to unify it with others. The Nordic case clearly shows that political will, support from the market as well as an institution with authority that points out the advantages of a reform is a

³² Two examples from of this is the request in 2007 of Poland’s president Kaczynski that also the population which was killed by German bombs during World War II should be accounted for when determining the number of votes for each Member State in the European Parliament [Focus 2007] and the Italian prime minister Berlusconi’s remark in 2003 that the German MEP Martin Schulz would be perfect as a concentration camp guard in a new movie [BBC 2003].

potent mixture to pursue such dramatic changes. On the continent, this political will is not as strong as it was in the Nordic countries, much due to powerful anti-liberalisation and anti-unification lobbying from the energy giants. This opposition effectively blocks the unification of the continental thermal-based power markets which would have a lot to gain from this, albeit to a lower extent than was the case with the Nordic hydro- and thermal-based market. Nonetheless, the European Commission seems to have made up its mind – the European power markets will be opened and unified and a strongly interconnected pan-European internal electricity market created. Very little speaks against this and it is hard to see why electricity should be treated differently than any other products which today can be traded freely within the internal European market. It is therefore likely that the European power markets will be fully opened and unified in the future, albeit probably with great agony and moaning from many Member States and companies. The relevant question is not whether the European electricity market will be unified and made competitive or not, but when this will happen.

At the time, in August 2007, the opposition against the liberalisations and the European unification is still solid, mainly in Germany and France, but there are first signs that the opposition against market unification is crumbling. Currently, plans for a German-French-Benelux power market are made, as are plans to unify Germany with the Nordic market. Possibly, there are other regional markets in planning which are not yet public. Looking at the Nordic example, where the unification of two markets started a snowball effect and soon spread to the neighbour countries, it is probable that a unification of two large, central continental markets could start an avalanche of market unifications among the other countries. Therefore, a highly speculative conclusion based on the Nordic experiences would be that the process in Europe will continue to be slow until the first regional market including either Germany or France, or both, emerges – after that, the opposition will fall, the advantages of unifying markets will prevail in the debate and the creation of a pan-European electricity market will be swift.

6 Conclusions

The most important factor for the successful liberalisations and the unification of the Nordic market was the political, profound over-the-blocks will to consequently deregulate and unify the markets to increase efficiency and keep electricity prices down. This strong political support is clearly shown by the prevailing consensus in all countries. In Norway, Sweden and Finland the reform was initiated and decided by conservative governments and implemented by Social democrats. In Denmark, the reform was an agreement between almost all parties in the parliament. The unanimous decision by the Nordic Council of Ministers in 1995, the Louisiana Declaration, to unify the Nordic power markets is of crucial importance and is the starting point of the actual unification. The tradition of political and economical trust and cooperation between the Nordic countries had thereby spread to and manifested itself also in the electricity sector. The creation of the liberalised pan-Nordic market has been largely successful, albeit with increasing prices, which however have increased less than on the continent, and an arising import dependency.

The will to liberalise can largely be explained by a general policy paradigm change toward less regulation; there was an ideological conviction that liberalisations are per se beneficial. In Sweden and Finland, the successful liberalisation in Norway and the sinking prices there, although they were not a result of the reform but of heavy rainfalls, increased the will to deregulate. The expectation of decreasing prices was especially important in the light of the economic crisis in the beginning of the reform processes in the early 1990s. In all countries, increased power sector efficiency and sinking prices were main goals of energy policy in general. A deregulation fit well with the new political paradigm as well as with the price goal and consequently the Norwegian model was considered successful and was successively adopted by the other countries. The requirements of the Electricity Directive of the EU were an important factor for the liberalisations. This was especially important in Denmark, which was forced by the EU to deregulate. However, the liberalisations in all countries were much more far-reaching than the EU requirements, which neither require the strict rules applied in the Nordic countries nor market unification.

The overwhelming majority of market actors were politically controlled; either they were owned by the state (the national champions and the TSOs) or by municipalities. Almost all actors, political as well as market actors, supported the liberalisations and the unification. Only the Swedish state-owned company Vattenfall and the private Sydkraft initially opposed the reforms. The state-owned national champions, which totally dominated the national mar-

kets, either supported the reforms or were forced to give up any opposition it by the state. Therefore, the state-ownership of the national champions, as well as of the TSOs, is a key parameter to explain why the opposition from the market actors was low.

The studies published during 1993 and 1994, most significantly the Svenska kraftnät study in 1993, showed that Norway and Sweden would achieve a higher level of security of supply during dry years, whereas Finland and Denmark would have lower electricity prices during wet years and be able to export their expensive thermal electricity during dry years. The Nordic region as a whole would increase its environmental performance and experience lower emissions due to the more efficient use of hydro power. Before these studies were published, no intentions to unify the markets could be found in any document from any country; the intention was to keep the liberalised markets national. After the Svenska kraftnät study, market unification is a political goal in all countries. The “objective” benefits of liberalising and uniting the markets – increased efficiency, market dilution, increased security of supply and environmental performance – and the fact the these benefits were recognised and published by credible organisations therefore were crucial to create and strengthen the political will to unify the markets and to diminish any opposition.

The problem structures in the four countries were in many aspects different, but in all countries a main hurdle for the liberalisation was the high market concentration and the market power of the national champions. By uniting the national markets, the market concentration was effectively diluted, which increased the competition in all countries. Further, it was feared, mainly in Finland and Denmark, that the strictly national markets would be too small to function properly. Both these problems were solved by integrating the market with the neighbours.

The main factor besides the market dilution leading to the mutual macroeconomic benefits of the unification was the large differences between the power systems and the high share of hydro power in Norway and Sweden. Norway and Sweden had low electricity prices and high environmental performance but low security of supply during dry years. The thermal-based systems in Finland and Denmark had a high level of security of supply but higher prices and lower environmental performance. Therefore, it was recognised that the neighbours to a large extent had the solution to the national problems.

7 Literature

- AAD (2003): *Mellom stat og marked. Selvstendige organisasjonsformer i staten*, NOU 2003:34, Arbeids- og administrasjonsdepartementet, Oslo. [”*Between state and market. Independent state organisations*, NOU (Norwegian government official report), Norwegian Ministry of Labour and Administration”].
- Aam, S., Wangensteen, I. (1998): *Deregulation of the Norwegian electricity supply industry expectations and experiences*, 17th World energy congress, World Energy Council, Houston, http://www.worldenergy.org/wec-geis/publications/default/tech_papers/17th_congress/1_4_04.asp?mode=print&x=10&y=10, 2007-07-11.
- Aftonbladet (1999): *Nu ber näringsministern norska folket om ursäkt för sitt påhopp*, Aftonbladet, Stockholm, <http://www.aftonbladet.se/nyheter/9909/24/rosen.html>, 2007-07-12. [”*Minister of Enterprise apologises for his attack*, Aftonbladet”].
- Alestalo, M., Kuhnle, S. (1987): *The Scandinavian route: Economic, social and political developments in Denmark, Finland, Norway and Sweden*, in: Erikson, R., Hansen, E. J., Ringen, S., Uusitalo, H. (ed.): *The Scandinavian model. Welfare states and welfare research*, M. E. Sharpe Inc, London.
- Amundsen, E. S., Nesse, A., Tjøtta, S. (1999): *Deregulation of the Nordic power market and environmental policy*, in: *Energy Economics* 21 (1999), pp. 417-434, Elsevier Ltd., Amsterdam.
- Amundsen, E. S., Bergman, L. (2005): *Why has the Nordic electricity market functioned so well?*, Department of Economics, University of Bergen, Bergen.
- Amundsen, E. S., Bergman, L. (2007): *Integration of multiple national markets for electricity: The case of Norway and Sweden*, in: *Energy Policy* 35 (2007), pp. 3383-3394, Elsevier Ltd., Amsterdam.
- Baltic cable (2007): *Who, when and where*, Baltic Cable AB, Malmö, <http://www.balticcable.com/aboutindex.html>, 2007-06-06.
- Barsebäck (2005): *Historik*, Barsebäckkraft AB, Löddeköpinge, <http://www.barsebackkraft.se/index.asp?ItemID=1291>, 2007-05-21. [”*History, Barsebäck power*”].

- BBC (2003): *Germany sickened by Berlusconi*, BBC News, London, <http://news.bbc.co.uk/1/hi/world/europe/3045618.stm>, 2007-07-26.
- Bergman, L., Brunekreeft, G., Doyle, C., Newbery, D. M. G., Pollitt, M., Regibeau, P., von der Fehr, N-H. M., David, M. G. (1999): *A European market for electricity? Monitoring European Deregulation 2*, Centre for economic policy research, London.
- Bergman, L. (2001): *Regulation and competition on the Nordic power market*, 18th World energy congress, World Energy Council, Buenos Aires.
- Betänkande 1993/94:NU22: *Näringsutskottets betänkande 1993/94:NU22. Handel med el i konkurrens*, Näringsdepartementet, Stockholm. [“*Report from the Commission of Enterprise, Energy and Communications. Electricity trade with competition*, Swedish Ministry of Enterprise, Energy and Communications”].
- Betänkande 1995/96:NU1: *Näringsutskottets betänkande 1995/96:NU1. Ny ellagstiftning*, Näringsdepartementet, Stockholm. [“*Report from the Commission of Enterprise, Energy and Communications. The new Electricity law*, Swedish Ministry of Enterprise, Energy and Communications”].
- Bigatto, M. (2000): *Systemtechnische Evaluation unterschiedlicher Marktmodelle eines offenen Strommarktes*, Eidgenössische Technische Hochschule (ETH), Zürich. [“*Systems technical evaluation of different market models for a open electricity market*, Swiss federal institute of technology Zürich”].
- BMU (2005): *Concentrating solar power for the Mediterranean region*, German federal ministry of the environment, nature conservation and nuclear safety (BMU), German Aerospace Center (DLR), Berlin, Stuttgart.
- BMU (2006): *Trans-Mediterranean interconnection for concentrating solar power*, German federal ministry of the environment, nature conservation and nuclear safety (BMU), German Aerospace Center (DLR), Berlin, Stuttgart.
- Bonde, B. (2002): *Deregulierung in der Elektrizitätswirtschaft: eine Untersuchung der politischen Ökonomie der Liberalisierung im internationalen Vergleich*, Peter Lang GmbH, Europäischer Verlag der Wissenschaften, Frankfurt am Main. [“*Deregulation of the electricity markets: an international comparison of the political economy of the liberalisation*, Peter Lang GmbH”].

- Bråten, J. (1997): Transmission pricing in Norway, in: *Utilities Policy* Vol. 6 No 3 1997, pp. 219-226, Elsevier Science Ltd., Amsterdam.
- Brunshagen, H., Haubrich, J., Heinz, D., Müller H. C. (1995): Entwicklungen zum gesamteuropäischen Stromverbund, in: *Jahrbuch 95*, pp. 257 – 278, VDI-Gesellschaft Energietechnik, Verband deutscher Ingenieure, Düsseldorf. [“*Development toward a pan-European electricity network, Association of German engineers*“].
- Bye, T., Hope, E. (2005): *Deregulation of electricity markets – The Norwegian experience*, Statistics Norway, Oslo.
- Carlsberg (2005): *The Carlsberg history*, Carlsberg, Copenhagen, <http://www.carlsberggroup.com/Company/Timeline/Pages/History.aspx>, 2007-07-20.
- Czada, R., Lütz, S. (2004): *Die politische Konstitution von Märkten*, Westdeutscher Verlag, Wiesbaden. [“*The political constitution of markets*, Westdeutscher Verlag“].
- Czisch, G. (2001): Interkontinentale Stromverbünde – Perspektiven für eine regenerative Stromversorgung, in: *FVS Themen 2001*, pp. 51-63, Forschungsverband Sonnenenergie, Berlin. [“*Intercontinental power networks – perspectives for a renewable power supply*, in: *FVS Themen*, Forschungsverband Sonnenenergie“].
- Czisch, G. (2004): *Least-Cost European/Transeuropean electricity supply entirely with renewable energies*, Institut für Solare Energieversorgungstechnik (ISET), Kassel.
- Diesen, E. (2003): *Vannkraft i Norge. Fra statlig styring til fritt marked. Tidligere vassdrag- og energidirektør Erling Diesen. Holdt som foredrag på Oslo Geofysikers forenings julemøte 2. desember 2003*, Norges Vassdrag- og energidirektorat, Oslo. [“*Hydro power in Norway. From governmental control to a free market, Speech of former director Erling Diesen, Norwegian water resources and energy directorate*“].
- DG-TREN (2005): *Trans-European energy networks. TEN-E priority projects*, Directorate-General for Energy and Transport (DG-TREN), Commission of the European Communities, Brussels.
- Directive 96/92/EC: *Directive 96/92/EC of the European Parliament and of the Council of 19 December 1996 concerning common rules for the internal market in electricity*, European Parliament, European Council, Brussels.

- E.ON (2007a): *Företagets historia 1915-1956*, E.ON Sverige, Malmö, <http://eon.se/templates/InformationPDF.aspx?id=44007>, 2007-05-10. [”*History of the company 1915-1956*, E.ON Sweden”].
- E.ON (2007b): *Företagets historia 1971-2005*, E.ON Sverige, Malmö, <http://eon.se/templates/InformationPDF.aspx?id=44088>, 2007-05-02. [”*History of the company 1971-2005*, E.ON Sweden”].
- E.ON (2007c): *Strategy & Key figures 2007 – Update*, E.ON, Düsseldorf.
- EEA (2006): *Annual European Community greenhouse gas inventory 1990-2004 and inventory report 2006. Submission to the UNFCCC Secretariat. EEA Technical report No 6/2006*, European Environment Agency (EEA), Copenhagen.
- ECB (2007a): *Danish krone (DKK)*, European central bank (ECB), Frankfurt am Main, <http://www.ecb.eu/stats/exchange/eurofxref/html/eurofxref-graph-dkk.en.html>, 2007-05-29.
- ECB (2007b): *Norwegian krone (NOK)*, European central bank (ECB), Frankfurt am Main, <http://www.ecb.eu/stats/exchange/eurofxref/html/eurofxref-graph-nok.en.html>, 2007-05-29.
- ECB (2007c): *Swedish krona (SEK)*, European central bank (ECB), Frankfurt am Main, <http://www.ecb.eu/stats/exchange/eurofxref/html/eurofxref-graph-sek.en.html>, 2007-05-29.
- EdF (2007): *EdF group annual report 2006*, EdF group, Paris.
- EFET (2001): *California experience – why the market failed*, European Federation of Energy Traders (EFET), Brussels.
- Eikeland, P. O. (1998): Electricity market liberalisation and environmental performance: Norway and the UK, in: *Energy Policy* Vol. 26 No. 12 1998 pp. 917-927, Elsevier Ltd., Amsterdam.
- Elmarknadsförordning (1995): *Elmarknadsförordning*, Handels- och industriministeriet (KTM), Helsinki. [”*Electricity market decree*, Finnish Ministry of Trade and Industry”].
- Elmarknadslag (1995): *Elmarknadslag*, Handels- och industriministeriet (KTM), Helsinki. [”*Electricity market act*, Finnish Ministry of Trade and Industry”].

- Elmarknadslag (2003): *Elmarknadslag*, Handels- och industriministeriet (KTM), Helsinki. [”*Electricity market act*, Finnish Ministry of Trade and Industry”].
- Enel (2007): *Company profile*, Enel, Rome, http://enel.it/azienda_en/chi_siamo, 2007-07-23.
- Energiateollisuus (2007a): *Sähkön kokonaiskäyttö ja käyttö per capita Euroopassa, Consumption and consumption per capita in Europe*, Finnish Energy Industries (Energiateollisuus), Helsinki, <http://www.energia.fi/fi/tilastot/sahkotilasto/kaytto/sahkonkokonaiskayttojakayttopercapitaeuroopassa>, 2007-05-29.
- Energiateollisuus (2007b): *Sähkölämmitteisten asuntojen määrän lisäys. Increase of the dwellings heated by electricity*, Finnish Energy Industries (Energiateollisuus), Helsinki, <http://www.energia.fi/fi/tilastot/sahkotilasto/kaytto/sahkolammitteistenasuntojenmaaranlisays>, 2007-06-09.
- Energiamarkkinavirasto (2002): *The opening of the electricity market*, Finnish Energy Market Authority (Energiamarkkinavirasto), Helsinki, <http://www.energiamarkkinavirasto.fi/data.asp?articleid=230&pgid=127>, 2007-06-12.
- Energiamarkkinavirasto (2004): *Development of the electricity price in Finland until July 1st, 2004*, Finnish Energy Market Authority (Energiamarkkinavirasto), Helsinki, <http://www.energiamarkkinavirasto.fi/files/Development0407.pdf>, 2007-06-09.
- Energiloven (1990): *LOV 1990-06-29 nr 50: Lov om produktion, omforming, overføring, omsetning, fordeling og bruk av energi m.m. (energiloven)*, Olje- og energidepartementet, Oslo. [”*Energy Act*, Norwegian Ministry of Petroleum and Energy”].
- Energimarknadsinspektionen (2007): *Elproducenter*, Energimarknadsinspektionen, Energi-myndigheten, Eskilstuna, <http://www.energimarknadsinspektionen.se/TOPPMENYN/Statistik/El/Elproduktion/Marknadsaktorer/#Nordens%20st%C3%B6rsta%20elproducenter>, 2007-06-11. [”*Electricity producers*, Energy Markets Inspectorate, Swedish Energy Agency”].
- Energiministeriet (1985): *Aftale mellem energiministeriet og ELSAM, ELKRAFT, Danske elværkers forening om øget anvendelse af vedvarende og indenlandske energikilder i elproduktionen*, Energiministeriet, Copenhagen. [”*Agreement between the Ministry of energy and ELSAM, ELKRAFT and the Danish Power Plant Association about the in-*”].

- creased use of renewable and domestic energy sources in the electricity production, Danish Ministry of Energy”].*
- Energimyndigheten (2000): *Yttrande avseende nättariffer på förbindelserna till Danmark N2000/5652/ESB*, Energimyndigheten, Eskilstuna, [http://energimyndigheten.se/infobank/remisser.nsf/b7e0f148538c2f77c12571fe00307747/2dfb51d9d63a8924c125697c00320e33/\\$FILE/02-00-2850%20Gr%C3%A4nstariff%20DK.doc](http://energimyndigheten.se/infobank/remisser.nsf/b7e0f148538c2f77c12571fe00307747/2dfb51d9d63a8924c125697c00320e33/$FILE/02-00-2850%20Gr%C3%A4nstariff%20DK.doc), 2007-07-03. [”*Statement regarding grid tariffs on the interconnections to Denmark, Swedish Energy Agency*”].
- Energimyndigheten (2004): *Prisområden som flaskhalshantering. En studie av konsekvenser för företagen*, Energimyndigheten, Eskilstuna. [”*Price areas as congestion management, Swedish Energy Agency*”].
- Energimyndigheten (2006a): *Energy in Sweden. Facts and figures*, Swedish Energy Agency (Energimyndigheten), Eskilstuna.
- Energimyndigheten (2006b): *Prisbildning och konkurrens på elmarknaden*, ER 2006:13, Energimyndigheten, Energimarknadsinspektionen, Eskilstuna. [”*Price setting and competition on the electricity market, Swedish Energy Agency, Energy Markets Inspectorate*”].
- Energinet.dk (2005): *Elektrisk Storebæltsforbindelse. Forprojekt om etablering af en elektrisk Store-bæltsforbindelse*, Energinet.dk, Fredericia. [”*Electric connection over the Great Belt, Energinet.dk*”].
- Energinet.dk (2007): *Den elektriske Storebæltsforbindelse*, Energinet.dk, Fredericia, <http://storebaelt.energinet.dk/da/menu/Forside.htm>, 2007-06-14. [”*The electric connection over the Great Belt, Energinet.dk*”].
- ENS (2006): *Energistatistik 2005*, Energistyrelsen (ENS), Copenhagen. [”*Energy statistics 2005, Danish Energy Authority*”].
- EREC (2005): *The myth of effective competition in European power markets*, European Renewable Energy Council (EREC), Brussels.
- ERGEG (2007): *ERGEG regional initiatives annual report. Progress and prospects*, European Regulators Group for Electricity and Gas (ERGEG), Brussels.
- Erikson, R., Hansen, E. J., Ringen, S., Uusitalo, H. (ed.) (1987): *The Scandinavian Model. Welfare states and welfare research*, M. E. Sharpe Inc, London.

- EurActiv (2006a): *Nuclear and renewables on the menu at EU ministerial*, EurActiv.com, Brussels, <http://www.euractiv.com/en/energy/nuclear-renewables-menu-eu-ministerial/article-159926>, 2007-05-02.
- EurActiv (2006b): *Blackout puts outdated power grid in spotlight*, EurActiv.com, Brussels, <http://www.euractiv.com/en/energy/blackout-puts-outdated-power-grid-spotlight/article-159530>, 2007-08-17.
- EurActiv (2007a): *Germany joins five-country electricity market*, EurActiv.com, Brussels, <http://www.euractiv.com/en/energy/germany-joins-country-electricity-market/article-164359>, 2007-07-16.
- EurActiv (2007b): *MEPs call for dismantling of energy giants*, EurActiv.com, Brussels, <http://www.euractiv.com/en/energy/meps-call-dismantling-energy-giants/article-165412>, 2007-07-31.
- EurActiv (2007c): *EU states reject breaking up firms*, EurActiv.com, Brussels, <http://euractiv.com/en/energy/eu-states-reject-breaking-energy-firms/article-164398>, 2007-08-16.
- EurActiv (2007d): *Electricity markets: MEPs urge full liberalisation*, EurActiv.com, Brussels, <http://www.euractiv.com/en/energy/electricity-markets-meps-urge-full-liberalisation/article-164712>, 2007-08-18.
- EurActiv (2007e): *Interview: European 'energy champions' needed*, EurActiv.com, Brussels, <http://www.euractiv.com/en/energy/interview-european-energy-champions-needed/article-164034>, 2007-08-18.
- Eurobarometer (2007): *Attitudes on issues related to EU energy policy. Analytical report*, Public Opinion Analysis Sector, European Commission, Brussels.
- European Commission (1988): *The internal energy market, COM(88)238 final*, Commission of the European Communities, Brussels.
- European Commission (2004): *Towards a competitive and regulated European electricity and gas market*, DG Energy and Transport, Commission of the European Communities, Brussels.
- European Commission (2005a): *Report from the Commission. Progress towards achieving the Community's Kyoto target. COM(2005)655 final*, Commission of the European Communities, Brussels.

- European Commission (2005b): *Evaluation of the performance of network industries providing services of general economic interest*, SEC(2005)1781, Commission of the European Communities, Brussels.
- European Commission (2006a): *Prospects for the internal gas and electricity market. Communication from the Commission to the Council and the European Parliament*, COM(2006)841 final, Commission of the European Communities, Brussels.
- European Commission (2006b): *Green paper. A European strategy for sustainable, competitive and secure energy*, COM(2006)105 final, Commission of the European Communities, Brussels.
- European Commission (2007): *Finland som medlemsland i EU*, Commission of the European Communities, Brussels, http://ec.europa.eu/finland/abc/eu_works/ms_role/index_sv.htm, 2007-07-20. [”Finland as an EU Member State, Commission of the European Communities”].
- Eurostat (2006): *Energy & Transport in figures 2005*, Eurostat, Directorate-General Energy and Transport, Commission of the European Communities, Brussels.
- Eurostat (2007a): *Electricity prices – households*, Eurostat, Commission of the European Communities, Brussels, http://epp.eurostat.ec.europa.eu/portal/page?_pageid=1996,39140985&_dad=portal&_schema=PORTAL&screen=detailref&language=en&product=Yearlies_new_environment_energy&root=Yearlies_new_environment_energy/H/H2/H21/er02b2, 2007-07-10.
- Eurostat (2007b): *Environment and energy*, Eurostat, Commission of the European Communities, Brussels, http://epp.eurostat.ec.europa.eu/portal/page?_pageid=0,1136239,0_45571447&_dad=portal&_schema=PORTAL, 2007-08-14.
- FERC (2003): *Final report on price manipulation in western markets. Fact-finding investigation of potential manipulation of electric and natural gas prices*, Federal Energy Regulatory Commission (FERC), Washington D.C..
- Financial Times (2007): *Energy break up backed*, Financial Times, FT.com, London, <http://www.ft.com/cms/s/234def9a-2f16-11dc-b9b7-0000779fd2ac.html>, 2007-07-31.

- Fingrid (2007): *Company*, Fingrid, Espoo, http://www.fingrid.fi/portal/in_english/company_info/, 2007-06-11.
- Focus (2007): *Kaczinsky will Kriegstote mitzählen*, Focus Online, Munich, http://www.focus.de/politik/ausland/stimmengewicht-in-eu_aid_64058.html, 2007-07-26. [“*Kaczinsky wants to count war victims*, Focus Online”]
- Folketinget (1985): *Folketingsbeslutning om offentlig energiplanlægning uden atomkraft. Vedtaget af folketinget ved 2. (sidste) behandling den 29. marts 1985*, Folketinget, Copenhagen. [“*Parliament decision concerning public energy planning without nuclear power*, Danish parliament”].
- Folketinget (1998a): *Bekendtgørelse om adgang til elforsyningsnettet m.v.. BEK nr 231 af 21/04/1998 (Gældende)*, Folketinget, Copenhagen. [“*Declaration about access to the electricity grid*, Danish Parliament”].
- Folketinget (1998b): *Spørgsmål nr S 660: Om el-direktivets krav til markedsåbning*, Folketinget, Copenhagen. [“*Question nr. S 660: about the market opening demands of the Electricity Directive*, Danish Parliament”].
- Folketinget (1999a): *Lov om elforsyning*, Folketinget, Copenhagen. [“*Electricity Supply Act*, Danish Parliament”].
- Folketinget (1999b): *Bemærkninger til lovforslaget*, Folketinget, Copenhagen. [“*Notes to the bill*, Danish parliament”].
- Folketinget (2006): *Valg og tendenser*, Folketinget, Copenhagen, <http://www.ft.dk/pdf/ark9.pdf>, 2007-06-15. [“*Elections and tendencies*, Danish Parliament”].
- Fortum (1999): *Annual report 1998*, Fortum, Helsinki.
- Fortum (2007a): *Our history*, Fortum, Espoo, <http://fortum.com/flash.asp?path=14022;14024;14026;14043;14070;14071;14079;35102;35107&level=4>, 2007-06-11.
- Fortum (2007b): *Annual report 2006*, Fortum, Espoo.
- Gronheit, P. E., Skytte, K., Wolffsen, P. (1998): *En nordeuropæisk elbørs*, Forskningscenter Risø, Roskilde. [“*A north-European electricity exchange*, Risø National Laboratory, Technical University of Denmark”].

- Haas, R. (2006): *Competition in the continental Europe electricity market: Despair or work in progress?*, Energy Economics Group, Vienna University of Technology, Vienna.
- Handelsblatt (2007): *Vorsicht, Spannung!*, Handelsblatt, Düsseldorf, http://www.handelsblatt.com/news/Politik/Deutschland/_pv/doc_page/1/_p/200050/_t/ft/_b/1312650/default.aspx/vorsicht%2c-spannung!.html, 2007-08-23. [“*Caution, electrical tension*, Handelsblatt“].
- Hegg Gundersen, M. (2007): *Experience with the Swedish-Norwegian certificate market*, International Workshop on Harmonisation and Coordination of European Renewable Electricity support mechanisms, Energy Economics Group (EEG), Vienna University of Technology, Vienna, Brussels, <http://www.futures-e.org/dcl/index.php?futures-e%20workshop%2020-June-2007.zip>, 2007-07-12.
- Helby, P. (2005): *Denmark: Developments regarding the directive on electricity from renewable resources*, Environmental and Energy Systems Studies, Lund University, Lund.
- Helm, D. (2005): *European energy policy: Securing supplies and meeting the challenge of climate change*, New College, Oxford.
- Hira, A., Amaya, L. (2003): Does energy integrate?, in: *Energy policy* 31 (2003) pp.185-199, Elsevier Ltd., Amsterdam.
- Hjalmarsson, L. (1993): Från kraftutbyte och tariffer till spotmarknad och kraftbörs, in: *Handelsplats för el. Utredning om förutsättningar för en svensk elbörs*, Bilaga 3, Svenska kraftnät (SVK), Vällingby. [“From power interchange and tariffs to spot market and power exchange in: *Trading place for electricity. Survey of the conditions for a Swedish power exchange*, Appendix 3, Svenska kraftnät”].
- Holmberg, S. (2006): *Swedish and European opinions on energy production*, SOM Institute, Department of political science, Göteborg University, Göteborg.
- Hope, E. (2002): *10 år med energiloven*, Norges handelshøyskole, Bergen. [“*10 years with the energy law*, Norwegian School of Economics and Business Administration”].
- IEA (2003): *Energy policies of IEA countries. Finland 2003 review*, International Energy Agency (IEA), Paris.
- IEA (2005): *Learning from the blackouts. Transmission system security in competitive electricity markets*, International Energy Agency (IEA), Paris.

- IEA (2007): *End-user petroleum product prices and average crude oil import costs*, International Energy Agency (IEA), Paris, <http://iea.org/Textbase/stats/surveys/mps.pdf>, 2007-08-14.
- Jann, W., Wegrich, K. (2003): Phasenmodelle und Politikprozesse: Der Policy Cycle, in: Schubert, K., Bandelow, N. C. (ed.): *Lehrbuch der Politikfeldanalyse*, pp.71-105, Oldenbourg, Munich, Vienna. [“Phase models and political processes: the policy cycle, in: *Policy analysis textbook*, Oldenbourg“].
- Jänicke, M., Kunig, P., Stitzel, M. (2003): *Umweltpolitik*, Verlag J.H.W. Dietz Nachf. GmbH, Bonn. [“*Environmental politics*, Verlag J.H.W. Dietz Nachf. GmbH“].
- Kaijser, A., Högselius, P. (2007): Elavregleringen ett skräckexempel, in: *DN Debatt*, Dagens Nyheter, Stockholm, <http://www.dn.se/DNet/jsp/polopoly.jsp?d=572&a=662580>, 2007-06-20. [“*Electricity market deregulation a shocking example*, Dagens Nyheter”].
- KKV (1996): *Fungerar elmarknaden?*, Konkurrentverket (KKV), Stockholm. [“*Does the electricity market work?*, Swedish Competition Authority”].
- KKV (2006): *Koncentrationen på elmarknaden – Konkurrentverkets fel?*, Konkurrentverket (KKV), Stockholm. [“*The concentration on the electricity market – is the competition authority to blame?*, Swedish Competition Authority”].
- KS (1998): *Konkurrence i energisektoren*, Konkurrentestyrelsen (KS), Copenhagen. [“*Competition in the energy sector*, Danish Competition Authority”].
- KTM (2003): *Energy trends in Finland 2003*, Finnish Ministry of Trade and Industry (KTM), Helsinki.
- KTM (2005): *Nuclear energy in Finland*, Finnish Ministry of Trade and Industry (KTM), Helsinki.
- KTM (2007): *Environmental impact assessment of the Olkiluoto power plant's fourth unit to be launched*, Finnish Ministry of Trade and Industry (KTM), Helsinki, <http://ktm.fi/?i=2205&l=en&s=222>, 2007-06-09.
- Larsen, A., Munksgaard, J. Jess Olsen, O., Holm Pedersen, L., Rieper, O., Moll Sørensen, E. (2004): *Virkemidler i den danske elreform: Foreløbige antagelser om sammenhænge mellem kontekst, mekanismer og resultater (outcome)*, Amternes og kommunernes forskningsinstitut, Copenhagen. [“*Mechanisms in the Danish electricity reform*, Danish institute of local government studies”].

- Lemström, B. (2001): *The impact of electricity network organisation, regulation and pricing on renewables and distributed generation, Inventory of the situation in Finland*, International Energy Agency (IEA), Paris, <http://www.iea.org/Textbase/work/2001/redg/REDGFIN1.PDF>, 2007-06-11.
- Lindblom, T., Andersson, B. (1998): Strategic moves at the prospect of a deregulated electricity market, in: *International journal of production economics* 56-57 (1998), pp. 423-432, Elsevier Ltd., Amsterdam.
- LogicaCMG (2006): *Mind the gap - the black hole at the heart of the UK's energy supply*, LogicaCMG, London, <http://www.logicacmg.com/r/5004/page/400004887>, 2007-08-17.
- Matthes, F. C., Gores, S., Graichen, V., Repenning, J., Zimmer, W. (2006): *The vision scenario for the European Union*, Öko-Institut e.V., Berlin.
- Matthes, F. C., Grashof, K., Gores, S. (2007): *Power generation market concentration in Europe 1996-2005. An empirical analysis*, Öko-Institut e.V., Berlin.
- MEM (1996): *Energi 21. Regeringens energihandlingsplan 1996*, Miljö- og Energiministeriet (MEM), Copenhagen. [”*Energy 21. Governmental energy action plan*, Ministry of Environment and Energy”].
- Midttun, A. (1996): Electricity liberalization policies in Norway and Sweden. Political trade offs under cognitive limitations, in: *Energy Policy* 24 (1996), pp. 53-65, Elsevier Ltd., Amsterdam.
- Midttun, A., Summerton, J. (1998): Loyalty or competition? A comparative analysis of Norwegian and Swedish electricity distributors’ adaptation to market reform, in: *Energy Policy* Vol. 26 No 2 (1998), pp. 143-158, Elsevier Ltd., Amsterdam.
- Näringsdepartementet (1993): *Nya villkor för ekonomi och politik*, Ekonomikommisionen, Näringsdepartementet, Stockholm. [”*New conditions for economy and politics*, Swedish Ministry of Enterprise, Energy and Communications”].
- Näringsdepartementet (2005): *Liberalisering, regler och marknader*, SOU 2005:4, Regelutredningen, Näringsdepartementet, Stockholm. [”*Liberalisation, rules and markets*, SOU (Swedish government official report), Swedish Ministry of Enterprise, Energy and Communications”].

- Nilsson, L. (ed.) (2007): *Det våras för regionen. Västsverige 1998-2005. SOM-rapport nr. 40*, SOM-institutet, Göteborgs Universitet, Göteborg. [”*Springtime for the regions*, SOM Institute, Göteborg University”]
- Nordel (1986): *Annual report 1985*, Nordel, Helsinki.
- Nordel (1987): *Annual report 1986*, Nordel, Helsinki.
- Nordel (1988): *Annual report 1987*, Nordel, Oslo.
- Nordel (1989): *Annual report 1988*, Nordel, Oslo.
- Nordel (1990): *Annual report 1989*, Nordel, Vällingby.
- Nordel (1991): *Annual report 1990*, Nordel, Vällingby.
- Nordel (1992): *Annual report 1991*, Nordel, Vällingby.
- Nordel (1993): *Annual report 1992*, Nordel, Vällingby.
- Nordel (1994): *Annual report 1993*, Nordel, Hellerup.
- Nordel (1995a): *Annual report 1994*, Nordel, Hellerup.
- Nordel (1995b): *En nordisk elbörs 1996*, Nordel, Copenhagen. [”*A Nordic power exchange 1996*, Nordel”].
- Nordel (1996a): *Annual report 1995*, Nordel, Hellerup.
- Nordel (1996b): *Nordisk elbørs. Rapport fra Elbørsgruppen*, Nordel, Copenhagen. [”*Nordic power exchange, Report from the Power exchange group*, Nordel”].
- Nordel (1997): *Annual report 1996*, Nordel, Helsinki.
- Nordel (1998): *Annual report 1997*, Nordel, Helsinki.
- Nordel (1999): *Annual report 1998*, Nordel, Helsinki.
- Nordel (2000a): *Annual report 1999*, Nordel, Oslo.
- Nordel (2000b): *By-laws*, Nordel, Helsinki,
<http://www.nordel.org/Content/Default.asp?PageID=170>, 2007-05-08.
- Nordel (2001): *Annual report 2000*, Nordel, Oslo.
- Nordel (2002a): *Annual report 2001*, Nordel, Oslo.
- Nordel (2002b): *Nordic grid master plan*, Nordel, Copenhagen.
- Nordel (2003): *Annual report 2002*, Nordel, Fredericia.

- Nordel (2004): *Annual report 2003*, Nordel, Fredericia.
- Nordel (2004): *Annual report 2003*, Nordel, Vällingby.
- Nordel (2005): *Annual report 2004*, Nordel, Vällingby.
- Nordel (2006): *Annual report 2005*, Nordel, Vällingby.
- Nordel (2007): *Annual report 2006*, Nordel, Helsinki.
- Nordic competition authorities (2003): *A powerful competition policy. Towards a more coherent competition policy in the Nordic market for electric power*, Nordic competition authorities, Copenhagen, Oslo, Stockholm.
- Nordic Council (1957): *Upphävande av passkontrollen vid de internordiska gränserna*, Nordiska rådet, Copenhagen. [”*Abolishing passport controls at the inter-Nordic borders*, Nordic Council”].
- Nordic Council (1962): *Treaty of cooperation between Denmark, Finland, Iceland, Norway and Sweden (the Helsinki Treaty)*, Nordic Council, Helsinki.
- Nordic Council (1983): *Överenskommelse om gemensam nordisk arbetsmarknad*, Nordiska rådet, Copenhagen. [”*Agreement about a common Nordic labour market*, Nordic Council”].
- Nordic Council (2006): *The Nordic countries in a globalised world. Visions, values and goals for the Centre group in the Nordic council*, Nordic Council, Lahti.
- Nordic Council (2007a): *The Nordic community*, Nordic Council, Copenhagen, http://norden.org/faktab/uk/nr_generel.pdf, 2007-05-23.
- Nordic Council (2007b): *Climate change in the north – hot topic*, Nordic Council, Copenhagen, <http://www.norden.org/webb/news/news.asp?id=7010&lang=6>, 2007-07-12.
- Nordic Council of Ministers (1995): *Kommuniké efter de nordiske energiministres møde den 27. juni 1995, ”Louisianaerklæringen”*, Nordisk Ministerråd, Humlebæk. [”*Communiqué after the meeting of the Nordic Ministers of Energy on the 27th of June 1995, “Louisiana Declaration”*, Nordic Council of Ministers”].
- Nordic Council of Ministers (2002): *Cooperation Nordic strength*, Nordic Council of Ministers, Copenhagen.
- Nordic Council of Ministers (2004): *Et godt råd for Norden*, Nordisk Ministerråd, Copenhagen. [”*A good council for the Nordic region*, Nordic Council of Ministers”].

- Nordic Council of Ministers (2007): *Klimagruppen under Nordisk Ministerråd*, Nordisk Ministerråd, Copenhagen. [“*The climate group in the Nordic Council of Ministers*, Nordic Council of Ministers”]
- NordPool (2004a): *The Nordic power market. Electricity power exchange across national borders*, NordPool, Oslo, Stockholm, Helsinki, Fredericia.
- NordPool (2004b): *Implementation of Elbas into Eastern Denmark*, NordPool, Helsinki, http://www.nordpool.com/information/press_releases/2004-009.html, 2007-07-16.
- NordPool (2005a): *NordPool Spot opens a price quotation in a new Elspot bidding area “KONTEK”*, NordPool, Lysaker, http://www.nordpool.com/information/press_releases/2005-010.html, 2007-07-11.
- NordPool (2005b): *NordPool carbon market opened today*, NordPool, Oslo, http://www.nordpool.com/information/press_releases/2005-003.html, 2007-07-12.
- NordPool (2007a): *NordPool’s history*, NordPool, Oslo, <http://www.nordpool.com/organisation/History.html>, 2007-05-29.
- NordPool (2007b): *Elspot system price for Electrical Exchange Area*, NordPool, Oslo, <http://www.nordpool.com/marketinfo/elspot/area/elspot.cgi?interval=last8¤cy=nok&type=html&usecookie=true>, 2007-07-12.
- NordPool (2007c): *Elcertificate price Sweden*, NordPool, Oslo, <http://www.nordpool.com/marketinfo/elcertificates/elcertificate.cgi>, 2007-07-12.
- NordReg (2006): *Work programme 2006. Report 1/2006*, NordReg (Nordic energy regulators), Eskilstuna.
- NordReg (2007): *Work programme 2007. Report 1/2007*, NordReg (Nordic energy regulators), Eskilstuna.
- Nousiainen, J. (2000): *The Finnish system of government: From a mixed constitution to parliamentarism*, Finnish Ministry of Justice, Helsinki.
- NUTEK (1995): *Avregleringen av elmarknaden. Facit från de fyra pionjirländerna Chile, England, Norge och Argentina*, Närings- och teknikutvecklingsverket (NUTEK), Stockholm. [“*The deregulation of the power market. Results from the four pioneer countries Chile, England, Norway and Argentina*, Swedish national board for industrial and technical development”].

- NVE (1998): *Produksjon og forbruk av elektrisk kraft i Norge i 1997, Norges vassdrags- og energidirektorat* (NVE), Oslo, <http://nve.no/FileArchive/154/Energifolderen%201998.pdf>, 2007-05-29. [”*Production and consumption of electric power in Norway 1997, Norwegian water resources and energy directorate*”].
- NVE (2005): *Energy in Norway*, Norwegian water resources and energy directorate (NVE), Oslo, <http://nve.no/FileArchive/154/Energy%20in%20Norway%202005.pdf>, 2007-05-09.
- NVE (2007): *Generelt om nettregulering og tariffar*, Norges vassdrags- og energidirektorat (NVE), Oslo, http://nve.no/modules/module_109/publisher_view_product.asp?iEntityId=9008&noscript=, 2007-06-25. [”*General information about grid regulation and tariffs, Norwegian water resources and energy directorate*”].
- OED (1985): *Energilovgivningen, NOU 1985:9, Hovedtrekk i delutredningen*, Energilovutvalget, Olje- og energidepartementet, Oslo. [”*The energy legislation., Main conclusions, Norwegian Ministry of Petroleum and Energy*”].
- OED (1990a): *Innst. O. nr. 67. (1989-90). Innstilling fra energi- og industrikomiteen om lov om produksjon, omforming, overføring, omsetning og fordeling av energi m.m. (energiloven). (Ot. prp. nr 43)*, Olje- og energidepartementet, Oslo. [”*Report from the energy and industry committee about the energy law, Norwegian Ministry of Petroleum and Energy*”].
- OED (1990b): *Forhandlinger i Odeltinget nr. 25. 1990. 11. juni – Energiloven*, Olje- og energidepartementet, Oslo. [”*Debate in the parliament – the Energy act, Norwegian Ministry of Petroleum and Energy*”].
- OED (1998): *Energi- og kraftbalansen mot 2020, NOU 1998:11*, Olje- og energidepartementet, Oslo. [”*Energy and power balance toward 2020, Norwegian Ministry of Petroleum and Energy*”].
- OED (2004): *Facts 2004. The energy sector and water resources in Norway*, Norwegian Ministry of Petroleum and Energy, Oslo.
- OED (2006): *Mutual green certificate market will not be established – too expensive for Norwegian customers*, Norwegian Ministry of Petroleum and Energy, Oslo, <http://www.regjeringen.no/en/dep/oed/Press-Center/Press-releases/2006/Mutual->

- green-certificate-market-will-not-be-established--too-expensive-for-Norwegian-customers.html?id=419833, 2007-08-22.
- Österman (2004): *Förtroende under vardag och kriser*, Styrelsen för psykologiskt försvar, Stockholm. [”*Trust in the everyday life and in crises*, Swedish national board for psychological defence”].
- Olsen, O. J. (2006): *Konkurrence på det danske elmarked efter reformen i 1999*, Anvendt KommunalForskning (AKF), Copenhagen. [”*Competition in the Danish electricity market after the reform 1999*, Danish institute of governmental research”].
- Pineau, P.-O., Hämmäläinen, R. P. (2000): A perspective on the restructuring of the Finnish electricity market, in: *Energy Policy 28 (2000)*, pp. 181-192, Elsevier Ltd., Amsterdam.
- Pineau, P.-O., Hira, A., Froschauer, K. (2004): Measuring international electricity integration : a comparative study of the power systems under the Nordic Council, MERCOSUR, and NAFTA, in: *Energy Policy 32 (2004)*, pp. 1457-1475, Elsevier Ltd, Amsterdam.
- President.fi (2007): *The president of the Republic Finland*, Office of the president of the Republic Finland, Helsinki, <http://www.president.fi/en/>, 2007-06-12.
- Prop. 1990/91:49: *Förslag om treårsplan för Vattenfallkoncernen m.m.*, Näringsdepartementet, Stockholm. [”*Proposal for three-year plan for the Vattenfall group*, Swedish Ministry of Enterprise, Energy and Communications”].
- Prop. 1990/91:87: *om näringspolitik för tillväxt*, Näringsdepartementet, Stockholm. [”*Economic policy for growth*, Swedish Ministry of Enterprise, Energy and Communications”].
- Prop. 1991/92:49: *Vissa frågor angående Vattenfall AB*, Näringsdepartementet, Stockholm. [”*Some questions about Vattenfall plc.*, Swedish Ministry of Enterprise, Energy and Communications”].
- Prop. 1991/92:133: *om en elmarknad med konkurrens*, Näringsdepartementet, Stockholm. [”*A power market with competition*, Swedish Ministry of Enterprise, Energy and Communications”].

- Prop. 1993/94:162: *Handel med el i konkurrens*, Näringsdepartementet, Stockholm. [*“Electricity trade with competition, Swedish Ministry of Enterprise, Energy and Communications”*].
- Prop. 1994/95:84: *Vissa ändringar i ellagen, m.m.*, Näringsdepartementet, Stockholm. [*“Some changes in the electricity law, Swedish Ministry of Enterprise, Energy and Communications”*].
- Prop. 1994/95:222: *Ny ellagstiftning*, Näringsdepartementet, Stockholm. [*“New Electricity legislation, Swedish Ministry of Enterprise, Energy and Communications”*].
- Prop. 1996/97:84: *En uthållig energiförsörjning*, Närings- och handelsdepartementet, Stockholm. [*“A sustainable energy supply, Swedish Ministry of Enterprise, Energy and Communications”*].
- Prop. 1996/97:136: *Ny ellag*, Närings- och handelsdepartementet, Stockholm. [*“New electricity law, Swedish Ministry of Enterprise, Energy and Communications”*].
- Prop. 1997/98:159: *Genomförande av Europaparlamentets och rådets direktiv om gemensamma regler för den inre marknaden för el, m.m.*, Närings- och handelsdepartementet, Stockholm. [*“Implementing the directive of the European Parliament and of the Council concerning common rules for the internal market in electricity, Swedish Ministry of Enterprise, Energy and Communications”*].
- Prop. 2001/02:143: *Samverkan för en trygg, effektiv och miljövänlig energiförsörjning*, Näringsdepartementet, Stockholm. [*“Cooperation for a secure, efficient and environmental supply of energy, Swedish Ministry of Enterprise, Energy and Communications”*].
- Prop. 2005/06:154: *Förnybar el med gröna certifikat*, Miljö- och samhällsbyggnadsdepartementet, Stockholm. [*“Renewable electricity with green certificates, Swedish Ministry for Sustainable Development”*].
- PVO (1999): *Annual report 1998*, PVO group, Pohjalan Voima, Helsinki, Oulu.
- PVO (2006): *Annual report 2005*, PVO group, Pohjalan Voima, Helsinki, Oulu.
- Regeringen (2005): *Genomförda nationella folkomröstningar*, Regeringskansliet, Stockholm, <http://www.regeringen.se/sb/d/2467/a/13454>, 2007-06-05. [*“National referendums, Government offices of Sweden”*].

- Regeringen (2006): *Sveriges väg till EU-medlemskap*, Regeringskansliet, Stockholm, <http://regeringen.se/sb/d/2477/a/13500>, 2007-07-20. [”Sweden’s way to EU membership, Government offices of Sweden”].
- Regeringen (2007a): *Sveriges regeringar under 100 år*, Regeringskansliet, Stockholm, <http://www.regeringen.se/sb/d/4393>, 2007-05-10. [”Swedish governments during the last 100 years, Government offices of Sweden”].
- Regeringen (2007b): *Kärnkraft*, Regeringskansliet, Stockholm <http://www.regeringen.se/sb/d/2447/a/47773;jsessionid=ag4WIt7VqCRe>, 2007-06-05. [”Nuclear power, Government offices of Sweden”].
- Regjeringen (2007): *Regjeringer siden 1945*, Fornyings- og administrasjonsdepartementet, Oslo, http://www.regjeringen.no/nb/om_regjeringen/tidligere/oversikt/ministerier_regjeringer/nyere_tid/regjeringer.html?id=438715&epslanguage=NO, 2007-05-10. [”Governments since 1945, Norwegian Ministry of Government Administration and Reform”].
- Riksdagen (2006): *Sveriges regeringar sedan 1971*, Sveriges riksdag, Stockholm, http://www.riksdagen.se/templates/R_Page____1542.aspx, 2007-06-05. [”Swedish governments since 1971, Swedish Parliament”].
- Ringnes (2004): *Historie*, Ringnes, Oslo, <http://www.ringnes.no/pub/index.php?id=50>, 2007-07-20. [”History, Ringnes”].
- Roche, P. (2005): *Is nuclear power a solution to climate change?*, no2nuclearpower, Edinburgh.
- Rothwell, G., Gómez, T. (2003): *Electricity economics. Regulation and deregulation*, Institute of electrical and electronics engineers (IEEE), Hoboken.
- RP 138/1994a: *Regeringens proposition till Riksdagen med förslag till elmarknadslag*, Riksdagen, Helsinki. [”Bill for a Electricity market act, Finnish Parliament”].
- RP 138/1994b: *Regeringens proposition till Riksdagen med förslag till elmarknadslag. Detaljmotivering*, Riksdagen, Helsinki. [”Bill for a Electricity market act, Explanatory statement, Finnish Parliament”].
- Rutledal, F., Hagen, J., Nystuen, K-O., Østby, E. (2000): *Kraftmarkedets føringer for sårbarheten i norsk kraftforsyning*, FFI/Rapport-2000/03451, Forsvarets forskningsinstitutt

- (FFI), Kjeller. [*Impacts of the power market on the Norwegian power supply vulnerability*, Norwegian Defence Research Establishment”].
- RWE (2007a): *Shareholder structure of RWE AG*, RWE, Essen, http://www1.rwecom.geber.at/factbook/en/servicepages/downloads/files/rwe_share_rwecom_fact07.pdf, 2007-07-23.
- RWE (2007b): *UCTE-Verbund, Verbundnetz, Regelzonen*, RWE Transportnetz Strom, Dortmund, <http://www.rwetransportnetzstrom.com/generator.aspx/netzwelt/regelung-netze/ucte-verbund,-verbundnetz,-regelzonen/language=de/id=270712/page.html>, 2007-05-22.
- SAS (2007): *Focus on the SAS group 2007*, Scandinavian Airlines System, Stockholm, http://www.sasgroup.net/SASGROUP_FACTS/CMSForeignContent/Focus%20on%20the%20SAS%20Group%202007_light.pdf, 2007-07-01.
- SCB (2007a): *Riksdagens sammansättning 1929-2006 efter parti och kön*, Statistiska centralbyrån, Stockholm, http://www.scb.se/templates/tableOrChart____32059.asp, 2007-05-10. [*Representatives in the parliament 1929-2006 sorted by party and gender*, Statistics Sweden”].
- SCB (2007b): *Inflation i Sverige 1831-2006*, Statistiska centralbyrån, Stockholm, http://www.scb.se/templates/tableOrChart____33831.asp, 2007-08-13. [*Inflation in Sweden 1831-2006*, Statistics Sweden”].
- Schwarz, H.-G., Lang, C. (2006): *The rise in German wholesale electricity prices: fundamental factors, exercise of market power, or both?*, IWE working paper Nr. 02 2006, Universität Erlangen-Nürnberg, Erlangen.
- Sener (2000): *Short history of free electricity*, Finnish Electricity Association (Sener), Helsinki.
- SFS 1902:71 s.1: *Lag (1902:71 s.1) innefattande vissa bestämmelser om elektriska anläggningar*, Närings- och handelsdepartementet, Stockholm. [*Rules for electric facilities*, Swedish Ministry of Enterprise, Energy and Communications”].
- SFS 1988:851: *Förordning (1988:851) med instruktion för Statens vattenfallsverk*, Näringsdepartementet, Stockholm. [*Decree with instructions for Statens vattenfallsverk*, Swedish Ministry of Enterprise, Energy and Communications”].

- SFS 1991:2013: *Förordning (1991:2013) med instruction för Affärsverket Svenska Kraftnät*, Näringsdepartementet, Stockholm. [“*Decree containing instructions for Svenska Kraftnät*, Swedish Ministry of Enterprise, Energy and Communications”].
- SFS 1994:618: *Lag (1994:618) om handel med el m.m.*, Närings- och handelsdepartementet, Stockholm. [“*Electricity trading law*, Swedish Ministry of Enterprise, Energy and Communications”].
- SFS 1997:857: *Ellag*, Näringsdepartementet, Stockholm. [“*Electricity law*, Swedish Ministry of Enterprise, Energy and Communications”].
- Skytte, K., Wolffsen, P. (1997): *Aktørkrav til en nordeuropæisk elbørs*, Forskningscenter Risø, Roskilde. [“*Actors’ demands for a Northern European electricity exchange*, Risø National Laboratory, Technical University of Denmark”].
- Spiegel (2007): *Deutsche Politiker schießen sich auf Sarkozy ein*, Spiegel Online, Hamburg <http://www.spiegel.de/politik/ausland/0,1518,497057,00.html>, 2007-07-30. [“*German politicians zero in on Sarkozy*, Spiegel Online“]
- SSB (2000): *Storingsvalg. Valde representater, etter parti 1906-2001*, Statistisk sentralbyrå, Oslo, <http://www.ssb.no/histstat/aarbok/ht-000110-002.html>, 2007-05-10. [“*Elections to the parliament. Representatives 1906-2001*, Statistics Norway”].
- SSB (2007a): *Hovudtal 1989-2005*, Statistisk sentralbyrå, Oslo, <http://www.ssb.no/elektrisitetaar/tab-2007-05-24-01.html>, 2007-05-29. [“*Main figures 1989-2005*, Statistics Norway”].
- SSB (2007b): *Fordeling av kraftprisar til hushald, etter prosentilar og standardavvik. 1994 - 2005. Øre/kWh*, Statistisk sentralbyrå, Oslo, <http://www.ssb.no/emner/10/08/10/elektrisitetaar/tab-2007-05-24-22.html>, 2007-05-29. [“*Distribution of electricity prices to households, percentiles and standard deviation*, Statistics Norway.”].
- SSB (2007c): *Produksjon, import, eksport og forbruk av elektrisk kraft. 1950, 1955 og 1960-2005. GWh*, Statistisk sentralbyrå, Oslo, <http://www.ssb.no/elektrisitetaar/tab-2007-05-24-12.html>, 2007-05-29. [“*Production, import, export and consumption of electric power 1950, 1955 and 1960-2005*, Statistics Norway”].
- SSB (2007d): *Gjennomsnittsprisar for import og eksport av elektrisk kraft. Sverige og Danmark. 1973-2006. Øre/kWh*, Statistisk sentralbyrå, Oslo,

- <http://www.ssb.no/elektrisitetar/tab-2007-05-24-25.html>, 2007-05-29. [”*Mean prices for imported and exported electricity to Sweden and Denmark*, Statistics Norway”].
- SSB (2007e): *Utslipp av klimagasser, etter kilde. 1990-2006. Millioner tonn CO₂-ekvivalenter*, Statistisk sentralbyrå, Oslo. [”*Greenhouse gas emissions by source*, Statistics Norway”].
- Statkraft (2007): *Statkraft i dag*, Statkraft, Oslo, http://statkraft.no/pro/om_statkraft/fakta/statkraft_i_dag/index.asp, 2007-05-02. [”*Statkraft today*, Statkraft].
- Statnett, SVK (1995): *Utredningen om gemensam elbörs. Lägesrapport: Mars 1995*, Statnett, Svenska Kraftnät, Oslo, Stockholm. [”*Inquiry about a common power exchange, Interim report March 1995*, Statnett, Svenska Kraftnät”].
- Statnett (2005): *Grid development plan 2005-2020*, Statnett, Oslo.
- Statnett (2007): *Sentrale dokumenter*, Statnett, Oslo, <http://statnett.no/default.aspx?ChannelID=1046&DocumentID=10350>, 2007-05-15. [”*Central documents*, Statnett”].
- Statsministeriet (2005): *Oversigt over regeringer der har fungeret fra 1953 – 2005*, Statsministeriet, Copenhagen, <http://www.stm.dk/Index/dokumenter.asp?o=49&n=1&d=2707&s=1>, 2007-06-15. [”*Overview of all governments 1953-2005*, The Danish Prime Minister’s Office”]
- Statsrådet (2005): *Finsk regeringshistoria*, Statsrådet, Helsinki, <http://regeringen.fi/tietoa-valtioneuvostosta/hallitukset/hallitusten-historiaa/sv.jsp>, 2007-06-12. [”*Finnish history of governments*, Finnish Government”].
- Stern, N. (2007): *The Economics of Climate Change. The Stern Review*, Cambridge University Press, Cambridge.
- Stoltenberg, J. (1996): *Tale/artikkel. Statsråd Jens Stoltenberg: Redegjørelse om kraftsituasjonen*, Nærings- og energidepartementet, Oslo, http://www.regjeringen.no/nb/dokumentarkiv/Regjeringen-Brundtland-III/Narings-og-energidepartementet/261268/261577/redegjorelse_om_kraftsituasjonen.html?id=261578, 2007-04-30.

- [*Speech of Minister Jens Stoltenberg: Description of the power situation, Norwegian Ministry of Enterprise and Energy*"].
- StoraEnso (2006): *StoraEnso Oyj*, StoraEnso, Helsinki, http://www.storaenso.com/CDAvgn/main/0,,1_EN-5605-12345-,00.html, 2007-07-20.
- SvD (2007): *Ja till ny kraftledning till Norge*, Svenska Dagbladet (SvD), Stockholm, http://www.svd.se/dynamiskt/inrikes/did_16821774.asp, 2007-08-23. [*Permission for new power line to Norway, Svenska Dagbladet*].
- SVK (1993): *Handelsplats för el. Utredning om förutsättningar för en svensk elbörs*, Svenska kraftnät (SVK), Vällingby. [*Trading place for electricity. Survey of the conditions for a Swedish power exchange, Svenska kraftnät*].
- SVK (1996): *Nya Svenska elmarknaden – och Svenska Kraftnäts roll*, Svenska Kraftnät (SVK), Vällingby. [*The new Swedish power market – and the role of Svenska Kraftnät, Svenska Kraftnät*].
- SwePol (2005): *SwePol link. The Swedish-Polish HVDC link*, SwePol Link AB, Vällingby, <http://www.swepollink.se/>, 2007-06-06.
- TeliaSonera (2007): *Facts and figures*, TeliaSonera, Stockholm, Helsinki, http://www.teliasonera.com/GetImages/GetImages_GetImage_pdf/0,1168,85109,00.pdf, 2007-07-01.
- Tilastokeskus (2007a): *Population*, Statistics Finland (Tilastokeskus), Helsinki, http://tilastokeskus.fi/tup/suoluk/suoluk_vaesto_en.html, 2007-06-29.
- Tilastokeskus (2007b): *Inflation*, Statistics Finland (Tilastokeskus), http://www.stat.fi/tup/suoluk/suoluk_hinnat_en.html, 2007-08-13.
- Turmes, C. (2002): *Market concentration in the power sector*, EU-energy.com, Brussels, <http://www.eu-energy.com/Market%20Concentration%20Briefing.pdf>, 2007-07-23.
- TVO (2007a): *Shareholders, shareholder companies*, Teollisuuden Voima Oy, Helsinki, <http://www.tvo.fi/469.htm>, 2007-06-11.
- TVO (2007b): *Organisation*, Teollisuuden Voima Oy, Helsinki, <http://www.tvo.fi/627.htm>, 2007-07-02.
- TVO (2007c): *OL3 project*, Teollisuuden Voima Oy, Helsinki, <http://www.tvo.fi/486.htm>, 2007-07-03.

- UCTE (2007): *UCTE keeps the lights on!*, Union for the coordination of transmission of electricity, Brussels, http://www.ucte.org/aboutus/mission/e_default.asp, 2007-05-23.
- Valtioneuvosto (2007): *Finnish cabinets*, Finnish government (Valtioneuvosto), Helsinki, <http://regeringen.fi/tietoa-valtioneuvostosta/hallitukset/en.jsp>, 2007-07-05.
- Vattenfall (2007a): *The history of Vattenfall*, Vattenfall, Stockholm, http://www.vattenfall.com/www/vf_com/vf_com/365787ourxc/367425histo/417345histo/index.jsp, 2007-05-02.
- Vattenfall (2007b): *Årsredovisning 2006*, Vattenfall, Vällingby. [”Annual report 2006, Vattenfall”].
- von der Fehr, N-H. M., Amundsen, E. S., Bergman, L. (2004): *The Nordic market: Signs of stress?*, Department of economics, University of Bergen, Bergen.
- von Prittwitz, V. (1994): *Politikanalyse*, Leske + Budrich, Opladen. [”Policy analysis, Leske + Budrich“].
- Windhoff-Héretier, A. (1987): *Policy-Analyse. Eine Einführung*, Campus Verlag, Frankfurt am Main, New York. [”Policy analysis. An introduction, Campus Verlag”].
- Woo, C.-K., Lloyd, D., Tishler, A. (2003): Electricity market reform failures: UK, Norway, Alberta and California, in: *Energy Policy* 31 (2003) pp. 1103-1115, Elsevier Ltd., Amsterdam

