NordREG
Nordic Energy Regulators

Nordic Market report 2007

- DEVELOPMENTS IN THE NORDIC ELECTRICITY MARKET

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1 Preface

The Nordic Market Report 2007 is NordREG's second annual report focusing on the Nordic electricity market.

The Nordic Market Report describes the status and development of the Nordic electricity market, covering Norway, Sweden, Finland and Denmark. Among other things the report offers statistical information on the Nordic market, description and data of the market structure and main players and information on the retail market.

A working group from the regulators of Norway, Sweden, Finland and Denmark has participated in the compilation of the report. The group consisted of Daniel Andersson (Energimarknadsinspektionen, chairperson), Veli-Pekka Saajo (Energiamarkkinavirasto), Nils Spjeldnæs (Norges vassdrags- og energidirektorat) and Henrik Gommesen (Energitilsynet).

Copenhagen, June 2007

Finn Dehlbæk

2 Summary

The electricity markets in the Nordic countries have undergone major changes since the middle of the 1990s. All Nordic countries have reformed their electricity markets, opening both electricity trading and electricity generation to competition. The liberalisation process in the middle of the 1990s was followed by an integration of the Nordic markets. In 1991, a Norwegian spot market was opened up for players in the Norwegian wholesale electricity market, and in the following years Sweden, Finland and western Denmark (Jutland) was included. The complete integration of the Nordic wholesale market was finalised in 2000, as eastern Denmark (Zealand) joined.

The Nordic countries have different portfolios of technologies in use for electricity generation. In Denmark the generation mainly comes from thermal units, like coal fired plants and wind power units. In Finland most of the generation consists of nuclear and thermal power plants and a smaller share of hydropower. The electricity generation in Norway is almost solely based on hydropower, while most of the Swedish generation originates from nuclear power and hydropower. The differences in generation technologies in the Nordic region imply benefits of trade. The-well functioning of the Nordic power market was well illustrated during 2006. The dry an warm summer together with an autumn with high levels of precipitation created demands for transmitting large quantities of power within the Nordic region. Accordingly, the power flowed within the Nordic market from areas with the less expensive generation sources to areas with more expensive generation sources.

The Nordic transmission grid connects almost the entire Nordic region to one synchronous power system. The reason for having such a system is to increase security of supply as well as to make it possible to use the generation capacity efficiently. During wet years, hydropower typically flows southwards while thermal power flows northwards during dry years. The Nordic transmission system operators (TSO's) have the overall responsibility to ensure momentary balance between supply and demand of electricity in the operating hour. Increasing trade and cross border power flows increases the demand for transmission capacity and can result in transmission congestions.

Generators and larger consumers trade electricity in a wholesale market. In the recent years an increasing amount of trade has been conducted at the common Nordic electricity spot exchange (Nord Pool Spot AS)[1]. In 2006, more than 60 per cent of the total electricity consumption in the region was traded in this day-ahead spot market. However, part of the electricity is still traded bilaterally, i.e. a two-sided contract between a seller and buyer. Bilateral trading is most common between generators or suppliers and large industrial customers.

Although the work of integrating the Nordic retail markets has begun it is still a question of four separate markets, influenced by national differences. The retail prices in the Nordic countries were, just like the price at Nord Pool Spot, relatively high during most of 2006. This was partly due to the extreme weather situation during the year in combination with some of the Swedish nuclear reactors being offline.

[1] Nord Pool Spot AS is jointly owned by the Nordic TSO's (Energinet.dk – 20 percent, Fingrid – 20 percent, Statnett – 20 percent and Svenska Kraftnät – 20 percent) and Nord Pool ASA (20 percent).

Active customers are essential for a well-functioning electricity market. Supplier switching differs considerably between the Nordic retail markets. This is partly due to the differences in how much retail customers can save from changing supplier, and partly due to differences in the customers' access to information. NordREG's work on creating common procedures for supplier switching is important for the creation of a common Nordic retail market.

3 Introduction: NordREG

NordREG is a cooperative organisation for Nordic regulatory authorities in the energy field. Although the national regulators have different responsibilities and authorities, the mission and common goal of the organisation is to actively promote a legal and institutional framework and conditions necessary for developing the Nordic and European electricity markets.

The specific strategic priorities of NordREG are to provide for a well-functioning Nordic wholesale market with competitive prices, be conducive to establish a common Nordic retail market with free choice of end-user supplier and to ensure a reliable supply within the region. Furthermore, NordREG aims to regulate and monitor the transmission system operators (TSO's) with focus on efficiency and Nordic harmonisation.

NordREG has drafted the following vision for the electricity market for the year 2010:

"In 2010 all customers in the Nordic electricity market will enjoy free choice of supplier, efficient and competitive prices and reliable supply through the common Nordic electricity market which also interacts smoothly with other regional electricity markets in the EU."

4 Generation and consumption

Electricity generation in the Nordic region is to a large extent based on hydropower. The remaining part is generated in thermal plants, nuclear power plants and by wind power units. The consumption of electricity in the Nordic region is highly influenced by the cold winters and the relative high proportion of energy intensive industries and electricity heated houses. Hence the electricity consumption in the Nordic region is high in comparison with other European countries.

4.1 Generation capacity

The installed capacity for power generation in the Nordic region amounts to 92 330 GW. About 56 per cent of the installed capacity comes from renewable power sources. Hydropower, mainly located in Norway and Sweden, accounts for 52 per cent of the total generation capacity. The large share of hydropower is mainly due to large rivers and significant quantities of precipitation in the mountains, filling the reservoirs during the spring flood. The second largest generation source in the Nordic region is CHP (Combined Heat and Power) supplying heat for district heating, accounting for almost 16 per cent of the total Nordic power generation capacity. The majority of the CHP district heating capacity is located in Denmark. The third largest power source is nuclear power, only located in Sweden and Finland and with a share of 13 per cent of the total Nordic generation capacity. Wind power is the generation source that has increased the most during the last few years. Table 1 shows the total power generation capacity in the Nordic region by power sources.

Table 1. Generation capacity (MW) by power source, 2006.
Source: Nordel

	Denmark	Finland	Norway	Sweden	Nordic region
Installed capacity (total)	12 699	16 544	29 268	33 819	92 330
Nuclear power	-	2 671	-	8 965	11 636
Other thermal power	9 554	10 743	244	8 094	28 635
- Condensing power	993	3 301	0	2 298	6 592
- CHP, district heating	7 687	3 737	131	2 954	14 509
- CHP, industry	567	2 924	49	1 229	4 769
- Gas turbines etc.	307	781	64	1 613	2 765
Hydro power	10	3 044	28 691	16 180	47 925
Wind power	3 135	86	333	580	4 134

Table 2 presents how the total power generation capacity in the Nordic countries is divided between the largest companies. As seen in the table, Vattenfall is the largest generator with a capacity of 16 101 MW and a 17.4 per cent share of the Nordic capacity. Fortum, the second largest generator with 11.6 per cent share of the Nordic capacity has a total capacity of 10 768 MW. Third largest is Statkraft, with a capacity of 10 653 MW the company has an 11.5 per cent share of the total Nordic generation capacity.

Table 2. Generation capacity by producers, 2006
Source: Regulators and Nordel

	Capacity (MW)	Share
Denmark		
-Dong Energy	6650	7.0 %
- Vattenfall	2120	2.3 %
Finland		
-Fortum	5 007	5.4 %
-PVO	3 394	3.7 %
-Helsingin Energia	1 064	1.2 %
Norway		
- Statkraft	10 653	11.5 %
Sweden		
-Vattenfall	13 981	15.1 %
-E.On Sweden	7 068	7.7 %
-Fortum	5 761	6.2 %
Other generators	36 632	39.9 %
Total Nordic region	**92 330**	**100 %**

4.2 Generation

In 2006, total power generation in the Nordic region amounted to 383.9 TWh, a decrease of around 2.5 per cent compared to 2005. Figure 1 illustrates the development of the total power generation in the Nordic region during 2004-2006. The power generation in 2006 was to a large extent characterised by the lack of precipitation throughout the summer and autumn, resulting in a lower hydropower generation than normal. At the same time, a majority of the Swedish nuclear power reactors were temporarily shut down due to technical reasons.

The lack of hydropower generation in Norway and Sweden during the summer and autumn was compensated by an increase in Danish and Finnish thermal power generation. Change in Finnish and Danish power generation is often congruent because of the high national shares of thermal power. Power generation in Norway and Sweden were 12 respectively 10 per cent lower in 2006 than in 2005. At the same time, Finland and Denmark generated 16 respectively 26 per cent more electricity than in 2005.

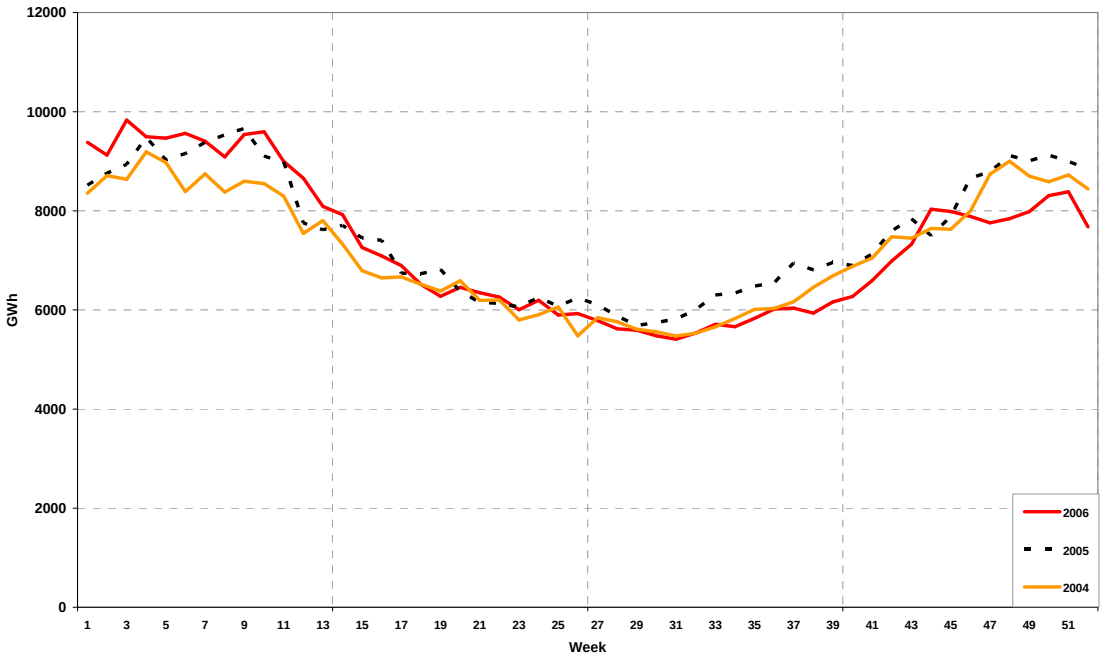

Figure 1. Total power generation in the Nordic region, 2004-2006
Source: Nord Pool

Figure 2 shows the total power generation in the Nordic region by energy sources. As seen in the figure the levels of hydropower generation in 2006 was low during the summer and early autumn. However, later during the autumn the generation returned to more normal levels. There were also technical problems in some of the Swedish nuclear plants from late summer throughout the year. As a result of this the thermal generation was significantly higher in order to compensate for the loss of hydro- and nuclear power. The large expansion of wind power in Sweden and Denmark also brought higher figures for generation than in the previous years.

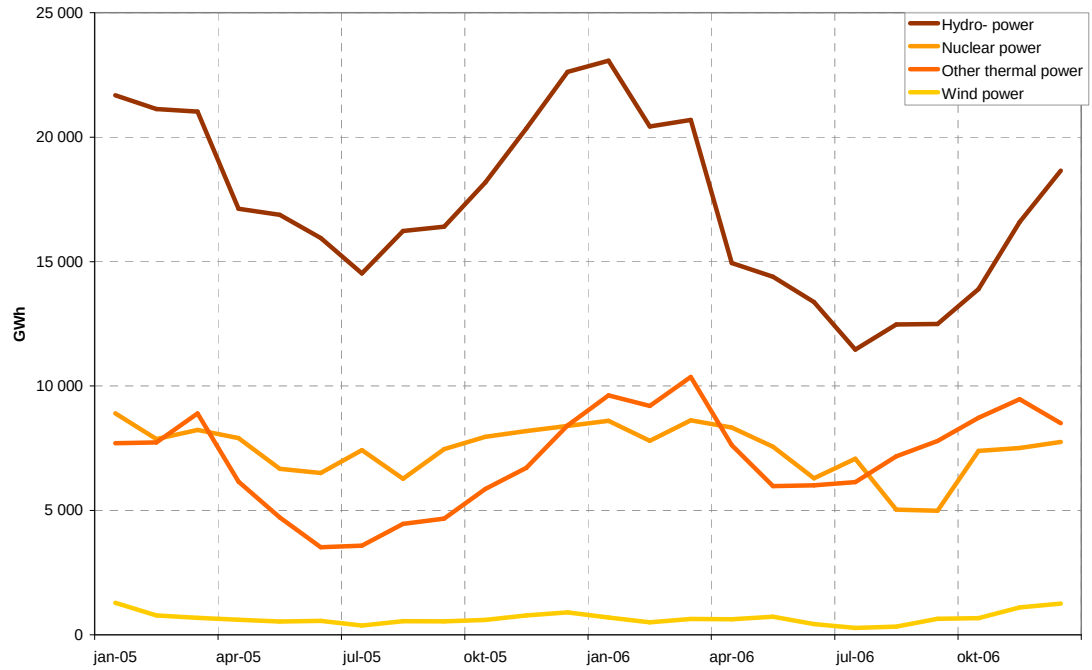

Figure 2. Power generation by power source in the Nordic region, 2005 and 2006
Source: Nordel

4.3 Consumption

The electricity consumption in the Nordic region varies widely depending on the specific conditions in each country. Figure 3 shows the electricity consumption in the Nordic countries during the last nine years.

Denmark, with relatively warm winters and a small amount of electricity heated houses, has less seasonal variations in electricity consumption than the other Nordic countries. In addition, Denmark has a relatively small share of energy intensive industries, leading to considerably lower electricity consumption than the other Nordic countries. In 2006, the total electricity consumption in Denmark was 36.4 TWh, an increase of 1.9 per cent compared to 2005.

Finland, with significant seasonal temperature variations and a large amount of electricity heated houses, has a much more fluctuant electricity consumption than Denmark. In addition, Finland also has a large share of energy intensive industries leading to relatively high electricity consumption. Electricity consumption in Finland has increased steadily since 2000. In 2006, the total electricity consumption in Finland was 90.1 TWh, an increase of 6.5 per cent compared to 2005. The large increase can to some extent be explained by a labour dispute in the Finnish paper industry during the summer of 2005 which reduced the total Finnish consumption during the year.

Norwegian electricity consumption increased steadily from 2004 until mid 2006, when the consumption decreased somewhat. Much like Finland and Sweden, Norway has significant seasonal temperature variations and a large share of electricity heated houses. The share of energy intensive industry is also relatively high and the consumption tied to petroleum activity is increasing. In 2006, the total electricity consumption in Norway was 122.6 TWh, a decrease of 2.6 per compared to 2005.

Sweden has the highest total electricity consumption of the Nordic countries. Swedish electricity consumption is highly influenced by a large share of energy intensive industries as well as a large share of electricity heated houses. As in Norway, the consumption in Sweden has varied during the last few years. In 2006, the total electricity consumption in Sweden was 146.4 TWh, a decrease of 0.6 per cent compared to 2005.

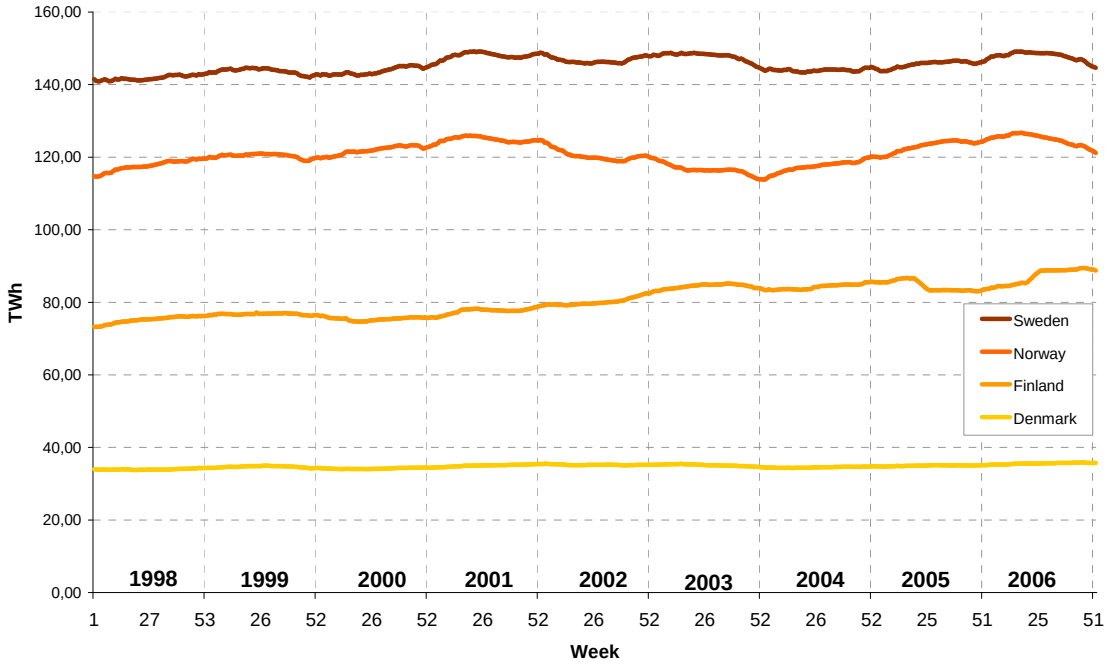

Figure 3. Electricity consumption in the Nordic countries (previous 52 weeks), 1998-2006
Source: Nord Pool

Figure 4 shows the development of the total electricity consumption in the Nordic region. As seen in the figure, the consumption has increased steadily during the last nine years. However, during the second half of 2006 the consumption decreased significantly. This can to a large extent be explained by the warm autumn in the Nordic countries, thus reducing the need for electric heating. The total electricity consumption in 2006 was 395.4 TWh, an increase of 0.5 TWh compared to 2005.

Figure 4. Development of the total electricity consumption in the Nordic region (previous 52 weeks), 1998-2006
Source: Nord Pool

Figure 5 illustrates the development of the total electricity consumption in the Nordic region during 2004-2006. The figure shows what affect the extreme weather conditions during the summer and autumn had on the demand. The Nordic consumption was somewhat lower, or at times even significantly lower, than the two previous years from week 34 throughout the year, with exception of week 44 and 45 when the consumption exceeded the consumption during the same time in 2004 and 2005. The temperature drop during these weeks, illustrated in figure 6, explains the sudden consumption increase.

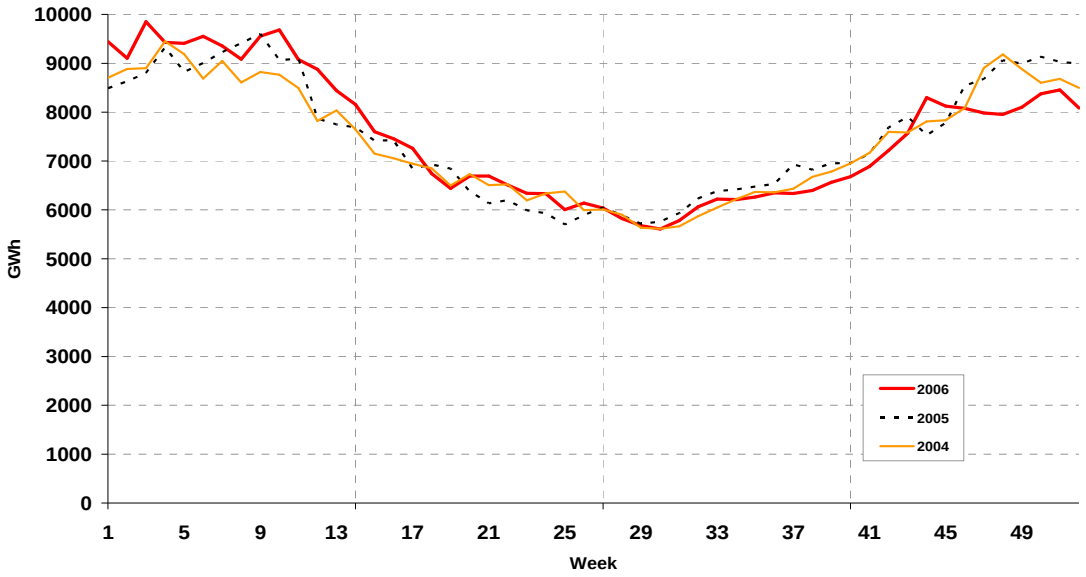

Figure 5. Electricity consumption in the Nordic region (GWh/week), 2004-2006
Source: Nord Pool

Table 3 shows the electricity consumption per capita in the Nordic countries in 1996 and in 2006. All Nordic countries except Denmark have high electricity consumption per capita compared to other European countries. A common feature of countries with high per-capita electricity consumption is that they have a high heating requirement due to a cold climate and/or have a large share of energy intensive industries.

Table 3. Electricity consumption per capita, 2006*
Source: Nordel

	Denmark	Finland	Norway	Sweden	Nordic region
Total electricity consumption (GWh)	36 392	90 111	122 572	146 366	395 441
- household consumption (GWh)	9 800	20 900	35 503	40 100	106 303
Population (million)	5.435	5.277	4.660	9.080	24.452
Household consumption per capita (kWh)	1 803	3 961	7 619	4 416	4 347

* Please note that all figures in the table are preliminary

Table 4 describes the electricity consumption for different customer categories in the Nordic countries in 2006. There are significant similarities between the countries. In Sweden, Norway and Finland, the industry is responsible for a large portion of the total consumption. These countries also have a high proportion of energy-intensive industries. Denmark, on the other hand, has a different industrial structure. Here, the use of electricity is more evenly distributed between residence, industry, and business and service. Also the customer category containing agriculture is using far more electricity in Denmark than in the other Nordic

countries. Households in Norway consume significantly more electricity than households in the other Nordic countries. Many Norwegian households use electricity as major or only heating source. The relatively low consumption in Denmark reflects the fact that electricity heating is less usual.

Table 4. Electricity consumption for different customer categories, 2006
Source: Nordel

	Denmark	Finland	Norway	Sweden	Nordic region
Housing	29%	24%	32%	30%	29%
Industry (incl. energy sector)	29%	58%	44%	45%	44%
Trade and services (incl. transport)	33%	17%	22%	20%	23%
Other (incl. agriculture)	9%	1%	2%	5%	4%

4.3.1 Temperatures in the Nordic region

Figure 6 illustrates the relatively high temperatures in the Nordic region in 2006. From mid April until the end of the year, the temperature was higher compared to a normal year. It is worth to notice in particular the warm weather from mid November until the end of the year, reducing the demand for electricity for heating purposes.

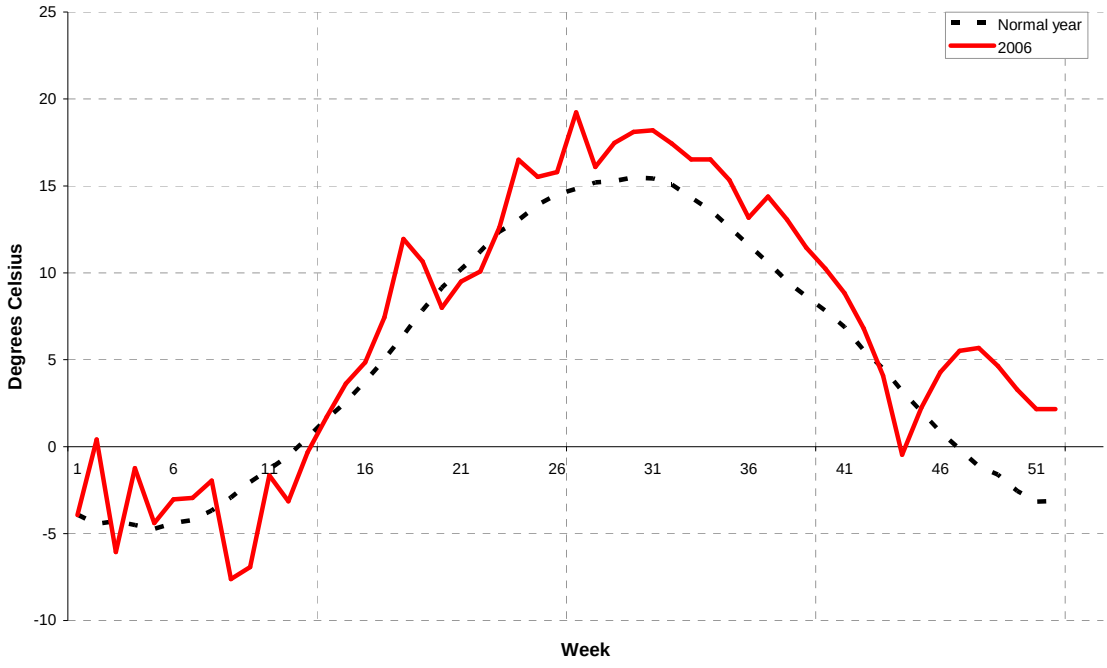

Figure 6. Mean temperature in the Nordic region[2] in 2006 compared to a normal year
Source: Nord Pool

4.3.2 Peak load

Peak load[3] usually occurs during periods of cold spells. In 2006, the peak load in the Nordic region was 67 648 MW and took place on January 20, hour 9, week 3. If western Denmark,

[2] Temperature measured weekly in 12 Nordic cities (Oslo, Bergen, Trondheim, Tromsø, Helsinki, Ivalo, Stockholm, Gothenburg, Östersund, Luleå, København and Billund).
[3] Peak load is defined as the maximum instantaneous electricity consumption or the maximum average electricity consumption over a designated interval of time.

which is synchronous with the UCTE[4] grid in Central-Europe is disregarded, the peak load was 64 127 MW. In Denmark the peak load took place on January 24, hour 18 with a load of 6 384 MW. The Finnish peak load happened on January 20, hour 8 with a load of 14 776 MW. Norway had its peak on March 6, hour 9 (21 575 MW) while the Swedish consumption peaked on January 3, hour 18 (26 385 MW).

Figure 7 illustrates the load during week 3, i.e. the Nordic peak load situation. As the figure shows, the load decreases significantly during night-time and peaks during the morning and late afternoon. The morning peak coincides with the time people arrive to their place of work while the afternoon-peak is related to cooking, washing and turning on TVs when getting home from work.

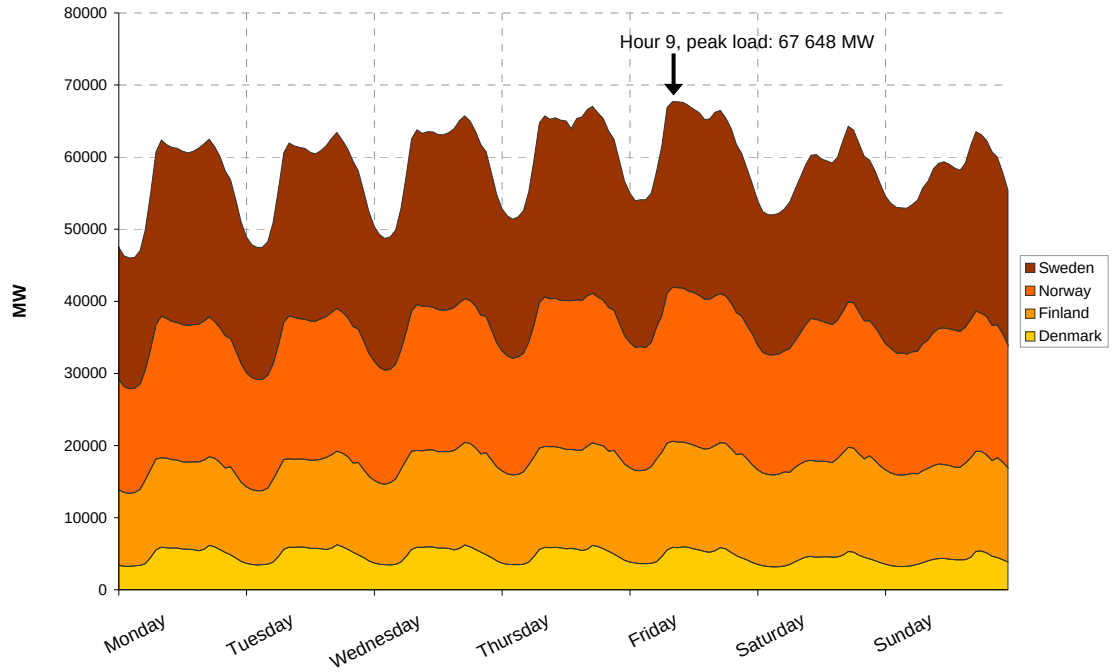

Figure 7. Load in the Nordic region during week 3, 2006
Source: Nord Pool

Figure 8 shows the consumption, generation and exchange in the Nordic electricity market during the most strained hour in the Nordic region in 2006, January 20, hour 9. As seen in the figure, the consumption in Finland and Sweden exceeded the generation by 4 222 MW. This led to a net import, partly from Denmark and Norway who were net exporters at this time. During this hour, Denmark and Norway both had a generation surplus, totalling 3 826 MW. In cold spells, such as week 3, most of the generation capacity is put into operation. The Norwegian surplus is characteristic of the Norwegian generation capacity when load is high, as the resources are easily accessible with low costs. During the hour of peak load, the Nordic region was a net importer of 396 MW from adjacent countries.

[4] UCTE (Union for the Co-ordination of Transmission of Electricity) is an association of transmission system operators in 23 countries in continental Europe. UCTE coordinates the operation and development of the electricity transmission in continental Europe.

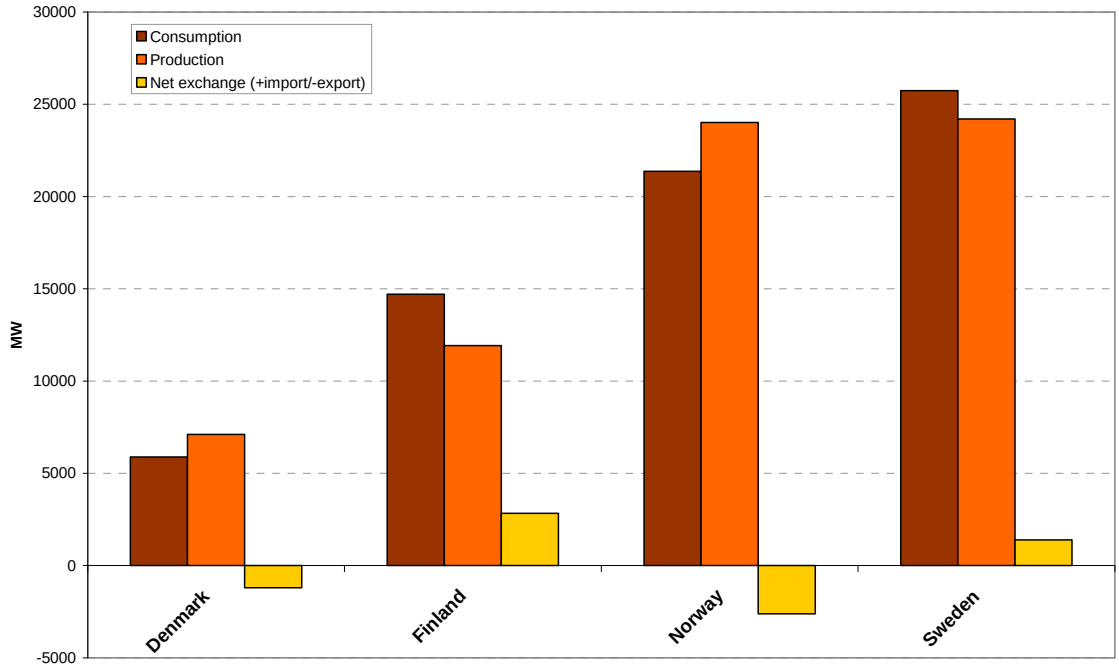

Figure 8. Consumption, generation and exchange in the Nordic region, January 20, hour 9
Source: Nord Pool

4.4 Generation and consumption: Conclusions

When comparing electricity generation and consumption patterns in the Nordic region with other European countries, it is crucial to have in mind the unique mix of generation sources in combination with the different weather situation in the Nordic region. The high share of hydropower, representing virtually all of the Norwegian and nearly half of the Swedish generation capacity, has a great influence on the amount of electricity generated. That makes levels of precipitation vital when calculating and analysing potential generation levels. In addition, the Nordic region has significantly colder winters than any other European country, influencing the consumption as many households are electrically heated.

In 2006 the over all temperatures in the Nordic region were higher than usual and the precipitation varied heavily, with an extremely dry summer and a wet autumn. As a result of the extremely dry summer, there were major concerns during the summer and early autumn for possible power shortages in parts of the Nordic region. The low reservoir levels got very high attention in Norway. In Sweden, with the power situation worsened by technical problems in several nuclear plants, preparations were made for situations with power shortages. However, the shortage was reflected in the market, with correspondingly higher prices, due to increased thermal generation with higher marginal costs. Hence, the lack of hydropower generation during the summer was compensated by increases in thermal power generation. During the autumn the reservoir levels increased due to high precipitation, at the same time as consumption was dampened due to unusually high temperatures and high retail prices.

5 Electricity transmission

The transmission grid is the physical backbone of an electricity market. The transmission grid in the Nordic region has been built up during many years, aiming primarily to meet the demands of each country. Early in the development of the national power systems it was recognized that the systemic differences between the countries meant that linking the systems together would enhance security of supply and make possible a more efficient use of the existing generation capacity. Today, the Nordic countries are closely linked together providing a solid foundation for a common Nordic electricity market.

5.1 Transmission network

Figure 9 shows the transmission network in north-western Europe. The Nordic transmission grid interconnects basically the whole Nordic region to one synchronous power system (excluding western Denmark). There are also interconnectors linking the Nordic market to Germany, Poland, Estonia and Russia. In the fall of 2007, a cable between Norway and the Netherlands will be commissioned. However, as illustrated in the figure, there are no transmission lines connecting western Denmark to eastern Denmark. Eastern Denmark is synchronous with the Nordic grid while western Denmark is synchronous with the UCTE area in continental Europe.

Each Nordic country has an appointed Transmission System Operator (TSO). The TSO's are responsible for the safe operation of the grid while allocating as much interconnector capacity as possible to the market.[5] The Nordic TSO's have the overall responsibility to ensure momentary balance between supply and demand of electricity in the operating hour.

[5] Energinet.dk in Denmark, Fingrid in Finland, Statnett in Norway and Svenska kraftnät in Sweden.

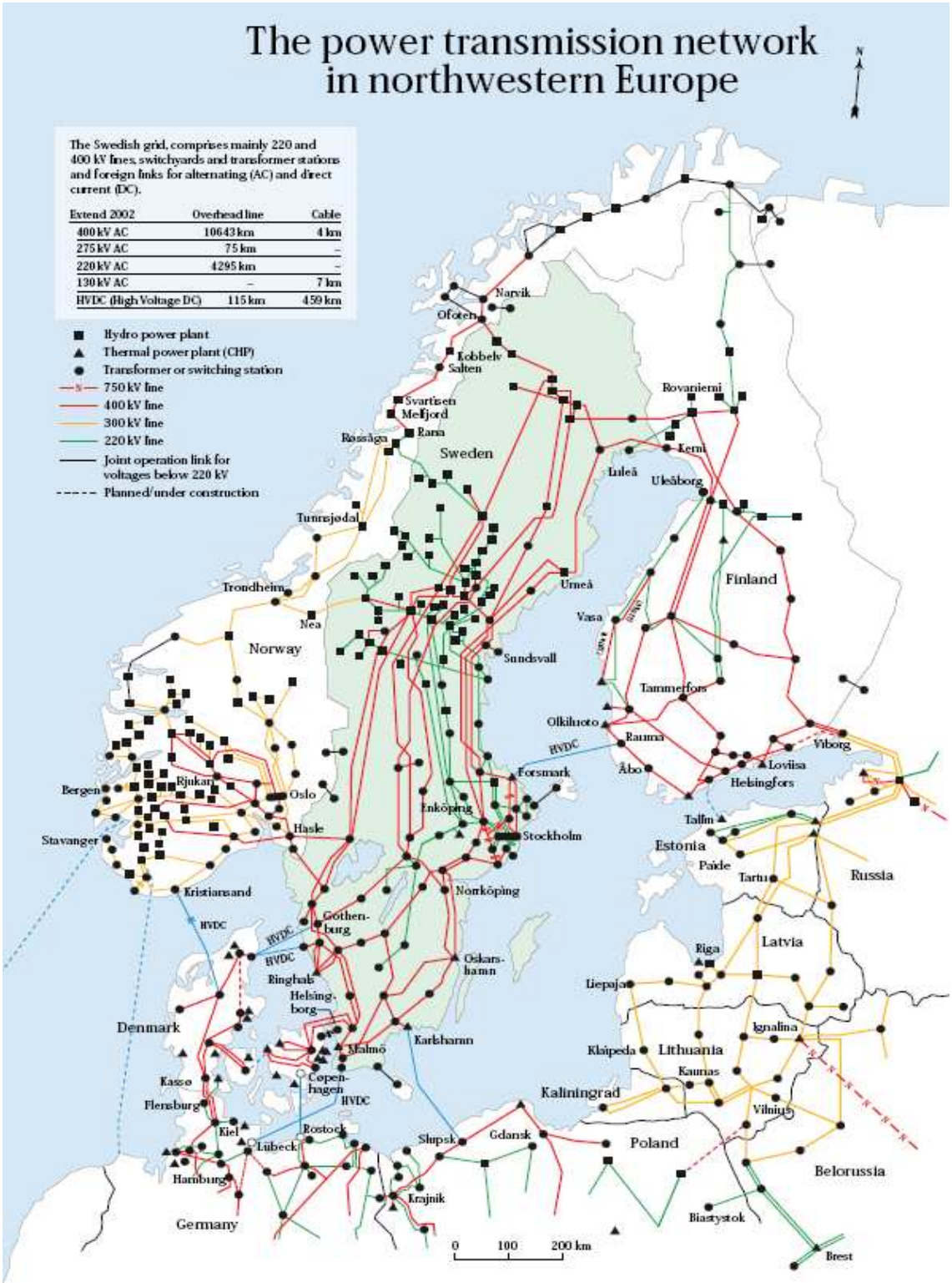

Figure 9. Transmission network in north-western Europe
Source: Svenska Kraftnät

5.2 Transmission congestions

There are variations in generation mix, generation costs and consumption patterns across the Nordic countries. A large share of the generation resources, especially hydropower, is located in the northern part of the Nordic region while the bulk of the consumption is located where the population is concentrated, mainly in the southern parts of the Nordic region. Volatile amounts of precipitation to the hydro plants in Norway, Sweden and Finland are to some

extent taken care of by utilization of large hydropower dams, but still there are huge seasonal and regional differences in the hydropower generation potential. In addition, the value of electric power varies over time and across regions due to for example fluctuations in supply and demand.

Regional differences in the value of electricity create a demand for transportation of electricity. The demand for transmission of electricity through the Nordic grid is sometimes larger than the available transmission capacity. While substantial reinforcements in the Nordic transmission system are planned to be made in the coming years, it is in general not economically efficient to expand the network capacity to a level where the demand for transmission is met in all hours and at all interconnectors.

Congestions between Nordic spot areas in the spot market are handled through market splitting, while internal congestions in general are handled through counter trade or by reducing interconnector capacity at the spot area borders. Counter trade is mainly used on intra-day operation and in certain other instances on day-ahead markets.

Increasing transmission capacity reduces the risk of congestion. However, the expansion of the transmission network entails high costs and therefore cannot always be justified from an economic point of view. Nordel, the organisation for collaboration between the Nordic transmission system operators, has identified the following five areas, or cross-sections, where the electricity network should be strengthened:

- The Southern Link between central and southern Sweden
- The Great Belt Link in Denmark
- The new Fennoskan 2 Link between Finland and Sweden
- The new Nea-Järpströmmen Link between Norway and Sweden
- The new Skagerrak Link between Denmark and Norway

Four of the five cross-sections listed above have already been decided[6], while energinet.dk and Statnett has made a letter of intent on the new Skagerrak link. If all goes according to plan, the reinforcements to the first four links will be commissioned between 2008 and 2012. The aim of the investments is to prevent transmission constraints and to increase security of supply in the Nordic market.

The roles of the regulatory authorities in the Nordic countries with regard to capacity allocation and congestion management vary. It is clear though, that the main responsibility for this issue lies with the system operators. The role of the regulatory authorities with regard to the system operators differ, from a very limited role for the Swedish regulator to a situation where NVE as only regulatory authority has to approve of the Nordic Grid Code.

5.3 Electricity transmission: Conclusions

The transmission grid in the Nordic region connects almost the entire region to one synchronous power system. The purpose of this common system is to increase security of supply as well as to use the generation capacity more efficiently. During wet years, hydropower flows southwards and during dry years, thermal power flows northwards.

[6] Prioritised cross-sections reinforcement measures within the Nordic countries, Nordel 2006.

However, increasing cross border power flows also strains the transmission lines and increases the demand for transmission capacity. Sometimes this leads to congestion. Congestions occurring between the Nord Pool spot areas are handled through market splitting, while internal congestions in general are handled through counter trade or by reducing interconnector capacity at the spot area borders. Counter trade is mainly used on intra-day operation and in certain other instances on day-ahead markets. Congestion management is currently one of NordREG's most prioritised issues.

6 Wholesale power market

The wholesale power market is a common Nordic market. In the Nordic wholesale power market, electricity is traded on the Nordic electricity exchange, Nord Pool. The market participants at Nord Pool are electricity generators, electricity suppliers, portfolio managers, industrial companies and other large electricity consumers. Nord Pool organises electricity trading in a physical market and a financial market.

The physical market consists of two sub-markets, the day-ahead market *Elspot* and the intra day market *Elbas*. In the day-ahead market, electricity is traded for the next 24 hours. In the intra day market, participants in Finland, Sweden, Germany and Denmark can trade for the forthcoming day after the day-ahead spot market is set. Remaining transmission capacities or capacities in the opposite direction of the day-ahead outcome is available for the intra day market. In the financial market the players can secure prices for future purchases or sales of electricity.

In addition to the physical day-ahead (*Elspot*) and intra day (*Elbas*) markets, there is a regulating market in order to ensure the balance between generation and consumption in the hour of operation. As seen in figure 10, the different market solutions are used depending on the distance to the operating hour. Participants can list their available generation/limited consumption volumes and accompanying price to the TSO's for the regulating market. This is a helpful tool for the TSO's, which have the overall responsibility to ensure the momentary balance between supply and demand. The TSO's can then employ the right regulating object after taken into consideration location and capacities in the network.

Nord Pool was founded in 1993 in Norway as Statnett Marked. In 1996 Sweden joined the power exchange and the world's first multinational exchange for trade in power contracts was created. Statnett Marked was renamed as Nord Pool. In 1998 Finland joined Nord Pool and in 1999 western Denmark joined the market place. In 2000 the Nordic wholesale power market became fully integrated when eastern Denmark joined Nord Pool.

Trading at Nord Pool is voluntary, however all crossborder trading must be done at Nord Pool Spot. About 60 per cent of the power generated in the Nordic region is traded via Nord Pool's physical spot market. The remaining 40 per cent is traded bilaterally. The Norwegian Water Resources and Energy Directorate (NVE) are responsible for regulating Nord Pool Spot.

The Nordic region consists of several spot areas at Nord Pool. During 2006, there were two areas in Denmark, one in Finland and Sweden respectively and three areas in Norway. In addition, Vattenfall's delivery area in Germany constituted a spot area. The capacities for the exchange of electricity between the areas are calculated and coordinated by the TSO's and distributed to Nord Pool Spot for exchange purposes, before price calculation at Nord Pool Spot. The prices for the spot areas and the flow between the areas are then calculated. This ensures an exchange where electricity flows from a low price area to a high price area. If the available capacity between the areas is adequate, the prices will be equal. If not, there will be price deviations between the spot areas.

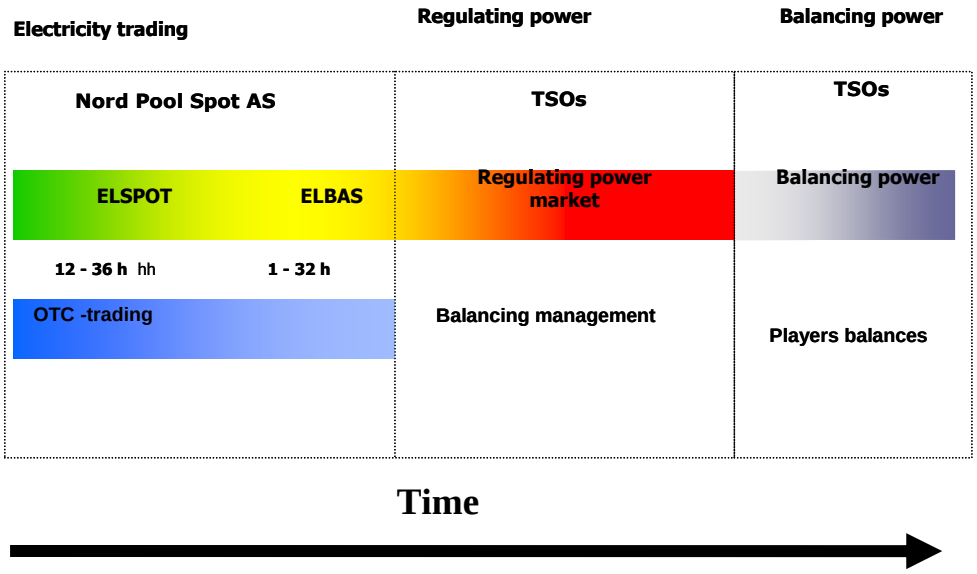

Figure 10. Nordic electricity markets

6.1 Price development in the spot market

In 2006 the average spot price at Nord Pool reached its highest level since 2003. The average system price during the year was 48.60 Euro/MWh, compared to 29.30 Euro/MWh in 2005. The average price in 2004 was 28.92 Euro/MWh. The highest monthly spot price during the year was noted in August when the average system price reached 66.53 Euro/MWh. Figure 11 illustrates the development of the Nord Pool system price since 1996

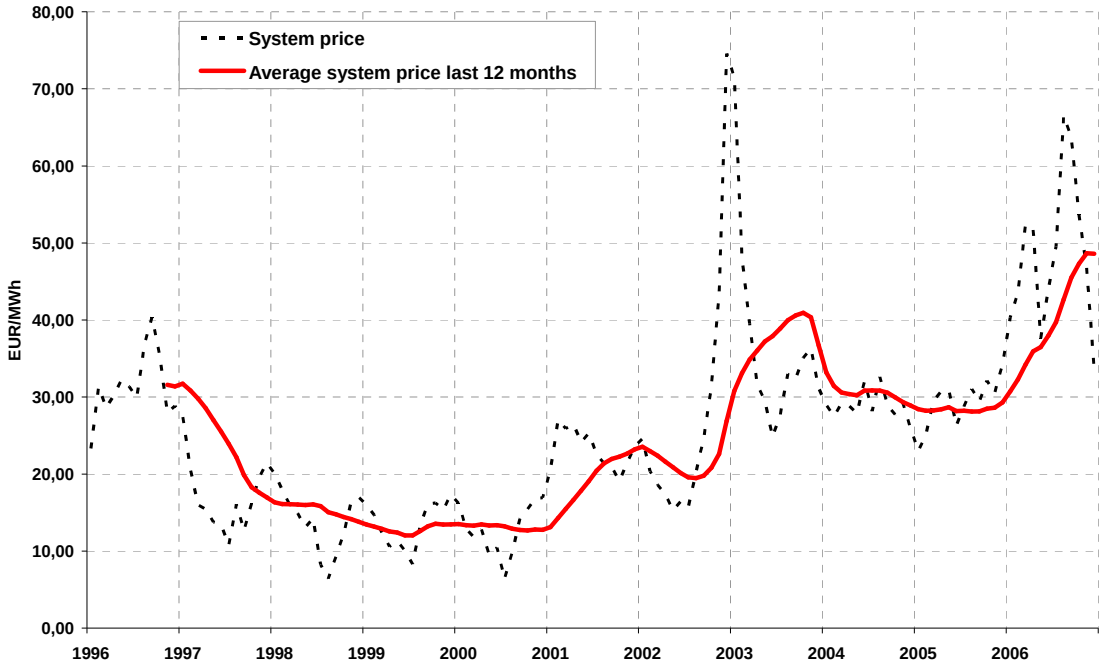

Figure 11. Development of monthly system price at Nord Pool Spot, 1996-2006
Source: Nord Pool

Table 5 describes the average spot prices for the different Nord Pool Spot areas in 2006. The table shows that southern Norway had the highest average price during 2006 while western Denmark had the lowest average price. The table also indicates that Norway, with a large amount of hydropower, was the Nordic country most affected by the low reservoir levels during 2006. Consequently the prices increased when more expensive thermal heating units had to compensate the lack of hydropower.

Table 5. Average price in the different Nord Pool spot areas, 2006
Source: Nord Pool[7]

Spot prices EUR/MWh	2006	Change from 2005
Finland (FI)	48.57	59%
Western Denmark (DK1)	44.18	19%
South Norway (NO1)	49.23	69%
Middle Norway (NO2)	48.97	66%
North Norway (NO3)	48.98	66%
Sweden (SE)	48.12	62%
Eastern Denmark (DK2)	48.53	44%

Table 6 shows the price differences between the spot areas during 2006. The table shows that the price in Sweden (SE) was lower than the price in Finland (FI) in 3 per cent of the hours in 2006. The table also shows that the price in the Danish spot area DK1 was higher than the price in the Norwegian spot area NO3 in 13 per cent of the hours in 2006. Sweden was the spot area that most seldom constituted a separate spot area. In 2006 there was a common Nordic price for more than 33 per cent of the time.

Table 6. Price differences between Nordic spot areas, 2006
Source: Nord Pool

2006 (%)		NO1	NO2	NO3	SE	FI	DK1	DK2
		Less than						
NO1	Higher than		24	24	23	26	43	28
NO2		14		0	14	18	42	21
NO3		14	0		14	18	42	21
SE		7	4	4		4	35	10
FI		9	6	6	3		37	12
DK1		11	13	13	11	12		10
DK2		12	10	10	7	9	34	

[7] NO2 and NO3 was a joint area until 19 November.

Figure 12 describes a duration curve of the spot prices in the Nordic region – listing the amount of hours the price has been below a certain level. As seen in the figure, western Denmark stands out with a relatively long time of prices higher than the other countries. The highest price in eastern Denmark was 160.3 Euro/MWh. The highest price in the Nordic region during 2006 was recorded in Finland; 317 Euro/MWh.

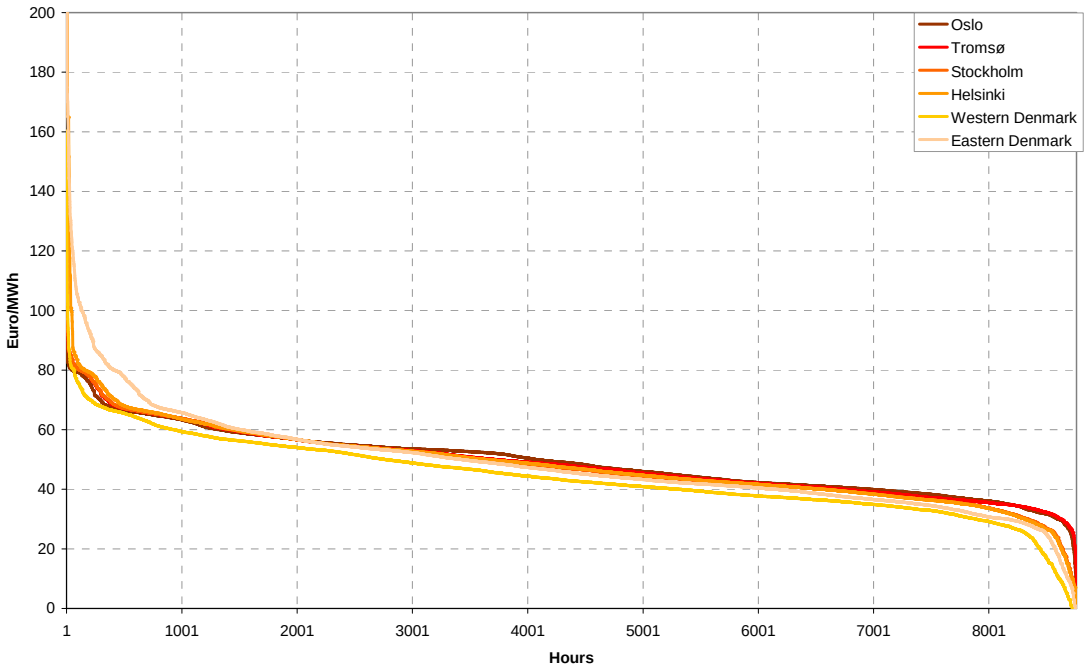

Figure 12. Duration curve of different spot prices, 2006
Source: Nord Pool

Figure 13 shows the average daily system price at Nord Pool Spot and the base load price at the European Energy Exchange EEX (shown in red) as well as the minimum and maximum prices in each 24 hour period during 2006 (shown in black). The figure very clearly illustrates the considerable difference between a hydro dominated system and a system dominated by thermal power. The Nordic system price is significantly more stable over the 24 hour period than the price on EEX. The input from hydropower in the Nordic electricity market evens out the normal price differences between low and high load in the system.

During most of 2006 the Nordic prices were lower than the German prices. However, from early August until mid October the Nordic prices climbed above the German prices due to the special hydrological situation. This influenced the cross-border trade and evened out the power exchange between the Nordic countries and Germany due to the at times lower German prices.

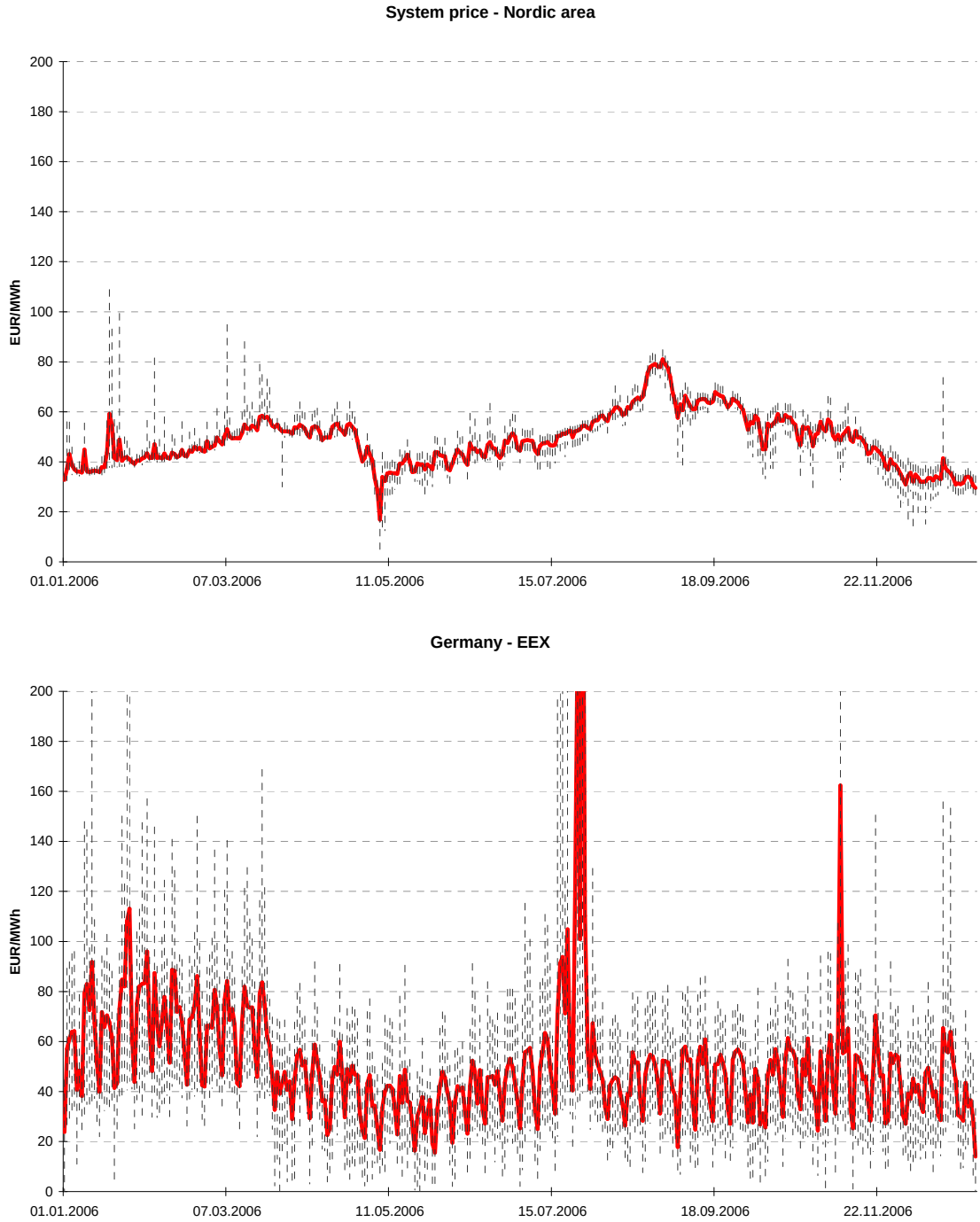

Figure 13. Comparison between the Nordic system price (Nord Pool) and German wholesale price (EEX)
Source: Nord Pool and EEX

Figure 14 illustrates the Nord Pool system price together with the forward price for the forthcoming period until 2009. In 2006 the average system price was 49.35 EUR/MWh. The high price level during the beginning of the year was due to low reservoir levels in combination with cold weather and high prices on CO_2 allowances. The first price decrease during the year can be explained by the information release about the actual use of CO_2 allowances during 2005, which was considerably lower than what the market expected. This dramatically lowered the prices for CO_2 allowances and hence the price at Nord Pool Spot. The price development on CO_2 allowances is shown in figure 17.

The price peak during the late summer and early autumn was caused by low reservoir levels and technical problems at the Swedish nuclear plants. However, the exceptionally wet and warm autumn brought down the prices to unusually low levels.

The price expectations for the next three years are somewhat higher than the prices in 2005 but lower than the prices in 2006. The forward price follows an expected cycle of lower prices during the summer and higher prices during the winter.

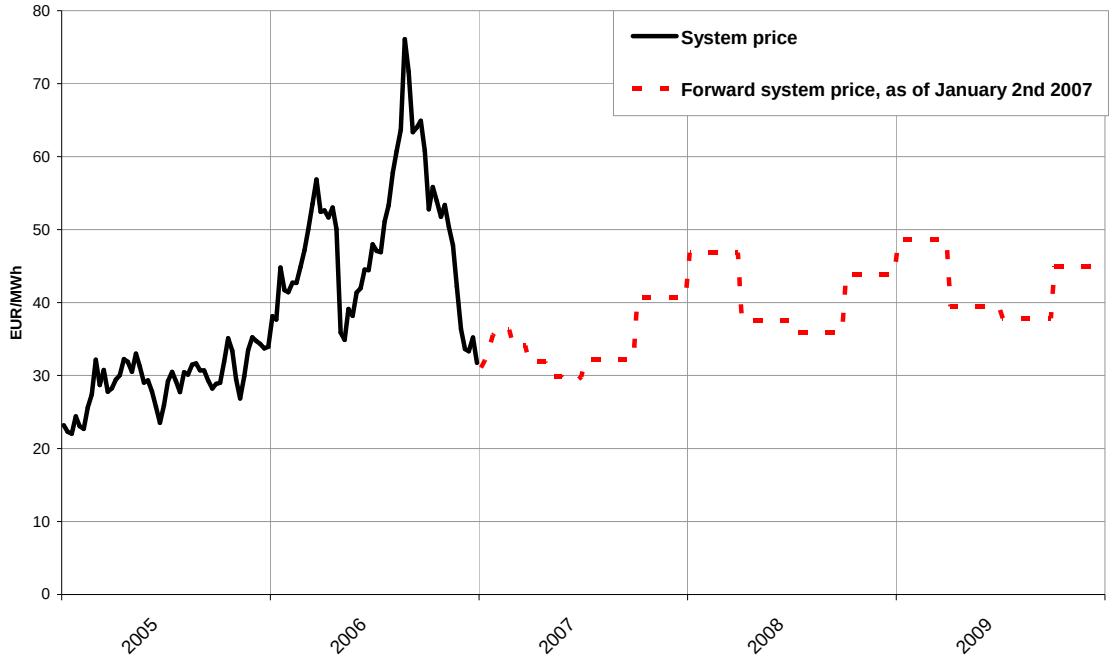

Figure 14. Weekly Nord Pool system and forward prices
Source: Nord Pool

6.2 Conditions for generation

Electricity generation in the Nordic region is to a very large extent based on hydropower, thus making the inflow and reservoir levels of crucial importance. The second largest generation technology is thermal power. The implementation of CO_2 quotas and tradable CO_2 allowances has made the price on CO_2 emissions to an important factor influencing the price on electricity.

Even though electricity in itself can not be stored, the water creating the electricity can be stored in reservoirs along the rivers. The main bulk of the inflow to the reservoirs occurs during the spring when the snow in the mountains melt and during rainy autumns.

Figure 15 shows the effective inflow to the water reservoirs in the Nordic region during the last three years. In the first three quarters of 2006 the inflow was lower than normal, especially during the summer. Small amounts of precipitation from the winter on through the summer combined with relatively low temperatures during the winter and spring resulted in low reservoir levels. During the fourth quarter, the inflow increased significantly as seen in the figure. Overall, the period from May through October in 2006 can be considered as a dry period while the end of the year can be categorized as a wet period.

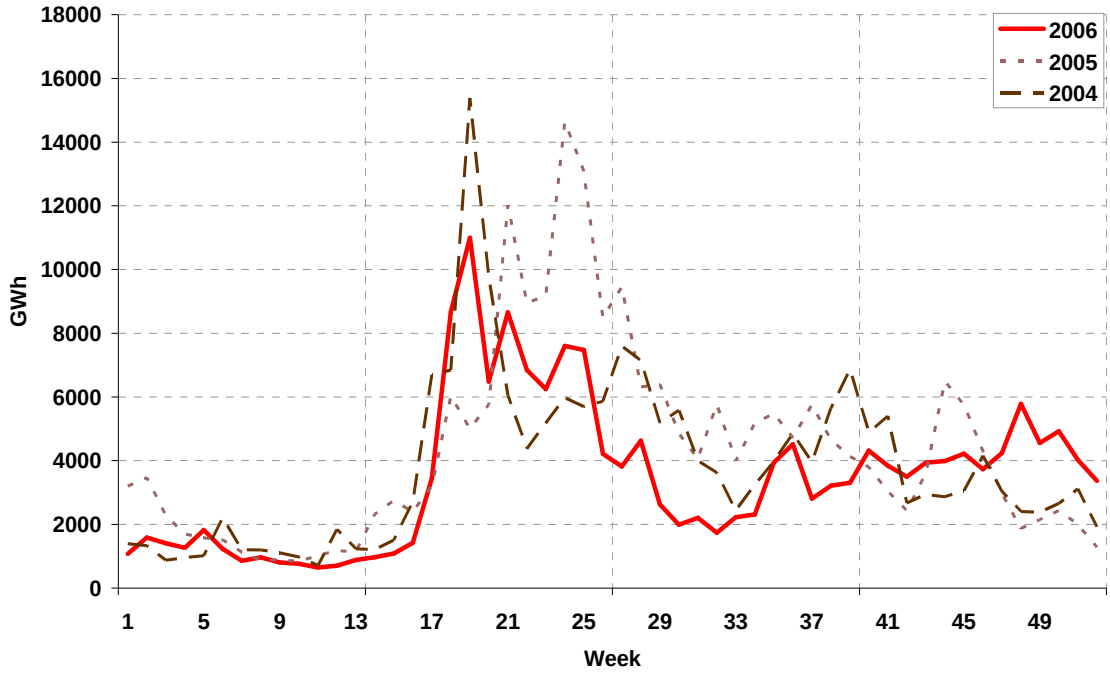

Figure 15. Effective inflow to the Nordic water reservoirs, 2004-2006
Source: Nord Pool

Figure 16 illustrates the reservoir levels in the Nordic region during the last three years. As seen in the figure the reservoir levels in 2006 were considerably lower than normal, especially during the summer and autumn. During this time, the levels were around 60 per cent compared to normal levels of around 80-90 per cent. The expectations of possible power shortage brought higher prices, reduced consumption and reduced hydropower generation at the same time as the import of electricity increased. However, due to more precipitation and higher temperatures than normal, the reservoir levels were restored to more normal levels at the end of the year.

At the beginning of 2006, the total reservoir levels in the Nordic region were 71 per cent of the total capacity. In Norway the reservoirs have a capacity of 84.1 TWh, which of 81.9 TWh is accounted for in this data set. Swedish reservoirs have a capacity of 33.8 TWh, while the capacity in Finnish reservoirs is 5.5 TWh. The Nordic capacity is 123.4 TWh. At the end of 2006, the reservoir levels in the Nordic region were 67 per cent of the total capacity.

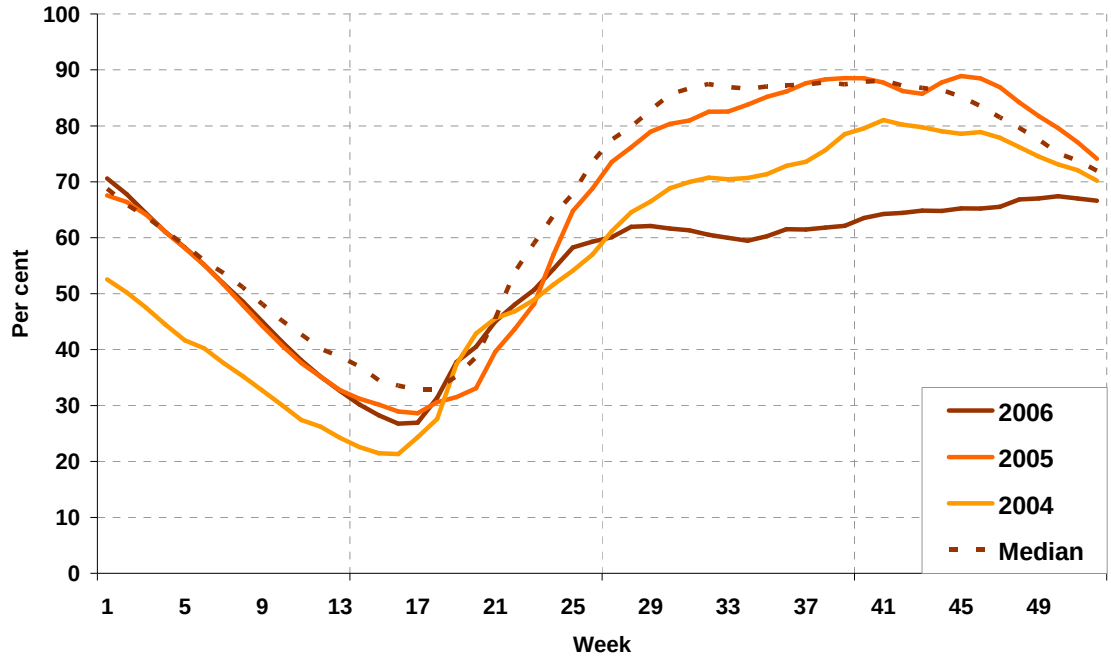

Figure 16. Reservoir levels in the Nordic region, 2004-2006
Source: Nord Pool

In 2005 the implementation of CO_2 quotas and tradable CO_2 allowances added new costs to thermal power producers with CO_2 emissions. Most of the thermal generation units within the Nordic region are located in Denmark and Finland.

Figure 17 shows the price for CO_2 allowances on Nord Pool during 2006. As seen in the figure, the price decreased dramatically in late April. On Monday, April 24 the prices were 31.30 Euro/ton but by Friday, April 28 the prices had fallen to 14.15 Euro/ton. This was due to information about the amount of CO_2 allowances that had actually been used. Since the amount was lower than what the market expected there suddenly were more CO_2 allowances available to the market and the prices consequently decreased. This also had an affect on the electricity spot price which consequently decreased at the same time.

Figure 17. Price on CO_2 allowances on Nord Pool, 2006 and 2007
Source: Nord Pool

6.3 Volumes in the spot market

The volume traded through the spot market is often regarded to be a measure of liquidity in the spot market. With exception of 2003, there has been a consecutive increase in volumes traded through the spot market since the formation of Nord Pool in 1993. During the last three years the volumes in the spot market have gone up with an increasing speed. This can to some extent be explained by the introduction of gross bidding. Particularly this has increased the volumes traded in Sweden from 40-45 per cent to approximately 90 per cent. The incentives for some of the larger vertically integrated companies to notify both buying and selling were strongly improved, as the total fees rebated netting from producers with both buying and selling orders.

As seen in figure 18, during 2006 the total volume traded at Nord Pool Spot for the first time exceeded half of the total Nordic electricity consumption. More than 60 per cent of electricity consumption was traded through Nord Pool Spot during the year. The total volume traded at Nord Pool Spot in 2006 was 251 TWh, an increase of 43 per cent from 2005. The spot market accounted for 250 TWh and the Elbas market for one TWh. The total value of the 251 TWh traded through the Nord Pool Spot group in 2006 was almost 12.3 billion Euro.

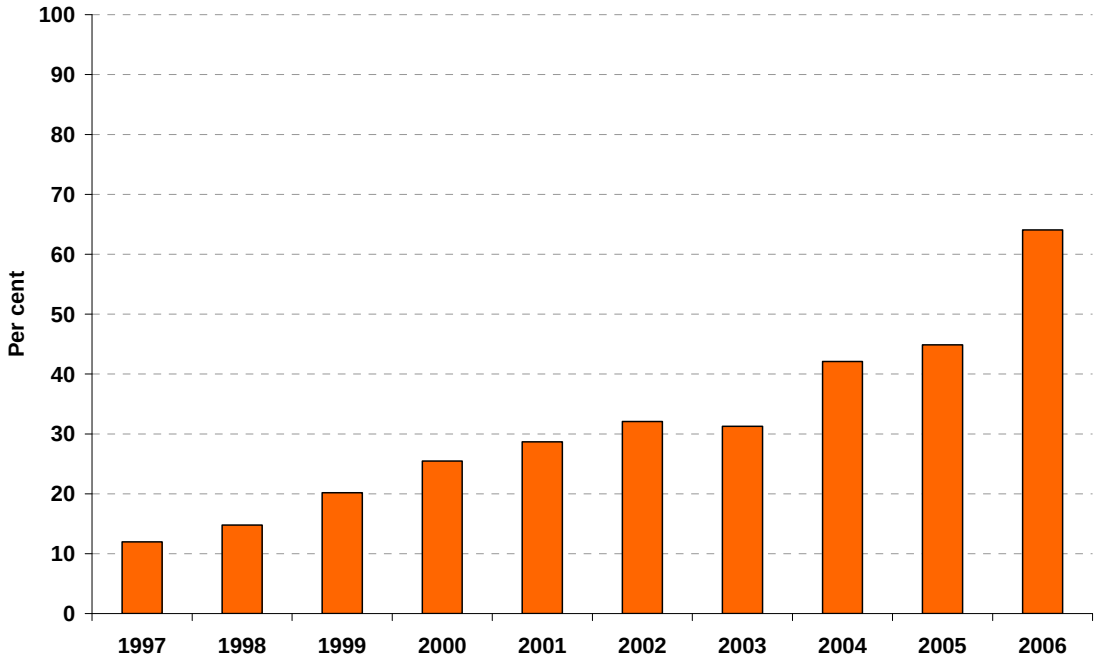

Figure 18. Volumes traded at Nord Pool Spot market as a percentage of total Nordic consumption, 1996-2006
Source: Nord Pool

6.4 Cross-border power flows

Figure 19 shows the power exchange between the Nordic and the non-Nordic countries during 2006. The extent of the power exchange is highly influenced by the resource situation. In 2006, the low levels of generation from hydropower in Norway and Sweden was compensated by import from generation thermal power units in Finland, Denmark and the continent. This is typical for the Nordic power system; in dry years the power flows north, while the power flows south in wet years. Likewise, changes in wind power generation influence the power flows, although with a time span of hours instead of months. This illustrates the flexibility of

the Nordic power system; power is generated where it is cheapest and is then transferred to more expensive areas and areas with not enough generation capacity.

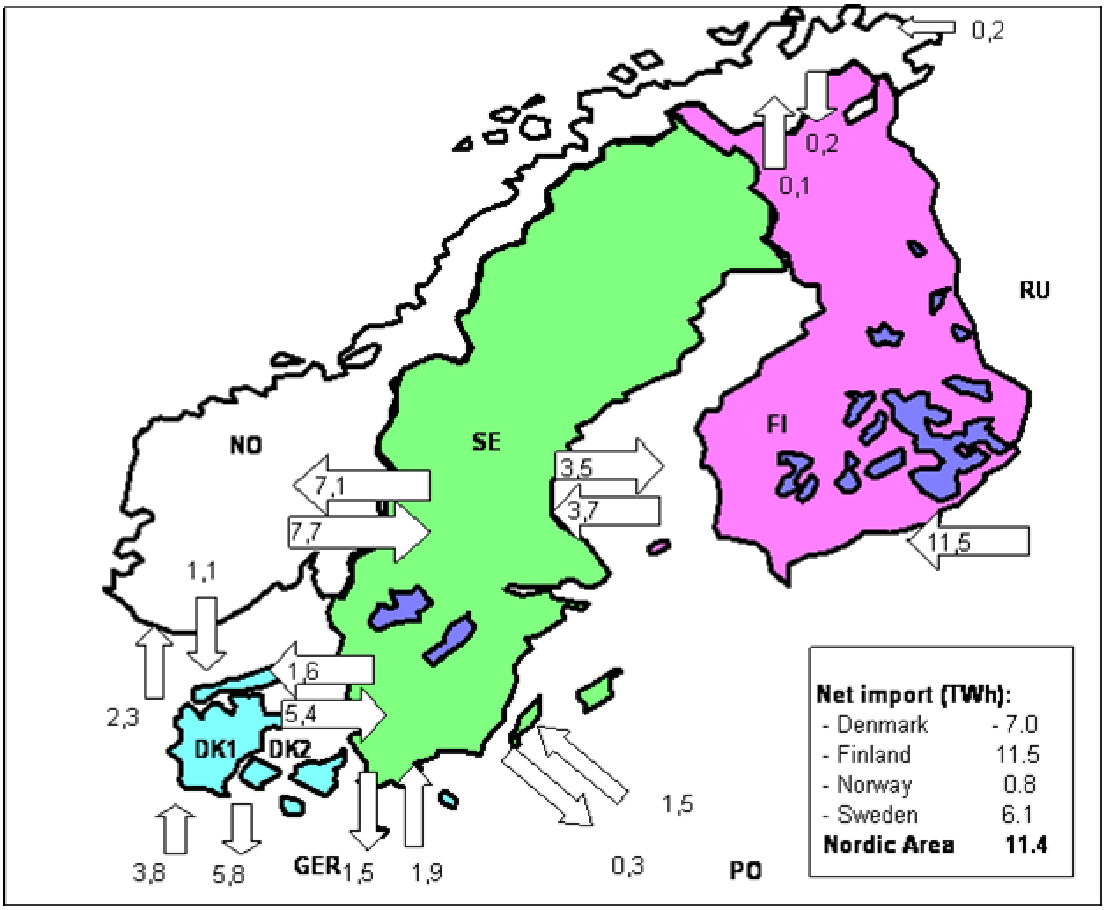

Figure 19. Power exchange, 2006
Source: Nord Pool

Figure 20 shows the Nordic power exchange during the last eight years. In 2006, the Nordic region was a net importer of 11.4 TWh. The major reason for this was the low level of hydropower generation during the year. In addition, a majority of the Swedish nuclear power reactors were offline during long periods of the summer and autumn. These factors combined contributed to high electricity prices. In some periods the system price at Nord Pool was higher than in the surrounding markets, which is unusual. During a normal year the large amount of relatively cheap Nordic hydropower keeps the price at the Nordic exchange at a lower level than the prices in adjacent markets.

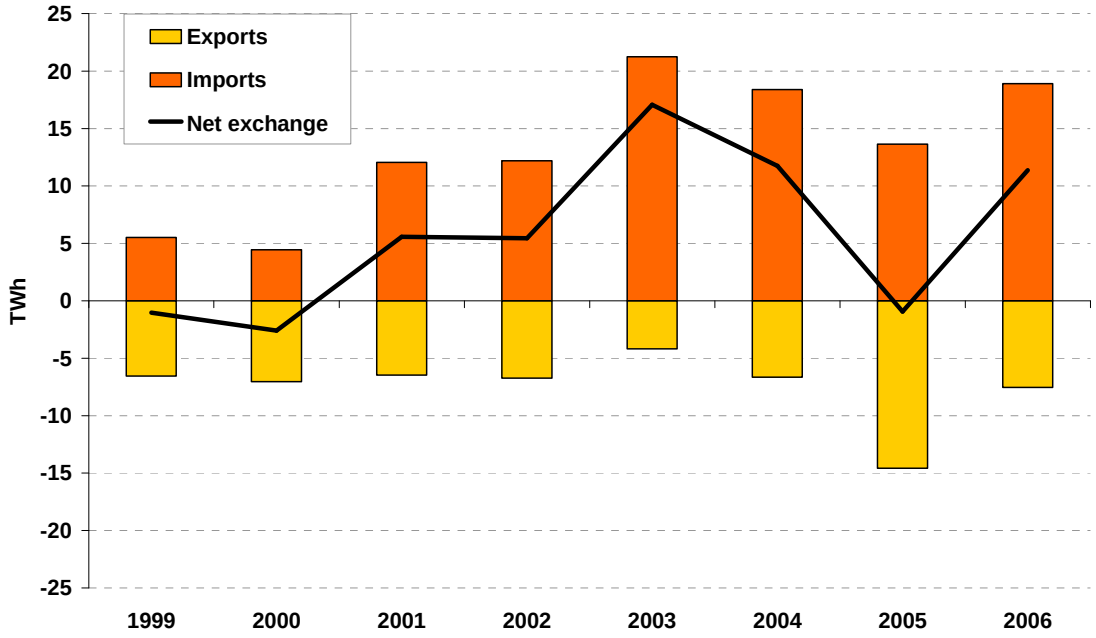

Figure 20. Nordic power exchange, 1999-2006
Source: Nord Pool

6.5 Main players

Vattenfall AB is by far the largest electricity generator in the Nordic region. The company is owned by the Swedish state. In 2006, Vattenfall generated over 68 TWh in the Nordic countries. Vattenfall has 45 per cent of the total Swedish generation capacity and more than 15 per cent of the total Nordic generation capacity. In 2006, a deal was concluded between Vattenfall and Dong in which Vattenfall acquired power stations and wind power capacity in exchange for its holdings in Elsam E/S and Avedöre 2. Vattenfall thereby increased its generation capacity by 6 TWh.

Fortum Oy is majority owned by the Finnish state. In 2006, Fortum generated more than 54 TWh of electricity in the Nordic region. Fortum has 35 per cent of the total Finnish generation capacity. When adding the Swedish division Fortum holds almost 12 per cent of the total Nordic generation capacity.

E.ON Sverige AB, formerly Sydkraft AB, is majority owned by the Germany company E.ON and Statkraft, which is owned by the Norwegian state. In 2006, E.ON generated 30 TWh in the Nordic region. E.On Sverige AB has 21 per cent of the total Swedish generation capacity and almost 8 per cent of the total Nordic generation capacity

Statkraft is by far the largest of the Norwegian generators. In a normal hydrological year Statkraft has more than 30 per cent of the total Norwegian generation capacity. If Statkraft's ownership in other Norwegian generation capacity is included the share becomes even greater. The yearly amount of electricity generated by Statkraft varies heavily because of the large share of hydropower in Statkraft's generation portfolio. According to the annual report, Statkraft generated 45.7 TWh in the Nordic region in 2006.

Figure 21 shows the market share of the four largest Nordic electricity generators during the last five years.

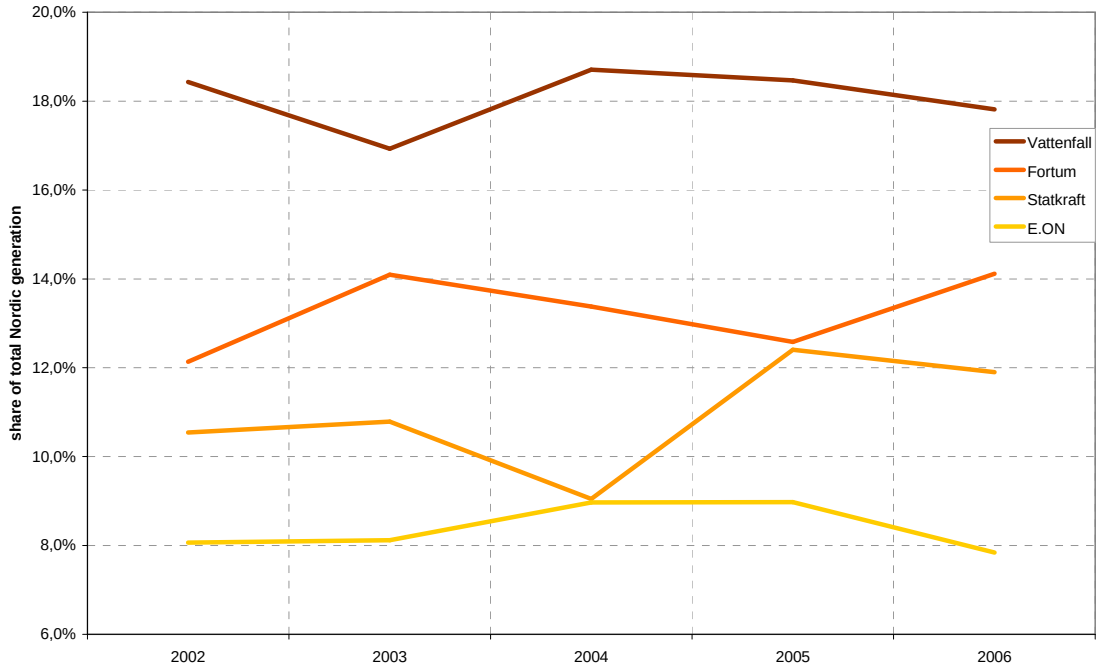

Figure 21. Share of total Nordic electricity generation by the four largest generators, 2002-2006
Source: Swedenergy, Nordel and regulatory authorities

6.6 Wholesale power market: Conclusions

The Nordic wholesale power market is one of the most well functioning electricity markets in Europe. The trade at Nord Pool has increased steadily since it was introduced in 1993. Although trading at Nord Pool is voluntary, more power is now traded on the market than bilaterally. During 2006 the average spot price at Nord Pool reached its highest level since 2003. The highest monthly spot price during 2006 was noted in August when the average system price reached 66.53 Euro/MWh. The high prices were partly caused by very low levels in the Nordic hydro reservoirs at the same time as several Swedish nuclear reactors were offline due to technical reasons.

The well-functioning of the Nordic electricity market was well illustrated during 2006. The dry and warm summer together with an autumn with high levels of precipitation created demands for transmitting large quantities of power within the Nordic region. Accordingly, the power within the Nordic market flowed from areas with the less expensive generation sources to areas with more expensive generation sources.

7 Retail markets

Unlike the integrated Nordic wholesale power market, the retail markets in the Nordic region are to a large extent still national in scope. There are several reasons for this. One reason is the lack of a common balancing market within the Nordic region. Another is technical differences for instance in switching models and message formats.

In 2005, the Nordic energy ministers commissioned NordREG to work towards a common Nordic retail market. Read more about the progress of this work in chapter eight.

7.1 Development of retail prices

Figure 22 illustrates the development of retail prices in the Nordic countries in 2006. The figure shows the development of contracts with spot related prices for household customers in Finland, Norway and Sweden. As seen in the graph, there are small price differences. The Finnish prices are slightly lower than the Norwegian prices while the Swedish prices in general are somewhat higher than the Norwegian prices. There is no information available about Danish prices[8]. It should be noted that spot related contracts are used by a minority of the household customers in the Nordic region.

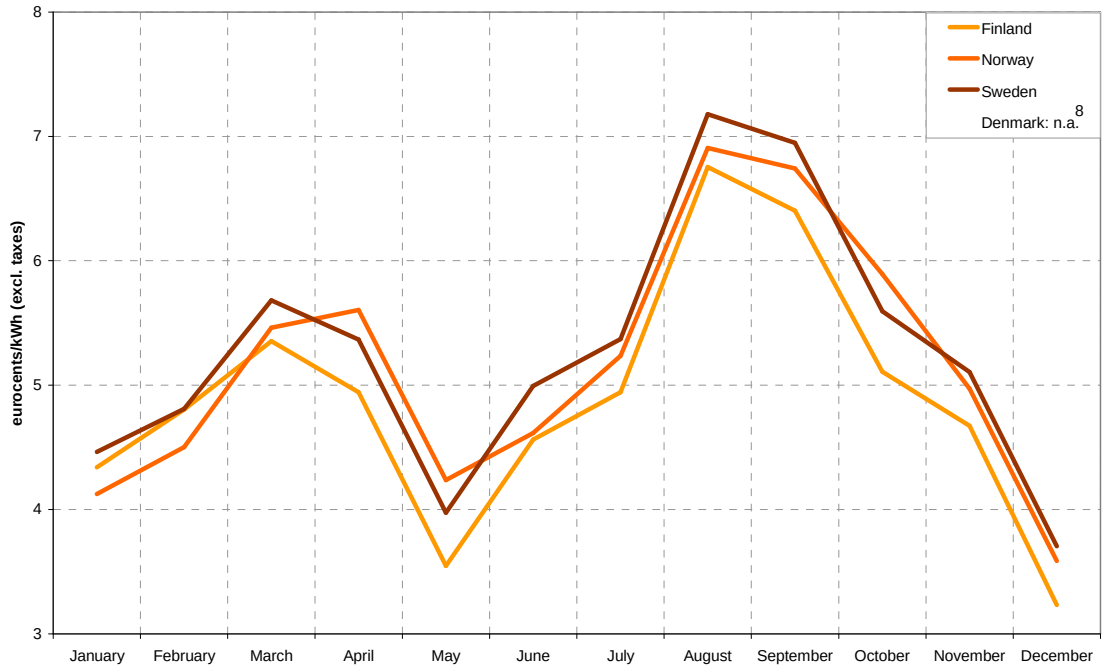

Figure 22. Development of retail prices[9] in the Nordic region, 2006
Source: Regulatory authorities

7.2 Supplier switching

Active customers are essential for a well-functioning electricity market. The share of customers having switched electricity supplier varies considerably between the Nordic

[8] The supply obligation product covers more than 95% of the Danish consumers (households and small businesses and enterprises). There are no Danish products comparable with the products shown in figure 22. The Danish supply obligation product is a quarterly product supplied by companies granted a concession. The prices for supply obligation electricity apply for one quarter and are under supervision by The Danish Regulatory Authority (DERA). In 2006 the quarterly average prices for the supply obligation product were respectively 5.1 eurocents/kWh (Q1); 6.1 eurocents /kWh (Q2); 5.6 eurocents /kWh (Q3) and 6.9 eurocents /kWh (Q4).

[9] Spot related prices without taxes. No information available for Denmark.

countries. The most active customers have been observed in Norway followed by Sweden, where more than half of the households have switched supplier since the deregulations took place. The Danish and Finnish customers have not been as keen to switch supplier. In the Finnish retail market, electricity prices provided by the local suppliers have so far been very competitively, thus reducing the customers' willingness to switch supplier. In Denmark as well, the low level of supplier switching can be derived to lack of incentives. The presence of regulated maximum prices reduces the possibility for a customer to save money by switching supplier.

The difference in switching activity can be explained by many factors. One of the most important factors is price differences and the possibility to save money from switching electricity supplier. Customers having a very limited budget seeing that switching supplier can reduce their electricity bill are more likely to switch supplier than others. The tendency to switch supplier also increases with the level of consumption. Obstacles to switching supplier are first and foremost lack of information. Customers who understand how the electricity market functions, know that they can easily switch electricity supplier and have access to information about which suppliers exists and what prices they offer.[10]

The collection of information about switching and definitions of key figures describing switching differs among the Nordic countries. This makes more precise comparisons difficult.

In Denmark the association of the Danish Energy Companies collects information on switching activity on a quarterly basis. According to this study 6 per cent of the customers have switched supplier since the deregulation. This is mainly large customers. In 2006 approximately 12 per cent of the large customers, and 1 per cent of the small customers switched electricity supplier. A sample survey carried out by the Finnish Energy Market Authority shows that approximately 3 per cent of the small and 8 per cent of the large Finnish customers switched supplier in 2006. In total, 130 000 Finnish customers switched supplier in 2006. In Norway an estimated 273 000 households and 22 000 industry customers switched supplier during 2006. During the same time 400 977 Swedish customers switched their electricity supplier, whereof household customers accounted for 85 per cent. Since the market reform, more than 55 per cent of the Swedish household customers have switched supplier or renegotiated their contract.

7.3 Main players

The number of electricity suppliers in Denmark is close to 70. There are two forms of supply companies – trading companies with supply obligation companies and trading companies without. The approximately 40 supply obligation companies have been each been granted a concession for a specific geographic region where they supply households and small businesses having not concluded an individual contract. More than 95 % of the Danish households and small businesses are suply obligation customers. The trading companies supply the rest of the market i.e. mainly larger businesses and enterprises. Among the largest tradig companies in Denmark are Dong Energy A/S, Energi Danmark A/S and Scanenergi A/S.

In Finland, the four major suppliers in the end-user market are Energiapolar Oy, Fortum Markets Oy, Helsingin Energia and Vattenfall Sähkönmyynti Oy. Together these retailers hold approximately 40 per cent of the electricity end-user market. The end-user market has

[10] Supplier switching in the Nordic countries, NordREG.

been under a significant consolidation process during the past ten years. When the end-user market was opened to all customers in 1997 there were 116 suppliers. In 2006 the number of suppliers had decreased to 74, of which, 90 percent are offering their products all over Finland.

At the time of liberalisation of the Norwegian electricity market, most customers continued as customers with their local supplier with a standard variable contract (where prices can be changed on 2-3 weeks notice). Since the liberalisation of the market NVE has closely monitored the market development in the Norwegian retail market. At the end of 2006, 28 percent of the household customers and one third of the industry customers had another supplier than the original supplier. Since 1997 there has been more than 1.6 million supplier switches in the household market and at least half the Norwegian households have switched at least once. Furthermore customers have switched away from the standard variable contract to fixed contracts or spot related contracts. At the turn of the year 06/07 only 10 percent of the industrial customers and 55 percent of the household customers had standard variable contract. In 2006, the four largest household suppliers in Norway had about 40 percent of the market share.

The number of electricity suppliers in Sweden has fallen since the deregulation of the electricity market. In 1996 there were over 220 such suppliers in Sweden. By 2006, this figure had fallen to just over 130. Approximately 90 of these companies sell electricity to end users and around 80 companies operate throughout the country. The decline in the number of electricity suppliers is mainly due to acquisitions and mergers. In 2006, the three largest electricity retailers – Vattenfall El, E.ON Försäljning and Fortum Markets – had a market share of approximately 50 per cent in Sweden. In 1996, when the market was deregulated, the three largest companies had a market share of just over 30 per cent.

7.4 Retail markets: Conclusions

Even though the work of integrating the Nordic retail markets has begun it is still a question of four separate markets, influenced by national differences. Therefore, comparisons between the markets should be done with caution. The Nordic retail prices have, just like the spot prices at Nord Pool, been higher during most of 2006 than before. A major cause of this was the extreme weather during the year in combination with some of the Swedish nuclear reactors being offline. This shows how vital the Nordic weather is to the prices as more rain and snow equals smaller electricity bills for the Nordic electricity customers.

Active customers are essential for a well-functioning electricity market. The share of customers who switches their electricity supplier differs considerably between the Nordic countries. In Sweden and Norway the trend is however clear; more customers are becoming aware of the possibility to choose which supplier they want to buy their electricity from. This is reflected in the statistics which clearly shows that an increasing amount of customers are changing suppliers or renegotiating their contracts each year.

A standardisation of the procedures and practices on supplier switching and agreeing on a common Nordic balance settlement would facilitate the work towards an integrated Nordic retail market. If the Nordic retail customers have the possibility to choose between suppliers from all Nordic countries, customer activity will most likely increase. New types of services and contracts will probably be developed and margins in the retail market could be lower than they would otherwise have been. Hence NordREG's work towards a common Nordic retail market is of great importance to the Nordic electricity customers.

8 NordREG assessments

So far the report has provided a general presentation of the recent development of the Nordic electricity market based on NordREG's running electricity market monitoring. In addition, NordREG makes deeper analyses of market issues and suggest changes to facilitate market development and market integration.

Some of NordREG's most important assessments are presented in this chapter. The assessments are based on conclusions drawn in NordREG's reports published in 2006. The assessments are organised according to the following of NordREG's strategic priorities:

- A truly common Nordic retail market with free choice of supplier
- Reliable supply
- Efficient regulation of TSO

8.1 A truly common Nordic retail market with free choice of supplier

One of NordREG's priorities is to work towards a common Nordic retail market with free choice of supplier. Such a market would reduce the dominance of the large players on the national markets, increase consumer choice and probably reduce retail prices.

NordREG divides the different obstacles currently preventing the formation of a truly integrated Nordic electricity retail market into three categories; technical, regulatory and commercial obstacles.

NordREG envisages a harmonised platform for a common retail market coming into place in the year 2010. To make this possible the following steps must be taken:

Design

- A shared vision on the milestones of the common Nordic end-user market
- Establishment of Nordic AMR forum
- Harmonised rules for data systems, data system protocols and metering
- Harmonised switching model
- Harmonised legal framework for neutrality

Implementation

- Nordic customer protection framework
- Harmonised market design

It is NordREG's opinion that neutrality of distribution system operators (DSOs) towards all suppliers is of utmost importance to the competition in the electricity retail market. Regulators therefore seek to harmonise regulation on neutrality. NordREG believe that legal unbundling is not sufficient to ensure that DSOs act in a neutral and non-discriminatory manner.[11]

Another important obstacle that prevents the formation of a common Nordic retail market is the fact that the Nordic countries use different balance settlement systems. Therefore NordREG proposes that the different systems should be replaced by a common Nordic

[11] The integrated Nordic end-user electricity market, report 2/2006.

balance settlement within a few years.[12] In February 2007, Nordel, the organisation of the Nordic TSO's, agreed on harmonised principles for the balance management. The harmonisation is subject to approval of the national regulators.

In 2007, the work towards a common Nordic retail market will continue. NordREG will, among other things, evaluate the Nordel suggestions on balance settlement as well as finalise a report on the practical, legal and market consequences of a common Nordic balance settlement. NordREG will also address a number of other issues of retail market integration, e.g. the socioeconomic effects of a common market, harmonised supplier switching model and the harmonised legal framework for neutrality of network operators.

8.2 Reliable supply

Another of NordREG's priorities is to contribute to reliable supply of electricity in the Nordic region.

The most important issue is that the regulation is compatible when it comes to handling extreme situations. There should not be regulations in one country having a major negative effect on handling extreme situations in neghbouring countries.[13]

The question of compatible rules for handling extreme situations should be limited to challenges where two or more of the Nordic countries are directly involved. Extreme situations in one country should be handled according to national regulations and acts.

In 2007, NordREG will continue to work towards harmonised rules for handling extreme situations in the Nordic market. Among other things, NordREG will review the tasks and responsibilities of the various authorities with regard to security of supply. Furthermore, NordREG will finalise a report on legislative measures to ensure security of supply and to avoid extreme situations.

8.3 Efficient regulation of TSO

NordREG actively works to provide for an efficient regulation of TSO's in the Nordic region.

In 2006, NordREG focused on defining the core activities for the Nordic TSO's. NordREG's conclusion is that the core activities are common and are covered by the legal frameworks, but differ in detailed regulation (technical). It is NordREG's opinion that these differences may have an impact on the market, and if so, may be adressed through further harmonised regulation.

NordREG recommends a further study evaluating if and how a more harmonised Nordic regulatory set-up could contribute to an enhanced development of the common Nordic electricity market in co-operation between NordREG, Nordel and relevant stakeholders.[14]

In 2007, NordREG will continue to work towards an efficient regulation of the Nordic TSO's. NordREG will among other things analyse if differences in regulation of TSO's constitute barriers to the efficient functioning of the market. In addition, NordREG will finalise a compliance report of Congestion Management Guidelines. A common coordinated congestion

[12] Development of a common Nordic balance settlement, report 3/2006.
[13] Handling extreme situations in the Nordic countries, report 5/2006.
[14] A common definition of the system operators core activities, report 4/2006.

management method is important in order to achieve a further integration of the Nordic electricity market.

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