NordREG
Nordic Energy Regulators

Nordic Market report 2012

Report 3/2012

Nordic Market Report 2012

Development in the Nordic Electricity Market

Report 3/2012

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1 Preface

The Nordic Market report describes in a timely manner the status and developments in the Nordic electricity market with focus on generation, consumption, transmission, wholesale power market and retail markets. The report has been published annually since 2006. The Nordic Market report 2012 is based on the information for the year 2011 available in June 2012.

The structure of the Nordic Market report 2012 has been revised from the versions published in the previous years. While the statistical content has been preserved and listed at the end of each chapter, the descriptive parts of the report have been made more compact. The aim is to give the readers a quick and clear view of the Nordic electricity markets.

A working group with participants from the regulators in Denmark, Finland, Norway and Sweden has prepared the report. The members of the group were Henrik Gommesen (Energitilsynet, chairperson), Håkan Östberg (Energimarknadsinspektionen), Ingri Guren (Norges vassdrags- og energidirektorat), Mats Øivind Willumsen (Norges vassdrags- og energidirektorat) and Markus Nora (Energiamarkkinavirasto).

Helsinki, July 2012

Riku Huttunen
Chair of NordREG

2 Summary

The Nordic power system has a mixture of generation sources – hydro, thermal (coal, oil and gas) and nuclear.

In 2011 *total generation* in the Nordic countries was 370 TWh – 3 TWh or app. 1 % less than in 2010. The high share of hydro power in the Nordic system makes reservoir levels and inflow very import. The inflow was very high in 2011 and by the end of the year the Nordic reservoir level was 79 % compared to 49 % in 2010.

The Nordic *electricity consumption* is relatively high compared to other countries due to the high level of electric heating in combination with cold winters and a relatively high proportion of energy intensive industry. Total Nordic consumption was 379.6 TWh in 2011 - a decrease of 4.4 % compared to 2010. The decrease in demand was mainly due to the weak economic outlook and warm weather that decreased the demand for electric heating.

The Nordic *transmission grid* is part of the transmission network in north-western Europe and it combines practically the whole Nordic region to one synchronous power system (excluding western Denmark). Interconnectors also link the Nordic market to Germany, Poland, Estonia and Russia and the Netherlands.

Congestions in the Nordic spot market are handled through market splitting. During 72 % of the hours one or more of the bidding areas in the Nordic electricity market had a different price in 2011 compared to the 74 % in 2010. During 2011, there also was a major change in the price area structure used in the Nord Pool Spot bidding area, as Sweden was divided into four price zones on November 1. This modification was done in order to improve the market efficiency and lay the groundwork for financing future network improvements.

Internal congestions within TSO control area are handled through counter trade or by reducing interconnector capacity at the bidding area borders.

The common Nordic *whole sale market* experienced an average system price[1] in the NordPool area of 46.86 €/MWh in 2011, compared to 53.06 €/MWh in 2010. The highest monthly spot price – 69.62 €/MWh – was noted in January while the highest weekly system price, 79.81 €/MWh, occurred in week 1 due to cold weather. The lowest weekly system price was in week 40 with 9.99 €/MWh. Increasing hydrological surplus throughout the year contributed to decreasing prices in most of the Nordic price areas in 2011 compared to 2010.

[1] The system price is calculated as the price that would be realized if there were no congestions between the elspot areas.

In May 2009 NordREG published a joint report about the creation of a well-functioning Nordic end-user market for electricity.[2] Even though the work of integrating the Nordic retail markets has begun the *retail markets* in the Nordic region are to a large extent national in scope and comparisons between the markets should be made with caution.

Retail prices in Sweden and Norway had a downward trend throughout 2011 with respectively some 40% and 50% lower prices in December than in January. In Finland and Denmark prices were pretty steady with an upward trend of app. 4% in Finland and app. 1,5% in Denmark from January to December.

The competition statistical indicators shows generally competitive retail markets for electricity in the Nordic countries but also highlights areas, where the markets could be strengthened and where special attention and actions could be considered – e.g. supplier switching and concentration in the whole sale market.

[2] The report "Market Design – Common Nordic end-user market" can be downloaded from: https://www.nordicenergyregulators.org/Publications/

3 Supply – Generation

Introduction

The Nordic power system is a mixture of generation sources such as wind, hydro, nuclear and other thermal power[3]. Hydropower, which normally accounts for more than 50% of the total Nordic generation capacity, is the major source of electricity generation in the region. It represents virtually all of the Norwegian and nearly half of the Swedish generation capacity.

CHP (Combined Heat and Power) is the second largest generation source accounting for 31 % of the total Nordic power generation capacity. The thermal power generation (Finland and Denmark) in the Nordic region act as "swing-production", i.e. balances the total production during seasons when the level of hydropower generation in Norway and Sweden is low. The third largest power source, with a share of 12 % of the total Nordic generation capacity, is nuclear power, only located in Sweden and Finland. Wind power accounts for about 7 % and its notable increase continued from previous year.

The Nordic region has a total of 98.414 MW installed capacity for power generation and the total power generation in the Nordic region in 2011 was 370 TWh – 3 TWh or approximately one percent less than in 2010. The decrease in demand, and thus supply, was due to the weak economic outlook and warm weather. The largest changes in comparison to year 2010 were 4 TWh increase of hydro power in Norway, 14 TWh decrease of thermal power in Finland and Denmark, 3 TWh increase of nuclear power in Sweden and Finland, and a 5 TWh increase of wind power in Sweden and Denmark.

The inflow to hydro reservoirs was low in the beginning of 2011. After the first quarter it turned exceptionally high, reaching on annual level 242 TWh, a value almost 20% higher than the long term average. Even though the hydroelectricity generation increased towards the end of the year, the annual output level was almost as low as in previous year. Most of the increase in the inflow was stored for the future and the reservoir level at the end of the year was 79% compared to the 45% year before.

The economic outlook and decrease of thermal power generation also affected the price of CO_2 emission allowances which fell as much as 50% from the end of last year. In December 2011 they were traded at a price around 7 €/ton.

The shares of the largest producers were close to the values of previous year. Vattenfall maintained its position as the largest electricity generator in the Nordic region with 21.8 % of the total generation followed by Statkraft (13.7 %), Fortum (12.8 %) and E.ON (7.7 %).

[3] Based on for example coal, gas and biofuels.

List of figures:

List of tables:

3.1 Generation capacity

Table 1 Nordic Generation capacity (MW) by power source, 2011

	Denmark	Finland	Norway	Sweden	Nordic region
Installed capacity (total)	13 540	16 713	31 714	36 447	98 414
Nuclear power	-	2 716	-	9 363	12 079
Other thermal power	9 582	10 651	1 062	7 988	29 283
- Condensing power	1 590	2 155	-	1 623	5 368
- CHP, district heating	7 118	4 300	-	3 551	14 969
- CHP, industry	674	3 362	-	1 240	5 276
- Gas turbines etc.	200	834	-	1 574	2 608
Hydro power	9	3 149	30 140	16 197	49 495
Wind power	3 949	197	512	2 899	7 557

Source: Swedenergy, NVE, DERA, EMI

3.2 Generation

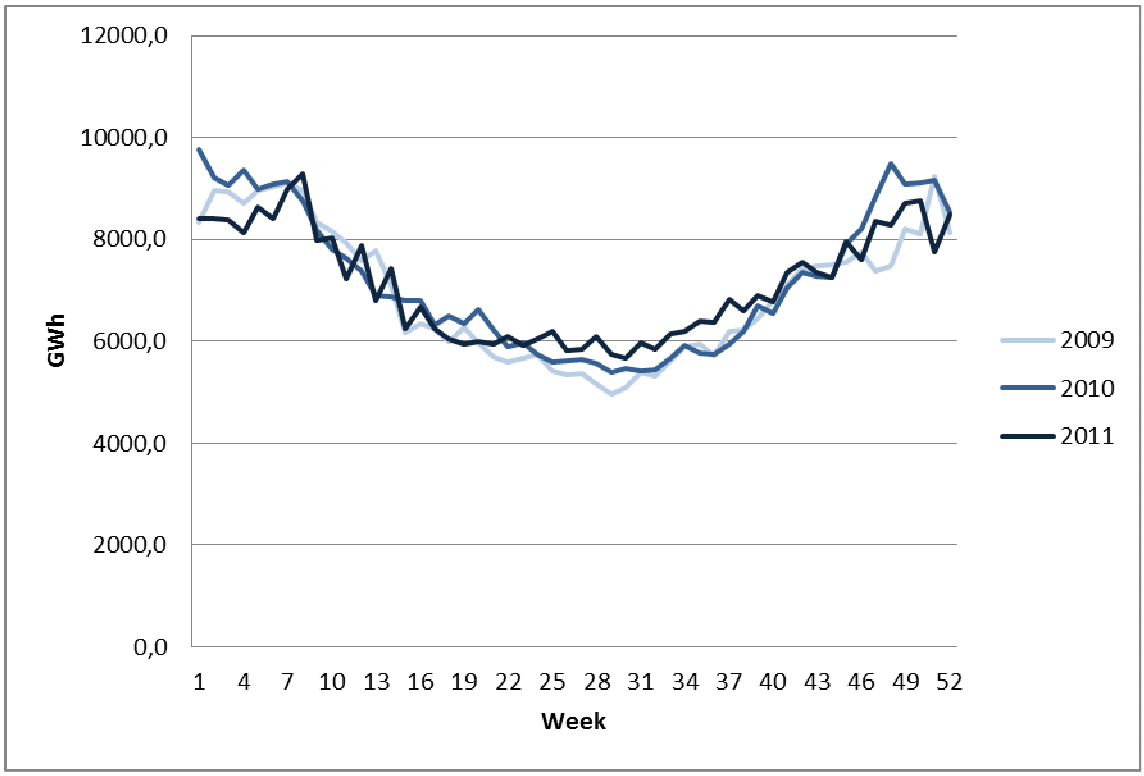

Figure 1 Total power generation in the Nordic region, 2009-2011

Source: Nord Pool

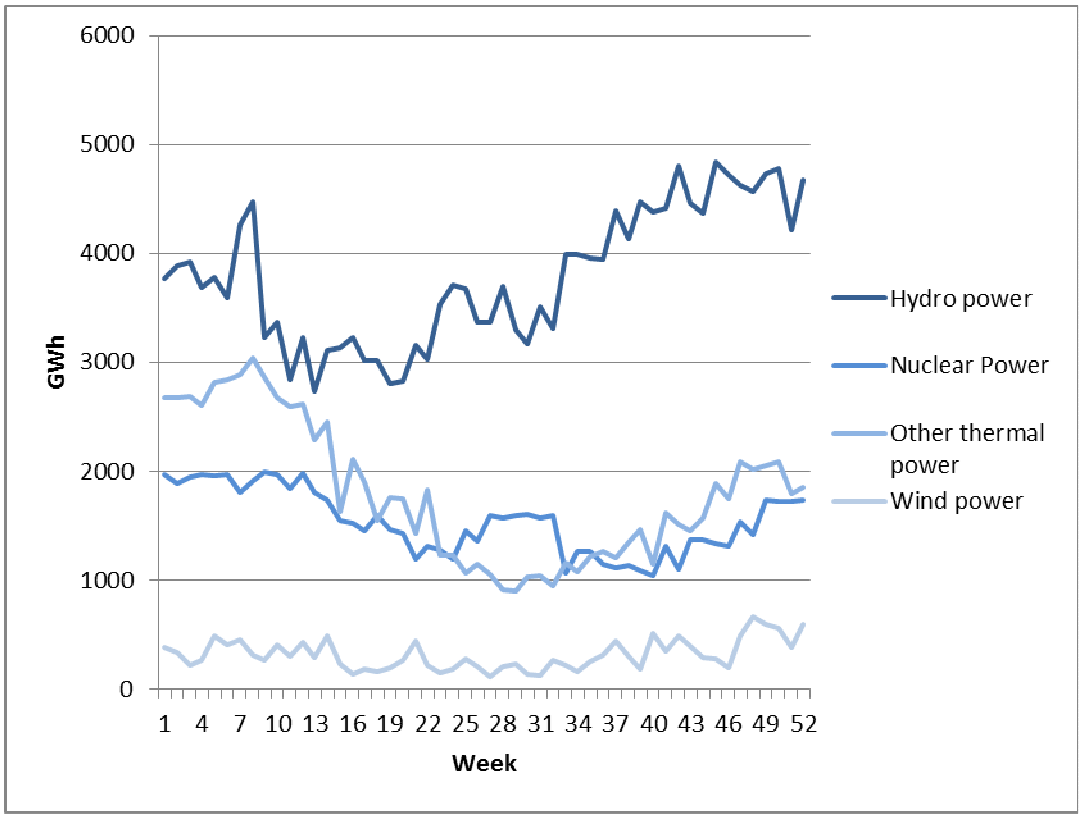

Figure 2 Power generation by power source in the Nordic region 2010

Source: Nord Pool

3.3 Main players

Table 2 Generation capacity by producers, 2011

	Capacity (MW)	Share
Denmark		
- Dong Energy	6142	6,2%
- Vattenfall	1792	1,8%
Finland		
- Fortum	5157	5,2%
- PVO	3510	3,6%
- Helsingin Energia	1349	1,4%
Norway		
- Statkraft	11122	11,3%
- E-CO Energi	2800	2,8%
- Hydro	1850	1,9%
Sweden		
- Vattenfall	16672	16,9%
- E.ON Sweden	6554	6,7%
- Fortum	5874	6,0%
Other generators	35 592	36,2%
Total Nordic region	98 414	100%

Source: Swedenergy, NVE, DERA, EMI

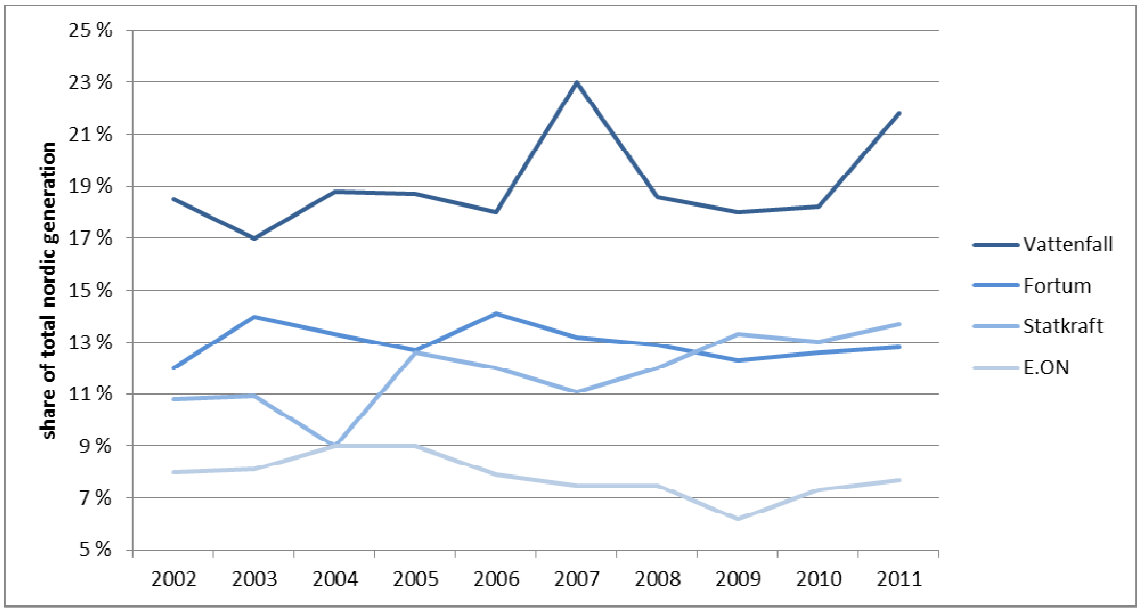

Figure 3 Share of total Nordic electricity generation (generated energy) by the four largest generators, 2002-2010

Source: Swedenergy, NVE

3.4 Conditions for generation

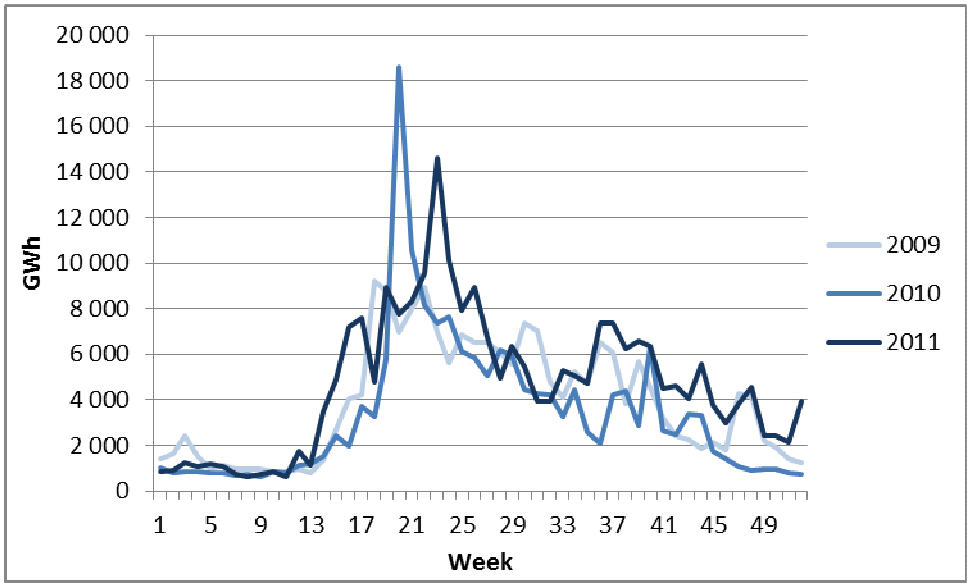

Figure 4 Effective inflows to the Nordic water reservoirs, 2009 – 2011

Source: Nord Pool Spot

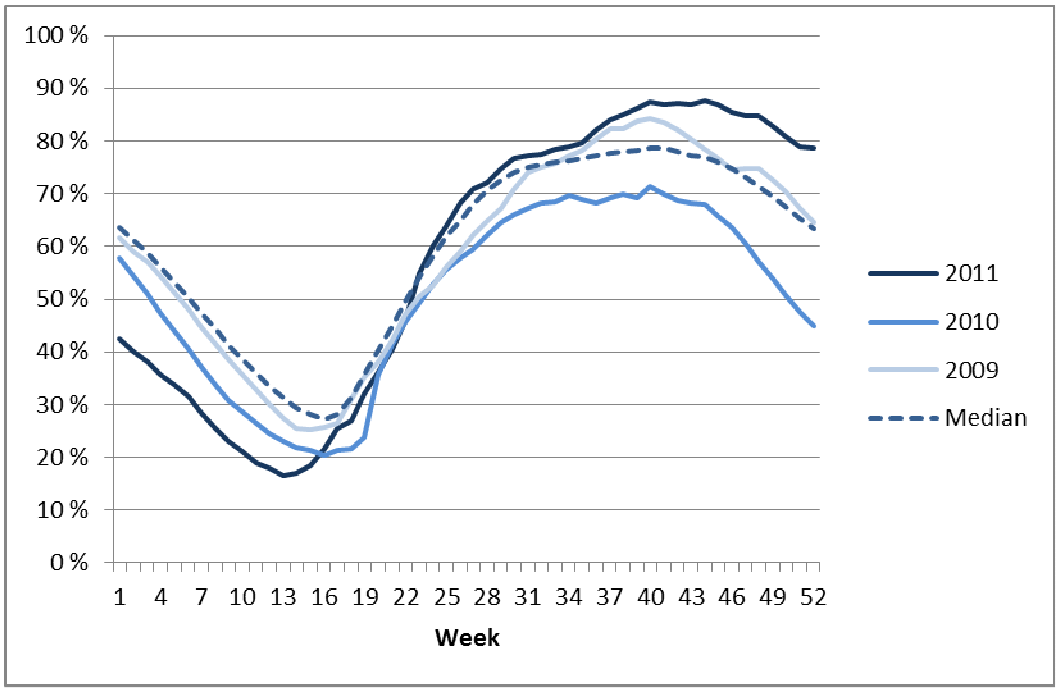

Figure 5 Reservoir levels in the Nordic region, 2009 – 2011

Source: Nord Pool Spot

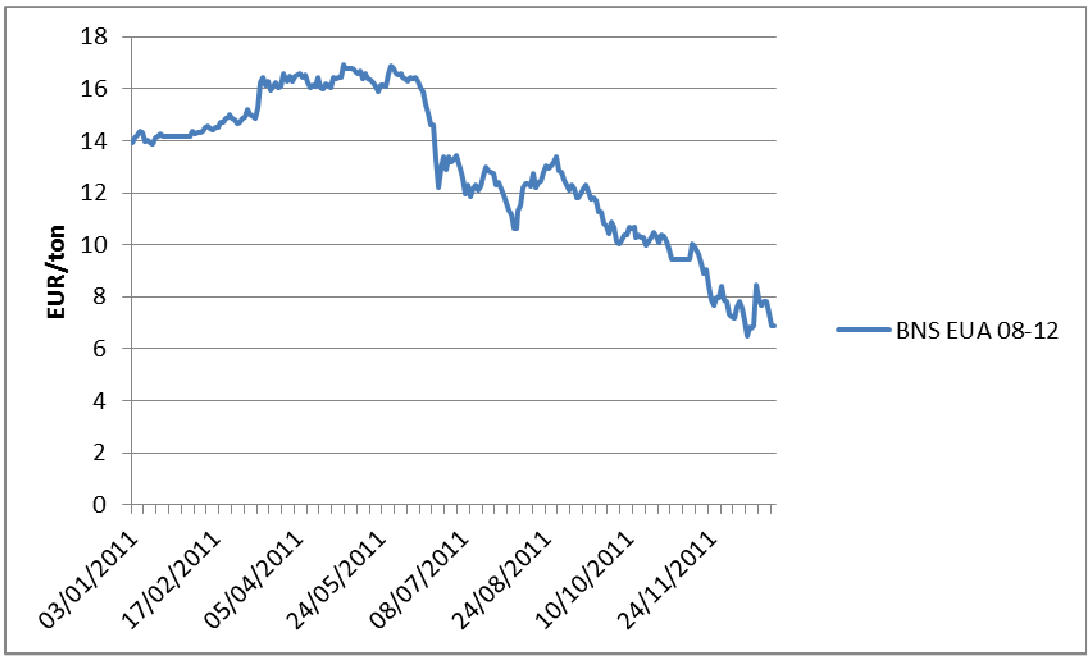

Figure 6 Price on CO_2 allowances on BlueNext

Source: BlueNext

4 Demand – Consumption

Introduction

Electricity consumption in the Nordic region is relatively high in comparison with other European countries. This is due to the influence of cold winters in combination with electricity heated houses and the relative high proportion of energy intensive industries.

In the Nordic region electricity prices have historically been low due to a large share of cost-effective hydropower and nuclear. This has resulted in abundance of energy-intensive industry and a large share of electricity heated houses. Development of overall energy consumption in the Nordic region depends on the development of the GDP and average temperatures during the year, with lower electricity demand in the summer and increased consumption in wintertime.

Total Nordic electricity consumption was 379.6 TWh during 2011, a 4.4 % decrease compared to 2010, mainly attributed to the economic turbulence in Europe and higher average temperatures during the year.

Sweden had the largest share of the total consumption (138.1 TWh) followed by Norway (122 TWh), Finland (84.1) and Denmark (34.4). Electricity consumption in the Nordic region varies widely due to specific conditions in each country (see figure 8), but are generally affected by temperature variation and economic growth.

Swedish, Norwegian and Finnish electricity is highly influenced by a large share of energy intensive industries and a significant amount of electricity heated houses, and hence a much more fluctuating electricity consumption than Denmark.

During the 2011, the Eurozone's economic crisis led to a slow down for Nordic industrial production. In combination with higher average temperatures Sweden, Finland and Norway experienced decrease in electricity consumption close 5 %. Danish electricity consumption has been very stable in the past five years, and is relatively small compared to the other Nordic countries due to less industrial demand. In 2011 Danish electricity consumption fell with 2,8 % mainly under influence of higher average temperatures.

Nordic temperatures were generally above normal during 2011, with a fairly warm autumn and winter period. Average temperatures were 1.8 degrees warmer than normal, which lowered general demand for heating throughout Scandinavia.

List of figures:

4.1 Security of supply

Finland

The total Finnish generation capacity is 16.995 MW, up 357 MW from last year. The power reserves related to system disturbances in Finland is 1 240 MW. Because total production of Finland is not able to meet up with demand during wintertime, imports from neighboring countries are essential to full fill demand.

Dependency on imported electricity will decrease in the end of 2013 when Olkiluoto 3, a new nuclear power plant of 1.600 MW, will be ready for production. Building project of Olkiluoto 3 has been delayed considerably. Original commissioning should have been in year 2009.

Currently the major infrastructure projects related to Finnish power system are Fenno-Skan 2 and EstLink 2. Fenno-Skan 2 is a submarine 500 DC cable of 800 MW between Finland and Sweden, which was taken into operation in November 2011. EstLink 2 also is a submarine HVDC cable of 650 MW between Finland and Estonia. The new transmission link should be ready at the beginning of 2014

Sweden

In 2011 the generation capacity of Swedish power stations was increased by 1.072 MW, while 329 MW were decommissioned. Hence there was a net increase in capacity compared to last year with 734 MW. The major part of the total increase in generation capacity came from wind power which contributed with 736 MW. Thereby the installed wind power capacity increased by almost 34 % compared to 2010. A large number of projects in new generation capacity are planned for the next few years. Most of them are planned wind power projects. There is a great deal of uncertainty about these projects but if all of them will be launched, it will increase the electricity generation capacity by 499 MW by 2012.

Power reserve in Sweden was 1.726 MW in 2011, and mainly consisted of oil-fired condensing power plants. Swedish power reserve is formed by Svenska Kraftnät concluding agreements with producers and consumers on making available further production capacity or cutting consumption. Since winter 2011/2012 reduction part of the power reserve are made available for trading on the electricity spot market. It’s in line with the gradual transition to a market solution that will envisage the complete abolition of the power reserve by the end of the winter of 2019/2020.

Several projects are currently under way to increase the capacity and operational reliability of the Nordic power system. One example is the South-West Link which is planned to reduce the existing transmission restrictions in Southern Sweden and between southern Norway and Sweden. The link is expected to be operational by 2015/2016. Svenska Kraftnät is also planning a link between Sweden and Klaipeda in Lithuania that is called NordBalt. There are also a number of projects designed to strengthen the electricity networks in the major urban regions of Sweden.

Denmark

Danish generation capacity rose by 12 MW - from 13.528 MW in 2010 to 13.540MW in 2011. The increase was made in wind generation capacity and CHP industrial capacity while capacities of Thermal power, Condensing power and CHP district heating were reduced.

There are no loads generally classified as special peak load reserves and operational Reserves are used to cope with disturbances.

To enhance security of supply Danish grid companies are reinforcing the grids (both transmission and distribution) according to the national Danish cable action plan. New interconnectors will also contribute to security of supply.

Norway

In Norway, more than 95 % of the installed capacity is hydro based, thus production is highly dependent on weather conditions.

Installed Norwegian power production capacity was 31.714 MW at the turn of 2011 - 2012, an increase of 321 MW from the year before. In addition, Norway has two reserve gas power turbines in Middle Norway with a total capacity of 300 MW.

A new 140 km DC cable between Norway and Denmark, Skagerak IV, was granted license June 2010. The transmission capacity will be 700 MW. The cable is expected to be in commission in 2014. There is also license applications for a DC cable to Germany with capacity of 1400 MW sent in 2009/2010, expected commissioned in 2018. Further, the Norwegian TSO (Statnett) and National Grid in UK have signed a cooperation agreement with the aim of commissioning a new DC cable between Norway and UK within 2020. A license application is planned to be sent in 2013. Excepted capacity is 1400 MW.

The 92 km, 420 kV OH line from Sima to Samnanger is under construction and is expected to be commissioned in 2013/2014. The line will improve the security of supply to the region of Hordaland/Bergen area with Norway’s second largest city, and also integrate new hydro power.

The 285 km, 420 kV OH line from Sogndal to Ørskog was granted license in 2011. This line will improve the security of supply in the Mid-Norway area. It will also improve RES integration and net transfer capacity. It is expected to be commissioned in 2015.

The 160 km 420 kV OH line for Ofoten to Balsfjord was granted license in 2012. This line will improve the security of supply in the North of Norway. Expected load growth and RES integration will benefit from this investment. It is expected to be commissioned in 2016.

The 360 km 420 OH line for Balsfjord to Hammerfest was granted license in 2012. This line will improve the security of supply in the North of Norway. This line will improve

the security of supply in the North of Norway. Expected load growth and RES integration will benefit from this investment. It is expected to be commissioned in 2018.

4.2 Peak load

Peak load usually occurs during periods of cold spells. 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, increased heating demand and turning on TVs when getting home from work.[4]

Peak load in the Nordic region occurred in the morning of February the 23th at 08:00 am, with a total load of 67335 MW, see figure 11.

Danish demand peaked during the evening of January the 4th at 17:00 (6270 MW). Swedish demand peaked in the morning of February 23 th at 08:00 (25820 MW). Finnish peak load occurred in the morning of February the 18th at 08:00 am (14107 MW), while Norway peaked in the morning of February 21th at 08:00 (21818 MW).

During the most strained hour in the Nordic region in 2011 the aggregate consumption in the Nordic area exceeded the aggregate production leading to a net exchange (net import) of 3278 MW from neighbouring countries, see figure x. In cold spells, such under week 8, most of the available generation capacity of the Nordic region is taken into operation.

[4] Peak load is defined as the maximum instantaneous electricity consumption or the maximum average electricity consumption over a designated interval of time.

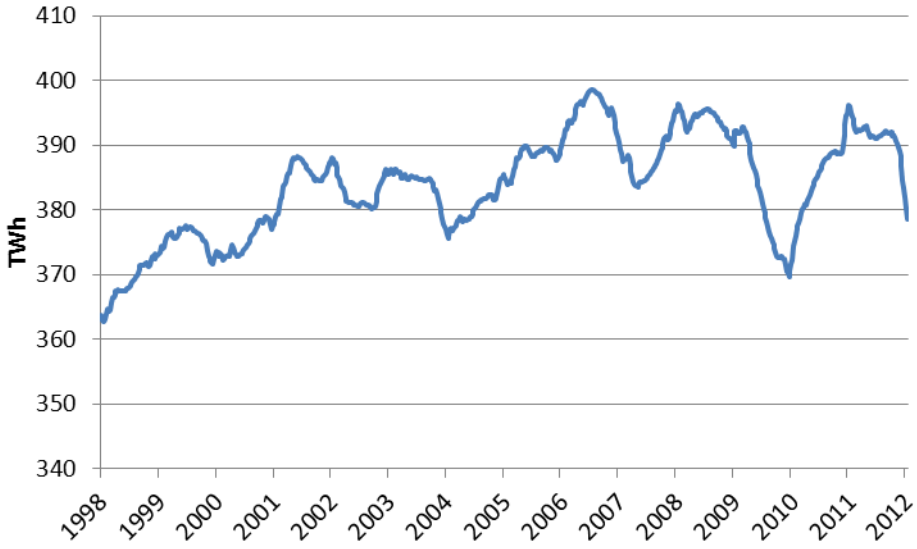

Figure 7 **Development of the total electricity consumption (last 52 weeks) in the Nordic region, 1998-2011**

Source: Nord Pool Spot

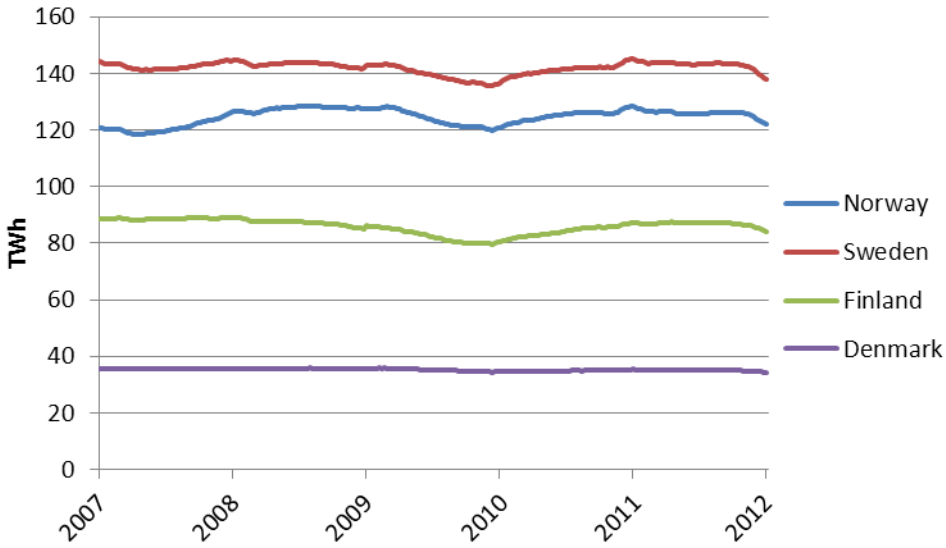

Figure 8 **Electricity consumption in the Nordic countries (last 52 weeks), 2007-2011**

Source: Nord Pool Spot

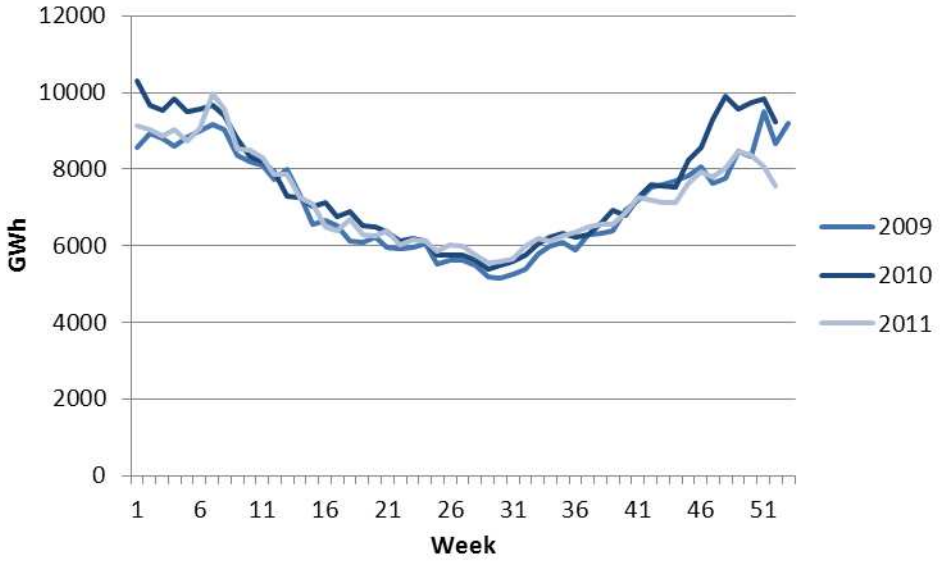

Figure 9 Electricity consumption in the Nordic region (GWh/week), 2009-2011

Source: Nord Pool Spot

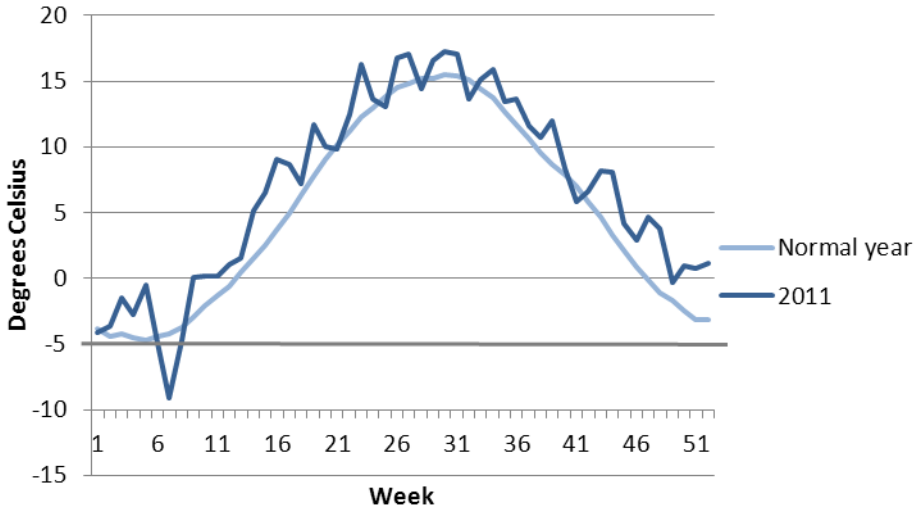

Figure 10 Mean temperature in the Nordic region[5] in 2011 compared to a normal year

Source: Nord Pool Spot

[5] Temperature measured weekly in 12 Nordic cities (Oslo, Bergen, Trondheim, Tromsø, Helsinki, Ivalo, Stockholm, Gothenburg, Östersund, Luleå, Copenhagen and Billund).

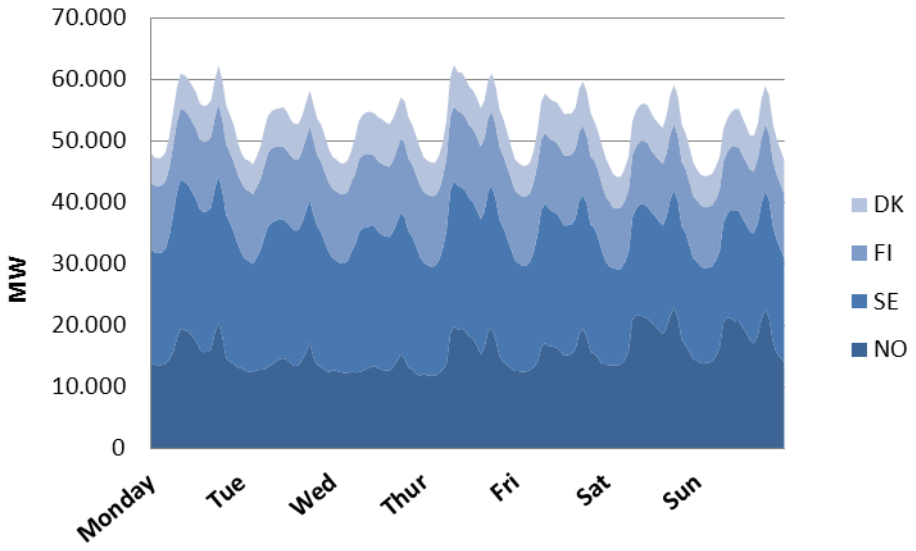

Figure 11 Load in the Nordic region during week 8, 2011

Source: Nord Pool Spot

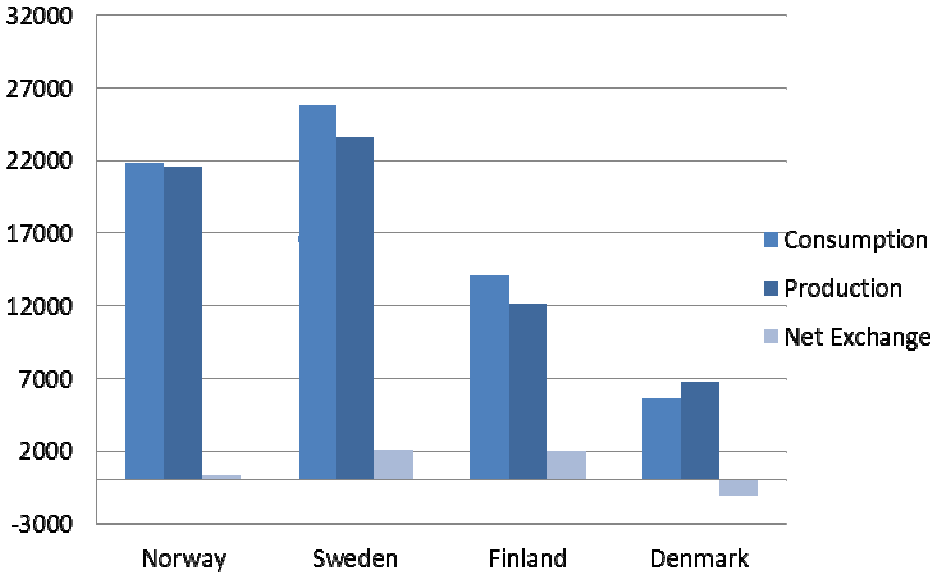

Figure 12 Consumption, generation and exchange in the Nordic region, February 23th 2011, hour 8.

Source: Nord Pool Spot

5 Electricity transmission

Introduction

The Nordic transmission grid is part of the transmission network in north-western Europe and it combines practically the whole Nordic region to one synchronous power system (excluding western Denmark). Interconnectors also link the Nordic market to Germany, Poland, Estonia and Russia and the Netherlands. Eastern Denmark is synchronous with the Nordic grid while western Denmark is synchronous with the UCTE area in continental Europe. A DC cable linking eastern Denmark and western Denmark has been operational since 2010.

The electricity price in the Nordic wholesale market is determined on a day-ahead auctioning process. In this process the objective is to utilize the total generation capacity in an optimal way. As the demand patterns and specific costs of the generation over the entire area do not coincide there subsequently emerges a need for transmission of electricity between different parts the Nordic grid. This demand may sometimes exceed the available physical capacity of the transmission system.

The main method for handling structural congestions in the Nordic area is to divide into bidding areas (zones). Congestions in the Nordic spot market will then result in market splitting. Internal congestions within the TSO control area are handled through counter trade or by reducing interconnector capacity at the bidding area borders. Counter trade is mainly used after gate closure of the day-ahead markets. In some cases the TSOs plan for counter trading so that more trading capacity can be allocated to the market. Substantial reinforcements in the Nordic transmission system are planned to be made in the coming years, though generally it is not economically efficient to expand the network capacity to a level where the demand for transmission is met at all hours and at all interconnectors.

There was one major change in the price area structure used in the Nord Pool Spot bidding area in 2011, as Sweden was divided into four price zones on November 1. This modification was done in order to improve the market efficiency and lay the groundwork for financing future network improvements. The market splitting within Sweden during November and December was mainly due to transmission capacity deficit to the southernmost part (SE4).

As a whole, market splitting in the Nordic electricity market was forced 72 % of the time. Compared to the 74 % in 2010, the congestion situation in bottlenecks between price areas remained almost the same.

Fenno-Skan 2, which is a 500kV DC-link with transmission capacity of 800 MW, was put in operation on November 15. It was constructed by Fingrid and Svenska Kraftnät between Finland and Stockholm (SE3) price areas. Even though price differences have occurred, Finland and Stockholm area shared the same price 92% of the time, whereas e.g. SE3 and SE4 shared the same price only 72% of the time.

Prices in eastern and western parts of Denmark were notably more uniform in 2011, than in 2010 indicating that the link connecting these areas commissioned in 2010 has improved the market efficiency. This link is especially important as a way to channel the wind generation to other parts of the market. Next network improvements are located between central and southern Sweden and between Norway and Denmark.

List of figures:

5.1 Transmission network and capacities

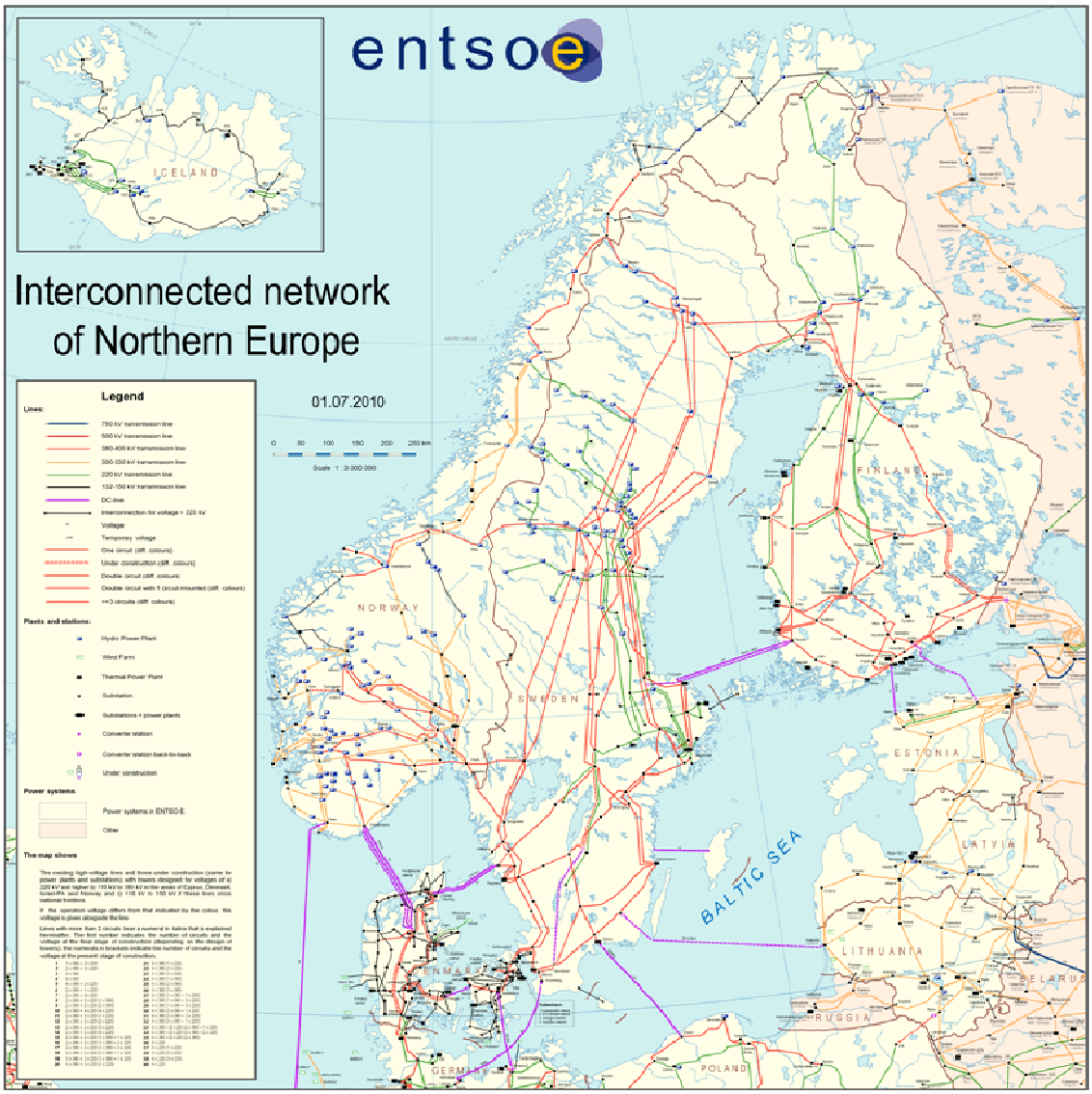

Figure 13 Transmission network in north-western Europe

Source: Svenska Kraftnät

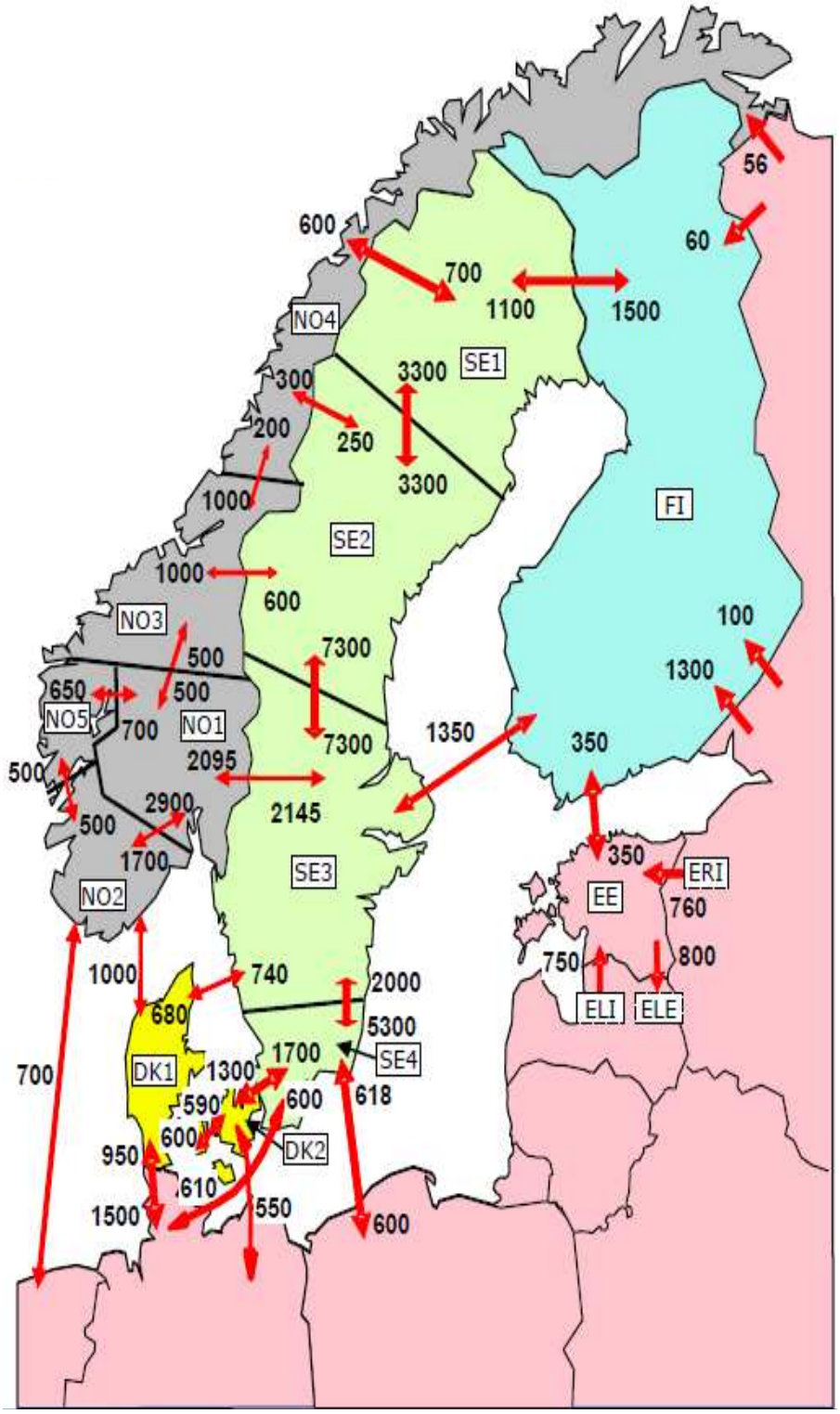

Figure 14 **Transmission capacities between the Nordic price areas, October 2011**

5.2 Congestion

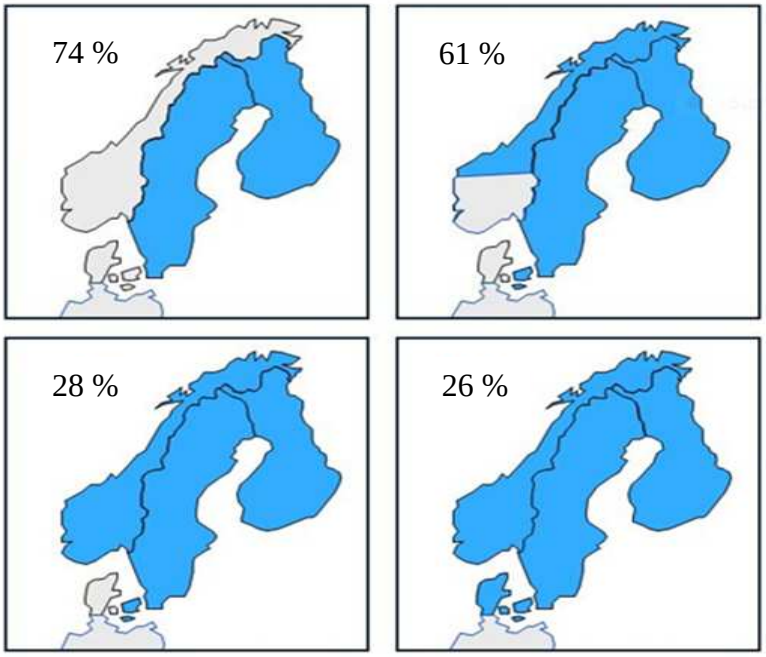

Figure 15 **Shares of the annual hours the different prices areas have shared the same price in 2011**

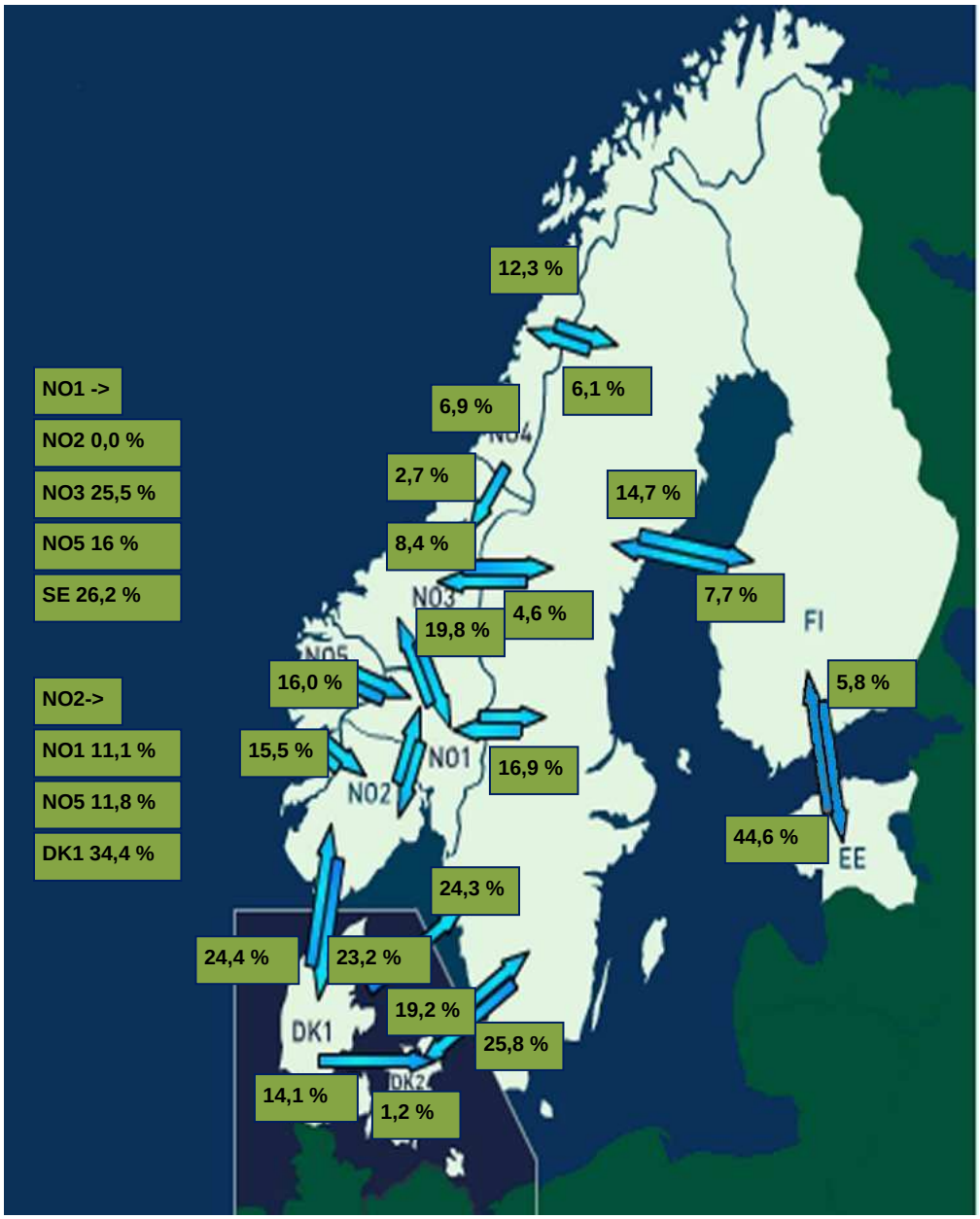

Figure 16 Shares of the annual congestion hours between different prices areas, 2011

The percentages and arrows illustrate the share of annual hours the flow between areas has been congested in the direction of the arrow.

6 Wholesale power market

Introduction

In 2011, the average system price[6] in the NordPool area was 47.05 €/MWh, compared to 53.06 €/MWh in 2010. The average price in 2009 was 35.02 €/MWh. The highest monthly spot price – 69.62 €/MWh – was noted in January.

The highest weekly system price, 79.81 €/MWh, occurred in week 1 due to cold weather. The lowest weekly system price was in week 40 with 9.99 €/MWh. By week 50 the weekly price had risen to 35.21 €/MWh. Increasing hydrological surplus throughout the year contributed to a decrease in prices in most of the Nordic price areas in 2011 compared to 2010.

East Denmark (DK2) had both the highest and lowest price in the Nordic area in 2011. The highest price, 190.38 €/MWh, was noted for two hours on October 12th. The minimum price of minus 36.8 €/MWh was noted for one hour on the night of February 4th. West Denmark also had negative prices during 2011. The negative prices in Denmark are caused by high unregulated wind energy feed.

There was a common Nordic price for 26.2 % of the hours in 2011. By comparison, there was a common Nordic price for 18.6 % of the time in 2010.

The wholesale power market is a common Nordic market, where electricity is traded on the Nordic electricity exchange, Nord Pool. Trading at Nord Pool is voluntary, however all day-ahead cross-border trading must be done at Nord Pool Spot which 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 day's 24 hours. In the intra-day market, participants in Norway, Finland, Sweden, Denmark, Germany and Estonia can trade for the forthcoming day after the day-ahead spot market has closed. In the financial market the players can secure prices for future purchases or sales of electricity.

The capacities for the exchange of electricity between the bidding 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.

The total volume traded at Nord Pool Spot in 2011 was about 78 % of the total Nordic electricity consumption – about the same percentage as the year before. The total volume traded at Nord Pool Spot in 2011 was over 294 TWh, compared to

[6] The system price is calculated as the price that would be realized if there were no congestions between the elspot areas.

approximately 305 TWh in 2010. The decrease from 2010 can be explained by a 3.8 percent decrease in overall consumption. Trade volumes at Nord Pool – often regarded as a measure of liquidity in the spot market - have increased steadily since it was established in 1993. The volumes in the spot market went up with an increasing speed from 2004 to 2007. 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 % to approximately 90 %. 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.

The Nordic market has a common balancing market in order to ensure the balance between generation and consumption in the hour of operation. The total volume of the Nordic balancing market was app. 4.3 TWh in 2011. Among the Nordic price areas Sweden had the largest volume with 1.2 TWh, while South West Norway had the second largest volume with 0.6 TWh

A common Nordic balance settlement is an important prerequisite for the development of a common integrated end-user electricity market in the Nordic region. A harmonized Nordic model for balance settlement with one imbalance price for consumption and two imbalance prices for production was implemented in the Nordic countries during 2009. In Finland generation under 1 MW installed capacity is settled as consumption (against a one-price-settlement), and in Norway generation units under 3 MW are settled as consumption.

The purpose of the balance settlement is in all Nordic countries to settle imbalances resulting from electricity deliveries between parties in the electricity market. The system operators perform two types of balance settlement.

The first is the balance settlement between the countries. Balance power between two countries is priced and settled in the Nordic balancing market (regulation power market), a so-called TSO-TSO market with a common merit order.

The second balance settlement is inside the countries. This is a settlement between the system operators and the balance responsible parties. This settlement is governed by national balance agreements. There are currently efforts among the TSOs to reach common procedures for balance settlement between the TSO and the balance responsible parties – Nordic Balance Settlement (NBS).

List of figures:

List of tables:

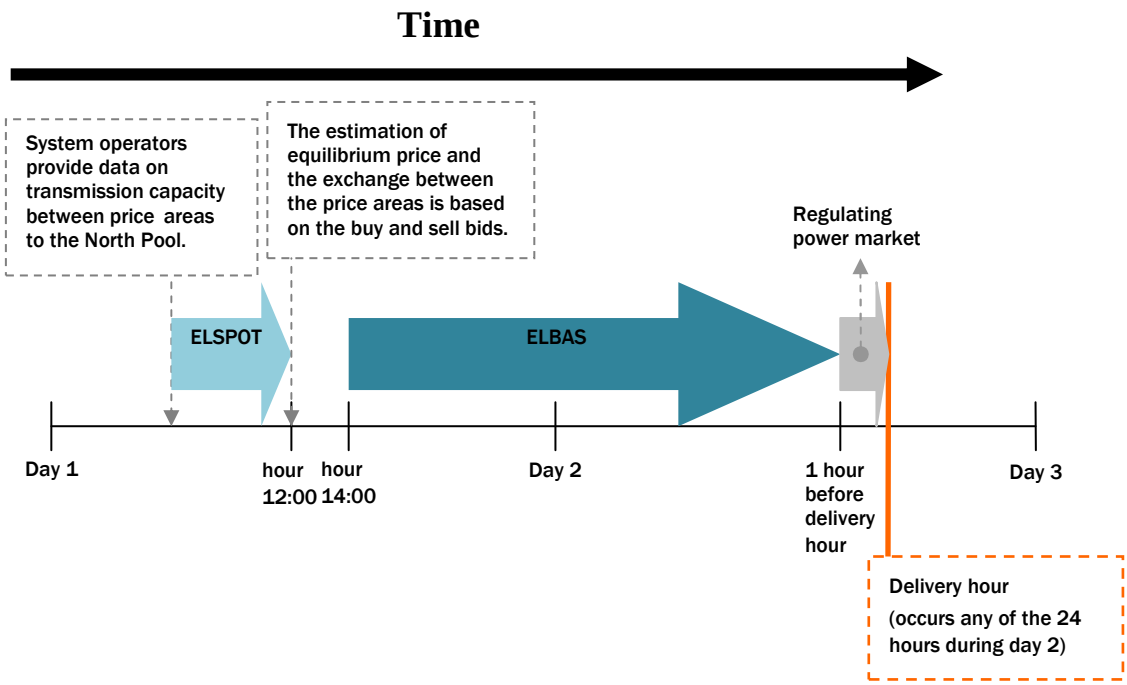

Figure 17 Timeframes for Nordic physical electricity markets

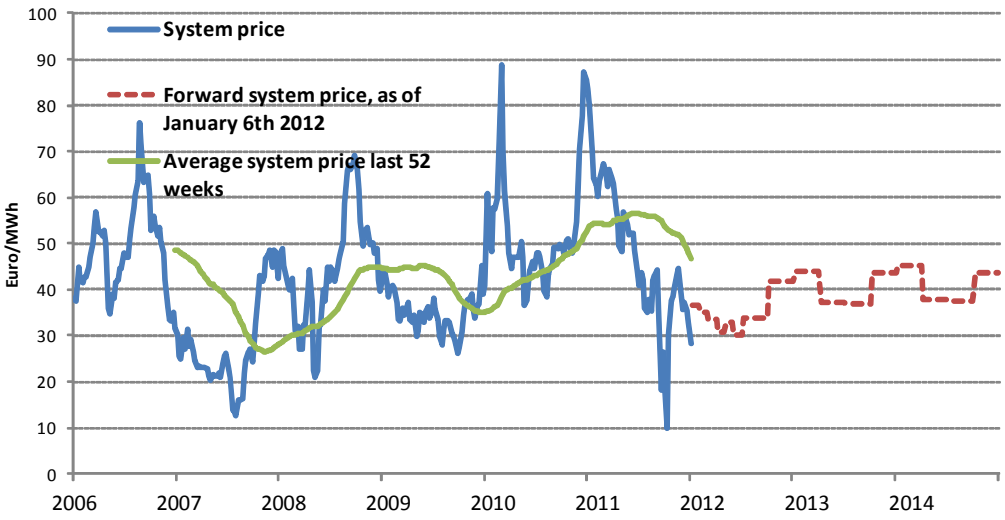

Figure 18 Development of weekly system price and forward price at Nord Pool Spot, 2006-2014

Source: Nord Pool

Table 3 Average price in the different Nord Pool spot areas, 2011

Spot prices €/MWh	2011	Change from 2010
East Norway (NO1)	46.42	-17 %
South West Norway (NO2)	46.09	-10 %
Middle Norway (NO3)	47.49	-22 %
North Norway (NO4)	44.75	-28 %
West Norway (NO5)	45.86	-13 %
Sweden* (SE)	49.77	-14 %
Finland (FI)	49.30	-15 %
West Denmark (DK1)	47.96	3 %
East Denmark (DK2)	49.41	-15 %

Source: Nord Pool Spot[7]

***Swedish data is limited to the first ten months, 2011**[2]

Table 4 Price differences in percentage of all hours in between Nordic spot areas, 2011

2011		NO1	NO2	NO3	NO4	NO5	SE	FI	DK1	DK2
		Lower than								
NO1	Higher than		11 %	20 %	17 %	16 %	19 %	20 %	26 %	24 %
NO2		0.3 %		19 %	16 %	16 %	17 %	19 %	24 %	23 %
NO3		26 %	33 %		7 %	34 %	5 %	11 %	24 %	20 %
NO4		38 %	41 %	16 %		46 %	34 %	20 %	27 %	25 %
NO5		2 %	12 %	20 %	17 %		33 %	21 %	27 %	24 %
SE*		27 %	36 %	7 %	7 %	30 %		8 %	27 %	23 %
FI		30 %	37 %	22 %	25 %	37 %	31 %		29 %	25 %
DK1		34 %	35 %	29 %	32 %	39 %	39 %	25 %		1 %
DK2		37 %	39 %	33 %	34 %	42 %	42 %	14 %	14 %	

Source: Nord Pool Spot

***Swedish data is limited to the first ten months, 2011**

[2] Sweden was separated into four elspot areas 1st of November

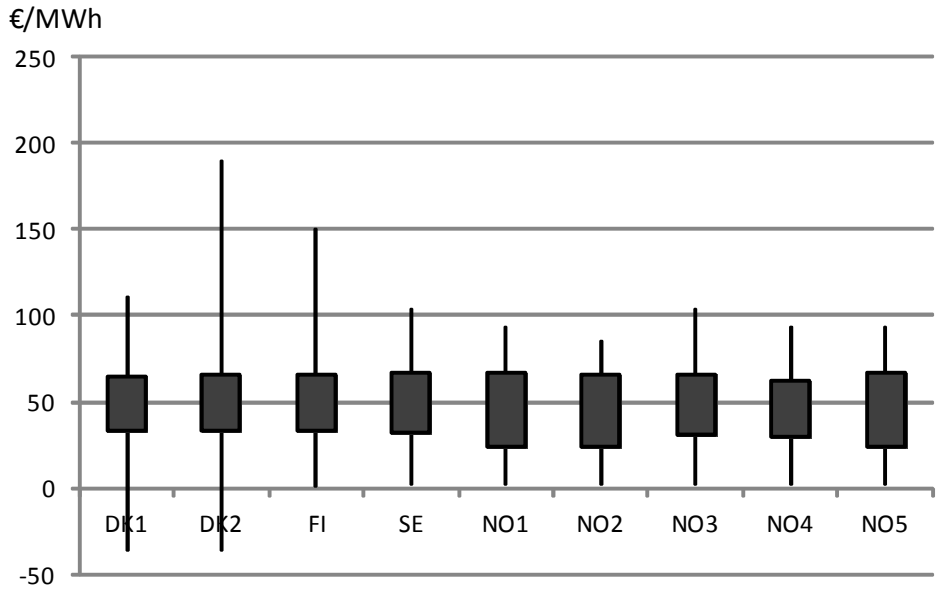

Figure 19 Area prices: highest, 90 % to 10 % (black box) and lowest.

Source: Nord Pool Spot

***Swedish data is limited to the first ten months in 2011

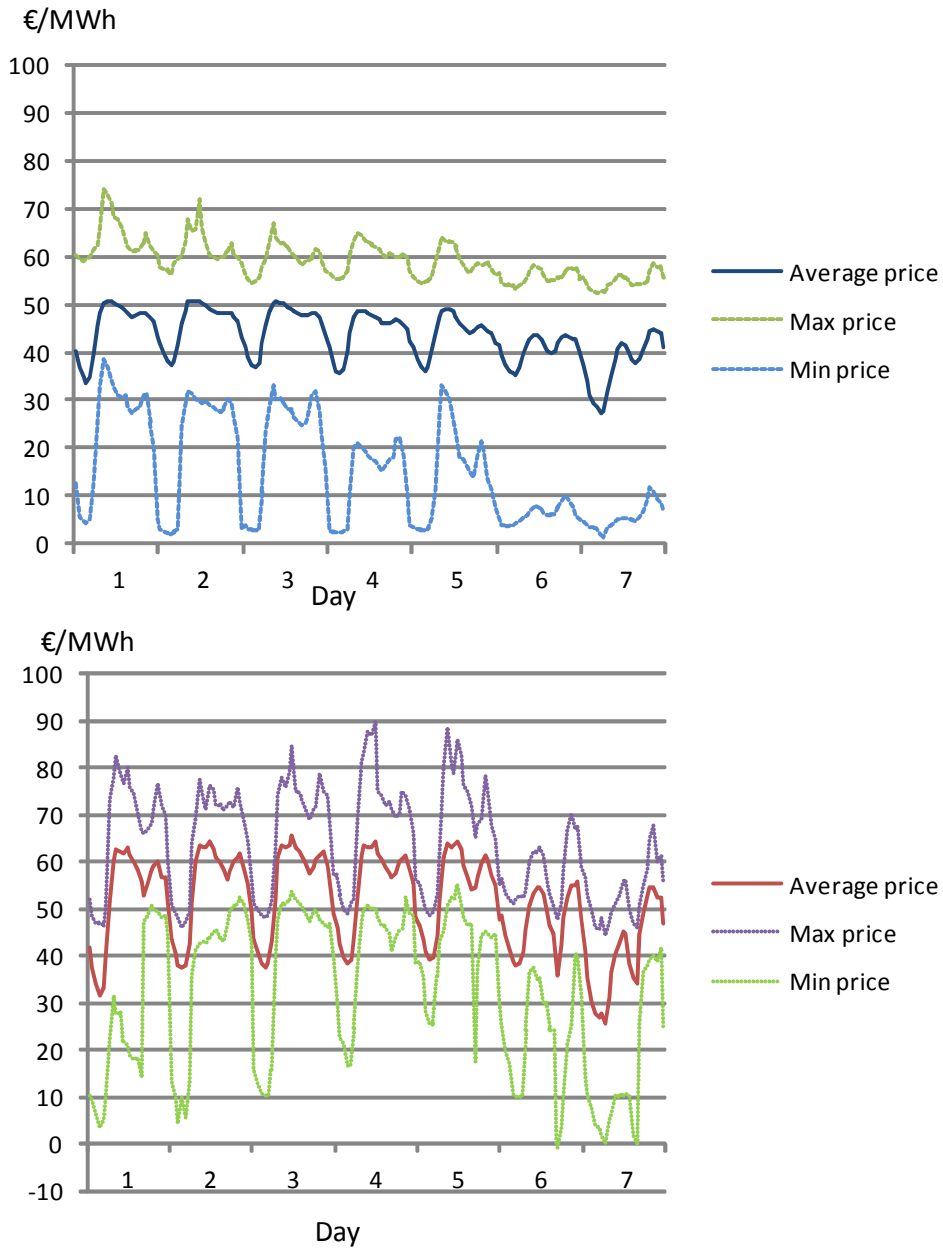

Figure 20 **Comparison between the Nordic system price (upper figure, Nord Pool) and German wholesale price (lower figure, EEX) - average, maximum and minimum hourly prices during the summer (week 14-39 2011)**

Source: Nord Pool Spot and EEX

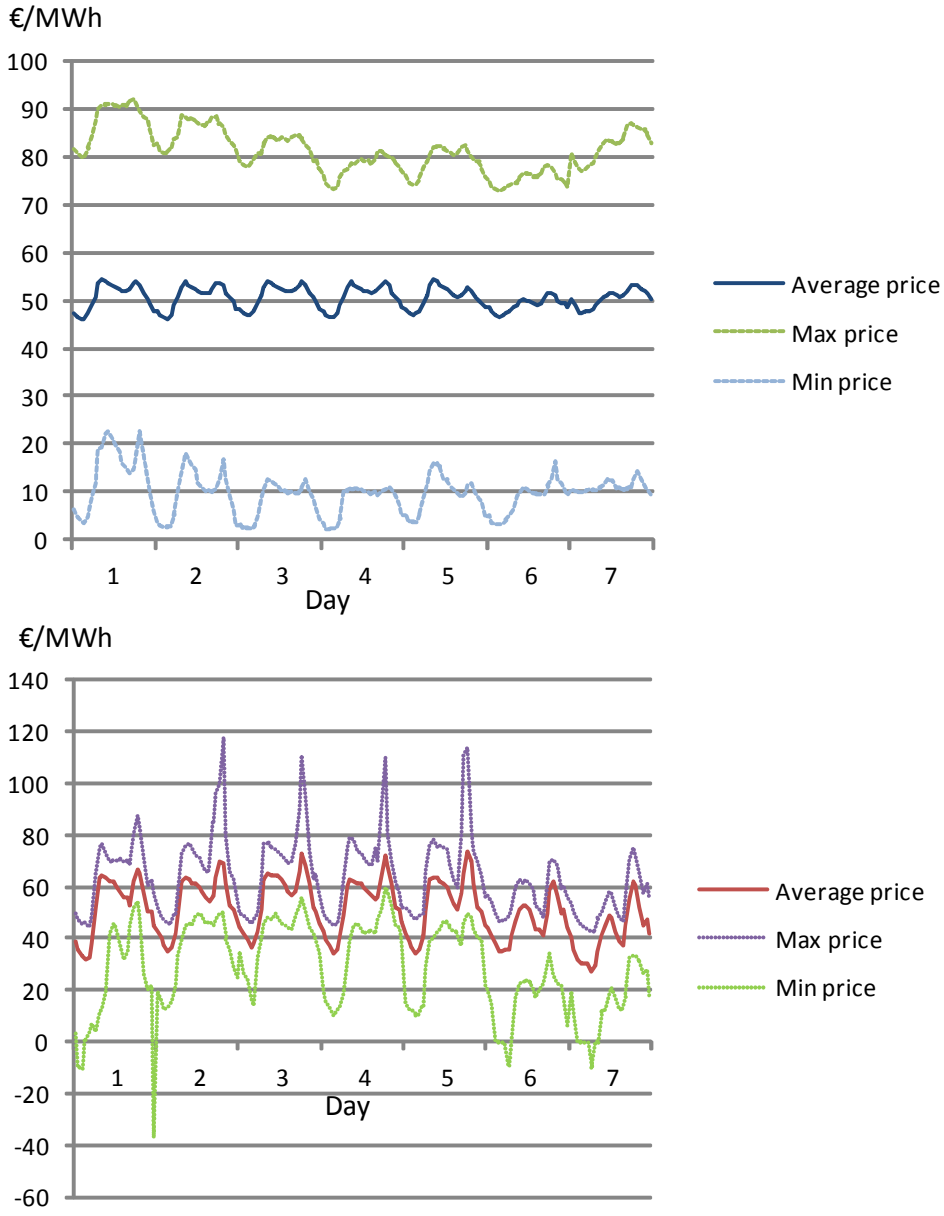

Figure 21 **Comparison between the Nordic system price (upper figure, Nord Pool) and German wholesale price (lower figure, EEX) – average, maximum and minimum hourly prices during the winter (week 40-13 2011)**

Source: Nord Pool Spot and EEX

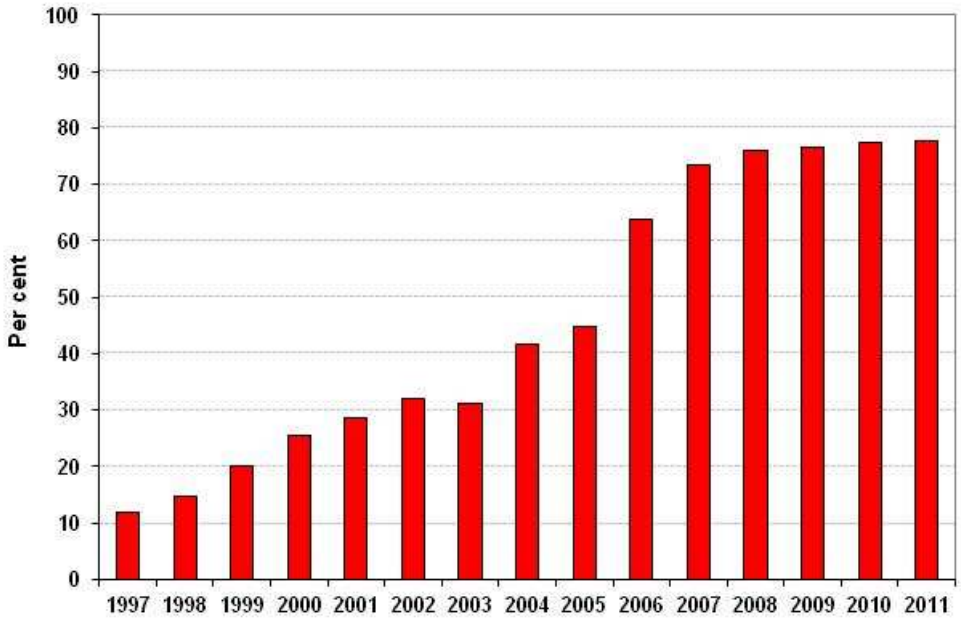

Figure 22 Volumes traded at Nord Pool Spot market as a percentage of total Nordic consumption, 1997 – 2011

Source: Nord Pool Spot

Table 6 Volume of the Nordic balancing market 2011 (GWh)

NO1	NO2	NO3	NO4	NO5	SE[8]	SE1	SE2	SE3	SE4	FI	DK1	DK2	Total
381	609	129	161	549	1206	158	101	45	7	335	467	151	4302

Source: Nord Pool Spot

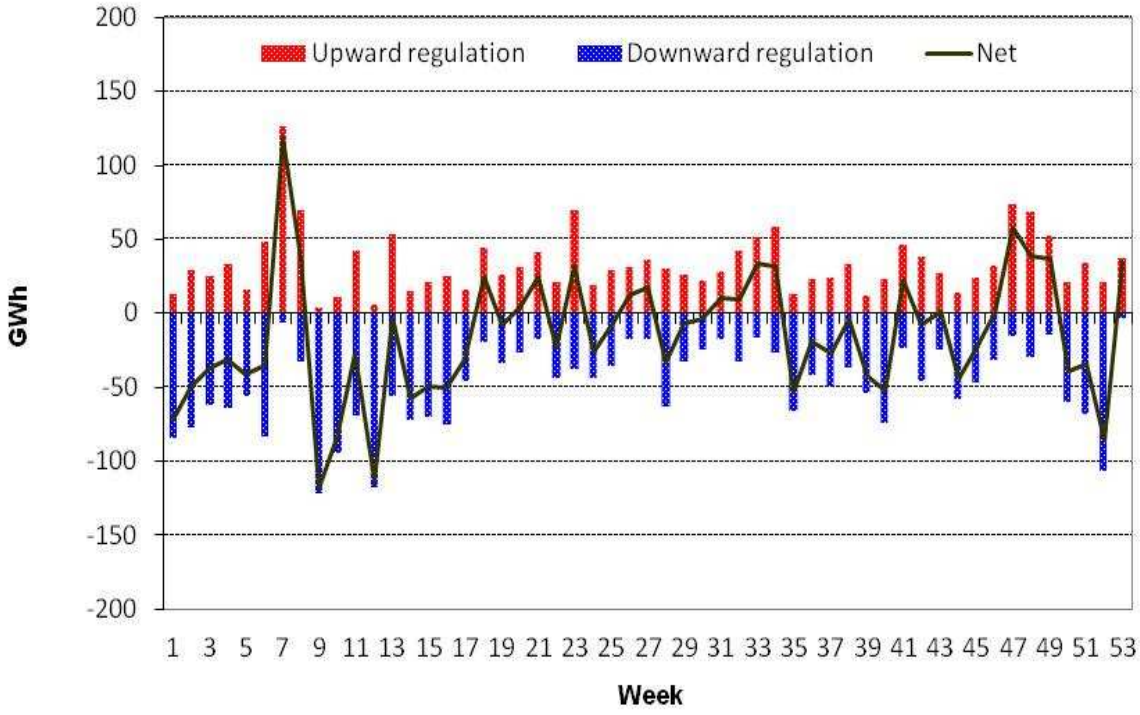

Figure 23 Weekly regulating volumes for the whole of Nordic area

Source: Nord Pool Spot

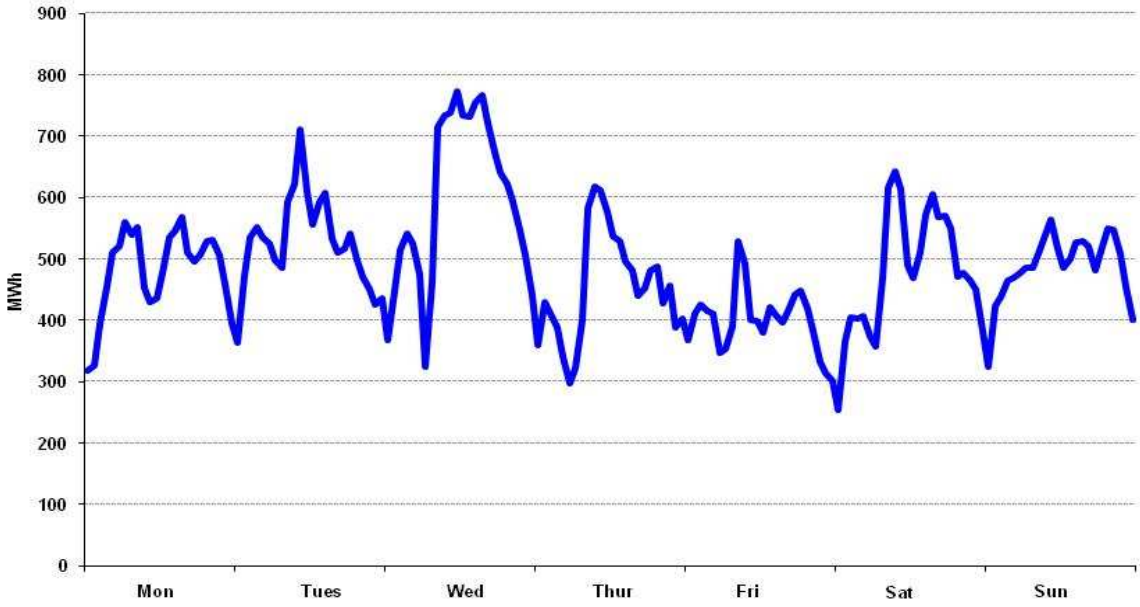

Figure 24 Hourly regulating volumes for the whole Nordic area for an average week in 2011, MWh

Source: Nord Pool Spot

7 Retail market

Introduction

In May 2009 NordREG published a joint report about the creation of a well-functioning Nordic end-user market for electricity.[9] Even though the work of integrating the Nordic retail markets has begun the *retail markets* in the Nordic region are to a large extent national in scope and comparisons between the markets should be made with caution.

In 2011, *retail prices* in the Nordic markets had diverging development. In Sweden and Norway retail prices generally had a downward trend throughout the year with prices some 40% and 50% respectively lower in December than in January.

In Finland and Denmark prices were generally steadier with an upward trend. In Finland prices were up almost 4% in December compared to January; In Denmark[10] prices rose just over 1.5% in the same period.

Supplier switching i.e. the rate of consumers changing supplier can be seen as an indicator of consumer awareness and activity on the market.

The share of customers switching electricity supplier differs between the Nordic countries; from 3.5 % in Denmark, 7.5 % in Finland and around 11% in Norway and Sweden.

Consumer's propensity to switch depends on many factors like transparency of prices and products, information/awareness of the market and active marketing etc., economic incentives and size of consumption and factors like contract lengths, demand for variable/fixed prices etc.

The number of suppliers on the Nordic markets varies significantly but on all markets the number of suppliers seems sufficient to support and maintain active competition on the markets.

In Norway there are some 20 suppliers operating nation-wide, in Sweden app. 100, in Finland app. 30 and in Denmark app. 25.

[9] The report "Market Design – Common Nordic end-user market" can be downloaded from: https://www.nordicenergyregulators.org/Publications/

[10] Danish regulation of prices of supply obligation products should be taken into account when prices/developments are considered.

List of figures:

List of tables:

7.1 Development of retail prices

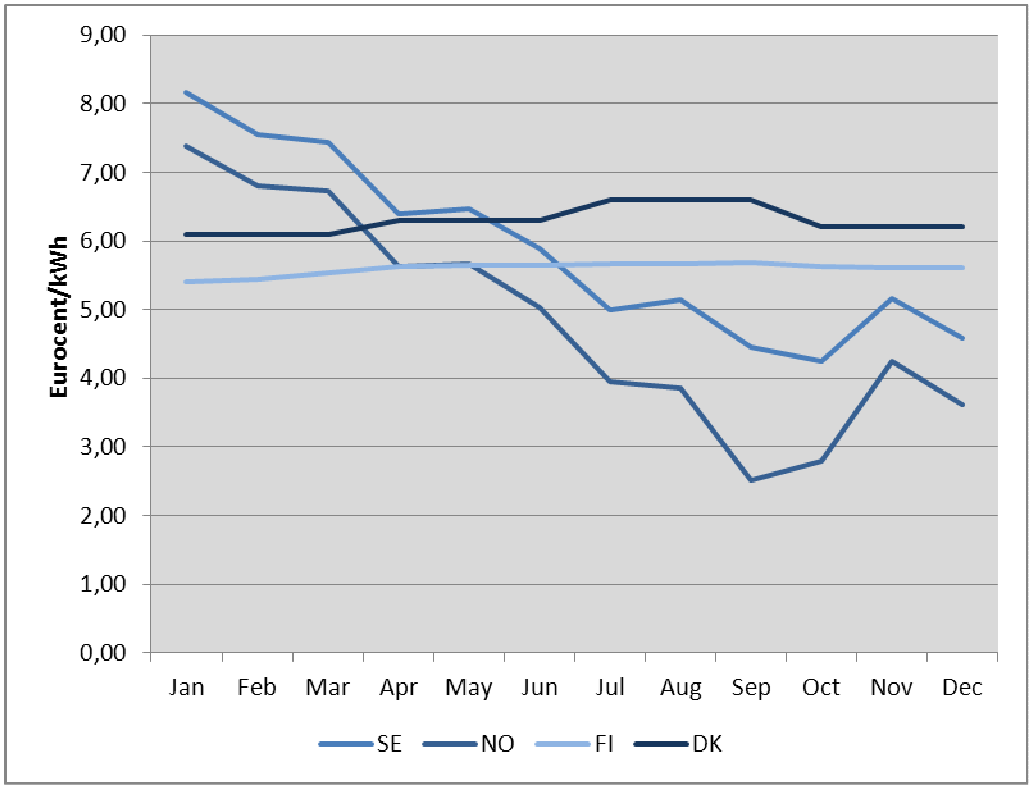

Figure 25 **Retail prices (excl. taxes, VAT, distribution tariffs etc.) in the Nordic region, 2011**

Source: Regulatory authorities

7.2 Supplier switching

Table 7 **Supplier switching on Nordic electricity markets 2008 – 2010**

	2008	2009	2010	2011
Norway	9.0	8.0	10.2	11,2
Sweden	9.0	11.0	10.0	11,3
Finland	4.4	8.1	7.6	7,6
Denmark	2.8	6.1	4.2	3,5

Source: Regulatory authorities

Information about products, prices, switching procedures etc. are crucial for the market and the consumer's actions here. One of the ways consumers can access such information are through web-portals offering price and product information,

information about switching procedures, suppliers etc. The web portals in the different countries are listed below:

Norway: www.konkurransetilsynet.no
Sweden: www.elpriskollen.se
Finland: www.sahkonhinta.fi
Denmark: www.elpristavlen.dk

7.3 Suppliers

At the end of 2011 there were a total of 112[11] suppliers in Norway – most of these former incumbent suppliers. 20 of these suppliers had offers in all grid areas.

In 2011, there were about 120 suppliers in Sweden. About 100 of these companies operate throughout the country.

In Finland there are currently more than 70 retail suppliers whereof 29 are operating nationwide.

In Denmark there where around 60 retail suppliers, whereof 33 are supply obligation companies with a concession for a specific geographic region to supply households etc. having not concluded a contract on the liberalized market (app. 90-95 %). App. 20-25 suppliers (non-supply obligation suppliers) operate nationwide.

[11] Data collected from the National price comparison site. All suppliers offering at least one of the three main contract types in Norway are obliged to register on this comparison site.

8 Financial market

This section shows annual liquidity development of the Nordic financial market in terms of volume turnover in the financial Nordic electricity market, value turnover in the financial Nordic electricity market and number of transactions.

Introduction

NASDAQ OMX is the single financial energy market for Norway, Denmark, Sweden and Finland.

The financial electricity market refers to trading in electricity-related commercial paper and derivatives for which electricity is the underlying commodity. There is also a (financial) market for emission rights relating primarily to carbon dioxide emissions, which clearly impacts the physical and the financial electricity markets, since certain electricity production plants generate substantial emissions of carbon dioxide. Consequently, the cost of emission rights influences production costs and electricity prices.

Electricity derivatives are used primarily by companies that conduct electricity trading, mainly to hedge against price movements in the electricity market, which can be considerable. So, the electricity prices contracted with the customers are hedged via the derivatives market. In other words, there is a clear connection between the electricity derivatives market and the price that households and companies pay for their electricity.

The Nordic financial electricity market once again suffered from a fall back due to warmer average temperatures and the economic turbulence in the Eurozone, which resulted in a decrease of Nordic industrial production and thus reduced demand for electricity in the Nordic countries.

After a longer period of significant growth, Nordic financial electricity trading was once again marked by a downfall in traded volumes. The total volume turnover under 2011 was 1723 TWh which is 17 % less than the year before, see figure 24.

The period 1998 to 2002 was characterised by rapid expansion due to the geographical expanse of the market to all Nordic countries and the inflow of US energy companies to the Nordic financial electricity market. Collapse of Enron by the end of 2001 and the collapse of TXU Europe by the end of 2002 drastically changed the view in the US stock market with severe reductions in stock prices for power companies with international trading operations making it essential to ease international operations. The exodus of the US power companies in 2003 resulted in a sharp decline in the turnover in the Nordic financial electricity market.

From 2004 to 2008 volume turnover grew steadily until the effects of the financial crisis showed in 2009 as a marked fall in volume turnover. In 2010 volume turnover fell a bit

more but not significantly. During 2011, European debt crisis and a lowered industrial demand had a negative effect on financial trading in the Nordic Region which again led to falling volumes compared to the year before

The value turnover on the Nordic financial electricity market has had similar development as the volume turnover with a significant monetary expansion over time. However, there are significant differences. In 2008 the value turnover was double as high as in 2002 while the volume turnover had fallen 20 %. The difference can be attributed to higher electricity prices in 2008. In 2011 the value turnover was down more than 15 % compared to 2010 due to lower Nordic average electricity prices and a smaller volume turnover than in 2010.

Also, number of transactions on the financial market has fallen with more than 21 % from 2010 to 2011, thus once again disrupting the general trend of steady rise from 2003-2008 and 2010. The sharp fall can be seen in light of the euro crisis.

List of figures:

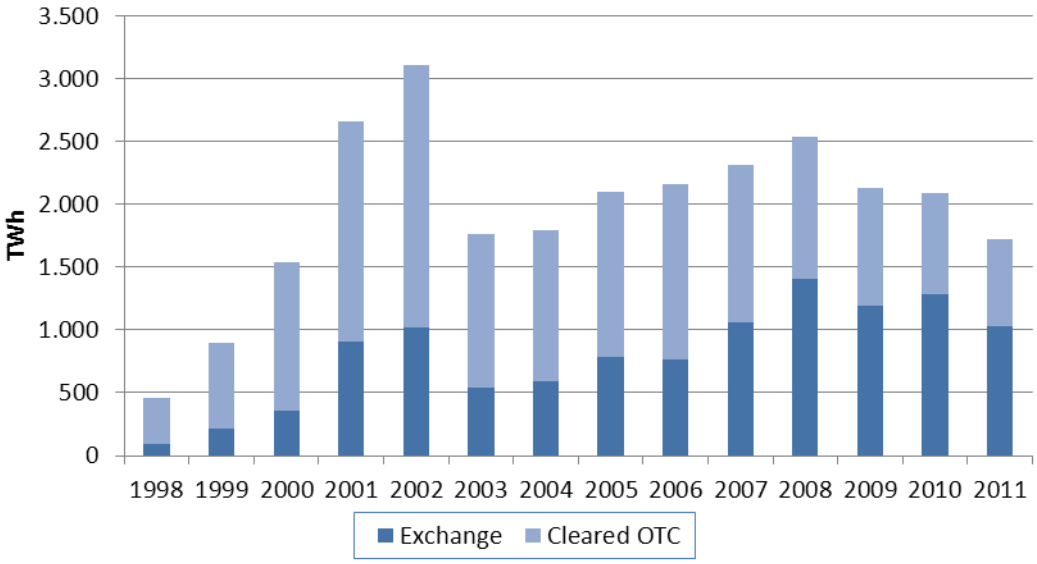

Figure 26 Volume turnovers in the Nordic financial electricity market 1998-2010

Source: Nasdaq OMX

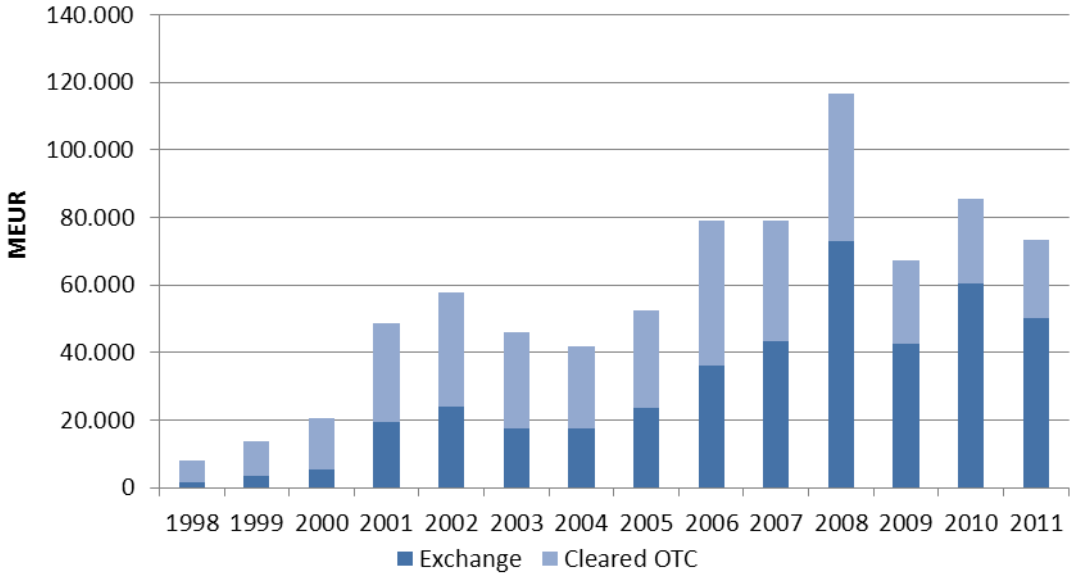

Figure 27 Value turnovers in the Nordic financial electricity market 1998-2010

Source: Nasdaq OMX

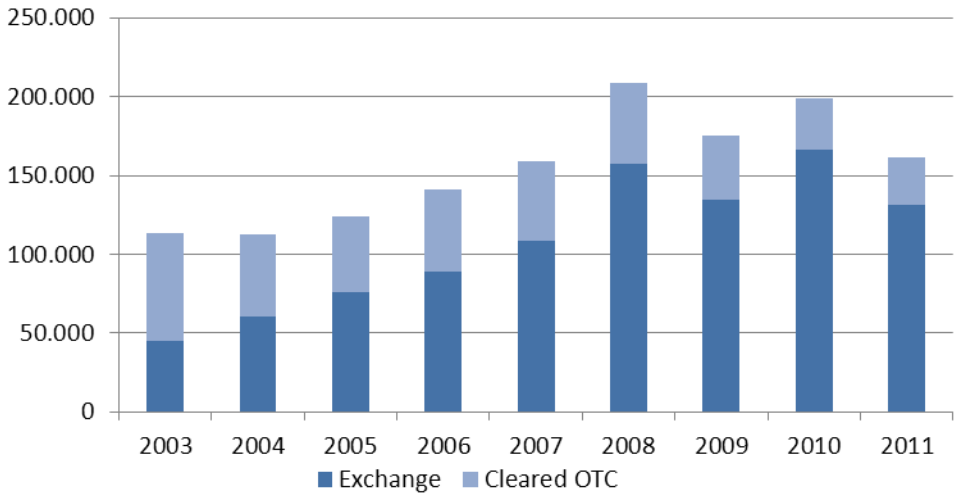

Figure 28 Number of transactions in the Nordic financial electricity market 2003-2010

Source: Nasdaq OMX

9 Market indicators

One of the objectives of NordREG is to monitor/evaluate the development of the electricity markets in the Nordic area. To monitor developments in the market and to develop methods of quantitatively evaluation of the market, NordREG has developed a set of retail market indicators. They have been selected on the criteria's that they should be based on of hard reliable data, data should be immediately available and there should be comparable data from all Nordic countries.

All indicators are shown with a score between 1 and 5, where 1 indicates a low competition on the market and 5 indicates a highly competitive market.

Definitions and descriptions of the indicators are presented and explained in appendix A. The indicators where first presented and explained in Nordic Market Report 2010.

Introduction

Based on the indicators, the Nordic retail markets for electricity appear competitive with a sufficient range of competing suppliers and active price competition. However there are certainly also areas where the competitive environments of the markets could improve, and the development in some of the indicators – e.g. price spread – suggest there is reason to pay special attention to price formation as an example.

Comparing the indicators between the four Nordic countries should take into account that there are structural differences between them – e.g. average consumption – which among other things affect consumer behavior.

On all Nordic retail markets consumers have a high number of suppliers to choose among giving all four countries a high score on this indicator.

Looking at consumer propensity to change supplier, the indicator shows considerable room for improvement; especially on the Danish market switching rates low are, but also the Finnish market shows relatively low switching rates.

The price spread indicator shows good or reasonable competition on all Nordic markets, although the indicator suggests that there is room for intensified price competition among the suppliers. Furthermore the development in the indicator since 2011 shows slightly widening price spreads in Denmark and Norway and diminished price spread in Finland. This suggests slightly weakened price competition in Denmark and Norway and slightly strengthened price competition in Finland.

The whole sale market indicator shows highly/medium concentrated wholesale markets where only the Norwegian market stand out as a market with low concentration. Even though high concentration can be very harmful to market competition it should also be

taken into account that power generation is a very capital intensive business which in itself tends to lead to more concentrated markets.

List of tables:

Number of suppliers

In a perfectly competitive industry there will be a large number of sellers. According to competition theory, the number of sellers could on the one hand be an indicator of economies of scale and scope and the existence of switching costs, and on the other hand an indicator of price taker behavior and utilization of market power in general.

Table 7 Number of suppliers' indicator, 2011

	Denmark	Finland	Norway	Sweden
Score	**5**	**5**	**5**	**5**
Share of suppliers covering the whole market	42%	32%	29%	50%

Supplier switching rate

Perfect competition also means that consumers should be fully aware of their alternatives. The question is whether they are. The supplier switching rate is an indicator of consumer awareness.

Table 8 Switching rate, 2011

	Denmark	Finland	Norway	Sweden
Score	**2**	**3**	**4**	**4**
Share of consumers who have switched supplier	3,5%	7,6%	11,3%	11,2%

Price differences in the retail market (Price spread)

The theoretical optimum of a fully competitive market is a market where no player is able to influence the price of the product in the market or any prices in the factor markets thereof. In practice this would mean that the market share of any player is so small that changes in supply by any individual actor would not alter the supply and demand balance.

Table 9 Price spread for product most commonly used on each national market, 2011

	Denmark	Finland	Norway	Sweden
Score	**4**	**5**	**4**	**5**
Price spread on most commonly used product	14,0%	8,4%	13,4%	8,6%

The price spread indicator shows Nordic markets with a reasonable high degree of price competition expressed by the price spread on each market. However, the price spread in both Denmark and Norway has widened a bit compared to 2011 suggestion a slightly weakened price competition while the price spread in notably Finland has been diminished from 2011 to 2012.

Concentration in whole sale markets (HHI)

In addition to indicators associated directly with the retail market NordREG has incorporated a component that illustrates the characteristics of the wholesale market. The key argument for this is that without a well-functioning wholesale market the development of competitive retail market is not feasible. If the wholesale market is not competitive, the actors in the wholesale market can discriminate between actors in the retail market, thus constraining the competition in the retail market.

Table 10 Concentration index for the Nordic whole sale markets, 2012

	Denmark	Finland	Norway	Sweden
Score	**2**	**3**	**5**	**2**
HHI-index	2112	1149	845	1989

Appendix A. Description and definitions of retail market indicators for the Nordic Electricity Markets

Indicator: Number of suppliers

It is difficult to determine the number of suppliers that is needed for competition to be efficient. The optimal number of competitors would basically depend on the characteristics of the production costs and the market. For example, in a market with no entry and exit barriers, no cost of switching, only one supplier would be necessary, as the threat of entry would be sufficient to keep prices in line with marginal cost. Thus the number of suppliers should be considered in relation with indicators of entry barriers, cost of production and switching costs. Scaling is a problem with this indicator. It is hard to determine where to draw the line between the number of suppliers that indicates imperfect competition and what number of suppliers indicates more efficient competition.

It should also be mentioned that not all suppliers are active in all regions of a national market, thus leading to different competitive situations in the regions. A large number of suppliers could as such actually indicate a large degree of market segmentation. Particular if there is cross ownership between the different suppliers.

Only suppliers covering the whole of the individual countries are counted. NordREG considered selecting eg. the capital region to work as a proxy, but concluded that selecting the whole country would still be more representative. When presenting this indicator in the Nordic Market Report, the total number of suppliers and the percentage share of the suppliers covering the whole market will be elaborated.

When presenting the number of suppliers' indicator, the following scale will apply:

Number of suppliers	Score
>10	5
>8	4
>5	3
>3	2
>0	1

The scale has been chosen in order to measure the indicators' impact on competition and in order to enable comparisons between the different indicators. The scale 1-5 has on the one hand been chosen in order to differentiate and on the other hand not to pretend accuracy which is not available.

Indicator: Supplier switching rate

Perfect competition also means that consumers should be fully aware of their alternatives. The question is whether they are. The supplier switching rate is an indicator of consumer awareness.

Switching supplier is defined as the action through which a consumer changes supplier. The switching rate measures the consumer awareness and activity which is crucial to a well functioning market. High switching rates could be interpreted as a sign of adequate consumer information, and vice versa.

The switching rate also reflects a number of other aspects in the retail market, such as general prevailing options among general public, innovativeness of contract offering, marketing activity and overall dynamics.

Though a low switching rate could indicate low consumer awareness, it is not necessarily so. No hinders to switching together with perfect consumer information would imply that the consumers switch supplier as soon as there is a better offer available. That again means that the switching rate could be low because of hinders to the switching or low price spread. If the former is the case, the switching rate would be low due to entry barriers on the demand side. If the latter is the case, low switching rate could be misinterpreted as imperfect consumer information when in fact the market could be working perfectly well. The indicator should thus be considered in relation with the price spread.

An insignificant budget impact of switching supplier could also explain a situation of low switching rate. The less the share of what the consumer will gain from switching supplier makes of his or her budget, the less is his or her incentive to make the switch.

The indicator will be calculated as number of household switching contracts per year as a percentage share of the total number of household consumers and presented in the following manner:

Switching rate, %	Score
>12	5
>9	4
>7	3
>3	2
>0	1

Indicator: Price differences in the retail market (Price spread)

A low price spread (no or only small price differences) in the retail market is regarded as an indication of a high level of competition as a competitive market tends to

minimize price differences between homogenous products. The price spread indicator will illustrate that a consumer can save money by switching the supplier. With a homogenous product[12] like electricity consumers should always choose the lowest price on comparable products. The price spread is included among the indicators to reflect the price taking behavior in the market, as if the law of one price would apply and the difference between different suppliers' prices would be negligible.

Choosing the same product in each country is problematic. Even though a product is available in each country the use of that product varies and may not be representative for the individual market. However, comparing price spreads of the most commonly used product in the free market in each country will constitute a coherent measure as an indicator for the competition in each national market.

The price spread will be calculated as the ratio between the lowest and highest price at the retail market, offered for the most commonly used product in each country. The supply obligation products are excluded. The aim is to measure price competition on the most used product in different markets; hence the product itself has less importance.

The price of the most commonly used product will be defined as the price of the offer for this product to an average consumption household. The capital regions will be used as a geographical proxy.

Observations defined as typical outliers could cause a problem when calculating the price spread as the ratio between the highest and lowest price. NordREG believes that the prices observed are actual prices for actual products. Thus there should be no general problem of outliers. However, this is first and foremost an empirical question, that will be dealt with if outliers appear.

When calculating the price spread it is also a question of whether to base the calculation on one or more observations. The more observations, the more robust the indicator might be. However, NordREG find the question best be answered and a decision taken, when there has been an opportunity to scrutinize the actual data collected for the indicator.

[12] Electricity in itself is a homogenous product. In recent years certain attributes has been inscribed to the product, such as green attributes for electricity generated from renewable energy sources. If green attributes are important for the consumers, the products are no longer homogenous but heterogeneous. And the consumers may not necessarily choose the product with the lowest price.

The price spread indicator will be presented in the following manner:

Price spread, %	Score
<10	5
>10, <20	4
>20, <30	3
>30, <50	2
>50	1

A low spread is regarded as an indication of a high level of competition as a competitive market tends to minimize price differences between homogenous products. The price spread indicator will illustrate that a consumer can save money by switching the supplier. With a homogenous product[13] like electricity consumers should always choose the lowest price on comparable products. The price spread is included among the indicators to reflect the price taking behavior in the market, as if the law of one price would apply and the difference between different suppliers' prices would be negligible.

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The price spread indicator will be presented in the following manner:

Price spread, %	Score
<10	5
>10, <20	4
>20, <30	3
>30, <50	2
>50	1

Indicator: Concentration in whole sale markets (HHI)

In the economic theory of industrial organisation a basic assumption is that the potential to abuse market power is related to the firm's market share. It is assumed that the more concentrated the market is the likelier it is that market is not well functioning. In the prolonging this implicates that an increase in markets concentration can lead to higher prices and lower consumer welfare.

The Herfindahl-Hirschman index (HHI) serves as indicator of market concentration and thus price taker behaviour of the wholesale market. The index however is not a very good indicator of the competitive character of a market since it merely points out the structural dominance of the market.

The HHI should be calculated for several market areas in order to reflect the Nordic electricity markets: The whole Nordic market as one, national markets and other subdivisions hereof (e.g. Sweden-Finland) subject to specific evaluations when numeric figures have been calculated.

NordREG has calculated the indicator for each national generation market and complemented this by weighing it with the time fragment the entire Nordic market shares a common price in the set of indicators.

The indicator both illustrates the concentration of the national generation market and the share of pan-Nordic sourcing. As the calculation of HHI for each country is based on market shares in the wholesale market, a market that in reality is a Nordic market, bottlenecks within the Nordic market is taken in to account.

The indicator will be presented according to the following scale:

HHI	Score
< 1000	5
>1000 <1100	4
>1100 < 1500	3
> 1500 < 2200	2
> 2200	1

NordREG
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