

# **Functioning of the Nordic Power market**

## **An overview and evaluation of studies and reports**

by  
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Functioning of the Nordic power market – an overview and evaluation of studies and reports  
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## **Foreword**

The Nordic Electricity market has undergone major changes over the past two decades and has consequently been the subject of many studies. Researchers, consultants and governments have conducted studies on various aspects of the market.

The Nordic Electricity Market Group commissioned this study of the latest reports to increase access to the many different conclusions and perspectives that exist regarding our common Nordic electricity market.

The study was carried out by Professor Torstein A. Bye. The selection of reports, evaluations and conclusions in the study is Professor Bye's and hence do not necessarily represent the view of the Electricity Market Group.

Flemming G. Nielsen  
Chairman, The Nordic Electricity Group

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# 1. Introduction and approach

This report reviews and evaluates some specifically stated reports concerning the functioning of the Nordic electricity market. The project is limited with respect to the included reports in the contract; however some relevant additional reports are also included and commented on. The total cost of the project sets the practical limit of reports and discussions.

According to the contract, the evaluation shall focus on criteria that characterize a well functioning liberalized market, such as:

- Transparency
- Fair trade
- Non-discriminatory third party access (barriers to entry)
- Etc.

The overall questions are how the Nordic market scores on these criteria, and how potential improvements may be obtained.

The following issues are essential to comment upon:

- Market power
- Market concentration
- Competition

The following studies are included in the evaluation according to the contract:

- Performance of electricity wholesale and retail markets (Matti Purasjoki, 2006)
- Energy sector inquiry (EU Com., 2005)
- Prisbildning och konkurrens på elmarknaden (Energimarknadsinspektionen, 2006)
- Konkurrensförhållandena på elmarknaden (Konkurrensverket 2007)
- Priområden på elmarknaden (POMPE) (Energimarknadsinspektionen, 2007)

I have further commented the following relevant additional studies partly on oral request from the principal and partly acted on own initiative:

- Capacity for Competition (Nordic competition authorities 2007)
- Capacity limitations of the Oeresund connection (Copenhagen Economics, 2006)
- Marknadsandelar och elhandelsmarginaler för E.ON, Fortum och Vattenfall
- Ifrågasatt samarbete om produktion vid gemensamt ägda kärnkraftverk och eventuellt missbruk av dominerande ställning på elmarknaden

Some other studies are referred to in the evaluation when relevant:

- Bye and Hope (2006): Electricity market reform – The Norwegian Experience
- Bye (2007): Country Comparison on Electricity Markets – The NordPool Area
- Singh et al. (2006): Ownership relations and cooperation in the Norwegian power market
- Energimyndigheten (2006): Ägarstrukturen på elmarknaden

This evaluation report is organised as follows:

Chapter 2 defines the relevant issues, summarizes some theoretically and practically important aspects in a well functioning electricity market. The chapter summarizes on this background the findings in the above mentioned studies. Conclusions and proposed actions from the evaluation is also part of this chapter.

Chapter 3-9 summarize important aspects in the respective reports included in this review (one chapter for each report). These chapters are a summary of what the evaluation considers the most important aspects in the respective reports. Remark that in chapter 4 several studies are included in separate subsections (four studies). These are grouped together, as they all refer to the same issue, and actually they have the same reference note, apparently to the same dossier. Each of the chapters 3-9 also comment on and raise questions about the relevance and interpretations made of several issues in the reports. Each chapter ends with an evaluation of the respective report. Since this evaluation is partly a summary and partly an evaluation of reports we have tried to keep it short in pages.

## **1. Evaluation, summary and conclusions**

### **1.1. The relevant issues**

In the evaluated reports mainly five issues are discussed

- Transparency and market functioning
- Concentration and market power
- The relevant market
- Price areas versus counter trade including the distribution of cost, and
- The handling of network capacities.

All these issues interact in the market. Let us start with clarifying some basic principals.

### **1.2. Some relevant theoretical and practical aspects**

For a society the fundamental operational goal in any market is to maximize total welfare, i.e. to maximize the sum of producer and consumer surpluses (income distribution issues disregarded). It is well known in the literature that this is obtained in a transparent market design, with free entry and many competing suppliers and consumers, i.e. all actors should have access to the same information and concentration in the market should be low, or preferably non-existent. In the electricity market two additional issues are important; the control of natural monopolies (transmission/distribution) and externalities.

#### **1.2.1. Transparency**

Both the power market and operation of the grid should be transparent. The NordPool exchange serves both as an exchange and an “information database” for the producers and consumers. Information from the pool is essential to all actors. The rules on the pool secure that any expected and unexpected

events that could affect the market are reported immediately. All market participants should be informed at the same time to minimise the risk for asymmetry and abuse of such asymmetric information. The same yields for any transmission capacity availability and constraint. Even though the rules at the pool are clear, the pool is only part of the market (cfr. bilateral markets) and the understanding of necessary and in time information may vary, i.e. whether this works well may be disputable. Several examples show that improvements in the flow of information are necessary.

### **1.2.2. Concentration and market power**

To hinder any exercise of market power, the control authority needs total in time information about all costs of operation for all plants and all transmission networks. In practise this is impossible. Therefore the Competition Authorities use some thumbs of rule concerning the approval of any merger or acquisition of production capacities. Proving abuse of market power is very difficult, and even more so in a system dominated by hydro power capacities. A combination of hydro power capacities and thermal capacities may even increase the possibilities to abuse market power. Besides, because of restricted transmission capacities the relevant market varies. This makes the control and the collection of evidence even harder. Normally this should lead to a *precautionary principle* when it comes to allowing market concentrations. Many of the evaluated studies (and others) show that concentration measures in the Nordic market are high relatively often, although in many hours the Nordic market is fully integrated and consequently less concentrated. High concentration does not necessarily imply abuse of market power, but it reveals presence of the possibility to exercise market power. This has not so far been sufficient to make steps to reduce concentration. Although Competition Authorities have argued against mergers and acquisitions politicians have overruled and allowed such takeovers. Probably due to a combination of a high degree of public ownership, high concentration even before deregulation of the electricity market, and industry structural political objectives, splitting of existing companies into smaller ones to hinder possible exercise of market power has proven difficult.

The networks are natural monopolies, and according to theory they should be controlled by the authorities. All Nordic countries have introduced control mechanisms which include both aspects of income regulation and efficiency measures. However, the actual day to day limitations of existing transmission capacities do not seem to be included in the control regimes.

### **1.2.3. Free entry**

By free entry we mean that any actor should have the opportunity to build any new plant as long as the actor finds it profitable, and is willing to take the economic risk. Free entry is a prerequisite for a long term well functioning electricity market. If the administrative process of concessions works swiftly, there should be no hindrance to free entry (see below on externalities).

### **1.2.4. Transmission**

In a socioeconomic optimized transmission system any producer and consumer should have free common access to the capacities. It is not socioeconomic optimal to invest in such capacities to get rid of any constraints. On the contrary, the value of the constrained capacities in any node measured by the capacity cost in a well functioning market should equal the cost of expanding the capacity at the node. When markets are separated due to capacity constraints, the price in the deficit area must increase and the price in the surplus area must decrease to secure market clearing in each area. The price difference represents the value of increasing flows between the areas which should be compared to the cost of expanding capacities (total system value). Any actor pays the price of the congestion. In theory this applies to any node in the network. In practice *price areas*, which cover several nodes, is a coarse adaptation to this criterion.



In Norway the market applies price areas according to this theory. This implies that all consumers in the deficit area pay the price of congestion, while all producers benefit (the electricity price increases to clear the restricted market). In the surplus area all producers suffer a loss and consumers benefit from low prices (prices decrease to clear the market). Then all actors pay the price and receive the benefits of the congestion according to their own load in the restricted cut, which accord to the full cost of participating in the market. Differences in prices between markets due to congestion, i.e. price areas, do not signal market inefficiency. The markets are not fully integrated at any time. An efficient electricity market should not always be fully integrated due to the cost of expanding transmission capacities.

The Swedish TSO applies counter trade to handle congestion in transmission capacities. The TSO pays for down and up regulation. The market clearing electricity price does not change. Two arguments for counter trade seem to apply: i) it secures an integrated market all the time, ii) if price areas were introduced, market concentration in the restricted market would arise. The first argument must be a misinterpretation of the EU decree on this issue, cfr. the cost of expanding the capacity. The second argument also applies for the use of counter trade – only a few actors could take part in the counter trading regime and abuse of market power in counter trade must also be important. I.e. the problem is concentration and none of the instruments circumvent this fact. Besides, the use of counter trade introduces two inefficiencies into the market; i) The consumers and producers in the respective markets do not face the relevant marginal cost in the market, ii) and the TSO has to add an extra tariff to ordinary transmission tariffs to pay for the counter trade. The last inefficiency affects efficiency when the market is restricted (cost is too low) and when the market is not restricted (cost is too high).

#### **1.2.5. Externalities and free entry**

Production and transmission of electricity introduce several possible externalities. Consumption of electricity does not introduce externalities (except from some possible radiation problems for some individuals). Production of electricity introduces two types of externalities; i) in the investment phase and ii) in the production phase. The externalities vary among technologies. The marginal cost of the externality should be added to the investment or operational cost respectively. Some actors seem to believe that taking externalities into account hinders entry; however, taking externalities into account implies higher cost, higher prices in equilibrium, and entry whenever profitable to the new cost. This results in a socio economic optimal expansion when externalities are included.

Two problems may occur since politicians have to decide upon the “price” of the externality; i) postponing the decision hinders entry, ii) and time inconsistency with respect to decisions adds to the uncertainty which in turn increases the discount rate and eventually the cost of expanding the system.

#### **1.2.6. Trade**

The Nordic electricity market is the first nationwide integrated electricity market in the world. The basic reason for trade is comparative advantages. In normal markets this implies trade of one commodity in one direction for a longer period of time. To balance trade the comparative advantage theorem is important in addition to the absolute advantage possibilities. Every country is *relatively* better than another country in producing some goods. Comparative (and absolute) advantages may change over time. The Nordic electricity market is very dependent upon the inflow of water, i.e. the primary energy supply and the cost are stochastic. The comparative advantage (and absolute advantage) then varies by seasons. Participation in trade benefits any country that takes part in the trade based on comparative advantage. Hindering trade reduces the potential welfare for both parties. Participating in trade implies accepting free and open trade. Although trade in many markets is

restricted by market participation rules and tariffs, restrictions are inconsistent with the idea and benefits of free trade.

In the Nordic electricity market free trade is emphasized. However, in the operation of the international grid, capacities now and then are limited to secure domestic regional balances with equal prices between regions, see chapter 2.2.4. This is inconsistent with free and open trade. A country benefits from trade when transmission capacities are sufficient. The same country transfers some of the cost of a domestic capacity restriction to other countries by limiting capacities on international connections. This creates asymmetry in the collection of benefits from the trade.

### **1.3. Summary of the findings in the reports**

The evaluated reports address varying aspects of the same questions. A summary over the reports then includes several dimensions. The present evaluation offers two approaches i) a brief summary and evaluation of each report is presented in chapter 3-9, ii) chapter 2 divides the issues in the reports along common dimensions and each report's argument along this dimension is compared. This is useful when drawing general conclusions from several reports on these common issues.

In table 1-4 in this chapter the reports are grouped in the columns and issues are grouped along the rows. Eight issues are brought up; Transparency, fair trade, non discriminatory access, market concentration, market power, the relevant market, competition and market functioning. Besides the reports also launch proposals which is included in a row in the table. Finally we report the evaluation of the reports in the last row.

#### **1.3.1. Transparency**

Only two of the reports are explicit about the lack of transparency in the Nordic electricity market, however, several of the reports touches upon the issue (marked by an x). There seems to be no dispute about the transparency issue. The market should be transparent; all information should come in time and be symmetric with respect to actors, cfr. also the asymmetric information issue discussed in paragraph 2.3.3 in this evaluation. The EU inquiry also emphasizes the lack of timely and relevant information in the EU market. The transparency needs to be improved.

#### **1.3.2. Fair trade**

Several of the reports question indirectly fair trade of electricity but from different departures. Some dispute fair trade based on information asymmetry (cfr. the nuclear plants), some address the problem from the regulation of congested capacities based on differences in regimes (price areas and counter trade) and some argue that the practice of down regulating trans-border transmission capacities to handle domestic capacity constraints implies unfair trade. All claims seem to be proper.

#### **1.3.3. Non-discriminatory access**

Svenska Kraftnät's limitation practice on the Oeresund connection to handle domestic congestions in the transmission network may be categorized in this section. The ownership of the capacity and the practice of limiting capacities favour one actor. The capacity is jointly owned by Svenska Kraftnät and Energinet.dk, however the Svenska Kraftnät is superior in the decisions. Energinet.dk first bid capacity in the connection and send this to Svenska Kraftnät. Then, based on this information Svenska Kraftnät decides on the limitation based on their information about domestic capacities (cfr. The report

on the Oeresund connection). This practice do not accord with the idea of free trade and bring asymmetries in the collection of revenue from free trade.

#### **1.3.4. Market concentration**

Almost all studies show that market concentration when the market is fully integrated is medium high but not necessary alarming. However, several studies emphasize that the market is not always integrated and then market concentration reach worrying levels. The market concentration has increased over time and may still increase if actions are not taken. In several studies market concentration is one applied argument for using counter trade instead of price areas to handle congested transmission capacities. Although the argument for counter trade in itself instead of price areas is wrong, see below, the argument of high market concentration around the relevant cuts is relevant. Splitting of publicly owned companies may be an option that few of the studies really propose. One exception is the managing director of the Swedish Ministry of industry which actually proposes this on a general basis in this concentrated market.

#### **1.3.5. Market power**

Several studies advocate unbundling of production and transmission. The vertical integrated companies create an additional problem to a general medium high concentration level in the production part of the market. Most of the studies demonstrate a common acceptance of the potential problem with the part time medium high concentration levels in the relevant markets. However, it seems as if most of the studies hesitate to draw the adjacent conclusion; splitting of publicly owned production companies into separate competing entities. Most of the studies instead advocate larger transmission capacities, new independent entry, and focus on increasing the demand elasticity that can reduce the market power of few companies. It seems like splitting companies is political hazard, while supporting instruments is more acceptable, despite the fact that supporting regimes reduce the cost for energy users and increase the cost of non-energy users (subsidies). The only exception is the report evaluated in chapter 4.3 which has highly relevant and concise proposals about splitting of companies.

The EU inquiry also emphasizes the high concentration and insufficient cross border transmission capacity in the overall EU market.

The practice of Svenska Kraftnät in limiting trans-border transmission capacities to reduce domestic capacity constraints shows that abuse of market power in the monopoly part of the market is less emphasized when advocating free competition and international trade. Income regulation and efficiency measures alone are not sufficient to control natural monopolies, control of actual operation of capacities are just as important.

#### **1.3.6. Relevant market**

Nordel has proposed investments in five prioritised connections in the Nordic countries, one in each country, and it seems as this is the basis for these studies discussing connections and cuts in the transmission system. The most important cuts discussed in the Swedish market are cut 1, cut 2, cut 4 and the west coast cut. The Oeresund connection adds to the problem. All studies seem to accept that the Nordic market is not always integrated, and the discussion of relevant markets and concentration is important. In this context the handling of capacity constraints by counter trade and price areas is on the agenda. The reports seem to diverge with respect to which instrument is the best, cfr. discussion below. Limitation of the capacity in the Oeresund connection is rightly disputed, see below.

### **1.3.7. Competition and market functioning**

Competition in Europe is generally low, both due to high concentration and small trans-border transmission capacities. Competition in the Nordic countries is generally considered good, however, improvements both with respect to concentration issues, transmission issues and end user markets seem necessary. Deregulation of electricity markets have produced results in line with theory and expectations, however, some efficiency potentials still exist.

Some of the reports emphasize problems when production capacity is closed down, the lack of correlation between spot and consumer prices, high margins, vertical integration, unbundling, limitations on trans-border transmission capacities and counter trade/price areas. Some of the statements do not follow economic logic but some of them do. In this context we can not discuss any detail in these arguments; however, some scepticism with respect to economic logic is important when reading the reports.

### 1.3.8. Proposals

Several of the reports include proposals for improvement of the market functioning. Among them are

- Entry for production capacity should be easier
- Government should invest in new production capacities
- Dominating companies should be split
- Vertically integrated firms should be unbundled
- Nordic TSO's should merge
- Joint ownership of nuclear plants should be dissolved
- Information to the market should improve
- Further mergers and acquisitions are problematic
- Counter trade should be used instead of price areas and vice versa (different proposals)
- Limitation of trans-border transmission capacities should not be allowed
- Price and cost should be the most important incentives to investors
- Political regulatory framework should be stable
- A Nordic end user market should be established

## 1.4. Conclusion and actions

If government should invest in power production, see 2.3.8 above, they should do so on a profitable basis (then the question is why a government is of special interest?) The question of counter trade and price areas seems to be influenced by parties' interests and not deducted from plain economics and efficiency measures. Except from these two all proposals summarized in chapter 2.3.8 seems to have well founded arguments.

Some of the discussions and some of the proposals in the evaluated reports are highly relevant and should get more emphasize, but generally the analyses and reports serve common arguments. What are really urgent are decisions.

The two most important aspects seem to be; i) Concentration and market power and ii) the handling of restricted transmission capacities.

### i) Concentration and market power

First of all a perfect market should maximize social surplus, which is consistent with the output from a free competitive market where any externality is internalized. All reports discuss the potential problem with high concentration and the possibility to exercise market power. Every report discusses the relevant market and calls attention to the fact that concentration is higher and the possibility to exercise market power increases when the market is restricted by transmission capacities. A couple of reports emphasize that *the ultimate conclusion is splitting of dominant firms*. The report from the General Director in the Swedish Ministry of industry is crystal clear on this issue. A precautionary principle is preferable when monitoring is difficult or almost impossible and a conclusion of splitting seems well argued.

Further mergers and acquisitions that increase concentration in the market should not be approved.

To improve market performance better information is a prerequisite. All actors should be instructed to release relevant and in time information of available capacity to the market.

All unnecessary uncertainty in this market should be avoided. This includes in time and time consistent political decisions.

Development of the supply side should be based on profitability where externality costs are included.

Free entry then should apply.

ii) The handling of restricted transmission capacities

Integration of electricity markets involves trade on a free and competitive basis. Free access to a transmission network is a prerequisite. Trade should be based on common principles and maximization of the total benefit of all existing capacities. In such a framework maximization of total surplus for the whole integrated area seems reasonable both when investing in new capacities and in the running of existing capacities.

Investment in transmission capacities is costly. When investing in one connection the new capacity influence on the cost and benefit for all associated connections, i.e. total system costs and benefits are essential.

Optimal investments in the grid bring about constraints in the system when the market fluctuates. It is not optimal to get rid of all constraints. Constraints reflect the shadow price of increasing capacity. The area price shows the benefit of increasing capacity.

Any actor in the relevant cut should take part of the cost of the constraint to secure efficiency in use. Optimization of total surplus implies that existing capacities should not be limited. Market pricing of constraints distributes the cost and benefit efficiently. Fair trade in an international market implies the same.

When a market is split by constrained connection, price areas are efficient means to regulate the market. The shadow cost of the restriction is optimally distributed among consumers.

Counter trade redistribute the cost of the restriction in a non-efficient way. Besides the collection of revenues to cover cost of counter trade introduces inefficiencies in the net also when the network is not constrained.

A common Nordic TSO – or a jointly owned and operated TSO would maximize the Nordic benefit and solve these issues by price areas. Any market concentration in the restricted area has to be dealt with separately under any circumstances. Splitting of public plants is one possibility. Direct regulation of prices from the supplier, based on marginal cost in the actual period is another possibility.

Price areas is not in conflict with the EU decree about free trade, on the contrary, a redistribution of cost of capacity constraints as in the counter trading regime is in conflict with free trade.

Chapter	3	4				5	6	7	8	9
Issues ...	Performance of electricity wholesale and retail prices	Market shares, margins and ownership of nuclear plants				Energy Sector inquiry	Price formation and competition in the electricity market	Price areas in the electricity market	Capacity limitations in the Oeresund connection	Capacity for competition
	Market shares and margins	Nuclear clear power and competition	Competition in the electricity market	Ownership in the electricity market						
	Konk.verk	Konk.verk	Gen.direktor	Emyndighet	EU	E-mark-inspektion	E-mark-insp.	Cop.Economics	Nord.Comp.A	
Transparency	Purasjoki				Lack of timely and relevant information. Information asymmetry incumbents and competitors. Improved Transparency necessary.					
Fair trade			x		Customers limited trust in price formation	Limiting cross border trade capacities to handle domestic capacity problems reduce efficiency.	Dispute that price areas are in line with an integrated market.	Capacity limitations in the Oeresund connection. Capacity constraints instead of price areas or counter trade		
Non-discriminatory								Common ownership on the connection. Svenska kraftnats superior in practice. Price increase in D - decrease in S. Net cost for Denmark, since 2000 is 800 mill DK		
Market power	Raise the question but do not conclude	Joint ventures of nuclear plants. Since 2001 no cooperation in planning between Vattenfall, Fortum, EON. Inconclusive	Based on statistics from two previous columns. Their conclusions do not imply no problem	A detailed statistical overview of ownership in Sweden Supports earlier findings	Lack of unbundling of network and power supply. Threatens security of supply.					

Chapter	3	4				5	6	7	8	9
Issues ...	Performance of electricity wholesale and retail prices	Market shares, margins and ownership of nuclear plants			Energy Sector inquiry	Price formation and competition in the electricity market	Price areas in the electricity market	Capacity limitations in the Öresund connection	Capacity for competition	
..		Market shares and margins	Nuclear clear power and competition	Competition in the electricity market	Ownership in the electricity market					
	Purasjoki	Konk.verk	Konk.verk	Gen.direktør	Emyndighet	EU	E-mark-inspekto	E-mark-insp.	Cop.Economics	Nord.Comp.A
<b>Market concentration</b>	High concentration, low demand barriers for entry, relevant market shifts. How to increase elasticities of demand?	Wholesale market share for EON, Vattenfall, Fortum 86% in S -relatively high, 33% in the Nordic market. End user market- 43 per cent customers, 65 per cent volumes.	Reports same figure as previous column			Market concentration high both physical and in derivatives. Scope of long term contracts worsens. Lack of interconnections still a problem.	Swedish market medium concentrated. Increase elasticity of demand and new entries.	Cut 1, Cut 2, Cut 4, West coast cut. Domestic constraints - limitation of transborder capacities. EU decree; TSO no restriction exchange to deal w domestic problems. Legality an open question. Price areas solve the issue.	Svenska kraftnät abuse market power when limiting trans border capacity	Market concentration has increased (Vattenfall and Elsam and Ek2, Statkraft and Agder and Trondheim).
<b>Relevant market</b>		Nordic -One market 33% of the time. Sweden a separate market 9% of the time.				Lack of interconnections	Three important cuts in the Swedish market. All methods of handling constraints imply the risk of exercise of market power.	Nordelt: Split more price areas. Nordel2; Counter trade false incentives. Energimarknadsinspektionen; Counter trade/price areas efficiency. Bjørndalen; More precise price areas. Copenhagen economics; Counter trade- No limiting capacities. Ea Energy Analysis/ COWI- price areas- no limitations.		



Chapter	3	4			5	6	7	8	9
Issues ...	Performance of electricity wholesale and retail prices	Market shares, margins and ownership of nuclear plants			Energy Sector Inquiry	Price formation and competition in the electricity market	Price areas in the electricity market	Capacity limitations in the Oeresund connection	Capacity for competition
	Purasjoki	Market shares and margins	Nuclear clear power and competition	Competition in the electricity market	Ownership in the electricity market				
	Konk.verk	Konk.verk	Konk.verk	Gen.direktor	Emyndighet	E-mark-inspektion	E-mark-insp.	Cop.Economics	Nord.Comp.A
<b>Com-petition</b>			Holm study - price guaranties hinder competition. Price margins now and then negative - risk and uncertainty?		Insufficient cross border capacity. Reservation of capacities despite rulings against. Better methods of congestion management necessary. Regulated tariffs instead of competitive markets. End user markets has low competition.		Competition in Europe is low		
<b>Market functioning</b>	Closing down of capacities negative? Lack of spot and consumer price correlation? Entry of new capacity is low? Hydro as a price setter?; Mis-interpretation of how the market function	High margins- small customers.Vatentail-EON highly correlated.Fortum volatile.Vatten fall-low margin strategy.	Seem to work well	When demand is increasing and capacity are constrained prices increase. Abuse of market power possible. Vertical integration a problem - asymmetric information. Security of supply a market issue. Lack of free entry a problem		Explains the functioning of the market - important points are missing. Margins in Sweden higher than margins in Norway. Competition in the end user market to low. Increasing prices increase profits.	The energy intensive industry need security of supply at low cost. They do not favour investments in domestic grid that increase consumer cost. They support downregulation of capacities. The consumers that cause counter trade should pay the bill.	A large set of econometric models. Partial models. Uncertainty. Prices increase in Denmark when capacity is limited. The volatility of prices also increase (consistent with model 1). Number of congested hours without limitation is low (consistent with model 1?). Counterfactual simulation from Nordpool ( a limited amount of hours).	Price signals from congestion should reach actors. Inefficient auction of capacities between Nordic and surroundings

Chapter	3	4			5	6	7	8	9	
Issues ...	Performance of electricity wholesale and retail prices	Market shares, margins and ownership of nuclear plants			Energy Sector inquiry	Price formation and competition in the electricity market	Price areas in the electricity market	Capacity limitations in the Oeresund connection	Capacity for competition	
		Market shares and margins	Nuclear clear power and competition	Competition in the electricity market	Ownership in the electricity market					
	Purasjoki	Konk.verk	Konk.verk	Gen.direktor	Emyndighet	EU	E-mark-inspektion	E-mark-insp.	Cop. Economics	Nord.Comp.A
	Easier entry. Increase public investments in independent production and transmission capacities? Another nuclear plant? Increase elasticity of demand. What about economics? Fortums ownership in hydro power should be reduced? More independent role for Fingrid? Merger of TSO's in Nordic countries! Supervision of the market.			Joint ownership of nuclear should dissolve. If dissolving not possible each plant a separate trading role. Vattenfall split. Nuclear plants made responsible for in time information to the market. Relax restrictions on new entry. Security of supply a market issue.		Competition law enforcement. Vertical foreclosure. Market integration. Structural issues; unbundling strengthen power of regulators. Lack of liquidity - divestiture of plants. Lack of transparency - publish information on a rolling basis. Harmonization of market design.	Well designed market. Income distribution effects should be handled outside the electricity market. Further mergers and acquisitions is problematic. Proactive competition policy - new entry - splitting of public owned companies - rules for handling restricted capacities. Nordici cooperation between TSO's. Separate price area cut 2, counter trade cut 4. Cost of counter trade split between countries. New contracts to increase competition	Arguments for counter trade: A common European market.Liquidity in the futures/forward market. Price areas imply market concentration in the relevant market. Downregulation of cross border transmission capacities.		Support Nordels 5 prioritised connections. Optimal investments based on Nordic welfare. Harmonized rules for congestion management.Split of revenue. Price is the most important incentive. Stable political regulatory framework is a prerequisite. Ownership unbundling is necessary. A nordic end user market, refined metering and auctions of greenhouse gaser are supported.
Proposals										
Evaluation	Unclear economics on investment and price mechanisms. Clear on splitting of Fortum, unbundling and Nordic TSO	Question market concentration but do not conclude?	Question market concentration - especially around nuclear but do not conclude?	Clear on advise: Splitting, improved, relax restriction on investments, no separate security of supply body.Economic textbook	Concentration is high - statistics are plenty	Sceptical to several elements in the market. Miss proposals and strengthened conclusions				

## 2. Performance of electricity wholesale and retail markets

*Performance of electricity wholesale and retail markets, report by Matti Purasjoki, Administrator. Ministry of Trade and Industry 2006- (44 pages)*

Chapter 1 of this included report is a summary of previous studies of the Nordic Electricity Market. Main points are that market concentration is high, the demand elasticity for electricity is low, there are high barriers for entry, and the relevant market shifts due to capacity constraints. The EU market is less competitive than the Nordic market, both due to a higher concentration and a separation of the market because of limited transmission capacities between countries. The "Swedish energy market inspectorate" concludes that the Nordic market fundamentally works well, but may be improved by easier entry to the market, increased transmission capacities and more focus on the consumer responses part of the market.

Chapter 2-4 review the historic development of the deregulation phase of the Nordic market and contains no real new information in this context, cfr. also Bye and Hope (2006).

Chapter 5 discusses different theoretical prerequisites for a well functioning electricity market and some problems of market concentration, but only rather superficially. No formalized relation to the actual market, unless some undocumented allegations, is made. The author emphasizes the closing down of some capacities due to emission trading and seems to misinterpret this as a problem for the pricing of electricity (chap 5.3). On the contrary, this is a restriction that internalizes the environmental cost into the electricity market and thereby improves the market performance with respect to social optimization. The author rightfully pinpoints the lack of correlation between the spot price and the consumer price development in Finland, however, he does not contribute to a full understanding of why (different contracts, imperfect information, abuse of market power, market segregation, mixed objectives for the companies etc.) This subject should be studied further.

Chapter 6 again is a verbal theoretical description of some problems with oligopoly in an electricity market, and chapter 7 discusses briefly transmission issues. None of these chapters include any formal discussion of the relevance to and any possible problems with the actual Nordic case.

Chapter 8 deserves some more specific remarks:

- In chapter 8.1 scarcities is on the agenda, and the author does not seem to accept that a well functioning competitive market has to be based on profitability in investments. In a cost benefit analysis of new projects all costs (including environmental cost internalized by governmental instruments - either taxes or permit prices (emissions) or direct regulations (new hydro power plants)) is to be compared to the power price in a dynamic calculation. The dynamic aspect is important since it is necessary to make estimates on all future cost and the future power price, i.e. uncertainty is a basic element in the considerations. This is normal in any markets. To evaluate whether the resource is scarce or not, one simply compares price and cost. So far the cost of primary energy (gas, coal, etc) and the price of emission permits have increased and made further investments in electricity production capacity non-profitable (hydro power is limited due to political decisions), so prices must increase to defend new investments. This price increase in the market then does not necessarily reflect scarcity - just that basic costs have increased.
- Chapter 8.2 discusses market concentration emphasizing the Finnish market. At times, the Finnish market is restricted by transmission capacity for imports (or exports). Then the Fortum company is the major producer with respect to regulating capacity and hence setting prices,

which actually also is proved by the regulating authority. Several studies, see for instance Nordiske konkurransemyndigheter (2003), show that in normal instances the Nordic electricity market is fully integrated and the market concentration is low. When trans-national electricity trade is restricted by transmission capacities, the market concentration in several of the Nordic countries is high, and the potential for abuse of market power increases. In several occasions, however, the government has approved acquisitions that increase the market concentration, despite warning from academia and the competition authorities. The market concentration issue should be followed up by further research.

- Chapter 8.4 discusses some aspects of the heterogeneity in the production structure in the Nordic electricity market. The author seems to mean that the hydro power plants are price setting plants. If so, this must be based on a misinterpretation of the price setting mechanism in the Nordic electricity market. The basic marginal cost of production or regulation in a hydro power plant is close to negligible. The present cost in a hydro power plant is dominated by the alternative value of the water at any time in the future. This alternative value of water depends upon the alternative cost of producing electricity in thermal plants (the short term marginal cost in such plants) adjusted by any shadow cost of capacity restrictions (capacity to store water between periods or generation capacity combined with any transmission restriction). A high inflow implies that less and a cheaper part of the thermal capacity is needed (the value of the water decreases), a low inflow implies the need for more of the expensive part of the thermal capacity (the value of water increases). The varying inflow indirectly influence on where on the thermal plant capacities we find the short term marginal cost and price.
- Chapter 8.5 claims that the market is not transparent enough since "the exchange (Nordpool) does not publish information on the production cost creating the balanced situation". It is hard to grasp whether this is another argument about market concentration or not. The exchange covers only 50 per cent of the market. The rest of the market is based on bilateral contracts. However, the spot price, together with the future/forward market price serves as reference prices for such contracts. The author claims that the price formation at the exchange is nontransparent, the large producers are able to analyze each other's position, and thereby increase their market power. The discussion is not convincing. The author also suggests several new market clearing rules that, obvious for any economist, would create losses in the market and reduce the effectiveness of this market.
- Chapter 8.6 concerns the price consciousness of electricity consumers. It is common knowledge that price sensitiveness in the short run is very low; see for instance Bye and Hansen (2007). If concentration is high enough, this increases the potential problem of market power. The author just points at the low flexibility and does not contribute to the discussion of how to increase the flexibility, which in turn may improve the functioning of the short-term market. Increasing the price responsiveness is one possible direction to reduce the possibility to exercise market power. If consumers face stable prices, there is no reason to invest in short term responsiveness. If consumers face fluctuating prices, the incentive to invest in flexibility increases. Studies of these issues should be emphasized in the future.

Chapter 9 gives some recommendations:

- Chapter 9.1 advocate public investments in new generation capacity since private investors do not seem to be able to take up such investments (or they do not want to because it will reduce their potential market power). The proposals are; Invest in a new nuclear plant, remove the obstacles to investment in more hydropower, increase the potential for new renewable energy sources, remove transmission bottlenecks and introduce incentives to electricity saving. An economist's way of thinking would rather be: to reduce the political risk of investing (for instance do not postpone political decisions about environmental regulations), reduce market concentration (split large public owned firms into several firms), be firm about environmental regulations, and introduce cost effective instruments to cope with externalities. After that, the

market will solve investments in new capacity based on cost benefit analysis. Prices in the market will increase and make new investments profitable.

- Chapter 9.2 advocates that more emphasis should be paid to market concentration and the author proposes that Fortums ownership in hydropower should be reduced for instance by an auction. Further investments in new capacity should take place in a new state owned company. Finally one of Fortums plants should be sold to independent producers. Market concentration and the possibility of abuse of market power in the electricity market in the Nordic countries have become major concerns. The governments have so far not listened to the competition authorities or academic advises. To obtain an efficient running of the existing power market and efficient new investments it is important that the competition platform is sound. This is in accordance with many studies of the market concentration in the Nordic electricity market. The proposal of splitting of Fortum and preferring new entrants when increasing capacity seems proper.
- Chapter 9.3 advocates a more independent role for Fingrid. Today they are too dependent upon the two dominating producing firms Fortum and Pohjolan Voima. This is easy to applaud on the basis of sound competition in the electricity market and an efficient regulation of a natural monopoly. It also accords to proposals from other studies that advocate unbundling. The author also proposes a merger of the TSO's in the Nordic countries. A close cooperation between the TSO's with respect to handling of the short term market clearing (based on the same principles) and the investments in new capacities to create an efficient overall market must be a minimum. Whether this calls for a merger or not, does not seem to be very important if cooperative solutions based on common principles are possible. A common ownership could work out.
- Chapter 9.4 advocates the need for supervision of the electricity markets. The proposal argues for the need for cooperation between two official bodies; the Energy market Authority and the Competition Authority. This coincides with the situation in the other Nordic countries and seems to be a proper proposal.

## **2.1. Evaluation**

This report does not seem to follow standard economics when it comes to proposals of expansion of capacities in the production and network system. The understanding of the price mechanism (changes in cost and prices) is not convincing. The paper is clear when it comes to proposals about splitting of Fortum and reducing market concentration. It is also clear on the proposal of unbundling of the network and the production capacities of Fortum and Pohjolan Voima. A proposal of a closer and more harmonized cooperation of the Nordic TSO's seem proper, whether it leads to common ownership or a merger.

## **3. Market shares, margins and ownership of nuclear plants**

The four following papers (chapter 4.1-4.4) concern the same issue: market concentration for nuclear dominating firms in the Swedish market. All papers operate with the same reference, 2007-05-07 Dnr 408/2006, so they are obviously part of a common public investigation.

### **3.1. Competition Authority. Market shares and margins**

*Konkurrensverket: BAKGRUNDS-PM, 2007-05-07 Dnr 408/2006 ; Marknadsandelar och elhandelsmarginer för E.ON, Fortum och Vattenfall Market shares and price margins for E.ON, Fortum and Vattenfall (9 pp)*

This paper reports a study of the market shares and the margins in the electricity market for three dominating firms in the Swedish electricity market: E.ON, Fortum and Vattenfall. The market shares are calculated for the wholesale market and the retail market. The margins are calculated gross (inclusive indirect costs) for two consumer groups, the 2000 kWh/year consumer and the 20.000 kWh/year consumer.

In the wholesale market, The Nordic area was one market in 33 per cent of the time in 2006; Sweden constituted a separate area in only 9 hours out of 8760 hours the same year. The market share for these three companies in the wholesale market was 86 per cent in Sweden and 39 per cent in the Nordic market. In the end user market the three companies had a market share of 43 per cent in the number of customers; however the market share was 65 per cent in the total volume of electricity.

The study calculates a reference price for different types of contracts based on a weighted average of a portfolio of prices in the market (Spot, futures, contracts for differences), which is supposed to reflect the purchaser cost for the firm trading electricity. This reference price is compared to the end user price from the firm, i.e. the intention is to calculate the firm's gross margin in the market (gross since other costs are exempted – profile risk, volume risk, currency risk, administrative cost etc).

For small customers the gross margin for one year contracts is high (cfr. that the fixed costs for a contract for small consumers are high per kWh). The margins lag behind the increasing market price and vice versa. The margins for E.ON and Vattenfall seem to be highly correlated while the margin for Fortum fluctuates and even became negative in a period. The margins for the large customers are less than the margin for smaller customers. For several periods the firm price is less than the reference price, i.e. the margin is negative. Fortum again has the most volatile margin. The margins for a three year contract are less than for a one year contract for all three companies, but not very much. Fortum's margin is the most volatile one. Vattenfall introduced a "security deal" in June 2006 which implied a low margin strategy on the three year contracts.

For the larger customers the margins have declined over the studied period (2004-2006) which may be due to increased competition. The margin for the smaller customer has not changed much.

### **3.1.1. Evaluation**

According to the study the wholesale market is relatively concentrated, while the end user market is less concentrated. The gross margin for small consumers is high, for large industries the margins are less. The margins for E.ON and Vattenfall seem to be highly correlated, while Fortums margins fluctuate and are even negative. This study raises the question about the market functioning but does not offer any real conclusions.

## **3.2. Nuclear power and cooperation**

*Konkurrensverket. BESLUT 2007-05-07 Dnr 408/2006: Ifrågasatt samarbete om produktion vid gemensamt ägda kärnkraftverk och eventuellt missbruk av dominerande ställning på elmarknaden. Cooperation and abuse of market power in jointly owned nuclear power plant in the electricity market. (8pages)*

Several market participants have made complaints about possible abuse of market power in the electricity market. Foremost the complaints are against the joint owners of nuclear plants. The large vertically integrated power producers Vattenfall, Fortum and E.ON are claimed to abuse their position in the end user market. In several occasions they are accused for selling below their cost price. The “security deals” from Fortum and Vattenfall are supposed to hamper competition.

The competition authority based its evaluation on a questionnaire to companies and institutions. They gathered information about contracts, electricity consumption, protocols and price information from the three companies. Professor Holm at Lund University performed an analysis of Fortums and Vattenfalls “Price guarantees” and he concludes that the guarantees may hinder competition. It is not possible from the report to evaluate his reasoning.

### **Production**

Before 2001 the planning of production in nuclear plants jointly owned by Vattenfall, Fortum and E.ON was partly coordinated between the owners. After 2001 the communication between partners and *plant operation* has been direct, and all coordination of the production has ceased.

### **The electricity market**

If end user prices are below the cost price, the competition law may apply, however, occasionally the price may still be below. A systematic negative difference may be framed by the law. If the margin is below the indirect cost of trade the competition law may also apply. The report shows that the gross margins have been positive for all contracts for most periods. For some periods the margins have been negative, but this yields periods with sharply increasing spot prices, i.e. uncertainty plays an important role.

A market share above 50 percent for a firm or cluster of firms on the relevant market is normally a presumption for dominance. To evaluate the degree of dominance, the relevant market has to be defined. Two dimensions are important: the wholesale market and the end user market.

### **The wholesale market**

Vattenfall, E.ON and Fortum constitute 85 per cent of the Swedish wholesale market (45, 21 and 19 respectively). The Swedish Nordic market is most of the time integrated with other parts of the Nordic market. The five largest producers in the Nordic countries constitute 60 per cent of the production (Statkraft and Dong add to the former). The conclusion is that neither Vattenfall nor the three Swedish companies together have a dominating position in the Nordic market. At the same time large vertically integrated firms have a strong economic position in the market, while consumers are small and not coordinated.

### **The end user market**

Vattenfall, E.ON and Fortum constitute 51 per cent of the volume in the Swedish market (31, 12 and 8 respectively). Taking into account subsidiary companies the market share is 65 per cent (36, 15 and 14 respectively). The conclusion is that neither one firm nor all firms together have a dominating position on the end user market. Fortums and Vattenfalls price guarantee may hinder competition. This conclusion seems correct, but the report does not fully analyse the question raised.

### **3.2.1. Evaluation**

The study is launched due to a complaint on Vattenfall, E.ON and Fortum for abuse of market power in the end user market. Especially owners of the nuclear capacity are accused. Although the three companies hold a major part of the Swedish market, they do not hold a major part of the Nordic market, i.e. when no trade transmission capacities are constrained the market function. Neither do they hold a dominating part in the end user market. The open question that remains is; what happens when the market is not cross border integrated. This happens due to restricted transmission capacities. In

some occasions Svenska Kraftnät also limit cross border transmission capacities, see below. The report is not really conclusive.

### **3.3. Competition in the electricity market**

*Generaldirektøren (Clas Norgren), Næringsdepartementet, 103 33 Stockholm, 2007-05-07 Dnr 408/2006: Konkurrenceforholdene på elmarknaden. (13 pages)*

The first part of the paper informs about the investigation in the Swedish competition authority and their conclusions, cfr. Chapter 4.2 above. The managing director do not dispute the conclusions. However, he pinpoints that the conclusions from the competition authority *do not imply* that there is no problems concerning the functioning of the market when concentration is at the documented level. On the contrary such problems may arise.

The paper discusses the price formation in the market, and focuses on the cost aspects (primary energy prices, permit prices in the CTS market, and taxes), but also production capacity constraints as excess capacity diminishes when demand increases, transmission constraints and possible abuse of market power when markets are restricted by transmission constraints, and price areas that consequently occur. Entry of new capacity is restricted and, hence, does not improve competition so far. The report also emphasizes that vertical integration implies biased information flows between actors.

The managing director argues that security reserves should be taken care of by the market participators and not by Svenska kraftnät (SK). He refers to a report by SK that argues that SK should no longer be responsible for such reserves. The proposal is that individual firms should take such responsibility based on market principles, but this requires governmental effort in setting up the design and rules for such a market. Until then, SK should still be responsible for security reserves.

One important factor for a well functioning market is the possibility of free entry. Several restrictions on new nuclear power, new hydro power, environmental restrictions etc limit new entry to this market. The managing director advocates policy instruments to stimulate such entry, to help out limiting the possible abuse of market power in this market.

The managing director conclusion departs from the conclusions in the competition authorities report:

1. The joint ownership of nuclear plants should be dissolved. Existing plants should be divided among existing owners
2. If dissolving is not possible, existing plants should have a more independent role against owners and should have a separate trading role at NordPool and responsibility for security of deliveries against SK
3. The government should consider if Vattenfall's producing plants should be sold out or new owners could be included as shareholders
4. Nuclear producers should be made responsible to inform all market participants about their running positions simultaneous in due time via the NordPool system.
5. The government should relax the restrictions on new investments in producing capacity
6. The government should not allow a new trade organization with the responsibility for the security of supply. Instead SK should continue to have this responsibility until a market where actors take this responsibility themselves is established

#### **3.3.1. Evaluation**



Although the formal data and analysis is the same in this study as in the former ones the conclusions depart severely. It is liberating to read a report that *does not hesitate to conclude* on the behalf of competition and the intention of a well functioning electricity market. The nuclear capacities should be dissolved, Vattenfall should be split, information about capacities should be immediate, new investments should be allowed on a profitable basis and the market should handle security of supply issues: Just like the economic textbook!

### 3.4. Ownership in the electricity market

*Energimyndigheten; Energimarknadsinspektionen; Ägarstrukturen på elmarknaden. Vem äger hva på den svenska elmarknaden? (40 pages + references)*

This study is not included in the evaluation. Still it is relevant reading, as it includes great amount of statistics concerning the ownership in the Swedish market, measures of the ownership of important facilities, the market shares for the 18 largest firms in Sweden and the major changes in ownership over the last decade. The report is a nice and detailed study, but does not bring up anything new with respect to major implications compared to chapter 3.1. – 3.3.

*Country Comparison on Electricity Markets- The NordPool area; Professor Torstein Bye (15 pages)*

This study covers a lot of aspects of the Nordic electricity market. In this context, the several references about market concentration mentioned are relevant:

- An updated study of the ownership structure in the Norwegian power market in 2005, Singh et al. (2006), shows that the HHI<sup>1</sup> index is 0.2, i.e the concentration in the market has not changed much since the 2003 study.
- An updated study of the concentration in the Swedish market, Energimyndigheten (2006), shows that the ordinary HHI can be calculated to 0.36, i.e. the concentration has increased during the last 5 years. The conclusion from the report is also that the incentive and control elements through cross ownership increase the potential concentration problem.
- From the Danish Energy Authority website we find information about the ownership of production capacities in Denmark, and calculation of the HHI index results in an index of 0.42 that is highly concentrated. Actually two companies, Elsam and Energi2, split almost equally 90 per cent of the total market. The western and the eastern Danish markets are also often separated markets due to transmission constraints (directly and indirectly). The market concentration in western Denmark is considered a problem.
- According to Energimarknadsvärket in Finland two large producers dominate the market, Fortum with its 40% share and Pohjolan Voimas 20% share. Other important producers are the energy intensive industries and Vattenfall from Sweden who has also entered the market.

### 3.5. Evaluation

These studies show that there is a lot of dispute about market concentration and abuse of market power in the Nordic electricity market. This is an ongoing debate and it seems as if the data show an increasing potential problem as mergers and acquisitions go on. In several occasions, Danish firms are doomed for abuse of market power . Now and again the Nordic market is split because of transmission constraints, and consequently market concentration in the relevant market increases to a disturbing level. But for one study, they all hesitate to do anything but to urge for competitive behaviour. The

managing director, cfr. Chapter 4.3, is a liberating exemption and pinpoints several important prerequisites to improve the overall market functioning.

## **4. Energy Sector inquiry**

*Communication from the Commission, Brussels 10.1.2007 COM (2006) 851 final. Inquiry pursuant to Article 17 of Regulation (EC) No 1/2003 into the European gas and electricity sectors (Final Report) (15pp)*

This report supports the conclusions of the Communication on “Prospects for the internal gas and electricity market” which is a follow up of the Green paper “A European Strategy for Sustainable, Competitive and Secure Energy”. The report concludes that the new deregulated electricity market has produced results in line with market fundamentals; however, all objectives of the market opening have not yet been achieved. The report concentrates on competition issues and the remaining obstacles to creating a single European competitive electricity market (the paper also considers the gas market but this is not commented on here). The majority of shareholders in the energy sector support the findings. The vertically integrated incumbent companies are not in favour of new measures, whilst customers, traders/new entrants and authorities support the call for legislative initiatives.

The report focuses on eight aspects of the market out of which 7 concern the electricity market

### **4.1. Market concentration**

At the wholesale level the market has maintained the high concentration level from the pre-liberalization period. Generators have scope to exercise market power. Also in the futures/forward market trade depends on few suppliers. The main generators have the ability to withdraw production to raise prices, even during off peak hours and in the less concentrated markets. The scope of log-term contracts can reinforce concentration levels, so do the lack of interconnection capacities.

### **4.2. Vertical foreclosure**

The current level of unbundling of network and supply interests creates negative impact on the market functioning and investment incentives, and constitutes a major obstacle to new entry and threatens security of supply.

### **4.3. Market integration**

Insufficient cross-border capacity and a lack of adequate incentives in different market designs hamper market integration and slows down new investments in additional capacity to eliminate relevant bottlenecks. On certain borders long-term pre-liberalization reservation of capacities still exist despite the ruling of the European Court of Justice, i.e. these reservations are not compatible with EC law. Better methods of congestion management are needed.

### **4.4. Transparency**

There is a lack of reliable and timely information in the electricity market. All market participants require information on equal footing in due time to ensure a competitive market. There is an information asymmetry between vertically integrated incumbents and their competitors. Improved transparency is necessary.

## 4.5. Price formation

Users have limited trust in the price formation mechanism. Regulated supply tariffs below market prices discourage new entry. Prices have increased due to increased primary cost (fuel prices) and permit prices in the ETS market. However, this does not fully explain the increase in electricity prices (comment: The report seems to omit the increasing shadow price of capacity as demand catches up with production capacity). Regulated tariffs for several consumer (for instance to reduce the cost for energy intensive industries) groups seem to have generated adverse effects for the development of a competitive market.

## 4.6. Downstream markets

Competition at the retail level is limited (no international market for retail trade). The duration of contracts and the contract bond to incumbent producers may have a lock in effect in the market, and thereby hamper efficiency.

## 4.7. Balancing markets

Balancing markets often favour incumbents and create obstacles for new suppliers. The size of the balancing zones is too small, which increases costs, protects the market power of incumbents and hinder new entrants. Harmonization of balancing market regimes is important.

In order to address existing malfunction, cfr. 1-7 above, it is essential to apply both competition and regulatory based remedies:

*i) Competition law enforcement* – full and combined use of the commission antitrust rules

- Ensure that competitive structure in relevant markets does not further deteriorate
- Launch energy release programs as means to develop market liquidity and increase entry
- Apply antitrust law

*ii) Vertical foreclosure*

- Commission should prevent competition infringements based on vertical integration
- Article 81 or 82 EC may be infringed when long term contracts vertically tie the market

*iii) Market integration*

- Analysis of the foreclosure mechanism in long term transmission contracts and capacity hoarding is necessary
- Analysis of lack and delay of investments when transmission companies are vertically integrated with producer companies is necessary

*iv) Structural issues*

- A systematic conflict of interest due to insufficient unbundling has hampered investments in new capacity. It is crucial that network owner's incentives are not distorted by supply interests of affiliates. It is important to decisively reinforce the current inadequate level of unbundling. No significant synergy effects of vertical integration are proven.
- Europe needs a substantial strengthening of the powers of regulators and enhanced European coordination. The main ingredients should be, enhanced powers for independent national regulators, reinforced coordination between regulators, reinforced cooperation between TSO's, and substantially enhanced consistence in the regulation in cross border issues.

*v) Chronic lack of liquidity*

- One should consider either divestiture or asset swaps of power plants on a European scale

*vi) Lack of transparency*

- All relevant market information should be published on a rolling basis in a timely manner. Any exception should be strictly limited to reduce the risk of collusion

*vii) Other important issues*

- Existing impact of remaining regulated supply tariffs on the development of competition should be assessed
- The commission should ensure that exemptions from access provisions (transmission) do not harm the competition
- There is a need for harmonization of market design with emphasis on cross border trade
- Implicit day-ahead auctions or equivalent measures should be promoted to ensure that interconnections are efficiently utilized
- Regulators should be empowered to collect and exchange relevant information to enhance market performance

## 4.8. Evaluation

This study enlarges the market to cover all Europe. Most comments and discussions support and extend the discussion of relevant aspects to secure a better functioning of the European electricity market: concentration, disintegrated markets due to too small transmission capacities, unbundling, liquidity, free entry, common carriage in the networks etc. The analyses seem proper but conclusions could be strengthened?

## 5. Price formation and competition in the electricity market

*Energimarknadsinspektionen; Price formation and competition in the electricity market (Prisbildning och konkurrens på elmarknaden: En rapport från Energimarknadsinspektionen) ER 2006:13 (189 pp)*

The report focuses on four main elements; The functioning of the wholesale market, Price areas and the competition in the Swedish market, The Swedish end user market, and finally Considerations about necessary organisational steps to improve competition in the Swedish and Nordic electricity market.

### 5.1. The functioning of the wholesale market

The price formation at Nordpool is based on asks and bids for each hour the next day, i.e. the equilibrium price reflects the marginal cost of production for the most expensive unit needed to clear the market (the marginal cost also includes a shadow cost of any capacity constraint – cfr. a stepwise increasing marginal cost function). All supply and consumption are traded at this equilibrium price. Proposals about trading at the bid price are refused because it would introduce inefficiencies and losses in the market.

The price formation in the fiscal market and the spot market are connected (fundamentally through the storage of water). A well functioning fiscal market then is essential for a well functioning spot market. The fiscal market works as a risk sharing instrument in the market where uncertainty is high, just as different contracts serve as a risk sharing instrument in the end user market. The fiscal market also serves as a valuation of future power in the end user contracts.

The liquidity on the Nordpool exchange is high compared to the liquidity in other exchanges. The number of participators is high and competition seems to prevail, although some actors may be large and eventually have the opportunity to exercise market power in some instances.

Prices changes over time as demand, and the cost of primary fuel or electricity production (inc. permit prices for emissions) changes. The Nordic and European market is becoming more and more integrated and the cross country interrelationship and electricity trade influence on both the short and long run development of prices. Even if the price of the primary fuels may drop, the price of electricity may prevail high due to capacity constraints and the development of the permit price for emissions (and the high cost of new investments).

## **5.2. Price areas and competition in Sweden**

The Swedish producer concentration has increased since market was deregulated in 1996. The four largest producers Vattenfall, Sydkraft, Stockholm Energy and Gullspång, had 85 per cent of the domestic production in 1996, in 2004 this had increased to 88 per cent. The Nordic market is dominated by the state owned companies Vattenfall, Statkraft and Fortum who together constituted 45 per cent of the market (2004). Co-ownership and potential tacit collusion adds to this concentration measure. By common measure of concentration the Swedish market had high concentration 2 per cent of the time in 2005, and weakly concentration half of the time. Even when the Nordic market is fully integrated the market is close to medium concentrated. Since the electricity market hold special characteristics (no storage possibility for energy, low demand flexibility etc) normal concentration measures are too weak to characterize concentration measures. The market concentration is now so high that further mergers “must not be considered non-problematic”. Co-ownership of the Swedish nuclear power capacities is of special concern. Two possible measures to reduce market power due to to concentration are; to increase demand flexibility, and foster new entry of independent producers. Policy regulation and policy uncertainty (time inconsistency) is a problem for new entry. Special surveillance of market performance when the market is concentrated (restricted due to transmission constraints) is considered necessary.

In the Swedish domestic electricity market three cuts in the transmission system are considered problematic – cut 1 in the north, cut 2 in mid Sweden and cut 4 in the south. The west coast cut face some special problems concerning the cross border trade with Denmark. The domestic constraints are handled by counter trade and down scaling of cross border capacities. The discussion in this report follows the discussions in the other reports commented on above. Some aspects add:

The report refers to Nordel that claims that all methods for handling constraints (cfr. counter trade and price areas) imply risk for abuse of market power in the restricted areas. The report also states that restricting the cross border trade capacities to handle domestic constraints reduces the integration of the market and reduces the efficiency in price formation in the Nordic market. To better integrate the Nordic market, counter trade in the planning phase or price areas should be utilized instead of reducing cross border transmission capacities. Counter trade implies that the spot price do not reflect restricted capacities and thereby introduces inefficiencies to the market. When considering the four essential cuts in the transmission capacities, the report advocates formation of price areas, except for cut 4 where the market concentration becomes too high (it is unclear why counter trade does not create the same problem. A better solution would be to split state owned production plants into several independent competing companies?). If counter trade should take place in the planning phase at Nordpool instead of through bilateral contracts or through the regulating power market (cfr. market power), a split in cut 4 is also necessary. Nordel argues against increasing counter trade at the regulating power market. A state responsibility for the security of supply will not be sufficient and stable in the long run.

## **5.3. The Swedish end user market**

The end user markets in the Nordic market are only domestic. If the end user markets were made common internationally the efficiency in the Nordic electricity market would increase. Over time the

trade margins in the Swedish end user market have increased (mostly due to changes in the fixed addendum to the price) (it is unclear if this is just inflationary changes). The margins on long term contracts do not differ systematically between suppliers. When it comes to current prices the margins vary a lot between electricity trading companies and vertically integrated companies (highest in the vertically integrated companies with own production). The margins in Sweden are higher than the margins in Norway. The large differences between variable prices and current prices imply that competition in the end user market should be emphasized, so do the large differences between margins in Sweden and Norway.

The energy intensive industries are not satisfied with the end user market; they claim that prices are too high (it is unclear what they mean by too high). Their willingness to pay is below the suppliers' willingness to supply. The industry argues against price areas, obviously because this benefits them on the cost of other actors in the market.

Over time prices have increased, due to increasing prices for primary fuels (energy inputs to power plants, permit prices and capacity constraints). Many technologies do not face these increasing costs (hydro, nuclear, wind etc) but receives the marginal market price. Over time the rate of return for power producers in average increase on the cost of all consumers' bill, i.e. a redistribution of income takes place. It seems as if the industry means that this indicates that the market does not function well. However, this does not imply an inefficient market, on the contrary the hallmark of an efficient market is that the basic prices are equal (except when transmission capacity is constrained) among customers and reflects the marginal cost of production (free competition assumed).

#### **5.4. Considerations and proposals**

The Energy market commission finds that the electricity market is well designed to secure an efficient price formation in the market. The price increases the last years is caused by fundamental cost factors like cost increases for primary fuels, the increasing prices in the emission market ETS, and production capacity limitations (cost off entry, decommissioning of Barsebäck etc). Income distribution effects from the development of prices in the electricity market should be handled outside the electricity market. To protect the energy intensive industry national measures should be avoided. The competition in the Swedish and the Nordic electricity market is in a European context relatively good but should be improved. In the Energy Sector Enquiry, see chapter 5 in this report, concentration in the market is shown to be high, new entry is limited and the power companies may well exercise market power. The concentration in the Nordic market is now so high that further mergers and concentration is not unproblematic. The risk of abuse of market power can not be rejected. There is a certain need for research on this subject. The competition policy should be proactive to hinder concentration and abuse of market power. This could imply new entry, splitting of governmental owned large producing companies into smaller companies, increase transmission capacities and make rules for handling of restricted capacities uniform. The government should perform an analysis of possible obstructions to new entry for independent actors to the market. One instrument could be to secure municipalities a share of the profit tax on power plants to make them more willing to allow investments in new plants. The Nordic TSO should cooperate in developing the transmission system further to create a more integrated Nordic market. A separate price area around cut 2 in Sweden is recommended. A counter trade around cut 4 should be recommended, but the cost of the counter trade should be split between Sweden and Denmark. Increased flexibility in demand would increase efficiency in the market. In this respect new types of contracts should be studied and the end user market made international. More competition would decrease administrative costs and trade margins. Electricity suppliers should not apply variable contracts but rather run for current and fixed price contracts.

## 5.5. Evaluation

The electricity market is functioning well, however some improvements are necessary. The market is concentrated, especially when the market is not integrated due to transmission capacity constraints. This could be circumvented by increasing demand flexibility and fostering new entry among independent producers. Special surveillance when markets are separated is advocated. Except for the surveillance both increasing demand flexibility and new independent capacity entrance will take time. A more efficient way to cope with the problem would be to split large companies into smaller independent entities (could still be publicly owned). Three of the 4 important cuts (1,2, West coast) could form price areas, while cut 4 should be handled by counter trade. The arguments favouring counter trade in cut 4 is not clear and convincing. The same problems arise with counter trade as for price area, while counter trade in addition create other inefficiencies. The end user market should be international.

## 6. Price areas in the electricity market

*Energimarknadsinspektionen; Price areas in the electricity market (Prisområden på elmarknaden (POMPE). Gemensam rapport från energimarknadsinspektionen, Svenska Kraftnät, Svensk Energi och Svenskt Näringsliv (87pages)*

### 6.1. Summary and conclusion

An efficient market is characterised by an efficient resource use and effective competition including market integration as far as possible. The ambition should be to have as large price areas as possible. The reason for this statement is not intuitive. A Nordic perspective should be upfront.

Any socioeconomic profitable investment in the grid is recommendable. Market integration through counter trade is desirable. The ones that benefit from counter trade should pay for it. Svenska kraftnät and Energinet.dk should together define a common principle of counter trading. A common price area for Sweden and Själland based on common rules for covering the cost is recommended. The cost of counter trade should be published by Nordel.

It is not possible to construct a price area to solve the west coast cut problem. A separate price area in cut 4 is not recommendable due to market concentration (Karlshavnverket). Why does counter trade solve this problem? Price area for cut 2 is possible. This could change when the five prioritised connections in the Nordic countries operates. They accept that price areas may occur occasionally despite earlier arguments against.

### 6.2. Earlier studies

Nordel 1 – The Nordic area should be divided into several price areas (N-4, S-3 (incl. cut 2 and 4), Jylland, Själland and Finland unchanged). Counter trade for some cuts up to a certain cost level – above those cost price areas. Hearing among actors; Fins agreed because the proposal would realize few price areas. The Swedes disagreed upon the separation of Sweden in price areas. The Danes pinpointed that price areas should follow restricted nodes. Fins, Swedes and Norwegians agreed upon increased counter trade. The Danes opposed.

Nordel 2 – It is possible to increase the element of counter trade to reduce the number of price areas, but the counter trade does not give the right economic incentives.

Energimarknadsinspektionen 1 – Either price areas or counter trade – the most important is to ensure economic efficiency. If counter trade applies, the cost should be paid by the actors responsible for the restriction in transmission.

Energimarknadsinspektionen 2 – Price area in Sweden around cut 2 should improve efficiency and give the right incentives to new investments in transmission that could improve security of supply. Price area around cut 4 is not recommendable because it would hamper competition.

Bjørndalen – More price areas are recommendable. Price areas should not be limited to national borders.

Copenhagen Economics – SK should have counter traded instead of reducing capacity in exports to Denmark.

Ea Energy analysis and COWI – Price areas without national border constraints should be implemented.

### **6.3. Transmission constraints in the Swedish system**

What is really important in this chapter, and for the present functioning of the market, is the development of the transmission system. Even though the chapter discusses important developments of the Nordic system the real emphasis is on the Swedish system. The Swedish transmission system has mainly been developed to manage domestic needs, i.e. deregulated Nordic market with open trade stress the system. Besides, flows have changed significantly since the decommissioning of Barsebäck.

The four main restricted cuts are the cut 1, cut 2, and cut 4 and the west coast cut.

**Cut 1** – north of Sweden – 4\*400 kWh connections. Production north of cut 1 constitutes 17 per cent of production capacity in Sweden. Cut 1 limits transmission southwards normally during the winter when consumption is high and during high inflow periods when hydro production in the north is high.

**Cut 2** – the middle of Sweden – 8\*400 kWh connections. The market south of cut 2 and covers 81 per cent of consumption and 58 percent of production. Cut 2 limits transmission southwards. The cut limits transmission southwards normally during the winter when consumption is high and during high inflow periods when hydro production in the north is high.

**Cut 4** – south of Ringhals and Oskarshamn – 5\*400 kWh connections. The market south of cut 4 covers 19 per cent of consumption and 10 percent of production. The cut limits transmission southwards normally during the winter when consumption is high and during high inflow periods when hydro production in the north is high.

**West coast cut.** The west coast cut restrictions do not show any special seasonal pattern.

Due to security system reasons, the west coast cut may be limited in hours in the north direction when importing from Poland, Germany and Denmark, exporting to Norway and the consumption is low in the Gothenburg area. This cut is also restricts during low flow periods since the regulation capacities in thermal plants in Denmark are low, which may switch the flows in this cuts.



Internal constraints in Sweden would occasionally occur unless handled by reducing the international trade capacities. According to the report gross flows out and in to Sweden have increased from approximately zero in 1963 to 15-20 TWh in both directions in 2005.

The TSOs evaluate the system transmission capacities on a daily basis which are reported to the Nordpool exchange in front of their clearing of the market based on power bids and asks. It is important to note that the system capacities may differ substantially from the theoretical capacities, due to loop effects, security reasons, balancing the stochastic wind power etc. Based on these capacities and bids and asks in the power market price areas arise (however limited to the number of areas possible decided in beforehand). Every system operator uses own methods of calculating transmission capacities. When common borders exist, the lowest claimed capacity is input to the Nordpool clearing.

There are two critical choices; down regulation of trans-border capacities when domestic constraints bind, ii) counter trading or price areas. To day TSOs mix all instruments.

#### **6.4. Rules and practices in EU**

The EU legislative decree EG nr 1228/2003 regulates trans-boundary trade with electricity. According to article 6.1 restricted transmission capacity should be handled by non-discriminating and market based instruments which send efficient economic incentives to market participants and the TSOs. The Commission's addendum 2006/770/EG (Congestion Management Guidelines) requires that the *methods for congestion management shall send economic efficient incentives and promote competition*. The management should ensure minimization of consequences for the inner electricity market. The system operators *should not restrict exchange capacities* to deal with domestic congestions, unless reliability demands such operations. In any case all actions should be transparent. To ease international trade *all instruments should be market based*. The methods for dealing with congestion constraints demand *coordination between system operators on common rules*.

To deal with congestion in the trunk network SK applies counter trade. The cost is covered by the network tariff. The cross border congestion management is solved through the price areas in the Nordpool exchange. However, to deal with congestion in the trunk network, SK has diminished the exchange capacities, partly due to reliability, partly to avoid that counter trade cost for exchange capacities harm trunk network tariffs. It is an open question whether the practice of reducing exchange capacities to handle trunk network constraints is in line with the EU directive. Introduction of price areas in Sweden could solve this issue.

Italy, Denmark and Norway are the only countries in Europe that apply price areas to handle transmission constraints.

#### **6.5. The consumers, competition and the network constraints**

This chapter primarily discusses the energy intensive manufacturing industry's needs in the electricity market, and the necessary prerequisites to fulfil these needs. The energy intensive industry needs security of supply at low prices. The industry thinks that today's deliveries are acceptable and the need for investments in the network that increase consumer cost (network tariffs) is unnecessary. The industry supports the down regulation of trading capacities (with other countries) to ensure domestic security of supply when capacities are constrained. The industry emphasizes the need for competitive electricity prices and network tariffs, but it is unclear what this exactly means (probably as low prices as possible?). The industry agrees that counter trade should be efficient and the consumers that cause the need for counter trade and gain from this trade should pay the bill.

The chapter also emphasizes the need for an efficient electricity market which implies that existing capacities is utilized in an optimal manner in the short run. This implies that transmission capacity reductions in certain cuts to handle domestic security of supply issues should be limited (contrary to existing practise and the energy intensive industries opinion?). Competition between a sufficient numbers of producers normally secures efficiency in production. Imbalances should be equally priced for all consumers at the regulating power price. In the long run efficiency depends upon free entry – which is not the case today with all the restriction on investments in different kinds of new capacities. The report also emphasizes investments in local production capacities to handle imbalances instead of investments in transmission networks which, according to the report will just move the imbalance to another location. It is unclear whether this implies optimal investments in the total system (a combined investment in production and transmission capacities?).

When the Nordic market is fully integrated the concentration in the market seems to be no problem. The report emphasizes that Norway, Denmark and Italy's approach applying the price area method to handle congested transmission is counterintuitive if striving for an integrated European market. (This must be a misconception of the term "an integrated European market". All electricity markets depend upon transmission capacities and if transmission capacities are optimal in economic sense, constraints will eventually occur.) However, the Nordic market is fully integrated only one third of the hours a year. Then the market becomes concentrated and exercise of market power may potentially happen. The concentrations in the European markets are even higher than in the Nordic market. The concentration is high both in the wholesale market and in the end user market. This chapter is then in line with the Competition authority paper referred in chapter 3 of this report.

The chapter emphasizes that different methods of handling constraints may imply different price risks, volume risks, profile risks and different supply company specific willingness to trade on the whole Swedish market. However, the report does not follow up on these issues so it is not possible to address the relevance.

## **6.6. Changes and effects of regulation of capacity constraints**

Transmission constraints may be handled by investment in new capacities, counter trade and changes in price areas. Existing capacities are mostly established to deal with electricity trade in domestic markets. Opening up of international markets demands changing capacities to optimize trade in a wider market. "The package" is Nordel's proposal for five new transmission lines in the Nordic countries to cope with the most serious capacity constraints in the Nordic electricity market. It is important to remember that it is not optimal to remove all constraints in an infrastructure. The constraint in itself secures the funding of the capacities and the price of the constraint and the restricted amount of trade informs the investor about the value of any new capacity expansion.

## **6.7. Evaluation**

From an efficiency point of view capacities should be priced in every node in the system. Practising a detailed node pricing is administrative cost consuming and demands a very detailed flow of information between the market and the consumer. Besides it is an open question if such a regime would produce any significant changes in demand in very short term. An approximate regulation is to introduce price areas to handle large deficit/surplus areas. This is an approximate efficient system. Any producer and consumer face the marginal cost of expanding/reducing production/demand when transmission into/out of the area is restricted. This maximizes the restricted consumer and producer surplus and any producer/consumer cover the cost on the margin. In Norway the TSO and NordPool

operate three price areas while Sweden is only one price area – despite severe occasional constraints in both cut 1, 2, 4 and the west coast cut.

In Sweden one treats these constraints by counter trade. The arguments for counter trade seem to be:

1. *A common European integrated market. This, according to the report, should imply one price. Counter trade ensures a common price over areas since the cost of counter trade is paid through the transmission tariff.* This must be a misconception of an integrated market. When transmission flows are non-restricted the market is fully integrated and one price prevails. When the market is restricted by transmission constraints the market is not integrated by definition. The market should price the restriction and all consumer/producers should face the same shadow price of the restriction. Counter trade hides the present cost of this constraint for producers/consumers and levies a tax on all consumption. This creates three inefficiencies in the system; Producers/consumers *do not face the shadow cost* at the time of the restriction and the *transmission cost is too high* in periods where transmission is not constrained. The *distribution of costs is not efficient*.
2. *Liquidity in the futures/forward market. The physical spot market and the fiscal futures/forward markets are linked by the storage of water possibilities.* The water that produces electricity today has an alternative value in production tomorrow. If we reduce the market by price areas in the spot market we also influence on the fiscal market. The futures/forward market is very important with respect to incentives for the storing of water over periods and for the incentives for investments in new capacities. Equalizing prices over areas through counter trade sends false information for the storing problem and hides shadow prices of capacities for investors, i.e. send disincentives to actors in the market. Besides, the price area experience in Norway has proven no disincentives to actors so far.
3. *Setting up price areas may imply a very high concentration of the supply side of the market, i.e. the exercising market power may be made easier.* There is no convincing argument that counter trade relaxes this problem – on the contrary, counter trade introduces the same problems. Any counter trading TSO faces the same concentrated actors.
4. *The Swedes down regulate international trading capacities to deal with domestic congested capacities.* A better approach would be to cooperate on cross border price areas to maximize the benefit of all capacities at all times. A negotiated sharing of the value of differences in prices should be possible. This would increase the total social surplus for all countries participating in the agreement.

*The arguments for counter trade instead of price areas are not convincing. On the contrary, counter trade would produce inefficiencies in many respects, and the arguments seem to be based on misconceptions (or hidden income distribution arguments?).*

## **7. Capacity limitations on the Oeresund connection**

*The Economic Consequences of capacity limitations on the Oeresund connection, 16. november 2006, 29402 Energinet.dk, Copenhagen Economics (77 pages)*

In a complex interlinked domestic and international transmissions system capacity limitations occur now and then. A limitation in one cut influences on the market equilibrium in other cuts. Capacity constraints form separate electricity markets. Equilibrium in each market may be secured by counter trade or by introducing separate price areas. One may also move constraints around the market to ease the concerned constraint. This paper concerns the last issue and the consequences.

Svenska Kraftnät applies capacity limitations in the trans-border transmission between Sweden and Denmark to ease domestic capacity constraints. Limitations in the access to capacity in the Oeresund

connection change electricity flows and thereby ease domestic capacity constraints in domestic cuts. Thereby the cost of the origin capacity constraint is redistributed. Dansk Energy asked the European Commission to open a competition case against Svenska Kraftnät (abuse of market power), which favours Swedish consumers at the expense of Danish consumers. The report at hand is a study of the cost and benefits of Danish and Swedish consumers based on a study by Copenhagen Economics.

## **7.1. The economic consequences of capacity limitations**

This chapter concludes that Svenska Kraftnät has limited the capacity on the Oeresund connection in the direction to Denmark 16.5 per cent of the time between 1. October 2000 to 28. June 2006, which has given rise in the congestion 5.6 per cent of the time. The Oeresund connection is jointly owned by Svenska Kraftnät and Energinet.dk, but a decision to limit capacity from one of the owners is superior to the other actor's decision, i.e. one owner is dominant in the limitation decision. Moreover, Energinet.dk informs Svenska Kraftnät about their decision, and then Svenska Kraftnät forms the conclusion and rules based on inside information.

When the capacity on the Oeresund connection is reduced to handle capacity constraints in cuts in the domestic Swedish transmission system, congestion may occur. When the flow is westbound (to Denmark – 91 per cent of the limited time in the data set) prices basically increase in Denmark and decrease in Sweden. This implies a net cost of the regulation for Denmark and a net benefit for Sweden. In Denmark the cost is increasing prices, in Sweden the benefit is reduced prices and avoided counter trade cost.

The net cost for Denmark is calculated to 800 mill. DKK since 2000. The net benefit for Sweden is calculated to 350-450 mill. DKK since 2000. Since prices do not change in Sweden, according to the study, this is basically avoided counter trade cost. The figures in the report implies a total loss for the Nordic market of 350-450 DK since 2000, which indicate a loss of efficiency in the Nordic market. In section 8.9 some of these results are questioned.

## **7.2. The relevant market**

This chapter defines the relevant market. The objective is to show that Svenska Kraftnät abuses market power in the Nordic power market by limiting capacity in trans-border trade to handle domestic bottlenecks. Three arguments apply; i) Oeresund is a relevant market separate since transmission between Denmark and Sweden through this connection cannot be substituted by domestic transmission in either country; ii) Transmission in each direction (Denmark-Sweden and Sweden-Denmark) are separate markets since there is no substitution between them; iii) The decision structure concerning limitations favours Svenska Kraftnät, and they have an economic motive to limit capacity unilaterally.

## **7.3. The effect on prices (capacity limitations create congestion)**

In this chapter a large number of econometric models are applied to identify the cost and benefits for Danish and Swedish consumers. All models are single equation models where price is the variable to be explained. In the simplest models the only explanatory variables are seasonal patterns and capacity limitations. In the more complex models additional variables like electricity demand in both markets (Sweden and Denmark), production of electricity by different technologies (wind, central production) in Denmark and some binary variables handling the direction of flows are included. Different kinds of dynamics in the models are tested. Both single Danish price equations and simultaneous Danish and

Swedish market price equations are tested. The results for all models are reported. It seems as if there are serious problems with autocorrelation, serial correlation and heteroskedasticity (non efficient parameters estimated) in the models. Several kinds of measures to deal with these problems have been applied. We have to remember that estimation like this implies some average effects of each variable in the model during the estimation period. It is not obvious that this is a good representation of the actual hour by hour market, see chapter 8.9 below.

The study does not seem to conclude with respect to which model performs best; it reports results from all models (based on the statistics for each model some models could be ruled out?). The most simplistic models explain only 35-40 per cent of the variability in prices. The most complex ones seem to explain more than 90 per cent of the variation in the prices. The prices in Denmark have, according to the report, in average been 47-109 per cent above higher in the hours when Svenska Kraftnät has limited the capacity in the Oeresund connection (the sign is intuitive but the variation is tremendous?). All models indicate that prices in Sweden would not drop if the limitations on the Oeresund connection were abandoned. It is not clear what the study means by “Sweden” – the origin of the limitation was a capacity constraint *somewhere* in Sweden, i.e. prices should increase for some part of the Swedish market and increase in some part – i.e. some Swedes have gained, some have lost?

#### **7.4. The effect on price volatility**

In this chapter the study establishes *a new* model to estimate the change in volatility in prices when capacity of the Oeresund connection is limited. Again, the model is based on a single linear equation in the variables. The variable to be explained is volatility, the natural logarithm of the intraday sum of squared gross returns. Explanatory variables are the congestion, the lagged volatility, time, and dummies for weeks and month. It is unclear to the reader why they estimate a whole new model for this study, instead of applying the model estimated in chapter 3. A completely new model implies inconsistency between the results in chapter 3 and chapter 4? Autocorrelation seems to be a problem in this model too.

The conclusion is that volatility in prices in Denmark on congested days where 250 per cent above the volatility in days without congestion.

#### **7.5. Congestion if no limitations**

In this chapter the study analyses the number of hours with congestion in the Oeresund connection if no limitations of the capacity existed. They calculate the probability that the connection is constrained if no limitation on the connection is applied. This is calculated as the number of congested hours in the absence of capacity limits divided by the total amount of hours without capacity limits in the southbound connection multiplied with the amount of remaining congested hours given a hypothetical withdrawal of capacity limitations. How many hours that still will be congested is a complex market oriented question, see chapter 8.9 below, and this model then seem to be limited in this context? It is also an open question whether this approach is consistent with the approach in chapter 3 in the report.

The conclusion in the chapter is that only 88 hours would still be congested after abandoning the capacity limitations.

## **7.6. Capacity limitations in the KontiSkån connection**

This chapter mainly discusses differences in the origin and consequences of capacity constraints in the Oeresund and the KontiSkån connections. The main point made is that when the market faces a restriction in transmission in one direction the restricted area faces increasing prices, which applies for the KontiSkån connection. For the Oeresund connection this does not apply since the price effect is transferred to the neighbouring country by the way domestic restrictions are treated.

## **7.7. Economic losses and gains**

In this chapter gains and losses are calculated, cfr. chapter 8.1. In addition to the uncertainty with respect to parameters and model choice several assumptions have to be made: What is the price before and after (cfr. the model in chap.3 in their report), what is the demand before and after, and what is the marginal cost of production within and around the area in mind before and after? To compare with the case of counter trade price information for counter trade is needed (in this study this is based on assumptions from Svenska Kraftnät). Basically all this could be handled in a simultaneous supply and demand model for this market, see chapter 8.9 below, but since the calculations are based on a single price equation, cfr. chapter 8.3, a lot of assumptions are made independently. Whether these are inner consistent is vague.

The results are reported in chapter 8.1 above.

## **7.8. Counterfactual simulations**

As mentioned above the applied model is based on linear equations and all the parameters then are averages over a long period and several market characteristics. Therefore the project has asked NoordPool to conduct a simulation of prices of 22 specified hours in their “model”. How these hours have been selected, and whether they are representative to the actual issue is not properly specified. It seems as if 22 hours with different characteristics is a very small sample to draw any categorical conclusions?

The conclusion is twofold; i) the number of hours with capacity constraints in the Oeresund connection if no limitation were applied is very limited (1 out of 22 hours). The price in Denmark is approximately 60 per cent higher than in Sweden when capacity is limited (cfr. that in chapter 8.3 the price was 47-109 per cent higher – i.e. the Nordpool estimate is within the variability of the study). In table 18, chapter 7 in the report absolute price differences are reported –table 1 chapter 2 shows actual prices. But since the former is for only constrained periods it is not possible to find what average estimate the study has applied, i.e. comparison to the Nordpool simulations is impossible.

## **7.9. Evaluation**

The study explores a very interesting subject; what would prices have been if no capacity limitations of the Oeresund capacity had been implemented by Svenska Kraftnet, i.e. if all constraints in the system, both domestically and trans-border, were handled by a price area approach. The model applied is partly a single equation price model for Denmark and partly a simultaneous model for prices in Denmark and Sweden. A lot of statistical problems have been tested and attempts to circumvent those have been implemented. In some of the models the explanatory power is low in other it's high. This kind of modelling raises a fundamental question, how does it capture very short term detailed

cost characteristics in the system. Prices should equal marginal cost, which consist of production cost and capacity costs in the whole system. Both types of cost change continuously due to changes in the marginal plant which produces. Are you on an increasing part of the cost curve or on a constant capacity cost (cfr. stepwise marginal cost function and the shadow cost of capacity which could vary from zero to the difference between the actual and the next plant variable cost). What connection is restricted and how is the market responding to that restriction, i.e. what is actually the shadow cost of this constraint. These issues could be studied in a simultaneous demand and supply model, but it is an open question if the present model approach covers all issues mentioned. However, the model captures some elements, but to what degree we can not be sure. Then the actual numbers of losses and gains are highly uncertain. Besides, the models of price changes, volatility and changing constraints are not inner consistent since the models are independently estimated. The sign of the effect, increasing cost for Danes and decreasing cost for Swedes is intuitive. It is however an open question whether all Swedes gains or whether some gains and some lose. This depend upon which domestic connection is constrained and how much.

## 8. Capacity for Competition

*Capacity for Competition, Investing for an efficient Nordic Electricity Market. Report from the Nordic Competition Authorities, no 1/2007(84 pages)*

This study is not formally included in this evaluation. The study was public 13th September 2007. We limit our considerations to the conclusions that are relevant for the rest of the studies;

- The concentration in the market has increased. A special emphasis is on Vattenfalls acquisition of parts of Elsam and E2, and Statkraft has an even stronger position after the acquisition of Aker Energi and Trondheim Energi. Crossownership is widespread. When bottlenecks occur, strategic behaviour are possible. Bottlenecks may also be a result of strategic behaviour.
- The Nordic competition authorities (NCA's) support Nordel's five prioritised investments, on the condition that the investments are socio-economic profitable. Then the competition problems in the Nordic market will be reduced.
- Price signals caused by bottlenecks in the transmission system contribute to creating incentives for efficient investments both in production an the transmission grid. It is a crucial prerequisite that correct price signals are visible for market participants.
- The auctioning of transmission capacities between the Nordic countries and the surrounding connections is inefficient.
- Optimal grid investments should be based on Nordic welfare.
- The NCAs stress the importance of harmonized rules to compensate TSOs for transit of electricity.
- In a well functioning market price is the most important investment signal. A stable, predictable regulatory framework is necessary. Regulation should not disturb necessary investment signals.
- The NCAs support EU when evaluating more use of auctioning of Greenhouse gas allowances.
- The NCAs recommend ownership unbundling between production and transmission in the electricity market.
- The NCAs support the work against a Nordic retail market and improvement of the market price awareness through a more refined metering.

## Reference list:

Bye and Hope (2006): Electricity market reform – The Norwegian Experience in *Competition and Welfare, the Norwegian Experience* (Sørgaard Lars eds.) The Norwegian Competition Authority, 2006, pp 21-50

Bye, T. and P.V. Hansen (2007): Do spot prices affect aggregate demand for electricity. An econometric study of Norway and Sweden. Forthcoming Discussion paper, Statistics Norway

Singh, B., and F. Skjeret (2006): Ownership relations and the cooperation in the Norwegian power market. SNF-Report No. 35/2006, pp 47

Bye, T. (2007): Country Comparison on the Electricity markets – The NordPool area. Memorandum, Oslo 2007 (pp 15)

Purjasoki, Matti (2006): Performance of electricity wholesale and retail markets, report Ministry of Trade and Industry, Administrator, 2006- (44 pp)

Konkurrensverket (2007a): BAKGRUNDS-PM, 2007-05-07 Dnr 408/2006 ; Marknadsandelar och elhandelsmarginer for E.ON, Fortum och Vattenfall Market shares and price margins for E.ON, Fortum and Vattenfall (9pp)

Konkurrensverket (2007b): BESLUT 2007-05-07 Dnr 408/2006: Ifrågasatt samarbete om produktion vid gemensamt ägda kärnkraftverk och eventuellt missbruk av dominerande ställning på elmarknaden. Cooperation and abuse of market power in jointly owned nuclear power plant in the electricity market. (8pp)

Generaldirektøren(Clas Norgren) (2007): Näringsdepartementet, 103 33 Stockholm, 2007-05-07 Dnr 408/2006: Konkurrensförhållanden på elmarknaden. (13 pp)

Energimyndigheten; Energimarknadsinspektionen; Ägarstrukturen på elmarknaden. Vem äger hva på den svenska elmarknaden? (40 pp + ref)

Communication from the Commission, Brussels 10.1.2007 COM (2006) 851 final. Inquiry pursuant to Article 17 of Regulation (EC) No 1/2003 into the European gas and electricity sectors (Final Report) (15pp)

Energimarknadsinspektionen (2006): Price formation and competition in the electricity market (Prisbildning och konkurrens på elmarknaden: En rapport från Energimarknadsinspektionen) ER 2006:13 (189 pp)

Energimarknadsinspektionen; Price areas in the electricity market (Prisområden på elmarknaden (POMPE). Gemensam rapport från energimarknadsinspektionen, Svenska Kraftnät, Svensk Energi och Svenskt Näringsliv (87pp)

The Economic Consequences of capacity limitations on the Oeresund connection, 16.november 2006, 29402 Energinet.dk, Copenhagen Economics (77 pp)

Capacity for Competition, Investing for an efficient Nordic Electricity Market. Report from the Nordic Competition Authorities, no 1/2007(84 pp)

Nordiske konkurransemyndigheter (2003):