



Coordination of network operations and system responsibility in the Nordic electricity market

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Nordic co-operation on energy

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Nordic co-operation, one of the oldest and most wide-ranging regional partnerships in the world, involves Denmark, Finland, Iceland, Norway, Sweden, the Faroe Islands, Greenland and Åland. Co-operation reinforces the sense of Nordic community while respecting national differences and similarities, makes it possible to uphold Nordic interests in the world at large and promotes positive relations between neighbouring peoples.

Co-operation was formalised in 1952 when *the Nordic Council* was set up as a forum for parliamentarians and governments. The Helsinki Treaty of 1962 has formed the framework for Nordic partnership ever since. The *Nordic Council of Ministers* was set up in 1971 as the formal forum for co-operation between the governments of the Nordic countries and the political leadership of the autonomous areas, i.e. the Faroe Islands, Greenland and Åland.

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Executive Summary

Abstract

Increased harmonization in the Nordic electricity market can lead to improved economic efficiency and a better functioning market. However, for many issues it is not harmonization as such that bring benefits, but coordination around the right policies. In this report several key harmonisation issues are identified. Optimal grid investments, and price signals to market participants to handle congestions and costs in the grid are probably the most important. The creation of a joint Nordic TSO could facilitate further harmonization. However, there are several practical challenges, most importantly ownership issues and political issues, which create significant obstacles which may be severe enough to prevent a successful move towards a joint TSO. Other less far reaching organizational changes, such as the creation of a Nordic grid company may be considered. Such a solution will however only handle a limited part of the issues, and it can also be questioned to what extent it brings actual benefits compared with a purely cooperative solution. Albeit, on the basis of a market survey of key stakeholders we have completed there are different views on how well the current cooperative approach is functioning. It does seem clear that increased commitment and focus on the Nordic perspective is needed from the TSOs.

Background

In this report ECON has been commissioned by the Nordic Council of Ministers (hereafter NCM) to study the issue of coordination of network operations and system responsibility in the Nordic electricity market. The background to the assignment is the Akureyri declaration in which the NCM advocated further integration and deepened cooperation in the Nordic electricity market. The NCM specifically asked the Nordic TSOs to investigate how increased coordination of the system responsibility, joint organization and financing of investments in the network, and handling of peak load can be managed in the Nordic Market. Nordel, the association of the Nordic TSOs, delivered a report to the NCM on 1 March 2005. In this study the work done by Nordel is followed up, and concrete possibilities for further integration in the Nordic market should be outlined. The study has been conducted in two phases.

Problem statement and method

Further harmonization may lead to increased efficiency and improved functioning of the Nordic electricity market. In this report two basic questions are asked:

- Which issues are most important to focus harmonization efforts on?
- How can different models for harmonization of network operations and system responsibility contribute to increased efficiency, and under what conditions?

The study has been conducted using two main methods. The primary method has been based on in-house research of relevant written documents and other public sources. This work has been supplemented with clarifying interviews/questions by e-mail or telephone when necessary.

The second method used has been a stakeholder survey where a web-based questionnaire has been sent out to relevant market participants and authorities. In addition we have conducted in-depth interviews with the national TSOs.

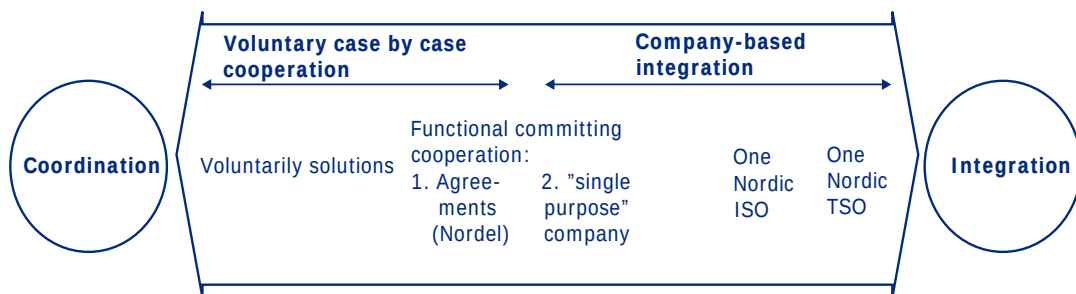
Conclusions and recommendation

Main conclusions

- It is not harmonization as such that bring benefits, but coordination around the right policies
- Identified key issues for harmonization/coordination:
 - Optimal grid investments
 - Correct price signals to market participants to handle congestions and costs in the grid
- The creation of a joint Nordic TSO could facilitate further harmonization
- Identified key practical challenges in achieving harmonization/coordination:
 - Ownership issues and Political issues
 - Creates significant obstacles for a successful move towards a joint Nordic TSO
- Creation of Nordic grid company a less far reaching organizational change
 - Will only handle limited part of issues
 - Actual benefits compared to purely cooperative solution can be questioned
- Different views on how well current cooperative efforts are functioning

- However, it seems clear from our analysis that increased commitment and focus on the Nordic perspectives is needed from the TSOs.

In order to get further on the way towards harmonization on the Nordic market on the TSO level there are two main directions that come out. Currently the operation of the Nordic market is based on a series of voluntary agreements between the four national TSOs. To further develop this way of functioning of the Nordic market there are essentially two types of approaches from which to choose from. The first direction points towards keeping the existing Nordic TSO organizations intact and seek to *improve cooperation* through more formalized cooperation agreements. The other main direction follows a path to adopt an approach which results in some form of *company based integration* of the existing TSO activities. A schematic illustration of the two types of approaches and main model types within each approach is given below.



Based on this we have developed five organizational models, which have been used as a starting point for discussions with stakeholders throughout the work process. These models are:

- Continued and improved harmonization
- A joint Nordic TSO
- A joint Nordic ISO
- A Nordic grid/inter-connector company for new investments
- A Nordic Market Operator (ISO with increased functions).

In order to evaluate these models a number of key issues have been identified. For most of these there is no clear link between the organizational structure and the possibility for increased harmonization. In general all the problems could be solved through negotiations and agreements between the Nordel members or bilateral agreements. In principle side-payments could make such agreements easier to reach, but in practice this may be very difficult.

Table A gives a summary of the key issues along three dimensions. The first one relates to how important harmonization is, primarily the potential efficiency gains that can be accomplished. The second dimension is how difficult it is to reach further harmonization and the third one relates to whether organizational change is needed, or continued and improved cooperation in line with the current situation will be sufficient. At this moment we do not discuss the practical problems related to politics, regulation etc., but that is dealt with in a later chapter 8.

We wish to stress that this is not by any means any exact science, but this is an attempt to categorize the issues and provide a general overview.

Optimal grid investments

The evaluation above indicated that there are large potential gains from improved grid investments and consequently this issue is given a high priority. We have here focused on methods to achieve *optimal* grid investments, but in our view this is very hard to accomplish. The fundamental reason is that decisions on grid investments will be made over and over again, and it is not sufficient to once and for all agree on some common principle. In addition, cost-benefit analysis of grid investments is very complex, implying that it is far from certain that an undisputed “scientific” basis for these decisions can be reached. For this reason organizational change, preferably a Nordic TSO, seems to be needed to accomplish *optimal* grid investments. A grid company for new investments could possibly help in coordinating these decisions, but to which extent is uncertain and depends on how strong mandate such an organization can be given. The fact that we claim that organizational changes are needed to achieve *optimal* investments, does not mean that it is not possible to improve the current situation through a cooperative approach, but it will most likely not lead to the optimal solution. On the other hand, since the cost-benefit analysis of grid investments is very complex, several parties that need to agree may provide some checks-and-balances that leads to improved decisions. The drawback would then be that it would take longer to reach these decisions, and in some cases an agreement may not be reached.

Congestion management and tariff models

Harmonization of congestion management and tariff models is to a large extent the same issue, since both deals with sending the correct price signals to the market. The total benefits of providing these price signals are most likely high. The congestion management is probably the more important of the two and is given a high priority; while harmonization of tariff model is given a medium priority. In both cases the difficulty for further harmonization is seen as medium. The reason for this is that the different TSOs have fundamentally different views on how these issues should be solved, which would warrant a high level of difficulty. On the

other hand, for these issues it would to a large extent be enough to agree once and for all on the principles to apply. Given such an agreement each TSO could then apply these principles independently. Since there is not the same need to continuously reach new agreements the level of difficulty is down-rated to medium. Again, since it is enough to reach an agreement on principles there is no real need for organizational changes. However, the creation of one joint Nordic TSO, would probably force this organization into adopting common principles. The fundamental difference in views would however not be resolved by an organizational change.

Ancillary services and peak reserves

Ancillary services and peak reserve capacity are to some extent very similar, but in other ways quite different. For both these issues there would be potential gains from increased harmonization. There is however already a common regulation market, and the TSOs have some possibilities to secure reserves outside its own area. The harmonization has thus come quite far already. For this reasons further harmonization is given a low priority level, which of course does not mean that continued harmonization to reap additional benefits should not be done. Since there is a general agreement on these kinds of reserves, and it should mostly be a technical issue to solve the practicalities the level of difficulty is also seen as low.

Peak reserve capacity is in this technical sense similar. If such reserves are to be procured by the TSOs, this should be done on a common market (given the technical restrictions). The problem is instead to agree on whether this is a task for the TSOs. All the TSOs seem to agree that this should not be a task for them, but still it is in some cases. A common view on whether this is needed, and if so, how it should be implemented without disturbing the market is important. Centrally procured peak capacity reserves can potentially disturb the market. Without coordination, or at least procurement on a common market, there is a risk that these reserves will not be obtained in the cheapest way and in the most suitable places from a Nordic perspective. The fact that the TSOs have a common view on such reserves, would lower the level of difficulty to increase the harmonization. However, there is considerable outside pressure from politics and market participants which could push the other way and for this reason the level of difficulty is seen as medium.

For neither ancillary services nor peak reserves organizational changes seems to be needed. For ancillary services continued cooperation will most likely be sufficient. Of course, a joint Nordic TSO, would probably facilitate the process towards a harmonized treatment of peak reserves, but the main difficulties seem to be outside the TSOs and have to be resolved on other levels.

Harmonized balance settlement

Harmonized balance settlement is a way to facilitate the creation of a single end-user market. We concur that differences in the balance settlement is one obstacle for creating a single end-user market. However, there are many other as well and a harmonization of balance settlement would most likely not be sufficient to achieve the goal. For this reason the harmonized balance settlement is given a low priority.

The level of difficulty is rated as medium. The reason is the same as for congestion management and tariff models. It would be sufficient to agree on common principles and it would not require new negotiations and agreements continuously. For technical reasons this service should possibly be centralized, which should not be a major problem. The difficulty lies instead with different views on which is the optimal model, which may be due to that there actually are differences in the optimal solution between the countries.

Solidarity in crisis situation

We have briefly touched upon the issue of solidarity in a crisis situation. We have not been able to evaluate to which extent this is a real problem, and can thus not draw any conclusion on the priority level. However, if it is a problem it would be quite difficult to solve since it basically depends on trust. Such trust could be built by long term interactions, where solidarity is shown in repeated situation. These cases are however few. For this reason integration into one organization would be a way to solve this issue.

Table A Summary of key issues

Key issue	Priority level	Harmonization difficulty	Organizational change needed?
Optimal grid investments	High	High	Likely. For optimal solution
Congestion management	High	Medium	Bilateral/cooperative solution possible. Organizational change facilitates.
Tariff harmonization	Medium	Medium	Gradual harmonization through cooperation. Organizational change facilitates.
Ancillary services and peak reserves	Low (ancillary serv.)	Low (ancillary serv.)	No
	Medium (peak capacity reserves)	Medium (peak capacity reserves)	
Harmonized balance settlement	Low	Medium	No
Solidarity	Uncertain	If the problem exists: High	Yes?

Practical challenges

Table B gives a summary of the practical challenges along three dimensions. The first one relates to how important the factor is for a possible organizational change, and this primarily relates to the size of the potential practical obstacle that is related to the accomplishment of an organizational change. The second dimension is how difficult it is to reach a harmonization and the third one relates to whether organizational change as a consequence can be viewed as possible or if the practical challenge is judged to be large enough to hinder an organizational change in the near future.

One serious practical challenge for organizational change is the ownership issue. As previously described the Nordic TSOs have different ownership structures. Three of the TSOs (Energinet.dk, Statnett and Svenska Kraftnät) are fully state-owned, while the fourth (Fingrid) has a mixed private and state ownership. It would both be difficult to allocate the ownership shares, but in addition the state dominance that almost by necessity would arise in a joint Nordic TSO is probably problematic from the Finnish viewpoint. The first issue would then be what ownership structure a new joint TSO should have. The issue is of high importance for the possibilities of a successful organizational change into a joint Nordic TSO and the expected difficulties in agreeing deem an organizational change unlikely.

The mandates given to the TSOs are in some respects a bit vague and the wording differ between the countries. We have discussed how the current TSOs mandates differ broadly in scope and that there may also be different interpretations amongst the companies as to how they should fulfill their respective obligations. This need not be a problem given that the TSOs have a long history during which their tasks have been defined. In that sense the TSOs “know” what their tasks are and the exact wording in the mandates may not be of the greatest importance. However, if a new entity is to be formed the need for clearly defined mandate becomes much more urgent. This should however not cause too large obstacles for carrying out an organizational change.

The regulation of the TSOs differs between the countries. The creation of a joint Nordic TSO, and to some extent also a Nordic grid company with a less broad mandate, would call for a harmonization of the regulation. It is always hard to regulate TSOs, since many of its decisions are extremely complex (e.g. investment decisions), and it is far from certain that it is meaningful that a regulator should approve the TSO decisions. In a Nordic context four different regulators with very different approaches to regulation would also have to agree. A more detailed regulation seems more difficult to agree on.

As for political acceptance it is clear that energy markets in almost any country are politically important for various reasons. Policy harmonization is at least as important for improved efficiency as harmonization of

the system responsibility. If a new Nordic entity is to serve as a coordination mechanism it probably needs to have a strong mandate, which would mean that the governments must give up much of their influence over the TSO operations and the possibilities to use the TSO for other energy policy objectives will diminish. This may prove to be quite a significant hurdle on the way to organizational change.

Denmark and Sweden has chosen to put the system responsibility for the gas market within the same organization as the system responsibility for the electricity market. Obviously they have found the solution in which the system responsibility for both sectors is integrated into the same organization beneficially. This should not be a dominating issue when considering a possible organizational change towards a joint Nordic TSO but it could not be ruled out that it may be an issue that creates some conflict.

Table B Summary of practical challenges

Practical challenge	Level of importance	Harmonization difficulty	Organizational change possible?
Ownership	High	High	Unlikely
Mandate and scope of responsibility	Medium	Medium	Yes, need for consensus view and clarifications in many cases.
Regulatory issues	Medium	Medium	Yes, but calls for harmonization of the regulation
Political acceptance	High	High	Unlikely, politicians need to give up much influence
Harmonization of countries vs energy systems	Low	Low	Yes

Conclusions

To summarize, from a purely technical perspective there seem to be advantages of creating a joint Nordic TSO. Such an organizational change could however have large redistributive effects, but need not have that given that tariff levels are differentiated between countries. In that case the tariff differentiation should primarily be on the consumer side, while the residual tariffs for producers should be equalized. Marginal losses and other marginal costs, should of course be reflected in the tariffs independently of whether it is a producer or consumer that pays it.

Most respondents in the stakeholder consultations question the move to a joint Nordic TSO for these practical reasons, although many see the principle advantages.

The two different ISO models that were presented to the stakeholders received little support, and most stakeholders question the idea of an ISO-solution. There seem to be strong arguments for keeping grid and system

responsibility integrated and this is also the preferred solution in most places in Europe. ISO solution has been chosen in other parts of the world, but the primary reason seems to be that it is difficult to transfer the ownership of the grid when these are privately owned. This argument has some relevance also for the Nordic area, given the ownership status of Fingrid, but the benefits of keeping grid and system responsibility together are probably larger even if it implies that four separate TSOs remain.

A grid company handling investments could speed up investments, and improve the Nordic coordination. Still, this solution would most likely require some negotiations between the TSOs and the fundamental conflict would not be resolved. One possibility is to give such an organization a very strong mandate, but it is questionable if it is possible to hand over the necessary decision power.

The views regarding the current cooperative approach differ. Some stakeholders mean that it works quite well, while others have the opposite view. It does seem clear that stronger commitment to the cooperative process is needed.

1 Introduction

In this report ECON has been commissioned by the Nordic Council of Ministers (hereafter NCM) to study the issue of coordination of network operations and system responsibility in the Nordic electricity market. The background to the assignment is the Akureyri declaration in which the NCM advocated further integration and deepened cooperation in the Nordic electricity market. The NCM specifically asked the Nordic TSOs to investigate how increased coordination of the system responsibility, joint organization and financing of investments in the network, and handling of peak load can be managed in the Nordic Market. Nordel, the association of the Nordic TSOs, delivered a report to the NCM on 1 March 2005. In this study the work done by Nordel is followed up, and concrete possibilities for further integration in the Nordic market should be outlined. The study has been conducted in two phases.

The first phase contained the descriptive elements of the project and an initial evaluation. This phase ended with a workshop in connection to the presentation of the mid-term report.

The second phase has primarily included a deeper analysis and evaluation of the organizational models and objectives.

1.1 Scope of the study

The first phase includes the following elements:

- Description and initial evaluation
 - Description of crucial similarities and differences in the Nordic TSOs.
 - Description of the models for system responsibility and network operation in other well functioning electricity markets.
 - Description of different organizational possibilities.
- Initial evaluation of the different organizational models

The second phase of the project contains a thorough analysis of the pros and cons of the different organizational models for a closer coordination between the Nordic TSOs. This analysis was based partly on results from phase 1 and in-depth interviews with the Nordic TSOs.

1.2 Nordel's ongoing work

Nordel, the organization of the Nordic TSOs, has traditionally and is currently working with harmonization issues. One such issue, where progress is proving to be slow, is regarding the management of trading capacities and bottleneck situations. More specifically, this involves establishing common principles as to how and when bottlenecks can be moved to the border. Other ongoing Nordel work concerns identifying new optimal Nordic grid investments, and developing modeling apparatus to evaluate the potential investments from a Nordic welfare economic perspective. In addition, there is the completion of planned activities covering analysis of harmonized balance settlement and common market reserves.

1.3 Method

The study has been conducted using two main methods. The primary method has been based on in-house research of relevant written documents and other public sources. This work has been supplemented with clarifying interviews/questions by e-mail or telephone when necessary.

The second major method used has been a stakeholder survey where a web-based questionnaire has been sent out to relevant market participants and authorities.¹ In addition we have conducted in-depth interviews with the national TSOs.

The result of the work conducted during the first phase has been documented in a mid-term report and presented in a workshop. This workshop has provided the NCM and other stakeholders with an opportunity to react to the findings in the first phase.

During phase two the in-house research has been focused on a more in-depth analysis of the issues of coordination of network operations and system responsibility in the Nordic electricity market.

1.3.1 Stakeholder survey

In order to get some other views on the subject of harmonization part of the study has been focused on a stakeholder survey. The object with this has been to not only base the analysis and conclusions on theoretical analysis but rather to include the experiences and views as expressed by relevant stakeholders active on the Nordic market.

The survey was sent out to TSOs, government authorities, producers, large users and industry organizations. All in all about thirty questionnaires were distributed and about half of them were returned. In phase 2 of

¹ ECON has used the web-based questionnaire system Questback.

the project the questionnaire was followed up with in-depth interviews with the four Nordic TSOs.

2 Current organization of the Nordic TSOs

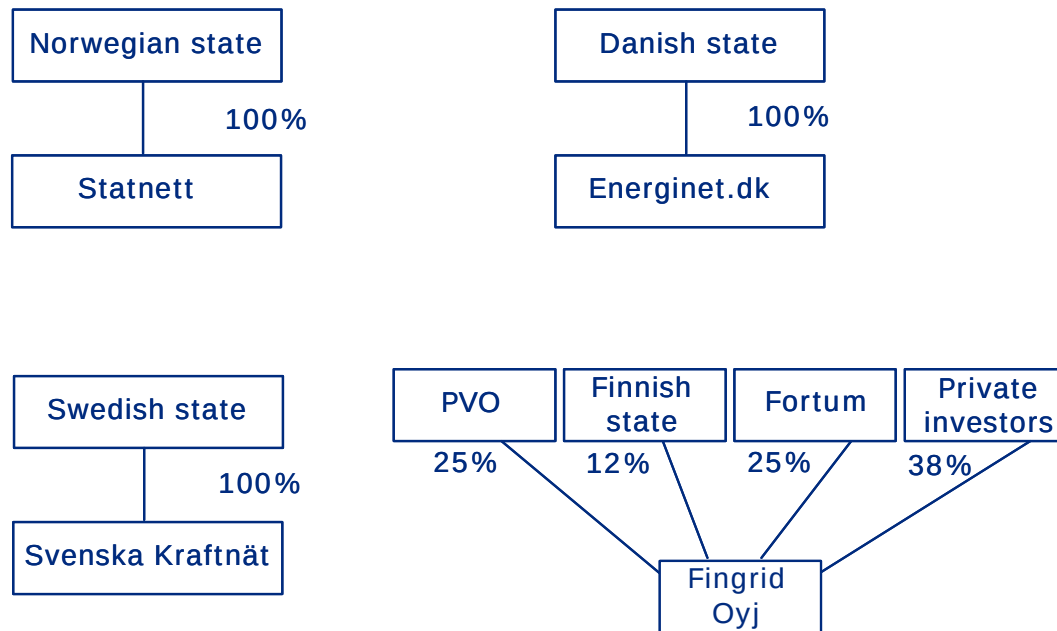
The Nordic power system consists today of the national power systems of Denmark², Sweden, Norway and Finland together with a number of cross border transmission lines between the countries which bind the national grids into one interconnected system. The different national systems are operated by national transmission system operators, but with mutual agreements on both short-term operational issues and long-term developments. This chapter provides an overview of the current organization of the Nordic TSOs. The main differences that exist relate to company form and regulative framework.

2.1 Ownership structure

In December 2004 the Energinet Denmark law was passed, making the two previous TSOs, Eltra (West Denmark) and Elkraft (East Denmark) wholly owned subsidiaries³ of the company. After these changes in Denmark, all the Nordic TSOs except Fingrid are now fully state-owned. Fingrid is a limited company with a mixed ownership. Being partly private and partly state-owned. Affärsverket Svenska Kraftnät is a state authority (and thus legally part of the state). Statnett SF is owned 100% by the Norwegian state.

² West Denmark is part of the synchronous European system and as such has to follow UCTE rules.

³ The actual merger took place in the autumn of 2005 with retrospective effect from 1 January 2005.

Figure 2.1 The different ownership structures in the Nordic countries

Source: Company annual reports and ECON.

2.2 Associates and subsidiaries

As a supplement to the analysis in the next chapter section we here provide an overview of the Nordic TSOs associate and subsidiary companies. This overview gives to some extent an improved sense of the scope of activities in the Nordic TSOs.

Table 2.1 Associates (A) and subsidiaries (S).

TSO (S)/ Ownership share	Company Name	Function
SvK	SwePol Link AB (S)	Operation and maintenance of power link between Sweden and Poland.
SvK	Svenska Kraftnät Gassturbiner AB (S)	Secure disturbance reserves to management peak load situations.
SvK	Svenska Kraftkom AB (S)	Conducted certain R&D and marketing activities in the telecom sector on behalf of the parent entity
SvK/ (50%) StN/ (50%)	Nord Pool ASA (A)	Nordic power exchange
Nord Pool ASA/ (20%) SvK/ (20%) StN/ (20%) FiG/ (20%) EnD/ (20%)	Nord Pool Spot AS (A)	Nordic power exchange (physical transactions)

TSO (S)/ Ownership share	Company Name	Function
SvK	Triangelbolaget D4 AB (A)	Administers optical-fiber infrastructure (Stockholm-Oslo-Göteborg-Malmö-Stockholm)
SvK	Kraftdragerna AB (A)	Secures transport of heavy infrastructure equipment (transformers etc). Co-operates with Statnett Transport.
SvK	STRI AB (A)	Research and development within power transmission
SvK	Elforsk AB (A)	Research and development within the power industry.
StN	Statnett Transport AS (S)	Secures transport of heavy infrastructure equipment (transformers etc).

Source: Companies annual reports 2004.

2.3 Regulatory framework

There are differences in the regulation of the Nordic transmission services. Whilst the Norwegian TSO is regulated by means of a revenue-cap, the Danish TSO's are subject to rate of return regulation, and the TSO in Sweden is self-regulated in practice. More specifically, there are no principles for regulation of SvKs tariffs. The regulator can be characterized as a "watch dog", only intervening when customers complain about grid tariff levels. In other words, the TSO has the possibility to develop tariffs quite independently and seek approval from their customers. The regulation in Finland used to resemble the Swedish situation. From the beginning of 2005 Finnish legislation was changed which for tariff regulation meant ex-ante regulation and supervision periods of four years. The implication of these differences for the creation of a new organizational entity is discussed in Chapter 8 concerning practical challenges.

2.4 Nordic cooperation and the Nordic Grid Code

Nordel is the association representing the Nordic TSOs, working to improve the functioning of the Nordic power market. In 2004, Nordel published the Nordic Grid Code which sets out to harmonize the rules that govern various national grid companies. The formulation of this common code for the Nordic grid can be viewed as a step towards the harmonization of the rules that govern the various national grid companies. The purpose of the Nordic Grid Code is to coordinate the Nordic TSO operation and the operation of the transmission systems, with the goal to establish the best possible conditions for development of a functioning and effectively integrated Nordic power market. A further objective is stated to be to develop a shared basis for satisfactory operational reliability and quality of delivery in the coherent Nordic electric power

system. The Code lays down fundamental common requirements and procedures that govern the operation and development of the electric power system. The main codes agreement entered into by the Nordic TSOs contained the following:

- **General provisions for the collaboration** - governs technical collaboration between the transmission system operators in the interconnected Nordel countries: Norway, Sweden, Finland and Denmark.
- **Planning Code** - includes system planning criteria and other important aspects of system planning and design.
- **Connection Code** - specifies minimum technical requirements for connection of facilities to ensure the operational reliability of the Nordic power system.
- **Operational Code (system operation agreement)** – includes provisions regarding capacity allocation and congestion management.
- **Data Exchange Code** - includes a data exchange agreement between the Nordic TSOs

The Operational Code and the Data Exchange Code are binding agreements with specific solutions for solving a dispute. The Planning Code and the Connection Code are rules that correspond to Nordel's recommendations in these areas.

As regards system planning criteria, Nordel presents a system development plan every two years. The latest plan from June 2004, titled "Priority Cross Sections", focused on which specific interconnector projects would contribute most to improving security of supply in the Nordic market area. In February 2005 Nordels members came to agreement over a common financing mechanism to finance such projects. The main element of the financing mechanism is that congestion rents will be earmarked for the interconnector projects. The aim is that this initiative will help speed up the construction of these interconnectors, and in 2007 Nordel will evaluate the effectiveness of the measures and on the basis of this whether a common financing organization is needed.

The Nordic Grid Code governs technical collaboration between the transmission system operators in the interconnected Nordel countries: Norway, Sweden, Finland and Denmark. Ideally, the planning, expansion and operation of all the subsystems would be governed by identical rules. However, this is not yet the case, partly for historical reasons and partly because the different subsystems are subject to different legislation and to supervision by different official bodies. However, an objective for Nordel is that the Nordic Grid Code should be a starting point for the harmonization of national rules, with minimum requirements for technical properties that influence the operation of the interconnected Nordic electric power system. The Nordic Grid Code must, however, be subordinate to

the national rules in the various Nordic countries, such as the provisions of legislation, and the conditions imposed by official bodies.

This first edition of the Nordic Grid Code was based on Nordel's former rules (recommendations), consisting of the System Operation Agreement, the Data Exchange Agreement and the National Codes.

No new Nordel recommendations have been introduced since 2000. The objective is that the content of the recommendations should be incorporated either in the Nordic Grid Code or in other binding agreements/documents. In its future development, the Nordic Grid Code should also be coordinated with rules established elsewhere, for example in UCTE, ETSO and the EU.

3 TSO responsibilities

In February 2005 a survey of the system responsibilities in the Nordic countries was completed (Hagman, 2005). The survey report discusses in detail the similarities and differences between the Nordic TSOs. One of the main findings was that there exist significant differences in the scope of mandate between the Nordic TSOs. More specifically, it was shown that Svenska Kraftnät and Energinet.dk perform a range of activities outside what are considered “standard” TSO functions. A second main observation was that mandate obligations related to technical functionality and operational reliability were broadly similar between the Nordic TSOs. The main exception from this conclusion is the use of price areas versus counter trading in bottleneck management.

This chapter, rather than trying to supplement the existing work, will seek to focus on TSO responsibilities in terms of which are most relevant to included if a new organizational entity is to be established. We will however firstly give a brief summary of what are “standard” TSO functions and other main obligations of the TSOs as given from their respective mandates.

3.1 System operator

3.1.1 *System services*

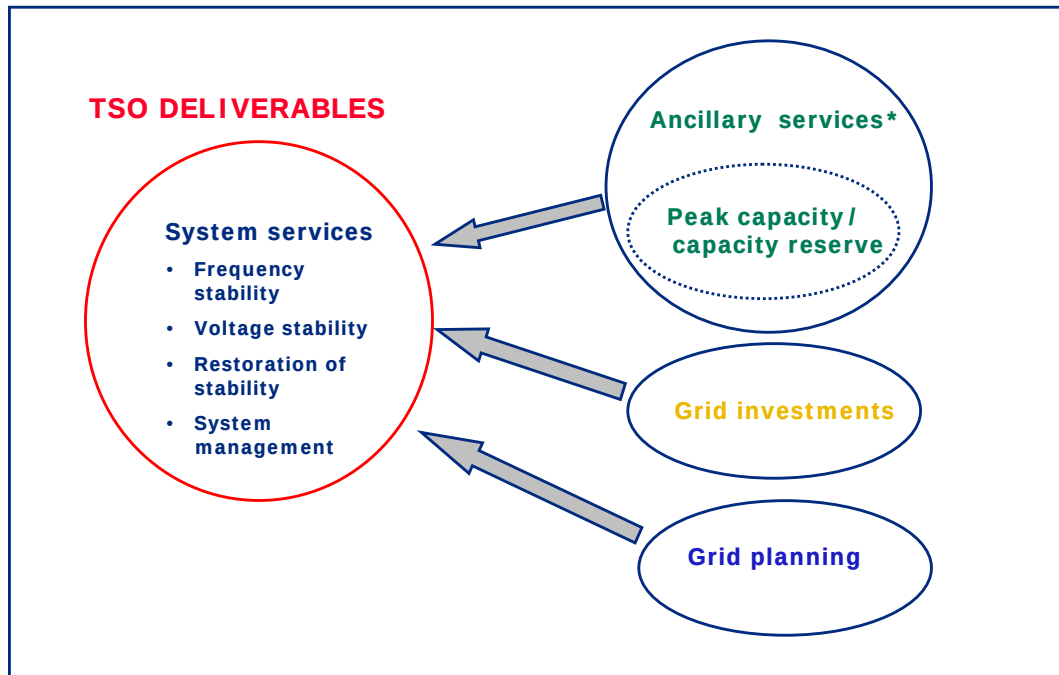
All the Nordic TSOs deliver *system services* to the users connected to the grid (see figure 2). System services can be thought of as consisting of a *quality* and a *management* component. Quality refers here to ensuring technical functionality and operational reliability of the power system. This includes keeping the momentary balance within each operational hour (e.g. total production equals total consumption) and managing the frequency of the system, which is a measure of its balance. The frequency of must be within a specific range around 50.0 Hz (+/- 0.1 Hz). Voltage levels in the system must also be regulated by the system operator. As for the management component, this entails restoration of system operations in the event of a black out and the daily operation of the grid.

3.1.2 *Ancillary services*

Ancillary services are the services procured by the system operator in order to deliver system services and are provided by network user (gene-

rators, customers) or system assets⁴. Procurement may occur via establishment of a balancing market or entering into bilateral contracts. There are a long list of types of such services (see Appendix). However, the most relevant for the purposes of our analysis is peak capacity and/or capacity reserves.

Figure 3.1 Overview of TSO deliveries, procurements and activities performed.



*A complete list of the ancillary services in the Nordel system can be found in the appendix.

Source: ECON.

All the Nordic TSOs operate their own Regulating Power Market (RPM) for disturbance reserves, to correct any imbalance between production and demand during the hour of dispatch. Sweden, Finland and East Denmark also have a common intraday market, the Elbas market, operating until the hour before delivery to provide extra balancing resources.

As of September 2002 the national TSO regulation lists were pooled into a common Nordic regulating market. In practice, this means that TSOs can offer and/or receive regulating services from other Nordic TSO (granted available interconnector capacity) to counteract imbalances.

3.1.3 Bottleneck management

A central part of system management involves the handling of bottlenecks in the transmission system. In Norway, Statnett is responsible for establishing price areas and engaging in counter trade to deal with per-

⁴ Official Eurelectric definition.

sistent and foreseen bottlenecks within the Norwegian system, and also those on the borders to Sweden, Denmark (Jutland) and Finland. Whereas Norway uses both price areas and counter trade to deal with internal bottlenecks, the rest of the Nordic TSOs only apply counter trade to balance the demand and supply of transmission capacity. By counter trading the TSO buys upward regulation on the production deficit side and downward regulation on the surplus production side of the bottleneck. Upward regulation means that generators are paid to increase their actual generation compared to their contracted generation. Through downward regulation the generator is compensated in a similar manner to generate less than what was bid in at the given system price. Actual compensation for up-/downward regulation is determined by the differential between the system price and the price in the respective regulating power market (counter trade market).

3.1.4 System planning

Another core function of a system operator's daily operation, includes market prognosis (power and capacity balances for a number of years ahead). All the Nordic TSOs have in-house planning divisions to complete long term power system development plans for many years ahead.

3.1.5 Long term security of supply

System adequacy is a term used when discussing whether the power system over time will deliver sufficient power to meet growing consumption levels and consumption peaks in extreme situations. The same term can also be thought of as the long term security of the power system. As documented below, the level of responsibility for ensuring system adequacy differs quite significantly between the various TSOs.

- **Energinet.dk** is obliged to maintain sufficient capacity through agreements with generators. Eltra had for the 2000-03 an agreement with Elsam and Elkraft had a similar agreement with Energi E2. A comprehensive planning in order to give a basis for an assessment of security of supply during the last 10 years must also be completed.
- **Fingrid** owns and leases capacity in gas turbines (circa. 850 MW) and contracts for load shedding with large industrial end users (circa 180 MW). Under the current legislative framework Fingrid has no predefined responsibilities regarding security of supply.
- **Svenska Kraftnät** has an obligation, expiring in 2008, to ensure that a maximum peak load reserves of 2000 MW is available. After 2008, market participant will be handed the responsibility for the maintenance of adequate peak load reserves in the system.

- **Statnett** is, as of 2005, furthermore obligated to assess the long term security of supply situation and invest in alternative solutions when necessary. Leasing of mobile gas turbine has been presented as a possible option in this context.

3.2 Grid owner

3.2.1 Grid investments

All the Nordic TSOs own considerable grid assets (see Table 3.1) and are responsible for ensuring an acceptable level of grid maintenance, reinvestments and new investments.

Table 3.1 Main grid assets of the Nordic TSOs

Company	Main grid assets
Statnett	Owns nearly all 400 kV and 220 kV grid lines including cross border interconnections to Denmark, Finland and Sweden.
Energinet.dk	Owns 400 kV grids in West and East Denmark including cross border interconnections to Norway, Germany and Sweden.
Svenska Kraftnät	Owns 400 kV and 220 kV grids in Sweden including cross border interconnections to Finland, Germany, Poland and East Denmark.
Fingrid	Owns 400 kV and 220 kV grid including most important 110kV grid lines. Cross border interconnections to Russia, Norway and Sweden.

Regarding operational and investment policies, the companies largely have approximately the same guidelines. The main focus as regards grid planning concerns the national grid system but there is also a great deal of cross border cooperation on this issues. The Nordic Planning Code sets up common rules that should be observed by the TSO, although the Planning Code is not binding. The companies generally operate with a certain degree of freedom within predefined frameworks. Svenska Kraftnät seems to have the most restricted operational and investment guidelines, especially concerning cost and investment level. The investment- and financing plan is determined by the government in the yearly regulation letter. In the regulation letter for 2006 a plan is determined for the budget years 2006-2008. In addition, new investment projects with an estimated total value above 100 million kronor should be sent to the government for approval. In Statnett's and Svenska Kraftnäts regulations it is explicitly stated that grid expansions are to be based on (welfare) economic cost-benefit analysis.

3.3 System responsibility for natural gas

The TSOs in both Denmark and Sweden also have system responsibilities for the natural gas sector in their countries. The difference is that Energinet.dk has ownership of gas infrastructure while Svenska Kraftnät functions simply as an ISO for gas in Sweden.

For Norway and Finland, with currently only limited gas distribution infrastructure, responsibilities have not yet been delegated. These activities could be considered a core activity for the two TSOs. However, this becomes a further complicating factor when considering which activities are to be merged into one common Nordic TSO. Nonetheless, this issue falls somewhat beyond the scope of this study and we have therefore chosen to exclude it when considering possible organizational models in the coming chapter.

3.4 Additional responsibilities

In addition to the activities described above the TSOs have, to a varying degree additional responsibilities and perform additional tasks. The list of such activities can be made very long, and below some of these tasks are presented. Some of these additional tasks are determined by the regulation (including regulatory letters from the government), while others are more voluntary for the TSO.

- All the Nordic TSOs have an obligation to issue renewable electricity certificates (RECS) for new renewable generation facilities. Svenska Kraftnät is also the accounting authority for the green certificate scheme that was set up in Sweden in 2003.
- Energinet.dk and Svenska Kraftnät also have additional responsibilities normally considered outside of a system operator's mandate.
 - Energinet.dk is obliged to buy green energy on a cost basis and distribute it to end users. The costs are covered by a specific PSO tariff.
 - Svenska Kraftnät has been given an emergency task. The company is paid approximately 270 MSEK/year for ensuring emergency preparedness in the electricity system. This includes strengthening regional plants and operational units owned by others. In addition, Svenska Kraftnät has responsibilities in relation to monitoring of dam safety.
- Rationing, contingency planning and dam safety

Sweden is the exception amongst the Nordic countries when it concerns these activities. Svenska Kraftnät is the authority responsible for Swe-

den's power supply contingency planning. This means that they have to plan, supervise and co-ordinate the electricity supplies resources in order to meet society's power requirements during times of crisis and war. In addition, responsibility of rationing and dam safety rests with Svenska Kraftnät. In the other Nordic countries, these activities have been delegated to other authorities.

- Telecommunication

Svenska Kraftnät has also been given a role in the development of telecom infrastructure in Sweden. This telecom infrastructure consists of two parts. Svenska Kraftnät has a telecom network to monitor and control the grid. This network also has external customers. In addition Svenska Kraftnät builds a broadband network and install opto-cables in the electricity grid. In 2000 SvK got a formal assignment from the government to build a backbone broadband network to all municipalities. By a new government decision in 2003 the assignment was changed, since it was decided that the municipalities should procure backbone connections. Svenska Kraftnät is a co-owner (together with E.ON Sverige, Vattenfall and Fortum) in Triangelbolaget, which offers connections between Copenhagen, Oslo, Stockholm, Gothenburg, Malmö and Helsinki.

- Research and development

Some of the TSOs carry out this in-house, but there is a trend towards increased outsourcing. This includes using universities and/or hiring external consultancy companies. Svenska Kraftnät is primarily involved in R&D through the part-owned companies Elforsk AB and STRI AB. Statnett has a target to use 1.2% of its annual revenue cap on R&D and states that 70% goes to projects outside of Statnett. Fingrid did, during 2004, finance a number of studies at different universities and Energinet.dk finance, among other things, research, development and demonstrations of environmentally friendly generation technologies as part of their PSO⁵ program.

3.5 Core vs. periphery responsibilities

In this section we attempt to classify the above into what we define as core and periphery responsibilities. Our definitions are as follows:

⁵ Public Service Obligation (PSO)

- **Core responsibility-** is included in the TSOs mandate and is part of the core function of the transmission system operator. They include *system operator* and *grid owner responsibilities*.
- **Periphery responsibility** – fall outside the scope of what determined core responsibilities and are relate to other tasks which the TSOs carry out on a frequent basis.

Nordel (2005) have described the common core of the system responsibility in the Nordic countries, which is in line with our definition. These tasks are:

- Ensure the operational security of the power system
- Maintain the momentary balance between demand and supply
- Ensure and maintain adequacy of the transmission system in the long term
- Enhance efficient functioning of the electricity market.

Table 3.2 presents the range of TSO responsibilities; some are carried out by only one of the existing Nordic TSOs while others are covered by all of them. Activities related to system operation have been highlighted in purple, those concerning grid operations in grey. Periphery activities falling outside these two categories have been highlighted in green.

As mentioned above, Hagman (2005) concluded that there are differences in the general definition of system responsibility between the Nordic countries and that this is of significance for the market development if the TSOs interpret their role in different ways. Different execution of the system responsibility can have a similar effect. A conclusion was thus that a common general definition of system responsibilities can be important for a further harmonization. Taking into consideration these definitional challenges, we have nonetheless attempted to broadly categorize the responsibilities of the TSOs by type.

Table 3.2 Overview of TSO responsibilities by type

	Activities	Svenska kraftnät	Energinet.dk	Fingrid	Statnett
SYSTEM OPERATOR	System services	●	●	●	●
	Ancillary services	●	●	●	●
	Balance settlement	●	●	●	●
	Long term security of supply	● *	● **	○	● ***
GRID OWNER	System planning	●	●	●	●
	Grid operation	●	●	●	●
	Grid financing	●	●	●	●
	Grid construction and maintenance	●	●	●	●
OTHERS	Rationing planning	●	○	○	○
	Contingency planning	●	○	○	○
	Dam security	●	○	○	○
	Telecommunication	●	○	○	○
	Research and development	○	○	○	○
	Transport services	●	○	○	●
	ISO Gas responsibility	●	●	○	○

● Clear mandate ○ Unclear mandate or no mandate

* = Temporary mandate to procure 2000 MW runs out in 2008.

** = Legal responsibility for security of supply and shall ensure sufficient production capacity.

*** = Responsibility to continuously investigate and develop necessary measures for handling extreme situations.

Source: ECON

4 Organizational models in other markets

4.1 ISO or TSO

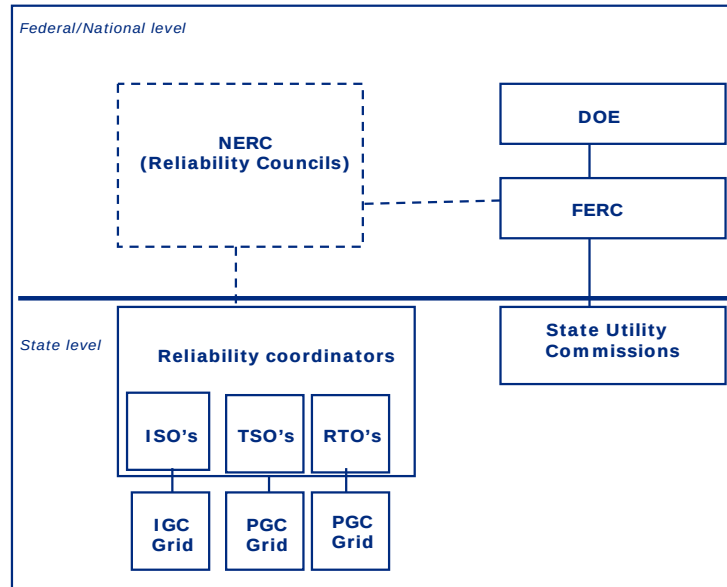
In the power sectors which have undergone restructuring over the past twenty years, one of two main models have been adopted when organizing system operations. In the Independent System Operator (ISO) model the company responsible for system operations has no ownership in the high voltage grid and functions as an independent entity (in most cases as a non-profit organization). In the Transmission System Operator (TSO) model there is one responsible entity that both owns and operates the high voltage grid.

Advocates of the TSO model claim that ownership of grid assets may help create better incentives for optimal grid maintenance and expansion. However, critics of this approach argue that grid ownership can often lead to sub-optimal investment decisions. For example, a TSO is likely to focus too much on congestion management when in fact (in some situations) from a power system perspective it would be more cost efficient to build new generation facilities.

The TSO approach is most commonly favored in European countries, whilst US regulators have increasingly adopted the ISO model supplemented with standardized regional markets.

4.2 US institutional structure

The US power system is not a single market governed by a harmonised regulatory and institutional structure, a market design commonly found in European countries, but rather a collection of regional markets with different market designs spanning one or more of the fifty states. Broadly speaking, there is currently a two-tier jurisdictional structure in place. Defining regional reliability standards, managing interstate trade and infrastructure coordination across regions have been the primary tasks of the Federal government. Whilst at the state level officials have to a large extent been granted jurisdiction over market design issues (i.e. congestion management, tariff structure, market organization etc.). This jurisdictional freedom at the state level helps explain why market designs have tended to vary from one state or group of states to the next. A simplified overview of the two-tier institutional structure in the US is provided in Figure 4.1.

Figure 4.1 US institutional structure

Note 1: PGC = Publicly owned grid company and IGC = independently owned grid company.

Note 2: The dotted line represents voluntary organizations which have no official jurisdictional authority. Note also that this chart does not reflect changes to institutional structure as a result of the newly passed Energy Policy Act

Source: ECON

At the national level there are the three main institutions⁶ shaping framework conditions:

- *Department of Energy (DOE)* - drafting energy legislation on behalf of the Federal government.
- *Federal Energy Regulatory Commission (FERC)* - regulation of transmission and wholesale trading between states.
- *National Electric Reliability Council (NERC)* – defining of mandatory reliability standards and system planning.

The institutions FERC and NERC will be discussed in more detail in following sections, as they play an active role in determining organisational structures for system operations in the US.

At the state/regional level the following institutions are involved in shaping framework conditions:

- *Reliability Coordinators* - which can be ISOs, TSOs or RTOs (defined and discussed in section 3.2.2) are responsible for monitoring system responsibility and system planning.

⁶ This list is by no means exhaustive; there are several more Federal and State/regional institutions and non-profit organizations which indirectly influence framework conditions. However, in our opinion the description of these bodies lies beyond the scope of this study.

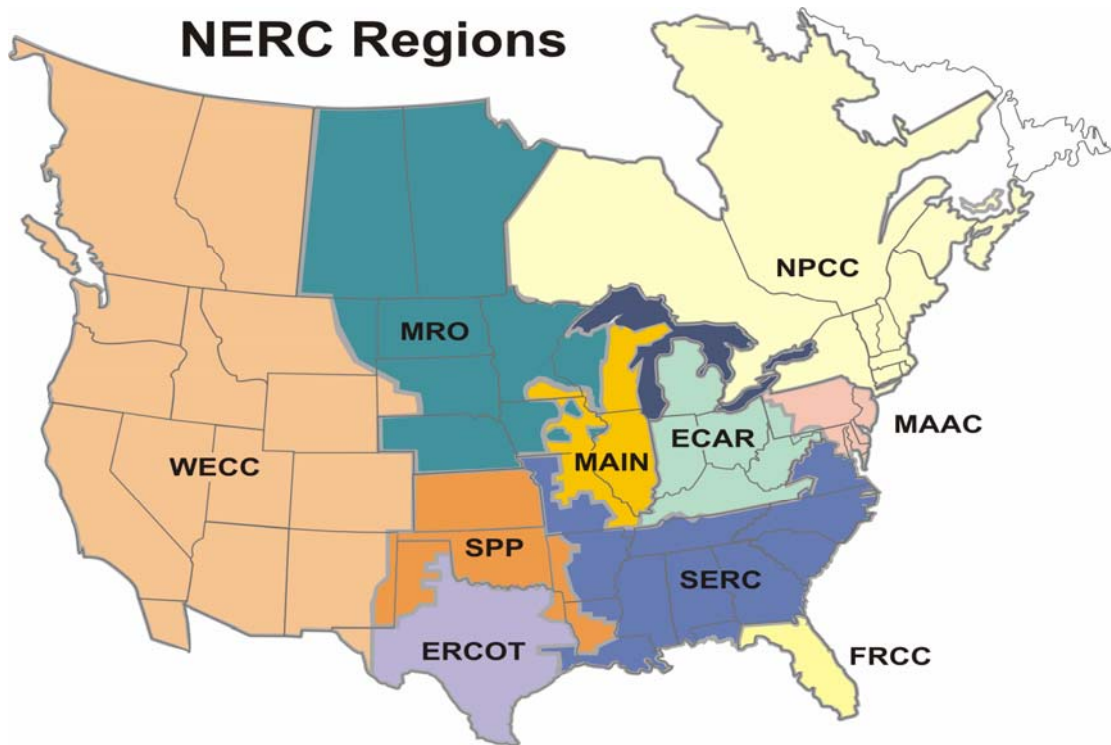
- *State Utility Commissions* – responsible for grid regulation including approval of transmission tariffs.

4.2.1 NERC

The North American Electric Reliability Council (NERC) was established in 1968 with the mission to ensure that the bulk electric system in North America is reliable, adequate and secure. Among its tasks is setting standards for reliable operation and planning of the system and monitoring and enforcement of these standards.

NERC's members are ten regional reliability councils, whose members come from all segments of the electric industry. The members account for almost all electricity supplied and used in the United States, Canada and a portion of Baja California Norte in Mexico. The geographical coverage of the regional councils is showed in Figure 4.2.

Figure 4.2 NERC Regions



Source: North American Electric Reliability Council webpage, www.nerc.com

NERC has historically been a voluntary organization “...relying on reciprocity, peer pressure and the mutual self-interest of all those involved”.⁷ However the large scale blackout on the East Coast in 2003 prompted

⁷ NERC webpage, About NERC

calls for these reliability standards to be made mandatory. Many regulators argued that voluntary reliability standards simply were no longer capable of securing adequate long term system reliability.

The recently passed Energy Policy Act includes language that creates an electric reliability organization (ERO) with the ability to develop and enforce mandatory reliability standards in North America. FERC has been directed to finalize new rules for establishment of an ERO by February 2006. These rules will include enforcement procedures for reliability violations.

4.2.2 FERC, standard market design and RTOs

The Federal Energy Regulatory Commission (FERC) is the federal regulator in the US and regulates wholesale electricity trade and interstate commerce. FERC has decided on a Standard Market Design and Structure (SMD), which includes the formation of regional transmission organizations (RTOs) and ensuring that all independent transmission organizations have sound wholesale market rules. The implementation schedules may vary depending on the regional needs and differences.

In order no. 2000⁸ FERC stated "...that traditional management of the transmission grid by vertically integrated utilities was inadequate to support the efficient and reliable operation that is needed for the continued development of competitive electricity markets, and that continued discrimination in the provision of transmission services by vertically integrated utilities may also be impeding fully competitive electricity markets." Furthermore, it was stated that regional institutions could address the operational and reliability issues confronting the industry. In the FERC order minimum characteristics and functions for Regional Transmission Organisations was established and the objective was that all transmission-owning entities should place their transmission facilities under the control of the appropriate RTO. The minimum characteristics and functions are listed and described in Table 4.1 and Table 4.2. Given that these minimum requirements are met there is flexibility in structuring the RTOs in a manner that suits the industry participants and regional needs. Thus, different organisational forms, such as ISOs, transcos, combinations of these or other options are possible.

⁸ FERC Order No. 2000, issued December 20, 1999

Table 4.1 Minimum characteristics of RTOs

Minimum characteristic	Description
Independence	Decision making process that is independent of control by any market participant or class of participants.
Scope and Regional Configuration	The RTO must serve an appropriate region — a region of sufficient scope and configuration to permit the RTO to effectively perform its required functions and to support efficient and non-discriminatory power markets
Operational Authority	RTO must have operational authority over all transmission facilities transferred to the RTO and must be the security coordinator for its region. As security coordinator, the RTO would be responsible for real-time monitoring of system conditions in order to anticipate potential reliability problems, and for directing and coordinating relief procedures to respond to transmission loading problems.
Short-term Reliability	RTO is that it must have exclusive authority for maintaining the short-term reliability of the transmission grid under its control: 1. The RTO must have exclusive authority for receiving, confirming and implementing all interchange schedules. 2. The RTO must have the right to order redispatch of any generator connected to transmission facilities it operates if necessary for the reliable operation of these facilities. 3. When the RTO operates transmission facilities owned by other entities, the RTO must have authority to approve and disapprove all requests for scheduled outages of transmission facilities to ensure that the outages can be accommodated within established reliability standards. 4. If the RTO operates under reliability standards established by another entity (e.g., a regional reliability council), the RTO must report to the Commission if these standards hinder its ability to provide reliable, non-discriminatory and efficiently priced transmission service.

Source: FERC Order No. 2000

Table 4.2 Minimum functions of RTOs

Minimum function	Description
Tariff Administration and Design	In order to ensure non-discriminatory service within the region the RTO should be the sole administrator of its own transmission tariff. The RTO would thus be the sole authority making decisions on the provision of transmission service including decisions relating to new interconnections.
Congestion Management	An RTO must ensure the development and operation of market mechanisms to manage congestion. The responsibility for operating these market mechanisms should reside either with the RTO itself or with another entity that is not affiliated with any market participant.
Parallel Path Flow	An RTO should develop and implement procedures to address parallel path flow issues within its region and with other regions.
Ancillary Services	The RTO must serve as the supplier of last resort for all ancillary services required by FERC Order No. 888.

Minimum function	Description
OASIS ⁹ and total Transmission Capability (TC) and Available Transmission Capability (ATC)	RTO must be the single OASIS site administrator for all transmission facilities under its control. RTO has the flexibility to contract out OASIS responsibilities to another independent entity. An RTO can participate in a "super-OASIS" jointly with other RTOs. The should RTO itself calculate ATC values based on data developed partially or totally by the RTO
Market Monitoring	In Order No. 2000 the minimum functions was that the RTO proposals should contain a market monitoring plan that identifies what the RTO participants believe are the appropriate monitoring activities the RTO, or an independent monitor, will perform. In the FERC White Paper on Wholesale Power Market Platform¹⁰ this was developed further and it was suggested to strengthen the requirements.
Planning and Expansion	RTO have the ultimate responsibility for both transmission planning and expansion within its region that will enable it to provide efficient, reliable and non-discriminatory service and coordinate such efforts with the appropriate state authorities. An RTO must satisfy the requirement to: 1. Encourage market-motivated operating and investment actions for preventing and relieving congestion. 2. Accommodate efforts by state regulatory commissions to create multi-state agreements to review and approve new transmission facilities, coordinated with programs of existing Regional Transmission Groups (RTGs) where necessary. 3. File a plan with FERC with specified milestones that will ensure that it meets the overall planning and expansion requirement no later than three years after initial operation, if the RTO is unable to satisfy this requirement when it commences operation.
Interregional Coordination.	It is required that an RTO develop mechanisms to coordinate its activities with other regions whether or not an RTO yet exists in these other regions.

Source: FERC Order No. 2000 and FERC White Paper on Wholesale Power Market Platform

Figure 4.2 shows existing and proposed RTOs and ISOs in the US (and Canada). There are currently six approved RTO (California ISO, SPP RTO, MISO RTO, PJM Interconnection, NY ISO and the New England ISO).¹¹ There are also a few proposed RTOs or other types of regional organisations.¹² Grid West covering the north-western parts of USA is a non-profit membership corporation, which currently is in development work for a possible future operational stage. This organisation is not de-

⁹ Open Access Same-Time Information System (OASIS)

¹⁰ FERC White Paper, "Wholesale Power Market Platform", issued April 28, 2003

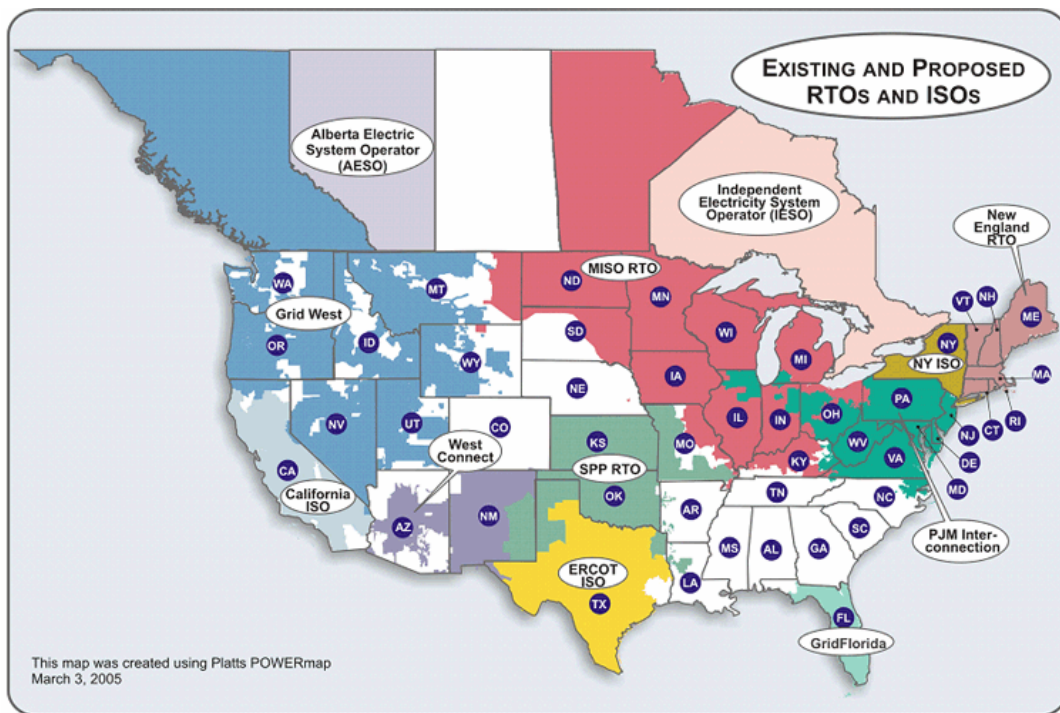
¹¹ Webpages: California ISO: www.caiso.com, SPP: www.spp.org, PJM: www.pjm.com, NY ISO: www.nyiso.com, NE ISO: www.iso-ne.co, MISO RTO: www.midwestiso.org (not working)

¹² Webpages: Grid West: www.gridwest.org, West Connect: www.westconnectrto.com, ERCOT ISO: www.ercot.com, GridFlorida: www.gridflorida.com.

signed to qualify as a RTO or comply with FERC standard market design principles, and its bylaws do not permit it to initiate filings to achieve such status. West Connect is intended to cover the parts of southwest US, but very little information is available on the organisation's homepage. GridFlorida aims at becoming the RTO of the Florida peninsula. The information on their webpage is very scarce. ERCOT (Electric Reliability Council of Texas) is the ISO in Texas (webpage currently down).

In the following PJM, CAISO and NE ISO will be discussed in more detail as examples of well functioning power markets. A common feature for all of these RTOs are that they have share the same minimum characteristics and functions as specified in tables 4.1 and 4.2.

Figure 4.3 Existing and proposed RTOs and ISOs



Source: FERC, www.ferc.com

4.2.3 PJM Interconnection

The PJM Interconnection is the world's largest wholesale power market delivering electricity to approx. 51 million users. The PJM operator was also the first entity to be granted RTO status by FERC in 2001. In terms of geographic scope the PJM Interconnection is substantial, it covers all or parts of Delaware, Illinois, Indiana, Kentucky, Maryland, Michigan, New Jersey, North Carolina, Ohio, Pennsylvania, Tennessee, Virginia, West Virginia and the District of Columbia.

As previously mentioned, RTO status implies amongst other things, that the system operator has operational authority over all transmission

facilities and is reliability coordinator for the PJM Interconnection. In the PJM Interconnection this covers 56,000 miles of transmission lines owned by 16 participating transmission owners (PTO's)¹³. PJM has overall operating responsibility for ensuring that these transmission systems are operated in accordance with NERC's region specific reliability standards. As an RTO, PJM is also responsible for planning the enhancement and expansion of the transmission system. To this end, PJM is required to publish an annual Regional Transmission Expansion Plan (RTEP). In the RTEP priority interconnections and transmission projects are outlined. PTO's are then committed, through the transmission operating agreement (TOA), to construct and own or finance the transmission enhancement(s)¹⁴.

4.2.4 *The New England ISO*

The New England ISO (NE ISO) has, along with PJM, been one of the strongest advocates of FERC's Standard Market Design approach. Already by 2003 the NE ISO had adopted SMD principles and in February 2005 the entity began its operation as a regional transmission organisation for a six-state region. In addition to New England, the NE RTO encompasses Vermont, Massachusetts, New Hampshire, Rhode Island and Maine.

Today, more than 260 market participants complete in excess of \$7 billion of wholesale electricity transactions annually, about a quarter of the power sold in the six-state region (the remainder is sold through negotiated, long-term contracts). In addition, there are currently 20 transmission owners participating in the NE RTO¹⁵. Combined they own approximately 8000 miles of high voltage grid and 12 interconnections to neighbouring power systems.

NE ISO and PJM have similar approaches when it comes to meeting NERC operational reserve requirements. Both have established capacity markets with a system of payments for reserve capacity. ISO NE calcu-

¹³ The 16 Transmission Owners are; American Electric. Power Service Corporation, Atlantic City Electric Co., Baltimore Gas and Electric Co., Commonwealth Edison Co., Dayton Power & Light Company, Delmarva Power & Light Co., Jersey Central Power & Light Co., Metropolitan Edison Co., Pennsylvania Electric Co., Pennsylvania Power & Light Co., Potomac Electric Power Co., Public Service Electric and Gas Co., Allegheny Power, Rockland Electric Power, and Virginia Electric and Power Company.

¹⁴ In the TOA it is specified that PTO's shall commence fulfillment of obligations within 60 working days.

¹⁵ The 20 Transmission Owners are; Bangor Hydro Electric BHE (BHE), Boston Edison Co. BECO (BECO), Cambridge Electric CELC (CELC), Central Maine Power Co (CMP), Central Vermont PSCo CVPS (CVPS), Commonwealth Electric Co (COM), Cross-Sound Cable CSC (CSC), Fitchburg Gas Electric (FGE), Florida Power & Light NED (FPL), Green Mountain Power GMP (GMP), Maine Electric Power Co (MEPC), Maine Public Service Co (MPSC), New England Power Company (NEP), Northeast Utilities System (NU), Saracen Merchant Energy (7630), United Illuminating UI (UICO), Unitil Energy Systems Inc (UES), Vermont Elect Coop (CZN) (VECT) and Vermont Electric Pwr VELC (VELC).

lates the Installed Capacity Requirements for each power year, and then each market participant must then obtain capacity credits to meet their individual capacity obligations.

Capacity credits can be acquired from self-supply, bilateral contract or through the capacity markets. The desired aim of this capacity payment system is to ensure adequate power supplies are available and generators are compensated for their production.

4.2.5 California ISO

Ever since the major power crisis in 2000-01 California has struggled with the restructuring of its power sector. However, finally on June 30th 2005 the new California power market design received approval from FERC. In terms of geographic scope the California ISO covers most, but not all of, the State of California. Sacramento (SMUD), Western Area Power Administration (WAPA) and Los Angeles (LADWP) are not included in the CAISO control area.

In contrast to PJM and NE ISO, the transmission system in the California ISO has a mixture of public and private ownership. There is one control area which is made up of the former control areas of the three Investor Owned Utilities: (Pacific Gas and Electric Company (PG&E), Southern California Edison Company (SCE), San Diego Gas and Electric Company (SDG&E)), and the other control areas covered by Municipal Utility Districts.

The transmission owners, investor owned utilities and municipal utility districts are required to file annual transmission expansion plans to the ISO. The role of the ISO is to consider these plans and to ensure that they are coordinated on a regional basis.

After receiving RTO status numerous changes have been made to the California ISO governing structure. This includes new rules that no more than 49% of the Governing Board may be represented by ownership interests in the Californian power market.

Compared to PJM and NE ISO, CAISO currently has a different approach to meeting planning and operating reserve criteria established by its regional reliability council (WECC) and NERC. CAISO prepares annual forecasts of weekly generation capacity and weekly peak demand. If reliability standards cannot be met, CAISO will solicit bids for replacement reserve¹⁶ contracts for up to one year and load curtailment contracts.

¹⁶ This is generating capacity dedicated to CAISO, capable of starting up if not already operating, being synchronized to CAISO controlled grid, and ramping at a specific load point within 60 minute period, the output of which can continuously maintained for a two-hour period (FERC CAISO Handbook).

To further improve the reliability situation in California the California Public Utilities Commission has recently issued a "white paper" that lays out plans to set up a "capacity market" similar to those in PJM and ISO NE.

4.2.6 Termination of Order 2000

Over the years, FERC's push for the creation of RTO's has been met with considerable resistance by some states. Certain state legislators have been critical of the "one size fits all" approach to market design, in that regional differences are not fully taken into account. Concerns have also been raised over the escalating costs related to the administration of RTO's. As a result of this mounting criticism FERC therefore announced it was terminating order 2000 as of 17. July 2005. In effect this means that FERC will no longer actively advocate the creation of RTOs. No information has of yet been made available which suggests that the six established RTOs will abandon this market design. However the areas which have not yet received RTO status (see section 3.2.2) are likely to adopt individually tailored market design solutions.

4.3 Britain

On April 1st 2005 BETTA (British Electricity Trading and Transmission Arrangements) were implemented creating one single system operator for Great Britain (GBSO). With this reform the National Grid Company plc (NGC), the TSO for England and Wales, extended its responsibility for system operation to Scotland.

National Grid Company plc changed its name to National Grid Electricity Transmission plc (NGET) on 26th July 2005. The company is listed on both the New York and London stock exchange, and to ensure independence in decision making, market participants are not allowed to own more than 1 percent of National Grid Electricity Transmission plc shares.

Following BETTA, NGET will now be responsible for balancing the demand and supply of electricity over the entire Great Britain transmission network, defining the arrangements for access to the system, and determining the charges for its use.

Prior to BETTA there were two TSOs in Scotland: Scottish Power and Scottish and Southern Energy. Ownership of the transmission assets will remain in the hands of their current owners. In addition, responsibility for maintenance and investment will be split between the two Scottish companies and National Grid Electricity Transmission plc.

As regards the 1200 MW¹⁷ inter-connector between England and Scotland, which is owned by all three transmission companies, responsibility relating to technical issues is to be shared equally by all three Parties.

Alterations have had to be made to the existing Electricity Act of 1989 to ensure that these new roles and responsibilities are clearly defined. Section 9 (2) had previously required transmission licensees to *"develop and maintain an efficient, coordinated and economical system of electricity transmission"*. However, in recognition of the fact that there is now only one single system operator, the text now requires the Scottish transmission owners to *"play as full a part as possible, within the framework of his license, in developing and maintaining an efficient, coordinated and economical transmission system"*.

A new grid code for Britain also came into force as of 1st September 2004. The Grid Code specifies data which system users are obliged to provide to National Grid for use in the planning and operation of the transmission system, including demand forecasts, availability of generating sets and intended dates of overhaul of large generating sets.

Government officials are confident that the creation of a single GBSO will contribute to greater security of supply, in that it should be better able to co-ordinate a response to significant disruptions than would three system operators working through different systems.

4.4 New Zealand

Transpower¹⁸ is the system operator and owner of the high voltage transmission grid (national grid) which transmits electricity throughout the North and South Island. The national grid comprises approximately 12,000 km of transmission lines and 170 substations and switchyards.

In March 2004, the Electricity Commission was established, following several years of concerns that the market system could not deliver adequate security of supply. The Electricity Commission oversees all aspects of the electricity market from generation, transmission and distribution through to consumption.

As System Operator, Transpower has a contract with the Electricity Commission to manage the real time transmission of electricity. The Electricity Commission determines the methodology by which Transpower sets its charges for electricity companies using the national grid. The Electricity Commission also has to evaluate and approve major transmission investments.

¹⁷ The interconnector is currently in the process of being upgraded to 2000 MW.

¹⁸ <http://www.transpower.co.nz/?id=4800>

The wholesale market for electricity is administered by a privately owned company, M-Co, on behalf of the New Zealand Electricity Commission. The main participants are the seven generator/retailers who trade at 244 nodes across the transmission grid. The generators offer their plant at grid injection points and retailers bid for electricity offtake at grid exit points.

4.5 Australia

In 1996 the National Electricity Market (NEM), a wholesale pool operated by the National Electricity Market Management Company (NEMCO), was created in Australia. The NEM comprises five interconnected electrical regions; Victoria, Southern Australia, ACT¹⁹, Queensland and Tasmania. (Western Australia and the Northern Territories are in the process of restructuring their electricity sectors and have no plans of yet of joining the NEM). There is a designated region reference node in each region where the regional spot price of electricity is set.

NEMCO is an ISO and the owners of the transmission system are so called transmission network service providers (TNSP's) located in each respective participating region (see table below).

State	Transmission Network Service Providers (TNSP)
Southern Australia	Electranet
Victoria	VenCorp
New South Wales and ACT	Transgrid
Queensland	Powerlink
Tasmania ²⁰	Transend

Source: NEMCO and company websites.

One of the main responsibilities of the NEMCO, as laid out Chapter 4 of the New Electricity Rules, is to “maintain power system security and co-ordinate the System Operators in undertaking certain of its activities and operations and monitoring activities of the power system”. In addition, NEMCO has the overall planning and coordinating responsibility to ensure the smooth functioning of the NEM. Each year NEMCO publishes a Statement of Opportunities (SOO), which includes:

- Forecasts of demand for electricity
- Details about the capacity of existing and committed generating plant,
- Information about inter-regional transmission capabilities and

¹⁹ Australian Capital Territory.

²⁰ Tasmania joined the NEW in 2005 via the Basslink interconnector, a high voltage direct current (HVDC) submarine cable.

- Advice on the impact of technical limits on sections of the network.

From 2004, NEMMCO has also published an Annual National Transmission Statement in conjunction with the SOO to provide an integrated assessment of the current state and potential future development of major national transmission flow paths.

4.6 Summary

In this chapter we have observed how the scope of system operator function is closely linked with the organizational model adopted (see Table 4.3). In the US and Australia where the ISO model approach has been adopted, the minimum functions include control of system operation and to a certain extent controlling grid investments via system planning. The scope of responsibilities is much broader for the TSOs in Britain and New Zealand whom must perform the functions of grid owner, grid operator and grid planner.

Table 4.3 Summary of structure for system responsibility in selected markets

Type of Entity	Maintains real time control of system operations	Maintains transmission facilities	Controls grid investments	Owns or leases transmission facilities
Independent system operator (ISO): NEMCO (Australia), PJM (US), ISO NE ISO (US) and CAISO (US).	Yes	No	Partially, via regional transmission expansion plans	No
Transmission system Operator (TSO): National Grid Electricity Transmission (Britain) and Transpower (New Zealand)	Yes	Yes*	Yes*	Yes*

* National Grid Electricity Transmission has grid owner responsibility for England and Wales, not Scotland. In Scotland this responsibility will be shared between the two transmission companies, Scottish Power and Scottish and Southern Energy.

Source: ECON.

A further observation is that system operations in well functioning markets should be organized in such a way as to ensure independence for market actors in the relevant area. Independence in decision making is needed to guarantee that system operations are not being managed in such a way so as to distort competition. Countries which have adopted the TSO model have ensured this either by one of the following: (1) 100 % state ownership as in New Zealand or (2) strict rules on shares ownership if the company is publicly listed, as in Britain.

In the ISO model, independent decision making implies having in place governance structures where market participants do not have any (or at least not a controlling) stake. This has been one of the fundamental characteristics of the market design approach adopted by FERC in the US.

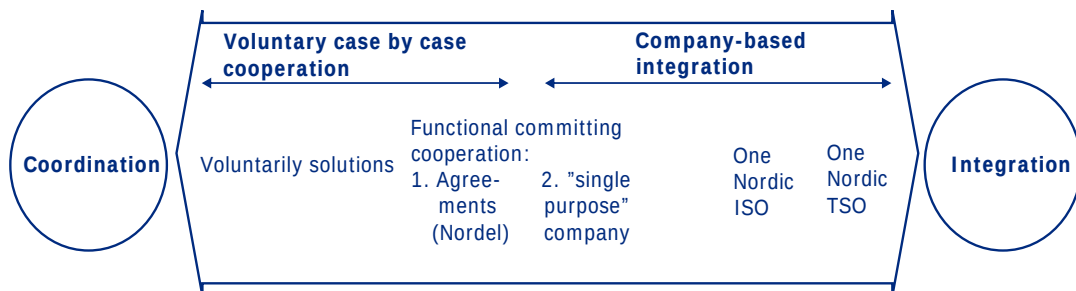
In general it can be said that the TSO is a key institution in order to achieving a competitive power sector. It has slowly been recognized by governments that they must create a TSO whose decisions are not controlled by any single or several market participants or by the government itself. This means that the government has to give up political power in order to obtain a competitive power market. This poses extra challenges when the power market in question has boundaries that cross over regular national boundaries.

5 Possible organizational models for the Nordic market

5.1 Introduction

In order to get further on the way towards harmonization on the Nordic market on the TSO level there are two main directions that come out. Currently the operation of the Nordic market is based on a series of voluntary agreements between the four national TSOs. To further develop this way of functioning of the Nordic market there are essentially two types of approaches from which to choose from. The first direction points towards keeping the existing Nordic TSO organizations intact and seek to *improve cooperation* through more formalized cooperation agreements. The other main direction follows a path to adopt an approach which results in some form of *company based integration* of the existing TSO activities. A schematic illustration of the two types of approaches and main model types within each approach is given below.

Figure 5.1 Schematic illustration of approaches for further harmonization



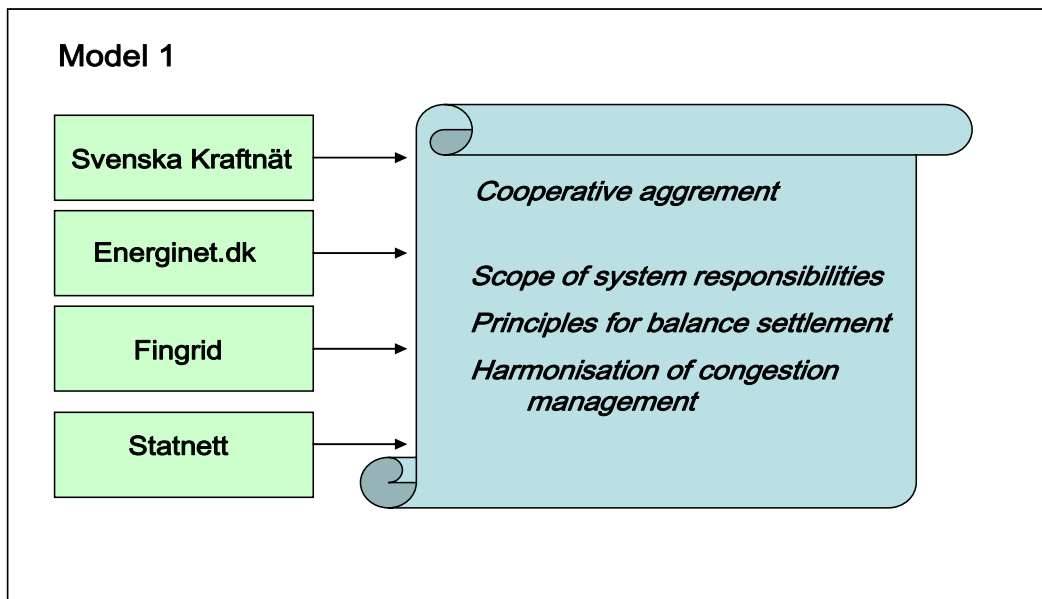
In section 5.1.1 – 5.3.4 we will outline five possible organizational models for the Nordic market. The first model is based on the approach of increasing cooperation, while the other four involve some form of company based integration.

5.1.1 Model based on Nordel's recommendations (Model 1)

After the NCM meeting at Akureyri in September 2004 Nordel was asked to perform specific tasks related to further Nordic market development. One of the key tasks was to analyze the current similarities and differences between the Nordic TSOs, and propose a list of recommendations for

further harmonization. A main takeaway from Nordel's report²¹ presented March 2005 is the considerable divergence in terms of both scope of mandates and management of system operations between the Nordic TSOs. Based on these conclusions Nordel has not specifically recommended establishing a new organizational entity (whether it be a TSO or ISO), but rather proposed a series of measures to improve cooperation between the Nordic TSOs.

Figure 5.2 Model 1: Improved cooperation



Although Nordel concludes with a final list of 11 concrete recommendations, there are essentially two levels of increased cooperation being suggested. The first is related to reaching a common understanding as to the minimum scope of system responsibility. The second is the adoption of common tools to deal with two priority operational challenges impeding further enhancement of the Nordic system; congestion management and balance settlement. These issues will be dealt with briefly in the coming sections and will be discussed in more detail in the next chapter.

Scope of system responsibility

As discussed above, the Nordel report illustrated considerable divergence in the mandate of the Nordic TSOs. The mandates are broadly similar with respect to short term operation reliability, but there are significantly different interpretations in terms of long term security of supply obligations.

²¹ Survey of system responsibilities in the Nordic countries (Nordel, 2005).

Nordels concrete recommendation is that the Nordic TSOs should come to agreement on a common minimum role concerning long term security of supply. This is due to the fact that all the TSO should have a role to play in the active development of the internal market and setting market rules. According to Nordel *“the TSOs have developed a broader role than only ensuring non-discrimination and ensuring the reliability of the electricity system”*.

In addition to active market development, Nordel proposes that each Nordic TSO should have a common focus on further development of an improved demand side flexibility and removal of barriers for demand response to high prices.

Congestion management

According to Nordel the current practice of restricting interconnector capacity in some Nordic countries should be abandoned. Common principle should be agreed on bottleneck management based on creation of price areas. The Nordel report states *“establishment of separate elspot areas gives a more integrated Nordic market and a more efficient price formation than reduction of trading capacities”*.

Balance settlement

In Norway a one-price system is used for imbalances. The balance power price is used in any case of imbalances. Finland, Sweden and Denmark have adopted a two-price balance settlement approach.

Nordel does not identify which of these two models are preferable, but simply recommends that harmonization of the national rules and frameworks for balance settlement are important. However, Nordel does advocate that the harmonization process should be pursued in such a way that reduces barriers of entry for new players in the national retail markets.

5.2 Company based integration

Whereas Nordel’s recommendations seek to preserve current organizational structures, taking the step towards some form of company based integration will have a direct impact on the structure of operations. Before describing concrete models we will here first briefly discuss some necessary prerequisites, and secondly outline key issues which are raised when a new entity is established.

Mandate and tools for market operation

If one is to create a new organizational entity the minimum characteristics should encompass a common mandate and agreement as to how the market is to be operated. It naturally follows from this that the common plat-

form outlined in *model 1* should form the minimum basis for any form of company based integration.

Organizational, operational, legal and regulatory issues

As opposed to formalized cooperation, there are a number of organizational issues to be resolved when policy makers are discussing company based integration:

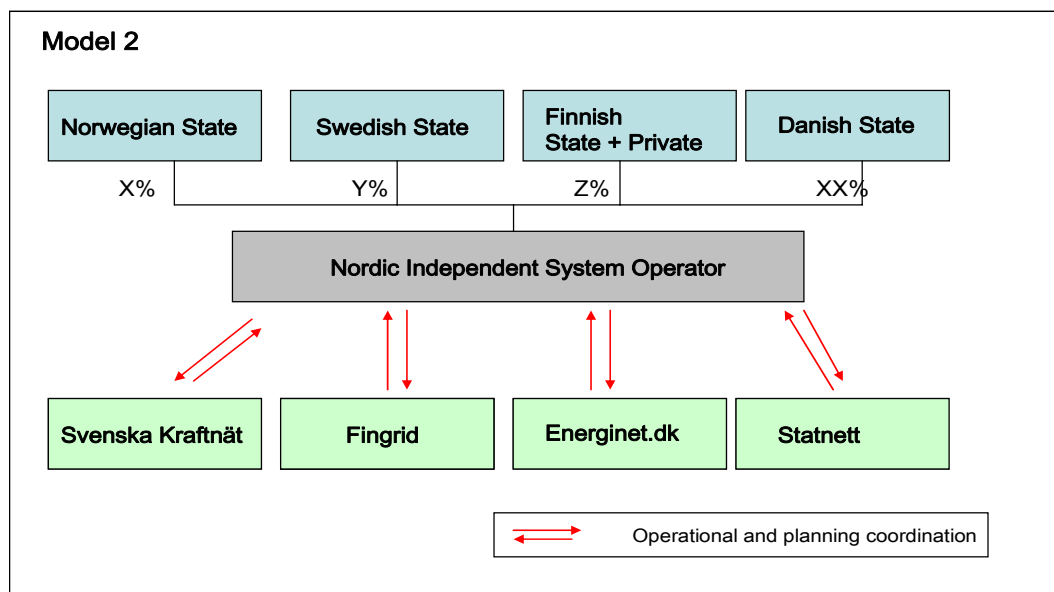
- What is to be the ownership structure of the new entity?
- What should be the governance structure i.e. how are decisions to be made?
- What should be the scope of system operations?
- How should investment choices be made?
- How will the new entity be regulated?

In the following we briefly describe how four models of company based integration will address these issues. There can be numerous levels of integration, however here we restrict ourselves to discussing minimum functions and characteristics needed to make the various organizational models function. We will return to the important issue of practical challenges in chapter 8.

5.2.1 A joint Nordic ISO (Model 2)

A new joint Nordic ISO is established with no direct or indirect ownership of any Nordic grid assets. The organization will solely be tasked with ensuring the reliable operation of the interconnected Nordic power system.

Figure 5.3 Model 2: A Nordic ISO



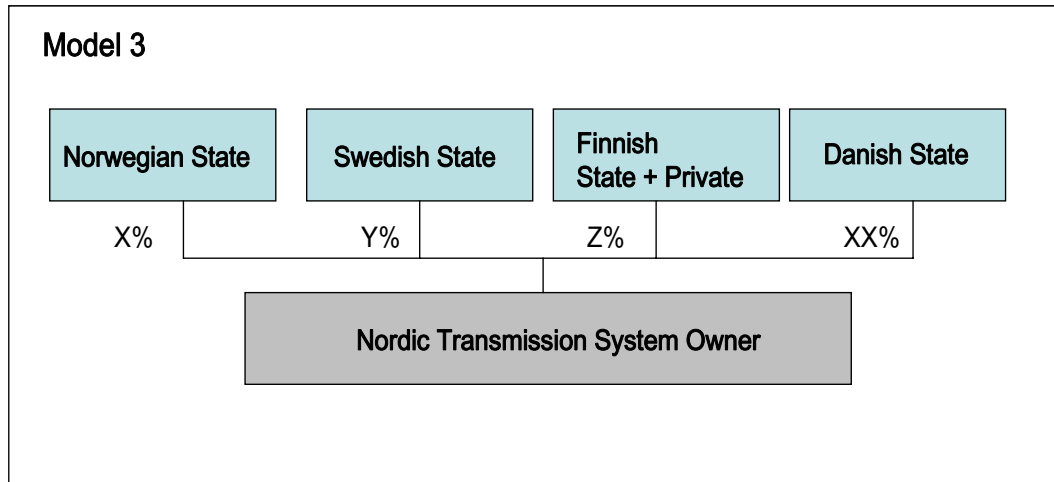
Below we outline key organizational characteristics of a joint Nordic ISO.

- **Ownership structure** – the new organization can be owned by the four Nordic states. Another possibility would be to establish the Nordic ISO as a holding company owned by the national TSOs. National considerations of ownership have to be taken into account. Choice of organizational type will significantly influence governance and decision making structure.
- **Governance and decision making structure** – Board of governors decide principles for market operation. Each country has representatives on the company's board of governors. There is a rotating chairmanship of the board and majority rule is the decision basis.
- **System operations** - The new entity will be charged with overall system operations and for coordination of the four transmission owning companies. This model of system operations is in many respects similar to the US RTO model and the Australian model.
- **Grid maintenance and expansion** – The joint Nordic ISO will not complete any grid investments but should be the overall system planner and must ensure that transmission owners expand the grid according to Nordic system development plans. In this respect it would be sensible to transfer most (if not all) of the existing competencies in Nordel into the new Nordic ISO.
- **Financing mechanism** – the Nordic ISO's would operate as a non-profit organization, and administration and system operation costs would be financed through a *system operation fee* levied on all market participants.
- **Regulatory issues** – the Nordic regulator group (FNER) conducts an annual review of system operations, including the *system operation fee*.

5.2.2 A joint Nordic TSO (Model 3)

The four national TSOs are merged together to create a joint Nordic TSO. As grid owner, the company will have to ensure adequate maintenance and expansion of the main Nordic grid. As system operator, the company will also be charged with the overall operational responsibility of the Nordic system.

Figure 5.4 Model 3: A Nordic TSO



Below we outline the key organizational characteristics of a joint Nordic ISO.

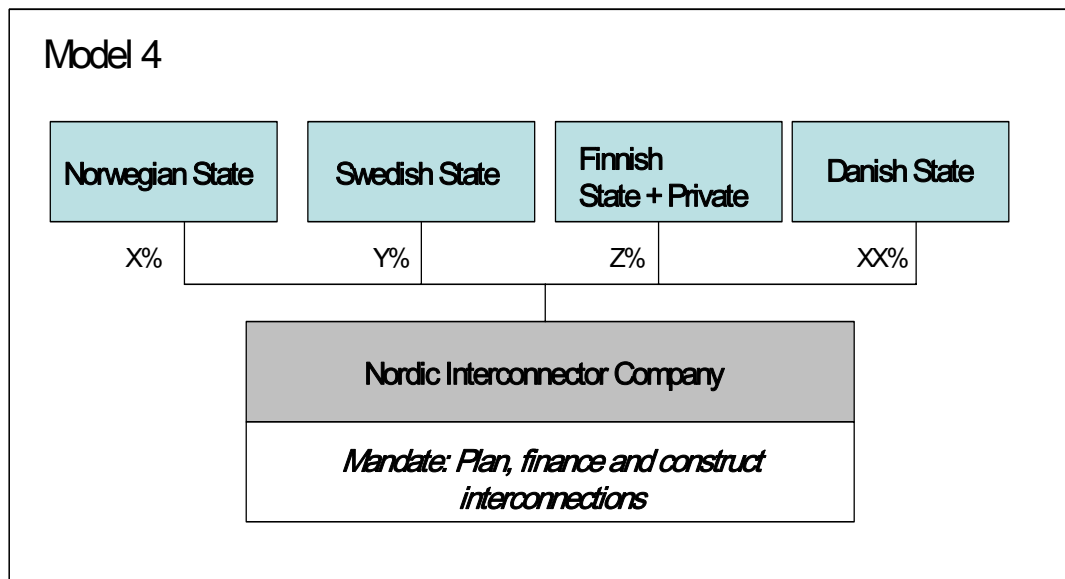
- **Ownership structure**- the new organization can be owned by the four Nordic states. Alternative ownership structures can also be considered. National considerations of ownership have to be taken into account.
- **Governance and decision making structure** – this point will be even more relevant for a joint Nordic TSO as both national and intra-national grid investments have to be decided.
- **System operations** – the minimum function would be simply to ensure short term reliability. However, as Nordel has pointed out, proactive measures in terms of the long term security situation should also be adopted.
- **Grid maintenance and expansion** – system plans for grid maintenance and expansion will have to be made both at the regional, national and Nordic level.
- **Financing mechanism** - tariff design issues related to use of grid fees, grid financing and payment of system services are just some key issues that need to be resolved. The Nordic TSOs currently have significantly different tariff designs.
- **Regulatory issues** – today there also exists differences in regulatory models adopted by regulatory authorities. Agreement therefore needs to be reached as to which regulatory model is adopted.

5.2.3 Nordic Inter-connector Company (Model 4)

Nordel has outlined 5 priority interconnectors that will help improve the security of supply situation in the Nordics. In addition, a common finan-

cing mechanism for the construction of these priority interconnectors has been agreed (earmarking of bottleneck revenues). One could argue that the completion of such projects would be speeded up by delegating this activity to a single operational entity. In other words, a single purpose holding company could be established with the mandate of planning, financing and ensuring completion of interconnector projects.

Figure 5.5 Model 4: Nordic interconnector company



Below we outline the key organizational characteristics of a Nordic Interconnector Company.

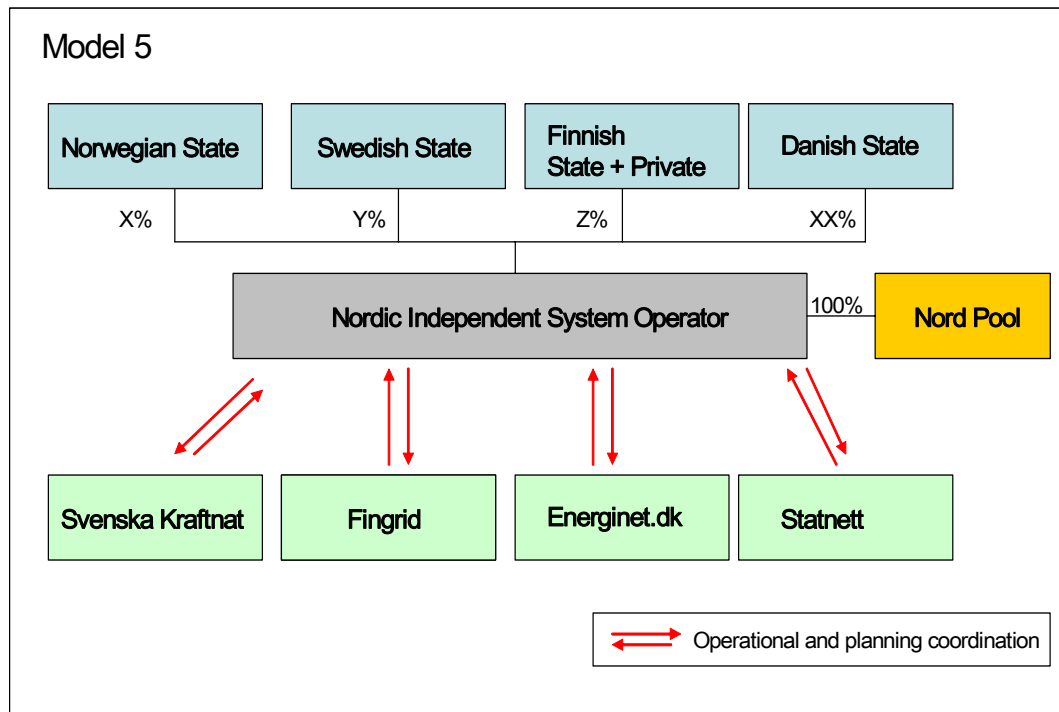
- **Ownership structure** – the new organization will be the four national TSOs. Alternative ownership structures can be discussed and national considerations of ownership have to be taken into account
- **Governance and decision making structure** – board of governors have a decision right for investment principles and a final say on projects. Each national organization has representatives on the board.
- **System operations** – this entity will have no responsibility for system operations.
- **Grid maintenance and expansion** – the sole focus will be on completing priority interconnector projects. Actual construction of interconnectors could be sub- contracted out to the TSOs.
- **Financing mechanism** – the entity would operate as a non-profit organization. Administration and system operation costs may be financed through a *system operation fee* levied on market participants alternatively from earmarking of bottleneck revenues.

- **Regulatory issues** – today there also exists differences in regulatory models adopted by regulatory authorities. Agreement therefore needs to be reached as to which regulatory model is adopted

5.2.4 Nordic Market Operator (Model 5)

This model is an extension of *model 2* but with the system operator having a much broader mandate. This broader mandate includes operation and ownership of the Nord Pool Exchange, as well as responsibility for Nordic market rule setting and development.

Figure 5.6 Model 5: Nordic market operator



Below we outline the key organizational characteristics of a Nordic Market Operator.

- **Ownership structure** – the new organization may be owned by the four Nordic states. Alternative ownership structures can be discussed and national considerations of ownership have to be taken into account
- **Governance and decision making structure** – A board of governors decide principles for the operations. Each owner has representatives on the entities board.
- **System operations** – In addition to having the responsibility for overall system operations the new entity will be involved in the market through the ownership of the market exchange.

- **Grid maintenance and expansion** – The new entity will not complete any grid investments but should be active in the role as the overall system planner.
- **Financing mechanism** – the new entity would operate as a non-profit organization, and administration and system operation costs would be financed through operation fees levied on market participants.
- **Regulatory issues** – The Nordic regulator group (FNER) conducts annual reviews of the system operations. The market exchange is monitored through existing rules and regulations.

5.3 Summary

Starting from Nordel's recommendations that seek to preserve current organizational structures, the following descriptions above have described alternatives that take the step towards different forms of company based integration. Any of these steps of integration will have a direct impact on the structure of operations for the system operator.

It is clear that these models that are described above imply different levels of more or less dramatic changes to the role described for the system operator. On one hand there is the model where there are no organizational changes but rather continued work towards increased harmonization through cooperation and the channels of information exchange that exist today. On the other hand there are different models suggesting organizational restructuring that would change the working environment for the TSOs as they are today.

It is clear that this will not happen over night. It has also become clear that there are certain key issues that a process of harmonization primarily is concerned with. Given these key issues it is important to evaluate and measure the different alternative approaches in terms of how much they each provide support to solve the problems identified in these key issues. In the following chapter focus will be set on the identification of these key issues and the evaluation criteria for the different model approaches.

6 Key issues and evaluation criteria

Efficient system operation and a well functioning market are two central prerequisites for efficient resource utilization in the Nordic power market. Our evaluation is focused on how increased harmonization in different key areas can contribute to increased economic efficiency, i.e., better resource utilization, and which implications this may have for the choice of organizational structure. Harmonization is thus not seen as a goal in itself.

Does organization matter?

One fundamental issue is to what extent the organizational structure matters. If there are benefits from harmonization this should be possible to achieve without organizational changes simply through agreements between the TSOs. In the case that the benefits are skewly distributed side-payments could ensure that beneficial agreements are reached.²² This view would however also question why we have organizations at all. In the economic literature a major reason for the existence of organizations is the existence of costly contracts. When it is costly to list all specific rights in assets there will be some residual rights that are not specified in the contract. Ownership will be the purchase of these residual rights.²³

The basic problem is thus firstly that it is costly, or even impossible, to write complete contracts that specifies every contingency. Contracts will thus be imperfect. Secondly, even if it should in principle be possible to use side-payments to ensure that beneficial agreement will be reached this may be difficult in practice. There might be institutional factors preventing such side-payments or the players may for strategic reasons not be willing to offer such side-payments. One response to this is to create organizations to decrease these transaction costs.

This means that it is very difficult to draw clear conclusions on the effects of different organizational structures on harmonization. In principle everything is possible, independently of the organizational structure. This

²² As Coase put it "So long as property rights are well defined, and may be transferred without transaction costs, market equilibrium outcome will be efficient."

²³ See for instance Grossman and Hart "The Costs and Benefits of Ownership: A theory of Vertical and Lateral Integration", *Journal of Political Economy*, Vol. 94, No. 4 (Aug., 1986) , pp. 691-719

means that the evaluations by necessity have to be based on judgements on how easy it is to reach consensus on various topics with different organizational structures. Two general conjectures can be made.

First of all this would imply that it is easier to reach consensus on issues where a well-specified “contract” (rules) can be set up, under which the different players then can operate more or less independently of each other. On the contrary, in issues where new agreements continuously have to be made, the transaction costs will be higher and an organizational integration is more likely to be successful than a structure based on repeated negotiations.

Secondly, it should be easier to agree on topics where the interests are more aligned, and it is also believed to continue to be that in the future. This would mean that even if a well-specified contract can not be set up, this is not likely to cause severe disagreements in the future.

It is important to note that the organizational structure will not solve possible problems related to opposing interests related to energy policy or the customers (e.g. tariff structures and levels). The organizational structure will only be a tool to overcome contractual problems. It will serve as a coordination and enforcement mechanism that ensures that coordinated decisions are taken and that these are subsequently implemented. In addition a new organization can serve as a commitment mechanism, helping to overcome external (e.g. from politics or customers) and internal (e.g. employees) opposition towards changes that are seen as beneficial in a Nordic context.

Choice of key issues

Before outlining different possible organizational models one must first identify and discuss the key harmonization issues at the Nordic level. This involves, where possible, evaluating the welfare economic cost and benefit related to the issue (i.e. what is the scope of the problem). With this analysis one will then be able to say something about whether, and if so, what type of organizational model is required to solve the issue at hand.

The choice of the key issues that are included in this section has been made in an iterative process, involving various stakeholders. Initially we suggested a few issues that we saw as potential key issues based on our own experience and knowledge of the Nordic electricity market as well as previous reports (e.g. Hagman, 2005). These were included in a survey sent out to various key stakeholders. The results of the survey, interviews, and further analytical work lead to some adjustments in the choice of key issues to include in the report. The final set of key issues is:

- Optimal main grid investment
- Congestion management
- Harmonization of tariff models

- Ancillary services and peak capacity reserves
- Harmonization of balance settlement
- Solidarity in a crisis situation.

The structure of the following sections is as follow. For each issue we first present the problem or current situation. We then continue with an evaluation of the importance of each issue, and finally we discuss the implication that each issue has on the choice of model.

6.1 Optimal main grid investments

6.1.1 *The problem*

We believe that estimates of (welfare) economic surplus should be the basis for grid investment decisions. Attempting to estimate the welfare economic costs and benefits of grid investments is however challenging exercises and is by no means an exact science. This may be a reason why the Nordic TSOs seem to use this approach to a varying degree.

A more important point is however whether the national TSOs should and possibly could base their investment decisions on estimates for the Nordic economic surplus rather than the national economic surplus. It may very well be so that a potential grid investment in country A primarily favors country B. This may imply that there is an economic surplus on the Nordic level, but not on the national level.

There are few public studies of investments that calculates both Nordic and national economic surplus, and there are hence few examples to illustrate our point. A case in point could be the possible large scale development of wind power generation in Northern Norway. It would require Statnett building large main grid extensions to transport the power southwards since Northern Norway is a surplus area in summer time. However, it could very well be a cheaper solution to increase the transmission capacity through Sweden. The “Swedish Solution” could have several advantages including more favorable terrain for building grid infrastructure (e.g. woodland in Northern Sweden vs. rugged mountainous terrain in Northern Norway). With the present organization with national TSOs, this solution has however several challenges, amongst them financing. Such an expansion would have large external effects into the Swedish grid and it would be hard to estimate and agree on the value of these.

6.1.2 *Evaluation of costs and benefits from a welfare economic perspective*

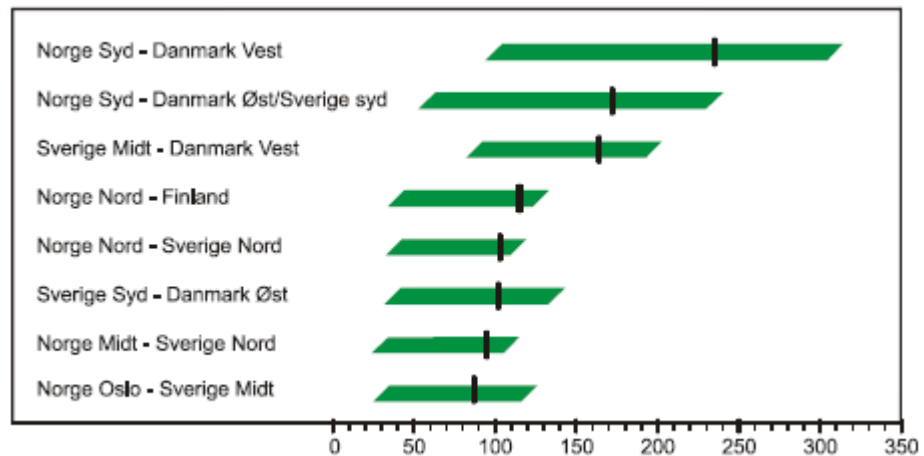
Without any high level of precision, it is easy to see that the potential for increased welfare economic surplus in the Nordic region could be very high with improved investment decisions. The total investment outlays for Statnett associated with new grid infrastructure are estimated to be a staggering 7 bn NOK. Even with only a 10% reduction in the Swedish alternative, this improved investment decision could save 0.7 bn NOK.

Nordel calculated in 2002 the welfare economic benefits of 8 main grid projects between and in the Nordic countries (See Figure 5). The range in the estimates is due to the changing circumstances between wet and dry years. We see in particular that the highest marginal benefit, at close to 250 kr/kW/year, is calculated for the Skagerrak IV connection between Southern Norway and Western Denmark. These estimates are based on six components to be included in such a welfare economic benefit calculation, taken from a Nordel report published in 2002:

- *Production optimization and power trade* – incorporates estimates of producer and consumer surplus, in addition to bottleneck revenues, at the country/Nordic level.
- *Reduced risk for capacity shortages* – benefit of increased security of supply.
- *Reduced risk for energy rationing*- welfare economic benefits of avoiding rationing and high power prices.
- *Trade in regulating reserves and ancillary services* - the value of increased access to regulating reserves.
- *Value of a better functioning market*- very much a qualitative variable related to weakened opportunities for abuse of monopoly power.

There is a great deal of uncertainty attached to the calculations and certain benefits have a better developed methodology for the estimation than others.

Figure 6.1 Marginal benefits in kr/kW/year of the grid project in Nordel area



Source: Nordel 2002

Our reasoning is simple: Since the numbers are so large, the potential benefit from improved decisions is likely to be substantial.

6.1.3 Implications for choice of model

Proponents of the common TSO model stress that one of the main advantages of such an organizational model would, amongst other things, strengthen the Nordic focus and contribute to a more optimal development of the Nordic market. In other words, there would be less focus on projects that are optimal from a national perspective though not from a Nordic perspective. Furthermore, it would increase the possibility of having grid investments carried out that are beneficial from a Nordic perspective, but not from the national perspective. Presently such projects represent a challenge when it comes to financing.

Agreement on five priority transmission lines

It could however be argued that today's organization actually do manage to have a common financing of both interconnectors and some important national grid investments. By 2004, Nordel had narrowed down the list to 5 projects, then including the Great Belt connection due to changed circumstances, in what are now known as the 5 priority interconnections.

In February 2005 Nordel proposed a bilateral financing model for interconnector projects. The approach that was outlined involves the earmarking of bottleneck revenues from cross-border transmission. No changes to current organizational structures will be needed. Furthermore, ownership of new transmission assets will reside with the national TSOs.

Some significant challenges lie ahead related to the structuring of potential bilateral agreements and reaching a common agreed methodology for calculating the welfare economic costs and benefits.

Investment decisions have been taken for four out of five projects in line with the plan outlined when the projects were presented. The remaining decisions are expected during the first quarter of 2006. (See Table 6.1). Moreover, two of the projects are in fact internal connections within a Nordic country, respectively Sweden (Snitt 4) and Denmark (Storebælt). Their importance for the Nordic system, beside for national systems, are the reason for them being included among the five projects. The common Nordic planning performed in this case has shown that interconnectors within a country with benefits for the Nordic system can be included in the planning as well as the financing.

Table 6.1 Status for five priority inter-connectors (January 2006)

Connection	Fenno-Skan 2	Nea-Järpströmmen	Snitt 4	Skagerrak IV	Great Belt
Connections between / in countries / country	Finland-Sweden	Norway-Sweden	South-Sweden	Norway – Denmark	Denmark
Investment decision	Feb 2005	Feb 2005 *	Nov 2005	Q1 2006	Dec 2005
Investment cost	€ 200- 220 m	€ 66 m	€ 150 m	€ 320-345 m	€ 160 m

Source: Nordel 2005 and SvK. *In Sweden

The agreement is however restricted in time. The financing of the projects is only supposed to last for a specific number of months. The agreement does hence not necessarily represent a lasting solution to the challenge of grid investments. Even with a lasting arrangement there may be at least two flaws to the “system”:

- It is much less likely to be applicable for smaller investments, but those may still be of considerable scale. Generally there are large external effects from grid investments and operations.
- It may be so that the decision as to which investments should be financed from a common pot may be more the result of bargaining and compromises than on “cold” estimates of Nordic economic surplus.

Too much internal focus?

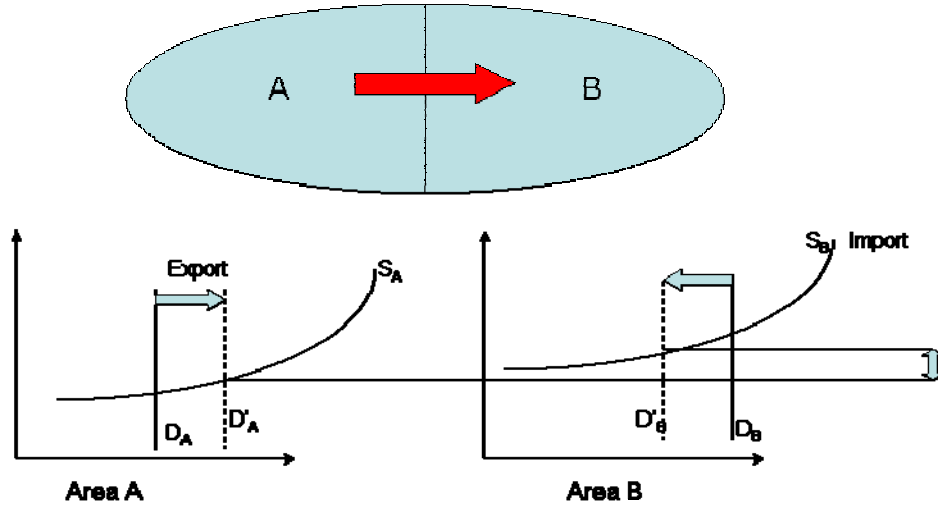
A potential disadvantage of having a common Nordic organization could however be too much focus on the internal Nordic perspective and relatively less focus on projects into and out of the Nordic area. If this was the case, then projects such as the NorNed cable (between Norway and the Netherlands) might be less likely to receive investment approval.

6.2 Congestion management

There are basically two different ways of handling congestions in power grids, called *market-splitting* and *counter trade* respectively.

The so-called market splitting is probably the most intuitive solution. If there is congestion, the market is split into two separate areas each having their own price. The power flow between the two areas is at maximum value, but still the importing area will have a higher price than the exporting area. This is illustrated in the figure below with congestion between area A and area B. For simplicity it is assumed that there is no price elasticity in demands which are hence vertical lines denominated D_A and D_B respectively in the price diagrams. Supplies in the two regions are denominated S_A and S_B respectively. The export from area A to area B is shown with arrows in the price diagrams. We have shown the flow between the two areas as a shift in demand in the price diagrams, a shift to the right for area A and a shift to the left for area B.

Figure 6.2 Market splitting

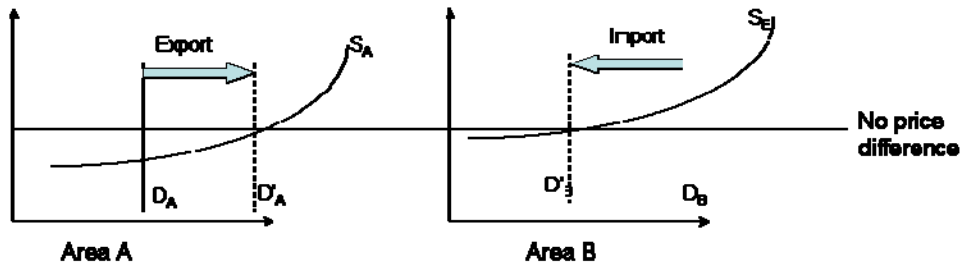


Counter trade on the other hand uses a two-step procedure. In the first round, the market is cleared as if there were no congestions. Consequently there will be only one price for the whole region. Due to the congestion, it is however not possible (or very costly since the power system would break down) to use the dispatch following the first round. In the second round, the system operators pay the market participants to change their planned production and/or consumption. The system is hence re-dispatched and that explains why this system for congestion management is sometimes referred to as re-dispatch.

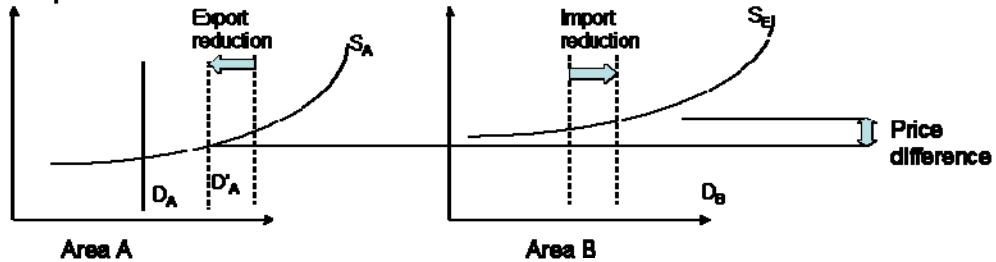
To choose the cheapest way to re-dispatch a system, the system operator typically uses some form of auction for this re-dispatch. Typically, the system operator can use the bids from the spot market (i.e. the same market that was used in the first round), the balancing market or may even create an auction dedicated for this purpose. The situation where the spot market is used in both rounds is illustrated in the figure below.

Figure 6.3 Counter trade where the same bids are used in both rounds.

Step 1



Step 2



It can be shown that given a number of assumptions, the final result in physical terms will be identical to the result using market splitting if the same bids are used for the re-dispatch. This is illustrated in the two figures above where the final result of counter trade (after step 2) is identical to the result from market splitting. We have shown the situation without any flexibility in the demand. The principal results will however be the same, but the diagrams become more complicated.

It is however important to note that the prices and payments are not identical. The public price for both areas will be P_0 when counter trade is used where as there are two public prices, P_A and P_B , when market splitting is used. This implies that producers in area A receive and consumers in A pay a higher price for their production when counter trade is used than when market splitting is used. Symmetrically, producers in area B receive and consumers in B pay a lower price when counter trade is used than when market splitting is used. Furthermore, those produces participating in the re-dispatch are typically compensated for this inconvenience.

Since prices and payments are of crucial importance in a market, there will be differences in the longer run. Fundamentally, with the use of counter trade, the prices reflect neither the marginal willingness to pay nor the marginal production costs. Hence an important criterion for a well-functioning market is not present. This will influence the use of water in hydro power plants in the intermediate run and investments in the long run.

In the very long run, this will influence the investments. It may be argued that investments in power plants are decided at a political level rather than in the market place and hence there should be no costs by incorrect market signals due to the use of counter trade. Counter to this view, it should be noted firstly that investments are not only new plants. Also minor upgrades of plants, energy saving equipments etc are covered under the term investments and their profitability is influenced by the price expectations. Furthermore, investments in the Nordic area may need a concession to be built, but they are not fully financed by the authorities. Part of the investment cost must be covered by the power sales. Using counter trade gives a too low price in the deficit area and hence too weak signals for investments in this area. Even if the final “price” after re-dispatch goes up to P_B , this is only valid for those producers that are used for re-dispatch.

It is also important to note that the use of counter trade will influence the bids. The easiest way of seeing this is to look at the producers in the deficit area. If the extra production dispatched in the second round gets a higher price than the production dispatched in the first round, every producer wants to get into the second round. They will hence deviate from the marginal cost bid when that can increase their expected payment for the production.

6.2.1 *The Nordic situation*

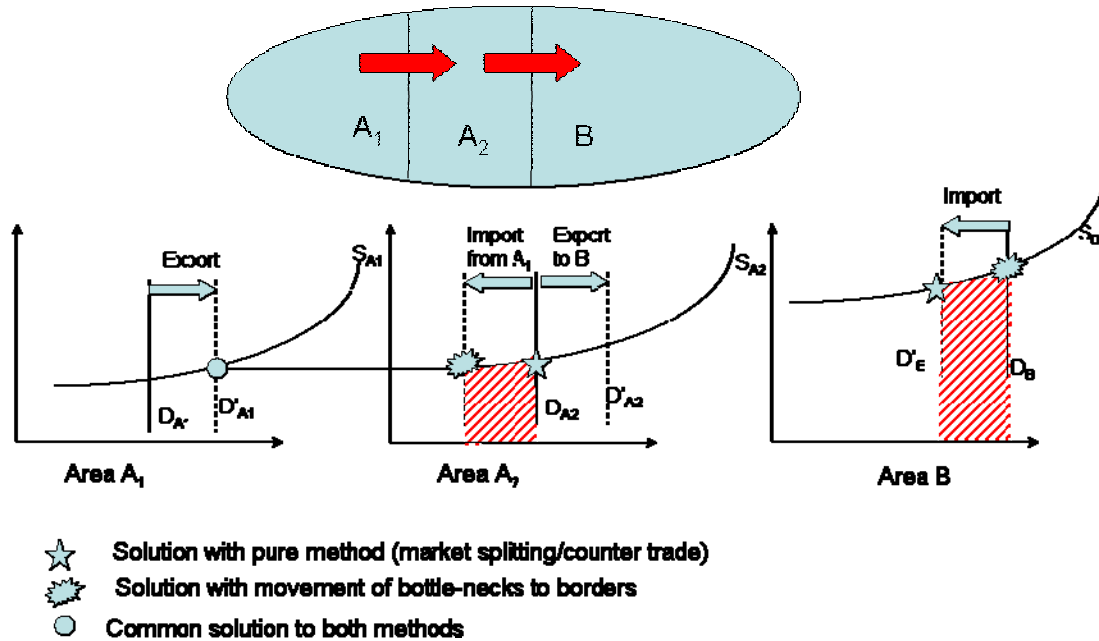
The Nord Pool region is divided into a number of potential price areas, i.e. the prices may differ between these areas if there are congestions, but will otherwise have identical price. The term *bidding area* is used. Presently, all bidding areas are restricted to one country, i.e. the borders between the bidding areas follow the national borders. Of the Nordic TSOs only Statnett and Energinet.dk use market splitting internally. Denmark is naturally two different price areas since there is no direct electric connection between the western and the eastern part of the country. Norway is divided into a few different price areas (typically three) following some consistent (structural) bottle-necks. Both the number of potential price areas and the exact definition between them do differ over time due to changes in the congestion pattern. There are hence typically 8 bidding areas: Norway1-Norway3, Denmark-West, Denmark-East, Sweden, Finland and Germany.

Furthermore, all the Nordic TSOs use counter trade to a varying degree. To minimize the TSO costs associated with the counter trade, the TSO will typically reduce the transmission capacity on the borders with their neighbouring countries. More detailed, they reduce the import capacity into the surplus area and the export capacity out of the deficit area. This procedure often eliminates the need for any counter trade. The system is typically referred to as “*moving the bottle necks to the border*”

and can be seen as some hybrid between market splitting and counter trade.

It is important to note that this solution does *not* give the same physical result as the counter trade/market splitting as described in the section above, not even in the short term. This is illustrated in the figure below. The area A is now sub-divided into two, A_1 and A_2 . Without trade, the price in A_1 would be lower than the price in A_2 which again would be lower than the price in B. There is hence a flow from A_1 to A_2 and from A_2 to B. For simplicity we have assumed that the two trade flows without transmission constraints are equal. Hence the price in A_2 would equal the autarchy price. Assume now that A_1 and A_2 belong to the same country and that congestion between the two areas is moved to the border between A_2 and B. Counter trade between A_1 and A_2 is only used if still required without any trade from A_2 to B. For simplicity, we have in our illustration assumed that the need for counter trade over the cut between A_1 and A_2 vanishes exactly when the export capacity from A_2 to B is set to zero. In that case the production in A_1 is the same no matter what method for congestion management is used. The production always covers internal consumption plus maximum export. We do however see that the solutions in the other two areas differ. In A_2 , the production is reduced when export capacity out of the area is reduced. Consequently, the production in area B is increased with the same amount. Since the marginal production in B is more expensive than the marginal production in A_2 , the result is an inefficient use of resources. The extra cost equal the difference between the two shaded areas; $C_1 - C_2$.

Figure 6.4 Consequences of moving the bottlenecks to the border.



The reason for this solution is that both among the TSOs and among market participants (also in the financial market) it is seen as a value that there is only one national price. Simplicity and liquidity in financial markets are arguments for this view.

In a recent paper Glachant and Pignon (2005) challenge the usual optimistic view of market-based arrangements used for cross-border congestion management within the Nordic region. The problem that they point at is that there is a measurement problem for the scarcity constraint. Is the signal that the TSOs emit reflecting the hard physical constraints or reflecting operators' opportunism? Congestion is a situation when the power flows exceeds the regulated limits set by the TSOs, and these limits are not stable and invariable. Glachant and Pignon argue that the methods chosen by the TSOs to generate the congestion signals are not neutral and may be manipulated by the TSOs and they show that the TSOs have incentives to do so. Whether this is an argument for increased harmonization is unclear. According to Glachant and Pignon, "light-handed" regulation makes this kind of opportunistic behavior more likely, and that there thus is a need for a more effective congestion regulatory mechanism.

6.2.2 The value of deeper cooperation between the Nordic TSOs

In general price signals that reflect marginal losses are of great economic importance. This does however both include marginal losses and bottle-neck management. Green (2004) estimated the costs of a system ignoring

both marginal losses and bottlenecks compared with a system that take these factors into account in the England/Wales market (as of 1996/97). This market had constant flow from north to south, with average transmission losses of 1.5 percent of demand and congestion costs of approximately 1 percent of the wholesale market turnover. He estimated the welfare gains from regional prices corresponding to 1.5 percent of the wholesale market turnover. The redistribution effects would however be large.

The total losses in the central grids in Denmark, Finland, Norway and Sweden are about 6 TWh (annually). With a power price of 3 euro-cent/kWh this corresponds to annual costs of about € 200 million. A Nordic system that ignores losses could increase these costs considerably. The total power consumption in the Nordic power market is about 400 TWh annually. Based on Green's results with welfare costs of 1.5 percent of the market turnover and again assuming a power price of 3 euro-cent/kWh this would imply a welfare effect of about € 200 million, i.e., about the same amount as the total losses today. Currently the Nordic market is however not in the situation that losses and bottlenecks are fully taken into account since there are no tariffs taking marginal losses into account in Finland and Denmark, and counter-trading is used for bottleneck management. Neither is the market in a situation in which these effects are completely ignored. Clearly large sums are at stake, but this is related both to bottleneck management and marginal transmission losses. The latter is discussed in the next section.

Even though there are potential large gains from choosing a more appropriate mechanism to handle congestions, it is however not obvious that this would be the result of further harmonization between the Nordic TSOs. If a common ISO or TSO is established, it is reasonable to believe that the principles of congestion management will be harmonized between the countries.

The harmonization could however reduce the welfare economic surplus if the harmonization is carried out to an inferior solution. It could result in an end to the splitting of Norway into separate bidding areas. As long as there is no connection between western and eastern Denmark, we do not see it as probable that Denmark would become one bidding area. But if the Storebælt connection is built, this could also result in Denmark becoming one bidding area. Furthermore, harmonization could possibly result in a common price area for both Sweden and eastern Denmark. Whether this will increase the Nordic welfare economic surplus is an empiric question.

It is worth noting that *if* the view that it is beneficial with one common Nordic spot power price becomes dominant, the TSO costs for counter trade may be very large. This will probably be followed by a focus on grid investments within the Nordic area to reduce the costs for counter trade. It will hence increase the probability of internal grid investments,

also those that are not welfare economically profitable. Furthermore, it will probably reduce the possibility of grid investments between the Nordic area and surrounding areas since it is likely that it will increase congestions within the Nordic area. Such investments may very well be more beneficial than internal investments. An intuitive way of seeing this is by noting that the price differences between the continental power market and the Nordic power market is larger than the price difference between the Nordic countries internally. And since the value of trade lies in the difference between the trading partners, the value of interconnectors with the Continent may be larger than the value of increased interconnector capacity between the Nordic countries.

Oppositely, harmonization could also give an improved overall handling of congestions. And this would obviously give an increased welfare economic surplus.

The harmonization of congestion management method between the Nordic countries will hence only increase the Nordic welfare economic surplus if the harmonization gives a better solution. Harmonization as such does not improve the welfare economic surplus.

6.3 Harmonization of tariff model design

6.3.1 *The problem*

All the Nordic TSOs apply point-of-connection tariffs, meaning that the customer pays for the right to input or output electricity at a single connection point and through this get access to the entire network system,

The grid charge in Sweden consists of three parts: a capacity charge, an energy charge and an investment charge. The capacity charge accounts for approximately 60% of the grid revenues of Svenska Kraftnät. This charge is based on the capacity leased annually by the customer at each connection point and varies geographically throughout the country. The annual entry fee decreases linearly with the latitude from SEK 25/kW in the north to SEK 5/kW in the south and the annual exit fee increases linearly with the latitude from SEK 11/kW in the north to SEK 47/kW in the south. This structure is explained by the fact that the predominant flow of power is from the north to the south.

The energy part is based on the actual input or output of energy and should reflect the network's marginal transmission losses. The loss coefficients vary geographically between $\pm 10\%$ and have been calculated for each connection point and for different load situations. A negative coefficient means that the customer is paid by Svenska Kraftnät.

Also in Norway there is an energy charge depending on the marginal losses caused by input or output in each point. For production there is a charge of NOK 5/MWh. There is also a reduced feed-in tariff in areas

where new production is beneficial for the grid (NOK 1/MWh). On the consumption side the tariff is based on the average total consumption during the peak load hour in each connection point during the five previous years, which is believed to be representative for the peak consumption. Several adjustments are then made to take different cost affecting factors into account. Load shedding capacity is deducted and a correction factor depending on the share of input and output in the point is then used to calculate the basis for the tariff. The correction factor includes the total peak load in the point, the available winter generation capacity, and the consumption by power intensive industry.²⁴ The charge is then NOK 130.000/MW. In addition there is a separate tariff for load shedding capacity.

Fingrid charges a consumption fee, use of grid fee and a connection point fee for the grid service (and a market border fee). The consumption fee depends on the consumption beyond a particular connection point and is differentiated between winter periods and other times of the year. The use of grid fee depends on the volume of electricity transmitted through the connection point and it is differentiated between input and output. Finally there is a connection point fee for each connection.

In Denmark there are differences between Denmark West and Denmark East. Even after the creation of Energinet.dk these two areas are considered as separate tariff areas (by law). In both areas there is a net tariff. In Denmark West it is a unit charge/kWh, while in Denmark East it is differentiated between low load, high load and peak load. This tariff is an energy charge. The larger part is paid by consumers, but a smaller part is also paid by the producers. This tariff is intended to cover the costs for the network operations. The second part of the tariff is the system tariff, intended to cover the costs for the system services. This is also a energy charge and the structure in terms of differentiation between load segments is the same as for the net tariff. Finally there is a PSO tariff that covers the costs for Public Service Obligations. This tariff is also a unit tariff/kWh in Denmark West and load differentiated in Denmark East.²⁵

Table 6.2 summarizes the main characteristics of the transmission pricing principles in the Nordic countries and it is clear that there are significant differences. The share of the tariffs that is covered by the producers and consumers, respectively, differs widely and the structure of the price

²⁴ The correction factor is calculated by the formula $k = \frac{F}{P + F + c \times KII}$, where F is the sum of the peak load, P is the available winter generation capacity, c is a correction factor for power intensive industry and KII is the consumption in the power intensive industry. The available winter generation capacity for hydro is the highest effect that can be produced during six consecutive hours (during peak) in a cold period that is at least three days long. For wind power the available capacity (for 2006) is 50% of the installed capacity and for thermal plants 100% of installed capacity.

²⁵ During the first quarter 2006 it will be a unit tariff also in Denmark East due to specific circumstances

signals also differs. Denmark East, Finland, Norway and Sweden have time (or load) differentiated tariffs to varying degrees while Denmark West does not. Only Norway and Sweden have location signals in the tariffs. There are however also some similarities, where there are differences on a European level, such that the losses fall within the cost base for the TSO in all the Nordic countries and that the system services are included in the transmission tariffs.

There are also differences in the basis for the tariffs (see Figure 6.5). In Finland and Denmark the tariffs are based on the energy (i.e. per kWh), while in Sweden and Norway there is a mix between basing the tariffs on the energy (per kWh) and on the power/effect (per kW).

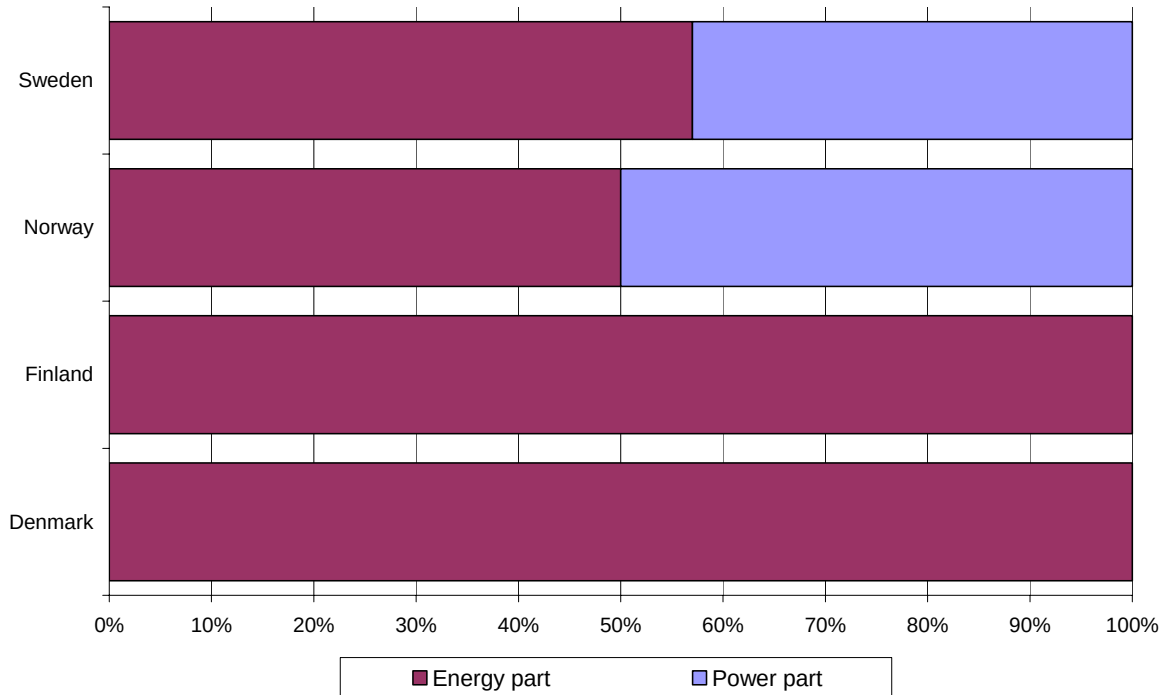
Table 6.2 Main characteristics of the transmission pricing principles in the Nordic countries

	Sharing of network operator costs among customers		Price signal		Do the losses fall within the TSO cost basis?	Are system services included in the transmission tariffs?
	Producer	Consumer	Seasonal time-of-day*	Location		
Denmark East	3%	97%	XXX	-	Yes	Yes
Denmark West	11%	89%	-	-	Yes	Yes
Finland	7%	93%	X	-	Yes	Yes
Norway	32%	68%	XXX (via losses)	Location	Yes	Yes
Sweden	25%	75%	XX (via losses)	Location	Yes	Yes

* The "X" indicates time differentiation. One "X" means that there is only one time differentiation (day-night, summer-winter, etc). For each additional X there are more time differentiation.

Source: ETSO Tariffs Task Force, Comparison on transmission pricing in Europe: Synthesis 2004 (April 2005)

Figure 6.5 Energy and power related components in the transmission tariff in the Nordic countries



Source: ETSO Tariffs Task Force, Comparison on transmission pricing in Europe: Synthesis 2004 (April 2005)

6.3.2 Evaluation²⁶

The effect on the economic efficiency of increased tariff harmonization can be differentiated in two ways. First of all it is likely that there will be efficiency gains of introducing tariffs (on input and output) that take marginal losses into account.²⁷ As described above there are large differences, where Norway and Sweden have tariff models designed to take marginal losses into account, while Denmark and Finland have more of a unit price model. It is not meaningful to discuss marginal losses in one particular point, but it is the loss in the transmission from one point to another. This means that to create tariffs based on marginal losses in different points one need to choose a reference point and calculate the marginal losses between each node and the reference point.

As was argued in the previous section (about congestion management) there are large potential gains from the introduction of tariffs, or a market structure that capture marginal losses and handle congestions in a more appropriate way in the Nordic area. The gains are also likely to increase

²⁶ We also refer to ECON Report 73/99 for more detailed discussions on this topic.

²⁷ The marginal loss is the share of the electricity that is lost (transmission losses) when the input is increased with one unit.

with increased transmission capacity within and out of the Nordic area. Harmonization around the *wrong* policy, i.e., one that disregards losses, could however be very costly.

Secondly there is an issue on harmonization around levels regarding the part of the tariff that does not reflect marginal losses. It is important first to note that if a tariff is put on all producers or all consumers in a market the equilibrium outcome is independent on who has to pay the tariff. The real burden sharing is not determined by who pays the tariff, but on the shape of the supply and demand curves.

However, in a market with several countries, that each uses different principles²⁸ for setting the tariffs the outcome is different. The marginal costs should naturally be covered, but this will not be sufficient to cover the total cost for the grid. Differences in the residual tariffs will distort competition and could lead to sub-optimal production and consumption decisions. This will in particular be the case when some countries cover the residual costs from the production side and some from the consumption side.

Differences in using energy or power (effect) as the basis may also create disturbances. In a pure hydro system this would not be a problem²⁹, but with thermal power a tariff on the generated energy adds to the marginal costs and affects the operation of the plants. With differences in tariffs thermal production will (in some load segments) be moved across borders in a way that reduce the total efficiency of the Nordic power market. Differences in tariffs based on the installed capacity do not have such an effect on the short run efficiency.

In the long run both tariffs on the installed capacity and on the energy production affects the producers profitability and thus their willingness to make investments. For instance, with high power capacity tariffs in one country more expensive peak load capacity can be built in one country even though that has higher total costs.

Another important need for harmonisation is related to a harmonization of the residual tariffs that the producers pay. It is reasonable to believe that the generation side is more elastic (i.e. reacts more to price signals) than the consumption side. If this is true, differences in tariffs on the generation side will have larger effects on than differences in tariffs on the consumption side. This means that the producers should pay the same *residual tariffs* in all countries.³⁰ The important issue here is not to equalize the share of the residual tariff that the producers pay, but the absolute level. The remaining part should then be covered by the consumers.

²⁸ This includes both that different models may be used, but also that different historical costs are to be covered by the tariff.

²⁹ The production is determined by the inflow and is not affected by the energy tariff.

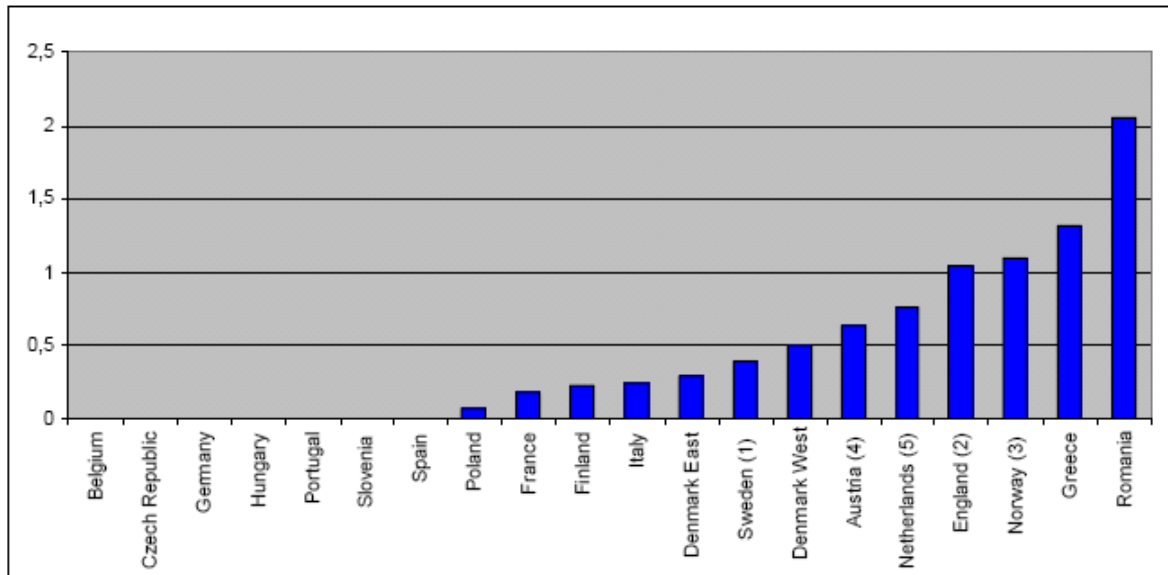
³⁰ The part of the tariff that is supposed to give the correct price signals should of course vary by costs

Figure 6.6 shows the differences in the tariffs paid by producers across Europe. This shows that the difference between Norway and Denmark East (which are the extremes for the Nordic countries according to this figure) was about € 0.8/MWh. This is not the same as saying as the residual tariff differs by this much as part of the tariffs also reflects costs such as marginal losses.

Figure 6.6 Differences in tariffs paid by producers

Diversity of G components paid in 2004 by producers across Europe

Euro per MWh



For the following countries it is a mean value: Denmark, Norway, Sweden, England, Romania and Greece

1. **Sweden:** G is ascending from south to north. G component is divided into an annual power part and an energy part
2. **England:** Generation tariffs range from 13.25€/kW in the « North » to -10.06€/kW in the Peninsula zone. The mean TNUoS generation tariff is around 5.24 €/kW
3. **Norway:** 0.5 €/MWh is a fixed component, while 0.5 €/MWh is a loss component. The value of the latter is dependent on time and location
4. **Austria:** Charge to generators in Network Area Austria (only Verbund-APG)
5. **Netherlands:** although since July it has been set to zero, it is still included in the tariff comparison.

Source: ETSO Tariffs Task Force, Comparison on transmission pricing in Europe: Synthesis 2004 (April 2005)

6.3.3 Implications for choice of model

There are potentially large gains if increased harmonization leads to the introduction of tariffs or a market structure that capture marginal losses and bottlenecks in a better way than what is currently the case. The costs of a harmonization that leads to the wrong policy would however also be large. There is thus not a clear link in this respect between harmonization and economic outcome. Since a reference point has to be chosen to calculate the marginal losses, it could be beneficial to use a reference point that is relevant for the entire Nordic market.

The drawback of increased harmonization could be that the chosen tariff structure will be determined by the least common denominator, which could lead to a solution that is not necessarily better than a situation in which some countries chose a model that reflect marginal losses, while others chose a model that ignores such effects.

Besides introducing tariffs that reflect marginal losses, it seems most important to harmonize the level of the residual tariffs paid by the producers. The difference in tariff paid by the producers in the Nordic is however not very large. It does therefore seem less likely that these differences will have a major impact on the localization decisions for new investments. It is more likely that the differences in levels and structures affect the short run efficiency.

Nordel has also worked on the issue of harmonising the grid tariffs. In 1998 a working group was put together by the Nordic TSOs with the task to suggest harmonisations (the work was reported done in a final report from 2000) and steps forward have been made.

Harmonisation of the tariffs, both in structure and level, is however clearly a difficult area in which the cooperative approach employed so far has not been fully successful. Merging the TSOs into a joint organization is likely to create a momentum for increased harmonization that can help to overcome national resistance.

6.4 Ancillary services and peak capacity

6.4.1 *The problem*

The Nordic electricity system consists of the synchronously interconnected sub-systems in Norway, Sweden, Finland and Eastern Denmark and the sub-system in Eastern Denmark which is connected to Norway and Sweden via DC interconnectors. The operations of the interconnected Nordic system depend on cooperation and coordination between the different system responsible entities, which is regulated through the System Operation Agreement between the TSOs.

To deliver the system services the TSOs need to procure *ancillary services*. There are a number of such services and a common Nordel definition (see Annex), but many of them refer to operational reserves. Peak capacity reserves are not defined as an ancillary service (according to Nordel), but there are many similarities. There is no unanimous belief that keeping/procuring peak capacity reserves should be a task of the TSO. In this report we do not deal with the issue on whether centrally procured peak capacity reserves are needed. We rather pose the question that if there is a need for such a reserve, are there benefits in coordination?

6.4.2 *Evaluation of costs and benefits from a welfare economic perspective*

Ancillary services

In order to achieve economic efficiency the cheapest available reserves should be used, given that these fulfill the needs of the system. The costs of reserves differ between the different subsystems. Rapid regulating hydro-capacity generally provides cheap possibilities for system reserves. The crucial point is to which extend reserves located in one area can be used as a reserve resource in other areas.

There is a restriction that 2/3 of the frequency controlled reserves should be localized within the TSOs own system, which potentially could be a factor that reduces the economic efficiency if a higher share could be acquired from other parts of the Nordic system without conflicting with system security. Nordel has proposed that the dimensioning and acquisition principles of the operational reserves should be included in the System Operation Agreement and that the Nordic TSOs gradually should introduce a common market solution for reserve functions where it is feasible and that common principles of financing the operational reserve and cost sharing between the countries should be developed (Nordel, 2005).

The costs for (selected) system operation services in 2004 for the Nordic TSOs are displayed in Table 6.3 The different TSOs have some differences in their reporting and it is thus hard to compare the numbers. What is important is that these costs are small in comparison with the total costs of the electricity system. The total consumption of electricity within the Nordel area was close to 400 TWh in 2004 and the average power price on Nord Pool was 242 NOK/MWh, which would imply a total value of close to 100 billion NOK. In addition to this there are significant costs for network operations (central and distribution grids). The fact that the costs for the system services are very small in comparison to the total costs of the power system is of course no reason not trying to create even more efficient operations, but it has implications on how large the potential efficiency gains are, and on which kind of organizational changes it is worthwhile to carry through in order to achieve these potential gains.

The actual economic costs of the ancillary services may be higher than what is indicated in the annual reports of the TSOs. Ancillary services are often procured through central bilateral negotiations between the respective TSO and the electricity industry. According to information received during this work the prices for these services have increase during the last years. This should however not primarily depend on increase real costs, but an increased awareness of the real opportunity cost of providing these services. There is thus a possibility that the costs in the annual reports do not reflect the true economic costs.

There are primarily two possible sources for efficiency gains. One is the potential to lower the total requirements for system services through increased coordination, and the other is to acquire a given amount of system services in a more efficient (cheaper) way.

Table 6.3 Costs for (selected) system services for the Nordic TSOs in 2004

TSO	Item	Cost, million	Comments
Svenska Kraftnät	Net balancing power	SEK 96	Sale: 757, Purchase: 853
	System operating services	SEK 195	
	Peak-power reserve	SEK 163	
Statnett	Net spot- and regulating power	NOK 93	Sale: 1467, Purchase: 1560
	Net operational coordination	NOK 257	Sale: 336, Purchase: 593
Elkraft System	Payment for ancillary services	NOK 375	Revenue from system operation pool DKK 424 million.
Eltra	Regulating power	DKK 82	Revenue from ancillary services sales was 432 (rev. from system tariff 363 million, rev. from real-time market 67 million, fee from regulating power market 1 million)
	Payment for reserve capacity	DKK 391	
Fingrid			System services are not separated in the annual account.

Source: Annual reports, 2004

Peak capacity and energy reserves

The electricity system is in need of capacity and energy reserves to meet unusual events without causing a shortage. There is however not a common understanding whether this should be a responsibility of the system responsible entities or not.

Capacity reserves are needed to meet the need for *the maximum effect*. Consumption could increase due to e.g. cold weather or capacity could go out due to plant or grid failures and the capacity reserves are needed to handle such situations. The energy reserves are important in hydro dominated systems where variations in available energy can vary substantially particularly due to weather variations (low precipitation).

The same units can sometimes function as both capacity and energy reserves. The capacity reserves are however in general only needed to function for a few hours per day and possibly only at a few occasions per year. Energy reserves are however needed to be operated for an extended period (weeks or months).

The Swedish TSO, Svenska Kraftnät, upholds a capacity reserve of up to 2,000 MW which should be available during the winter season (16 November – 15 March). The capacity is procured from owners of production facilities or large consumers and SvK pays a fixed fee for the availability and a variable fee when the resource is used. The units can be procured for one or several seasons. This is a temporary arrangement which

is in place until 2008 and the intention is that the market operators shall take the full responsibility for adequate capacity after that.³¹

Energinet.dk is obliged to maintain sufficient capacity through agreements with generators and the TSO also has a responsibility for a comprehensive long-term planning in order to give a basis for an assessment of the security of supply. Fingrid owns or leases capacity in gas turbines and contracts for load shedding (in total more than 1000 MW), but has no predefined responsibility for security of supply. Statnett acquires peaking reserves from its regulating contract options market (RCOM) and has a responsibility regarding the energy balance during exceptionally difficult hydro situations.

In other parts of the world different centrally organized schemes to ensure adequate capacities are in place, for instance capacity certificate schemes.

It is beyond the scope of this report to evaluate whether there is a need for a centrally procured reserve, or some other centrally organized capacity/energy reserve scheme. Nordel recommends that the TSO's responsibility with respect to security of supply should be limited to operational security of the power system (momentary balance and operational reserves). The momentary balance however involves a long-term commitment by the TSOs to have the necessary capabilities for it at all times, but "In order to give the right signals for the market, the TSOs' responsibilities in maintaining the balance between demand and supply should in principle be limited to the operational security of the power system and for the adequacy of the operational reserves necessary for that task". Furthermore, "Involvement of the authorities or TSOs in ensuring peak resource adequacy in the market should be avoided. If there is, however, a risk of market failure in this respect, any safeguarding action should be transitory and its costs of such resources should be covered by the market players. A harmonized Nordic procedure and criteria to initiate a tendering process (EU Directive) or any similar safeguarding measure should be developed." (Nordel, 2005).

6.4.3 *Implications for choice of model*

Already today the TSOs can acquire ancillary services outside their own respective area (given that there is physical capacity) and the TSOs should show solidarity in the event of a crisis. In September 2002 a common Nordic regulating power market was established. Each TSO collects regulation bids in its own subsystem and submits these to the

³¹ The views on the necessity of such a centrally procured capacity reserve differ even within Sweden and there is currently an ongoing debate in which representatives of several large generators have expressed the view that some sort of a centrally procured reserve probably will be needed when this temporary arrangement expires.

Nordic Operational Information System (NOIS). A joint Nordic list of all regulation bids is then composed. Statnett and Svenska Kraftnät share the responsibility for the frequency regulation (Energinet.dk performs the regulation in Denmark West). Furthermore Energinet.dk is also connected to Statnett's RCOM market.

The general conclusion is that there are benefits of coordinating acquisition and markets for reserves (both operational reserves and a possible peak capacity reserve). Important steps towards a more integrated market have already been taken. That said, it is not fully integrated yet and improvements could be made. As an example, the Swedish peak capacity reserve is procured solely in Sweden, while it is far from obvious that this is an optimal solution from the Nordic perspective.

Differences in the views on peak capacity reserves can also lead to sub-optimal solutions, in which the reserves are either under-supplied (due to a free-rider problem) or procured by the most "nervous" countries/TSOs. The latter could lead to a sub-optimal localization of the reserves if the procurement is done within the TSO area.

Such free-rider problems and other kind of sub-optimal solutions could more easily be avoided with a closer coordination, even though the most important problem could be solved through the establishment and continuous improvement of common markets for reserves. An entirely new organizational structure does not seem necessary, but could facilitate better solutions.

6.5 Harmonized balance settlement and the creation of a single end-user market

6.5.1 *The problem*

All the Nordic TSOs apply their own system and pricing for balance settlement. These systems have evolved out of historical needs and to a certain degree they reflect differences in system structure and technological characteristics. Norway uses a one-price system (the regulating price), while Denmark, Finland and Sweden uses a two-price system (the regulating price and the spot price). Furthermore, Norway and Finland uses one single balance, while Denmark and Sweden uses separate balances for generation, consumption and trade.

These differences between the national markets in turn mean that there are differences in costs for the actors that are active on the respective markets. For instance, a distributor on the Swedish market has a balance cost each hour both for ending up above or below expected level of distribution to its end customers, whereas a distributor in Norway only has to pay for hours where the level became higher than expected.

The Norwegian one-price model is motivated by simplicity and low thresholds for balance providers, and the Norwegians seem to have a positive experience. Norway do have a unique generation mix with (almost) only hydro power, which provides the possibility for fast and cheap regulation, compared with a mixed thermal and hydro based system (or pure thermal). The consequence for the market participants is however that the costs they are faced with are higher on the Swedish market than on the Norwegian.

This cost difference puts a wedge in to the notion of having a single Nordic end-user market. The power distributors have to cover their costs for being present on a market and when the costs differ this implies that there will not be a single end-user market. According to ECONs calculations there are clearly differences in price levels on the end-user level between the different national Nordic markets. For household customers these differences can be established by examining official statistics. For larger industrial customers this is more difficult to establish but according to market participants own perception these differences have an impact on how well the Nordic market can be viewed and treated as a single end-user market.³²

6.5.2 Evaluation

If a goal is to establish a single end-user market it should be clear that a prerequisite for this to become a reality is that costs facing the market participants can not be different between the national markets that make up the joint market. Depending on how large the differences are there will be larger or smaller differences in offers to end-users in the respective markets. In this respect it should be pointed out that the differences in balance costs that are a consequence of not having harmonized the balance settlement principles between the Nordic TSOs do not impose a substantial factor for market distortion. For this it is judged to be too small to take all the blame for the fact that there is still not a single end-user market.

The picture is however somewhat different for different customer segments. If we focus on smaller residential customers there is clearly the case that the differences in balance costs do not answer the whole question. There are several other hurdles which impose barriers for the market participants when considering entering another national market. These hurdles range from language issues to the fact that one has to establish local customer support to existing brand loyalties among customers etc. Altogether this means that the differences in balance costs is one of several entry barriers for market participants that are considering

³² This has for instance been claimed by large industrial representatives in Svenska Kraftnät's electricity market council (see protocol from the meeting 22 November, 2005).

moving into new markets and a harmonization of the balance settlement would thus only partly offset this.

For larger customers this looks different. For them the power market can be viewed as more of a joint Nordic market where they are not limited to their local suppliers. The large users even have their own possibilities to be part of Nord Pool. For the large users being active on several on the Nordic markets themselves the market barriers mentioned above are less important. Instead the differences in balance cost play a much more important role and can be viewed as making a difference for actually being able to have single end-user market in this customer segment.

The facts that there are differences between the balance settlement systems in the Nordic countries have historical reasons that often are based in differences in costs between the countries. These cost differences have resulted in different views on what is the optimal technical solution for each national market. The issue here is whether the cost differences imposing the differences in national balance settlement systems are large enough to imply a continuation of the present situation or if the benefits from harmonization of the balance settlement between the Nordic markets would offset the cost increase?

6.5.3 Implications for choice of model

The existing differences in balance settlement models for the Nordic national markets do not create substantial differences in costs between the markets. The costs related to the present systems contribute to the entry barriers that are present for actors interested in entering another Nordic end-user power market. However, for a large share of the market the balance costs are just one of several market barriers that impose common barriers to a single end-user market.

In light of this it is the case that harmonized balance settlement will not create a single end-user market, but it will make it easier to reach that goal. This is especially the case for the market consisting of large industrial electricity users where the balance cost stands out as a more important barrier to a single end-user market.

A process towards harmonization of the balance settlement costs will probably prove to be easier if there is a joint Nordic TSO in place. But this is by no means necessary to reach that goal. If there is a joint understanding that this is a goal to strive for it should be possible to reach agreements between the national TSOs without having to make any organizational alterations.

6.6 Solidarity in crisis situations

A final issue, which is somewhat different than the previous ones, is whether the TSOs trust that the other TSOs will show solidarity in a crisis situation. According to the Nordic Grid Code they should do that, but this has rarely been tested in practice. So far, when it comes to immediate actions to solve acute situations our understanding is that the solidarity is shown. Another issue relates to whether they will show economic solidarity, i.e., help each other to avoid costly outcomes. A further issue is how far the solidarity will go in time. There is a fundamental difference between showing solidarity in an emergency situation, compared if problems prevail for a longer period (e.g. a situation when the nuclear plants have to be shut down for some reason, perhaps during an extreme dry year).

It is very difficult to assess whether this is a real or even perceived (among the TSOs) problem, today.

If there is a lack of trust this could have two effects. The first one is that it may cause the TSOs to over invest in safety measures, since they do not trust that they will be supported in a crisis situation. The second effect is that if the TSOs are not showing solidarity in preparing for a crisis situation they may under invest in safety measures that benefit the other TSOs. This would probably again lead to a less efficient solution.

6.7 Summary of evaluation of key issues and the impact for the choice of organizational structure

For most of the key issues identified in this study there is no clear link between the organizational structure and the possibility for increased harmonization. In general all the problems could be solved through negotiations and agreements between the Nordel members or bilateral agreements. In principle side-payments could make such agreements easier to reach, but in practice this may be very difficult.

Table 6.4 gives a summary of the key issues along three dimensions. The first one relates to how important harmonization is, and this primarily relates to the potential efficiency gains that can be accomplished. The second dimension is how difficult it is to reach further harmonization and the third one relates to whether organizational change is needed, or continued and improved cooperation in line with the current situation will be sufficient. At this moment we do not discuss the practical problems related to politics, regulation etc., but that is dealt with in the next chapter.

We wish to stress that this is not by any means any exact science, but this is an attempt to categorize the issues and provide a general overview.

Optimal grid investments

The evaluation above indicated that there are large potential gains from improved grid investments and consequently this issue is given a high priority. We have here focused on methods to get *optimal* grid investments, and in our view this is very hard to accomplish. The fundamental reason is that decisions on grid investments will be made over and over again, and it is not sufficient to once and for all agree on some common principle. In addition, cost-benefit analysis of grid investments are very complex which means that it is far from certain that an undisputed “scientific” basis for these decisions can be reached. For this reason organizational change, preferably a Nordic TSO, seems to be needed to accomplish *optimal* grid investments. A grid company for new investments could possibly help in coordinating these decisions, but to which extent is uncertain and depends on how strong mandate such an organization can be given. The fact that we claim that organizational change is needed to achieve *optimal* investments, does not mean that it is not possible to improve the current situation through a cooperative approach, but it will most likely not lead to the optimal solution. On the other hand, since the cost-benefit analysis of grid investments are very complex, several parties that need to agree may provide some checks-and-balances that leads to improved decisions. The drawback would then be that it would take longer to reach these decisions, and in some cases an agreement may not be reached.

Congestion management and tariff models

Harmonization of congestion management and tariff models is to a large extent the same issue, since both deals with sending the correct price signals to the market. The total benefits of providing these price signals are most likely high. The congestion management is probably the more important of the two and is given a high priority; while harmonization of tariff model is give a medium priority. In both cases the difficulty for further harmonization is seen as medium. The reason for this is that the different TSOs have fundamentally different views on how these issues should be solved, which would warrant a high level of difficulty. On the other hand, for these issues it would to a large extent be enough to agree once and for all on the principles to apply. Given such an agreement each TSO could then apply these principles independently. Since there is not the same need to continuously reach new agreements the level of difficulty is down-rated to medium. Again, since it is enough to reach an agreement on principles there is no real need for organizational changes. However, the creation of one joint Nordic TSO, would probably force this organization into adopting common principles. The fundamental difference in views would however not be resolved by an organizational change.

Ancillary services and peak reserves

Ancillary services and peak reserve capacity are to some extent very similar, but in other ways quite different. For both these issues there would be potential gains from increased harmonization. There is however already a common regulation market, and the TSOs have some possibilities to secure reserves outside its own area. The harmonization has thus come quite far already. For this reasons further harmonization is given a low priority level, which of course does not mean that continued harmonization to reap additional benefits should not be done. Since there is a general agreement on these kinds of reserves, and it should mostly be a technical issue to solve the practicalities the level of difficulty is also seen as low.

Peak reserve capacity is in this technical sense similar. If such reserves are to be procured by the TSOs, this should be done on a common market (given the technical restrictions). The problem is instead to agree on whether this is a task for the TSOs. All the TSOs seem to agree that this should not be a task for them, but still it is in some cases. A common view on whether this is needed, and if so, how it should be implemented without disturbing the market is important. Centrally procured peak capacity reserves can potentially disturb the market. Without coordination, or at least procurement on a common market, there is a risk that these reserves will not be obtained in the cheapest way and in the most suitable places from a Nordic perspective. The fact that the TSOs have a common view on such reserves, would lower the level of difficulty to increase the harmonization. However, there is considerable outside pressure from politics and market participants which could push the other way and for this reason the level of difficulty is seen as medium.

For neither ancillary services nor peak reserves organizational changes seems to be needed. For ancillary services continued cooperation will most likely be sufficient. Of course, a joint Nordic TSO, would probably facilitate the process towards a harmonized treatment of peak reserves, but the main difficulties seem to be outside the TSOs and have to be resolved on other levels.

Harmonized balance settlement

Harmonized balance settlement is a way to facilitate the creation of a single end-user market. We concur that difference in the balance settlement is one obstacle for creating a single end-user market. However, there are many other as well and a harmonization of balance settlement would most likely not be sufficient to achieve the goal. For this reason the harmonized balance settlement is given a low priority.

The level of difficulty is rated as medium. The reason is the same as for congestion management and tariff models. It would be sufficient to agree on common principles and it would not require new negotiations and agreements continuously. For technical reasons this service should

possibly be centralized, which should not be a major problem. The difficulty lies instead with different views on which is the optimal model, which may be due to that there actually are differences in the optimal solution between the countries.

Solidarity in crisis situation

We have briefly touched upon the issue of solidarity in a crisis situation. We have not been able to evaluate to which extent this is a real problem, and can thus not draw any conclusion on the priority level. However, if it is a problem it would be quite difficult to solve since it basically depends on trust. Such trust could be build by long term interactions, where solidarity is shown in repeated situation. These cases are however few. For this reason integration into one organization would be a way to solve this issue.

Table 6.4 Summary of key issues

Key issue	Priority level	Harmonization difficulty	Organizational change needed?
Optimal grid investments	High	High	Likely. For <i>optimal</i> solution
Congestion management	High	Medium	Bilateral/cooperative solution possible. Organizational change facilitates.
Tariff harmonization	Medium	Medium	Gradual harmonization through cooperation. Organizational change facilitates.
Ancillary services and peak reserves	Low (ancillary serv.)	Low (ancillary serv.)	No
	Medium (peak capacity reserves)	Medium (peak capacity reserves)	
Harmonized balance settlement	Low	Medium	No
Solidarity	Uncertain	If the problem exists: High	Yes?

7 Stakeholder consultation

During this work stakeholder consultations have taken place primarily in two forms. A questionnaire was sent to a large number of stakeholders (see appendix) in order to get a broad view from as many parties as possible. Secondly, we have conducted interviews with the four TSOs to get their input on this issue. In addition there have naturally been numerous informal contacts with various market participants.

It was clear from the answers to our survey that most stakeholders agree that the Nordic power system requires certain coordination of tasks in order to improve efficiency and resource allocation. This implies a need for harmonization and is important in terms of both a well functioning system as well as security of supply.

Among the most important issues that the respondents pointed out as areas for harmonization were the following;

- Interconnector investments;
- Bottleneck management;
- Balance settlement and
- TSO operations in general.

It was also pointed out that interconnector projects, i.e. investment decisions in future capacity is something that inevitably should be subject to some kind of harmonization and joint effort to use resources efficiently.

One very general comment concerns several of the models and that is the notion that "if it ain't broken, don't fix it". This sentiment can be seen through many of the comments regarding the different alternative models. The interpretation of this is that many of the participants think that today's system works. Albeit, there is still room for improvement many of the stakeholders think that the path taken should not involve too dramatic and sudden changes.

One very sensitive area concerns the room for national considerations. Whether the elimination of possibilities for national considerations should be viewed as an advantage or a disadvantage is not entirely straightforward. It may be the case the important national prerequisites that should be considered when optimizing the Nordic system are not internalized in a joint Nordic perspective when nationalistic considerations are left outside. Something that then may reduce total efficiency of a fully harmonized Nordic system.

In Table 7.1 that follows some of the major advantages and disadvantages of the models that were pointed out by key stakeholders are summarized. The detailed answers are found in the appendix.

Table 7.1 Summary of comments in the survey

Model	Advantages	Disadvantages
1. Increased cooperation	Not politically sensitive Historically delivered good results	National interests still a priority Difficulties to reach decisions
2. Joint Nordic ISO	Deeper cooperation between the TSO's Can be a step towards a common Nordic TSO	Has a lack of suitability to optimize both grid and market Congestion management through investments remain open issue
3. Joint Nordic TSO	Clear model for Nordic investments Easy to harmonize operational practices	Regulatory structures have to be established on a Nordic basis Difficult to establish ownership shares
4. Nordic interconnector company	Formalizes system planning Focus on interconnector capacity adds credibility to whole system	No clear relation between system planning and operation Interconnectors only part of the problem – internal bottlenecks also important
5. Nordic market operator	Integrated Nordic system operation and Nordic pool in one body Nord Pool spot ideal position	Politically impossible Risk of losing Nord Pool stability if not operationally independent from grid owners

8 Practical challenges

The general conclusion from above was that it is likely that there are benefits from further harmonization and that a joint TSO in many ways may facilitate such a process. There are however also examples where the optimal policies may differ between market areas, and where harmonization are not necessarily beneficial.

There are however numerous factors that may make organizational changes, such as the creation of a joint TSO very difficult or impossible. Even if it would be possible to carry through the actual organizational change, it may be difficult to get an efficient and well-functioning organization in place.

In this section we briefly discuss and highlight the important difficulties that have been identified throughout our work. Many of these factors lie outside the natural scope for our analytical work, and are highly dependent on the views and attitudes from owners, governments and regulators.

8.1 Ownership

As previously described the Nordic TSOs have different ownership structures. Three of the TSOs (Energinet.dk, Statnett and Svenska Kraftnät) are fully state-owned, while the fourth (Fingrid) has a mixed private and state ownership. The first issue would then be what ownership structure a new joint TSO should have. One solution could be to keep the existing TSOs and let them be the owners of a new joint Nordic entity.³³ This would create an entity with the Danish, Norwegian and Swedish states controlling the ownership shares from these three countries, while the Finnish ownership share would be controlled by the majority³⁴ among the owners of Fingrid. This would however clearly be an entity governed by the states, which may be problematic. The (Finnish) state is not allowed to increase its ownership share in Fingrid.³⁵

³³ If the new joint Nordic entity is a joint TSO (or ISO) this would of course imply that the existing organisations will no longer be TSOs.

³⁴ According to Fingrid's charter the approval of six out of the seven members of the board of directors are needed for decisions. Since the Finnish state has two members of the board, the state approval are always needed.

³⁵ Source: Interview with Timo Toivonen and Matti Tähtinen. According to our understanding this was a prerequisite in order for PVO to sell its parts of the grid to the Fingrid.

There thus seems to be two options. Either it is accepted by the Finnish owners that a new Nordic entity is formed where states have the majority.³⁶ The other alternative is that the organizational structure in the rest of the Nordic area is changed giving private owners the majority in the new entity. Although it is beyond the scope of this study to evaluate which of these options is preferable, and in particular which of the options that are likely to be accepted by the current owners and the governments, some remarks on voting rules are relevant to make.

In very general terms the ownership structure (or voting rules) should facilitate coalitions that agree on implementing the “right” projects or policies, while it agrees not to implement the “wrong” projects or policies.³⁷ The first question is then if an ownership structure/voting rules can be created that with certainty guarantees this? The answer to that question is most certainly a clear no.

A second question is then if there are certain ownership structures that should be avoided? Since this is an area where there may arise serious conflict of interest (re-distributional issues), it seems likely that a situation should be avoided where a stable coalition can implement its preferred policies consistently. That gives rise to a risk that policies that benefit these parties are accepted, even though the policies are not beneficial for the Nordic area as a whole. The conclusion is thus that parties with aligned interests should not be given a majority. One possibility is of course to separate the capital ownership shares and the voting shares, e.g., through requiring that three of four countries should be in favor in order for a policy to be accepted.

One possibility would be to introduce voting rules similar to those current in place in Fingrid. That would ensure reasonable influence from the states and possible other stakeholders. The problem with the Finnish voting rules is that if many parties have a blocking vote there is a considerable risk that no decisions can be reached. If all the states and in addition some private owners should have a blocking vote this new entity may not be more efficient when it comes to reaching decisions than the current cooperative regime.³⁸

³⁶ It would then still be possible that the current ownership of Fingrid is unchanged, but one option is of course that the Finnish state takes over the ownership.

³⁷ With “right” and “wrong” we are here referring to whether the policy is welfare improving or not. Many decision that have to be made by a TSO are very complex, and it is not certain that an agreement can be reached on whether a policy is welfare improving even from a scientific/analytical point of view.

³⁸ This is a general problem within political economy in relationship to democracy. It could be claimed that only unanimous decisions should be accepted since that would guarantee that only welfare improving decisions are made. In theory agreements on all welfare improving decisions should be possible through side-payments. However, such a voting rule vote is likely to lead to a situation where many (wanted) decisions will not be made. There is thus a need to strike a balance between making sure that only welfare improving decisions are made, and that the decision process is reasonable efficient.

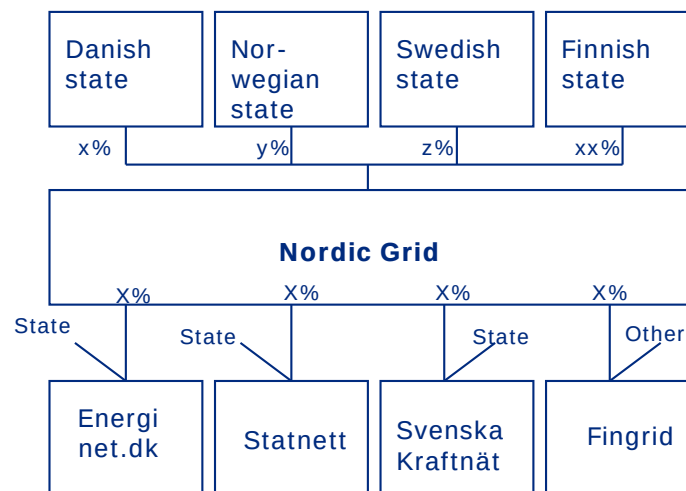
8.1.1 Two ownership models

Moving the full step to a joint Nordic TSO seems difficult for the above reasons, although we can not conclude that it is not possible. Due to the difficulty in creating a joint Nordic TSO it would be worthwhile to briefly outline two possible ownership models for a joint Nordic entity that will not lead to a joint Nordic TSO, but possibly provide some of the benefits. The first is labeled the “national state model” while the other is labeled the “TSO model”. These are not the only possible options, but represent to distinct possibilities with some qualitative differences.

National state model

Figure 8.1 shows the “national state model”. The basic characteristic is that the Nordic states have ownership shares (that may or may not differ between states) in the Nordic entity “Nordic grid”. Nordic grid then has an ownership share in each of the national TSOs, but in addition to Nordic grid there are other owners to the each of the national TSOs. For Denmark, Norway and Sweden this is assumed to be the state, since these TSOs currently are fully state-owned. Of course other owners could be invited. For Finland it seems likely that the current owners continue to have an ownership share.

Figure 8.1 The national state model



Nordic grid will have its mandate from the states and can give instructions to the national TSOs, within the framework set by its mandate (and other possible agreements between the states). Nordic grid will need to have considerable decisions power, and the states need to give up much of their control.

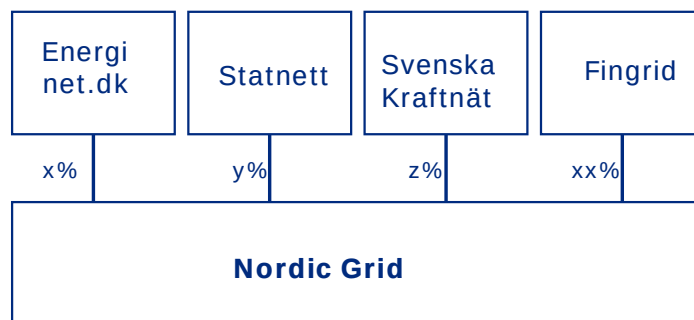
Nordic grid should be equipped with the power to take initiatives, suggest and carry through investments and other improvements. Nordic grid then needs to be established with sufficient capital (equity). Still there is an issue on how the decisions are to be made within the board, as

was discussed above. Outside the Nordic TSO structure, there will still be a need for national approval from the competent authorities (for environmental and other reasons).

TSO model

Figure 8.2 describes the TSO model in which the current TSOs are the owner of the new Nordic grid. This structure implies that the mandate of Nordic grid is given by the national TSOs and that Nordic grid will not have the power to give instructions to the national TSOs. Instead there will have to be negotiations, and the same need to give up national influence as in the national state model will not exist.

Figure 8.2 The TSO model



In the TSO model Nordic grid will not have as strong mandate as in the national state model. The mandate is likely to be restricted to identifying, study and promote proposals for investments and improvements at a Nordic level. Decisions will require unanimous decisions, at least from the parties affected (financially) by the decision. This would also mean that it would be possible for two countries to agree on investments outside the Nordic grid system based on bilateral financing.

With this model the existing grid assets would be owned by the existing TSOs, while (most) of the new assets are likely to be owned by Nordic grid. This would thus to a considerable extent be a Nordic grid company.

A brief discussion of the two models

The national state model is the one that most resembles a joint Nordic TSO, although not all assets, decision power, and responsibilities are transferred to the new entity. This model does thus have many of the same advantages as a joint Nordic TSO such as the mandate to take a Nordic decision and the ability to decide on these issues. The model does however also have some of the main weaknesses linked to giving up the national influence and the effect that has on the possibilities to actually realising the model. The possibilities to keep national solutions in issues such as tariffs, bottleneck management are likely to be larger with the Nordic grid company than a joint Nordic TSO.

The TSO model more resembles the Nordic inter-connector company outlined above. This version of a Nordic grid company will rely on negotiations. It can therefore be questioned to which extent it will actually be different compared with the current cooperative model. The main difference would be that the Nordic grid company would have their own resources to plan, study and propose investments and that it would create a structure around these decisions. The difficulties in agreeing will however be rather similar to the current situation. A major drawback of both these models would be that an additional actor will become a grid owner and this may weaken the link between operations and investments, i.e., system responsibility and grid ownership.

8.2 Mandate and scope of responsibility

The mandates given to the TSOs are in some respects a bit vague and the wording differ between the countries.

Chapter 2 discussed how the current TSOs mandates differ broadly in scope and that there may also be different interpretations amongst the companies as to how they should fulfill their respective obligations.

This need not be a problem given that the TSOs have a long history during which their tasks have been defined. In that sense the TSOs “know” what their tasks are and the exact wording in the mandates may not be of the greatest importance.

However, if a new entity is formed the need for a clearly defined mandate becomes much more urgent since the new entity can not rely on its history and common understanding of its tasks and responsibility. This will probably both require a thoroughly worked-through mandate before the organization is launched and substantial work in the new organization to create a common understanding of its responsibilities. A vital first step in the mandate definition process will be reaching a common definition and understanding of TSO responsibilities at the Nordic level (i.e. between the Nordic TSOs).

The primary focus of the mandate of a common Nordic TSO should be on equipping the organization with the tools necessary to deal with the key issues. From the perspective of a new organizational entity some of these tools are already in place and provided by the national TSOs today. This includes somewhat similar solutions to dealing with system control and (some) ancillary services, and differences in terms of organization of balancing markets and balance settlement. The challenge is to harmonize these activities so as to achieve a more efficient operation and development of the Nordic system. Most important of which is developing a new framework to ensure optimal main grid investments at the Nordic level.

We believe that at a bare minimum the core responsibilities related to system operation and grid ownership should be included in the new man-

date. Certain of the national TSOs have what can be deemed energy policy tasks that we believe can initially be excluded from the mandate. This includes the planning and rationing tasks of Svenska Kraftnät. Such responsibilities can and should be delegated to other relevant national authorities and departments.

One should also distinguish between *task responsibility* as specified in the mandate and *task completion*. It need not necessarily be the case that all the areas of responsibility have to be carried out by the new common TSO. If outsourcing in some cases facilitates a more efficient task completion, then the mandate should open up for that. A relevant case in point here is grid construction and grid maintenance which the Nordic TSOs have responsibility for, but by in large choose to outsource to third party contractors.

Currently some of the TSOs have responsibilities beyond what could be considered as core activities. In our view this need not be a great problem, but these other tasks should be clearly defined and paid for separately either through a specific tariff/tax on the grid customers (such as the Danish PSO tariff), through other specified charges or by the state that has given the task to the TSO (the two latter examples could be for instance be relevant for tasks such as the dam safety responsibilities of Svenska Kraftnät). In general it does seem preferable to remove most of the additional tasks from the TSO, but it does not seem to be very important as long as the separation is made clear.

8.3 Regulatory issues

The regulation of the TSOs differ between the countries. In Finland the regulation recently was changed (beginning of 2005) and is now based on a tariff regulation that means an *ex-ante* regulation and supervision periods of four years. Previously Fingrid developed their tariffs independently, and in consultation with its customers, and in general the regulator did not intervene unless complaints were filed.³⁹ In Sweden there is no clear formal principle. Svenska Kraftnät obeys to the same legislation as all other network operations (regional and local grids), but the most important restriction is the rate-of-return requirements from the government (the owner). There is no *ex-ante* approval of tariffs. In Denmark there is a rate-of-return regulation, while in Norway a revenue-cap regulation is applied. The Norwegian regulator also performs wide ranging control of all grid activities and is probably the regulator that has the most interventionist approach.

³⁹ The regulator conducts their own reviews and investigations even if no complaints are filed.

The creation of a joint Nordic TSO, and to some extent also a Nordic grid company with a less broad mandate, would call for a harmonization of the regulation. In general, there are of course many markets with international players working under different regulations. But, if the purpose of further harmonization of the Nordic TSOs is to improve the economic efficiency a regulatory structure that creates incentives for strategic responses to differences in regulation should be avoided. This would require both a harmonization of the legislation and coordination/harmonization of the function of the regulator. One problem in this field is of course to which extent a country can commit to a common regulatory approach over time, but also to which extent it is desired. A too strong commitment to a specific regime could hinder changes in the regulation that is later found to be desired.

Which regulatory approach that should be chosen within such a harmonized framework is beyond the scope of this study. There are however some arguments for choosing a “self-regulation” approach with a regulatory watch-dog. It is always hard to regulate TSOs, since many of its decisions are extremely complex (e.g. investment decisions), and it is far from certain that it is meaningful that a regulator should approve the TSO decisions. In a Nordic context four different regulators with very different approaches to regulation would also have to agree. A more detailed regulation seems more difficult to agree on.

Independent of the regulatory approach chosen a strong Nordic coordination is needed, to avoid differences in the regulation that creates perverse incentive for the TSO.

8.4 Political acceptance

Energy markets are in almost any country politically important for various reasons. A reliable and “cheap” supply of energy is important for the competitiveness of many countries and affects consumers and companies directly. Security of supply as well as well functioning competition is thus important. The production, distribution and consumption on the goods traded on these markets have an environmental impact that can not be disregarded. Political involvement in the sector will thus continue.

This political involvement includes various support mechanisms for investments, public service obligations, regulation of investments and tariffs, environmental taxes and regulations etc. These regulations clearly have a significant impact on the sector and do to a large extent determine for instance which investments that are acceptable and the localisation of these investments. Policy harmonization does thus seem at least as important for improved efficiency as harmonization of the system responsibility.

If a new Nordic entity is to serve as a coordination mechanism it probably needs to have a strong mandate, being able to make decisions that are not dependent on negotiations at higher levels, such as between the owners of the new company or between national governments. By necessity this would mean that the governments must give up much of their influence over the TSO operations and the possibilities to use the TSO for other energy policy objectives will diminish.

8.5 Harmonization between countries vs. between energy systems

Denmark and Sweden has chosen to put the system responsibility for the gas market within the same organization as the system responsibility for the electricity market. There can clearly be advantages of this organization. For instance could investments in gas and electricity infrastructure be substitutes (or possibly complements) and coordination between these infrastructures is then likely to be advantageous. There may also be negative aspects of this organizational model, and we have not within this work looked into this issue. Obviously Denmark and Sweden has found the solution in which the system responsibility for both sectors is integrated into the same organization beneficially. Norway and Finland has not chosen this solution (and the gas networks are also limited in extension).

The gas sector is however not very integrated on a Nordic basis. The Swedish network is directly linked to the Danish network and from the Norwegian fields in the North see there are pipelines down to the continent. There is however no large gas grid in Norway. The benefits of a Nordic harmonization of the system responsibilities for the gas sector do not seem to be as large as for the electricity sector, but this has not been studied within this project.

Given that Nordic harmonization of the system responsibility for the gas sector is not aimed at, a creation of a Nordic TSO seems to imply the break-up of the organizational link between the two sectors on national level. A solution in which the system responsibility for the gas sectors in Denmark and Sweden is moved to the new Nordic entity does not seem very appropriate. In any case this organization will have different objective functions for the gas sector (national) and the electricity sector (Nordic) and it cannot be ruled out that this will not create a conflict.

8.6 Summary: Practical challenges

Table 8.1 gives a summary of the practical challenges along three dimensions. The first one relates to how important the factor is for a possible organizational change, and this primarily relates to the size of the potenti-

al practical obstacle that is related to the accomplishment of an organizational change. The second dimension is how difficult it is to reach a harmonization and the third one relates to whether organizational change as a consequence can be viewed as possible or if the practical challenge is judged to be large enough to hinder an organizational change in the near future.

One serious practical challenge for organizational change is the ownership issue. As previously described the Nordic TSOs have different ownership structures. Three of the TSOs (Energinet.dk, Statnett and Svenska Kraftnät) are fully state-owned, while the fourth (Fingrid) has a mixed private and state ownership. It would both be difficult to allocate the ownership shares, but in addition the state dominance that almost by necessity would arise in a joint Nordic TSO is probably problematic from the Finnish viewpoint. The first issue would then be what ownership structure a new joint TSO should have. The issue is of high importance for the possibilities of a successful organizational change into a joint Nordic TSO and the expected difficulties in agreeing deem an organizational change unlikely.

The mandates given to the TSOs are in some respects a bit vague and the wording differ between the countries. We have discussed how the current TSOs mandates differ broadly in scope and that there may also be different interpretations amongst the companies as to how they should fulfill their respective obligations. This need not be a problem given that the TSOs have a long history during which their tasks have been defined. In that sense the TSOs “know” what their tasks are and the exact wording in the mandates may not be of the greatest importance. However, if a new entity is to be formed the need for clearly defined mandate becomes much more urgent. This should however not cause too large obstacles for carrying out an organizational change.

The regulation of the TSOs differs between the countries. The creation of a joint Nordic TSO, and to some extent also a Nordic grid company with a less broad mandate, would call for a harmonization of the regulation. It is always hard to regulate TSOs, since many of its decisions are extremely complex (e.g. investment decisions), and it is far from certain that it is meaningful that a regulator should approve the TSO decisions. In a Nordic context four different regulators with very different approaches to regulation would also have to agree. A more detailed regulation seems more difficult to agree on.

As for political acceptance it is clear that energy markets in almost any country are politically important for various reasons. Policy harmonization is at least as important for improved efficiency as harmonization of the system responsibility. If a new Nordic entity is to serve as a coordination mechanism it probably needs to have a strong mandate, which would mean that the governments must give up much of their influence over the TSO operations and the possibilities to use the TSO for other energy po-

licy objectives will diminish. This may prove to be quite a significant hurdle on the way to organizational change.

Denmark and Sweden has chosen to put the system responsibility for the gas market within the same organization as the system responsibility for the electricity market. Obviously they have found the solution in which the system responsibility for both sectors is integrated into the same organization beneficially. This should not be a dominating issue when considering a possible organizational change towards a joint Nordic TSO but it could not be ruled out that it may be an issue that creates some conflict.

Table 8.1 Summary of practical challenges

Practical challenge	Level of importance	Harmonization difficulty	Organizational change possible?
Ownership	High	High	Unlikely
Mandate and scope of responsibility	Medium	Medium	Yes, need for consensus view and clarifications in many cases.
Regulatory issues	Medium	Medium	Yes, but calls for harmonization of the regulation
Political acceptance	High	High	Unlikely, politicians need to give up much influence
Harmonization of countries vs. energy systems	Low	Low	Yes

9 Conclusions

It is generally hard to establish a clear link between the organizational structure and the possibility for increased harmonization. In principle it should be possible to solve all issues through negotiations and agreements between the Nordel members or bilateral agreements. Side-payments could make such agreements easier to reach, but in practice this may be very difficult.

An organizational change, and in particular a move to a joint Nordic TSO, would however facilitate harmonization since it would become more or less necessary to arrive at common principles for the entire TSO area. One drawback would then be that it could be hard to keep different solutions, even when that is optimal given the specific circumstances.

The evaluation indicated that there are large potential gains from improved grid investments and consequently this issue is given a high priority. We have here focused on methods to get *optimal* grid investments, and in our view this is very hard to accomplish. The fundamental reason is that decisions on grid investments will be made over and over again, and it is not sufficient to once and for all agree on some common principle. In addition, cost-benefit analysis of grid investments are very complex which means that it is far from certain that an undisputed “scientific” basis for these decisions can be reached. For this reason organizational change, preferably a Nordic TSO, seems to be needed to accomplish *optimal* grid investments. The fact that we claim that organizational change is needed to achieve *optimal* investments, does not mean that it is not possible to improve the current situation through a cooperative approach, but it will most likely not lead to the optimal solution.

Harmonization of congestion management and tariff models is to a large extent the same issue, since both deals with sending the correct price signals to the market. The total benefits of providing these price signals are most likely high. The congestion management is probably the more important of the two and is given a high priority; while harmonization of tariff model is given a medium priority. Since there is not the same need to continuously reach new agreements the level of difficulty is down-rated to medium. Again, since it is enough to reach an agreement on principles there is no real need for organizational changes. However, the creation of one joint Nordic TSO, would probably force this organization into adopting common principles. The fundamental difference in views would however not be resolved by an organizational change.

Ancillary services and peak reserve capacity are to some extent very similar, but in other ways quite different. For both these issues there would be potential gains from increased harmonization. There is however

already a common regulation market and the TSOs have some possibilities to secure reserves outside its own area. The harmonization has thus come quite far already. For this reasons further harmonization is given a low priority level, which of course does not mean that continued harmonization to reap additional benefits should not be done. Since there is a general agreement on these kinds of reserves, and it should mostly be a technical issue to solve the practicalities the level of difficulty is also seen as low.

For neither ancillary services nor peak reserves organizational changes seems to be needed. For ancillary services continued cooperation will most likely be sufficient. Of course, a joint Nordic TSO, would probably facilitate the process towards a harmonized treatment of peak reserves, but the main difficulties seem to be outside the TSOs and have to be resolved on other levels.

Harmonized balance settlement is a way to facilitate the creation of a single end-user market. We concur that differences in the balance settlement is one obstacle for creating a single end-user market. However, there are many other as well and a harmonization of balance settlement would most likely not be sufficient to achieve the goal. For this reason the harmonized balance settlement is given a low priority.

The level of difficulty is rated as medium since it would be sufficient to agree on common principles and it would not require new negotiations and agreements continuously. For technical reasons this service should possibly be centralized, which should not be a major problem. The difficulty lies instead with different views on which one is the optimal model, which may be due to that there actually are differences in the optimal solution between the countries.

In the study we have briefly touched upon the issue of solidarity in a crisis situation. We have not been able to evaluate to which extent this is a real problem, and can thus not draw any conclusion on the priority level.

The general conclusion from above is that it is likely that there are benefits from further harmonization and that a joint TSO in many ways may facilitate such a process. There are however examples identified in the study where the optimal policies may differ between market areas, and where harmonization is not necessarily beneficial.

In addition, there are numerous factors that make organizational changes, such as the creation of a joint TSO very difficult or impossible. This implies that even if it would be possible to carry through the actual organizational change, it may be difficult to get an efficient and well-functioning organization in place.

In the study we have highlighted the important difficulties that have been identified during the work process. Many of these factors lie outside the natural scope for the study but are never-the-less important to point

out. Many of them have in common that they are highly dependent on the views of and attitudes from owners, governments and regulators.

The two most difficult practical challenges seem to be ownership and political issues. These are both very important to solve, but also the most difficult ones. Regulatory issues and defining the mandate for the new organization are other important practical challenges, but probably less severe than the previous ones.

To summarize, from a purely technical perspective there seem to be advantages of creating a joint Nordic TSO. Such an organizational change could however have large redistributional effects, but need not have that given that tariff levels are differentiated between countries. In that case the tariff differentiation should primarily be on the consumer side, while the residual tariffs for producers should be equalized. Marginal losses and other marginal costs should of course be reflected in the tariffs independently of whether it is a producer or consumer that pays it.

Most respondents in the stakeholder consultations question the move to a joint Nordic TSO for these practical reasons, although many see the principle advantages.

The two different ISO models that were presented to the stakeholders received little support, and most stakeholders question the idea of an ISO-solution. There seem to be strong arguments for keeping grid and system responsibility integrated and this is also the preferred solution in most places in Europe. An ISO solution has been chosen in other parts of the world, but the primary reason seems to be that it is difficult to transfer the ownership of the grid when these are privately owned. This argument has some relevance also for the Nordic area, given the ownership status of Fingrid, but the benefits of keeping grid and system responsibility together are probably larger even if it implies that four separate TSOs remain.

A grid company handling investments could speed up investments, and improve the Nordic coordination. Still, this solution would most likely require some negotiations between the TSOs and the fundamental conflict would not be resolved. One possibility is to give such an organization a very strong mandate, but it is questionable if it is possible to hand over the necessary decision power.

The views regarding the current cooperative approach differ. Some stakeholders mean that it works quite well, while others have the opposite view. It does seem clear that stronger commitment to the cooperative process is needed.

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⁴⁰ All handbooks can be downloaded from the following website:
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Sammendrag

Harmonisering av elmarkedet mot en felles systemansvarlig?

I tråd med Ministrenes uttalelser fra Akureyri 2004 og Narsarsuaq 2005 arbeides det bredt med en videre harmonisering av det nordiske elmarkedet. Harmonisering kan bety. I forlengelse av dette arbeidet ble Econ bedt om å utrede videre muligheter for harmonisering og integrering i form at en felles nordisk TSO.

Å skape en felles nordisk TSO kan legge til rette for økt harmonisering og dermed høyere økonomisk lønnsomhet og effektivitet. Imidlertid er det ikke nødvendigvis harmoniseringen i seg selv som innebærer fordeler, men koordinering omkring utvalgte regler og vedtak. I denne rapporten identifiseres flere nøkkelområder for harmonisering. Optimal investering i overføringskapasitet og riktige prissignaler til markedsaktørene i håndteringen av flaskehalser er antakelig de viktigste.

Econ har gjennomført en markedsundersøkelse blant aktørene i det nordiske markedet og denne undersøkelsen avslører blant annet ulike syn på hvor godt det nordiske elmarkedet fungerer i dag. Imidlertid synes det å være klart at de systemansvarlige burde føle en økt forpliktelse til det nordiske perspektivet.

Annex 1: Stakeholder questionnaire

A1.1 Questionnaire

Company/institution/organization:	
Contact person:	
Title:	
Email/telephone	

Survey to stakeholders concerning organizational models for the Nordic market

ECON has been asked by the Nordic Council of Ministers to propose and analyze different organizational models for the Nordic market. In this connection ECON has developed five preliminary organizational models which are briefly described in this survey. By means of this survey, we wish to get an initial evaluation of these models from the perspective of key stakeholders in the Nordic market. The questions in this survey are divided into two sections. Section A wants key stakeholders comments on the ongoing process of harmonization in the Nordics. The question in Section B seeks to identify what are the key measures in terms of improved resource utilization. In Section C we ask to which extent alternative organizational models will lead to more efficient resource utilization.

Section A : Broad perspective on harmonization

Q1:How important is it with the harmonization of the Nordic power market?

Comments:

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Q2: What are the most important issues that need to be harmonized?

Comments:

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Q3:What are the key advantages and disadvantages of harmonisation?

Comments:

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S2: Recommendations for improved resource utilization in Nordic market

Efficient system operation and a well functioning market are the two central prerequisites for efficient resource utilization in the Nordic market. Rank the recommendations listed below in terms of the extent to which they contribute to a more efficient utilization of resources in the Nordic market.

Q4: How important are the following issues for the harmonization of the Nordic power sector?

Table 1

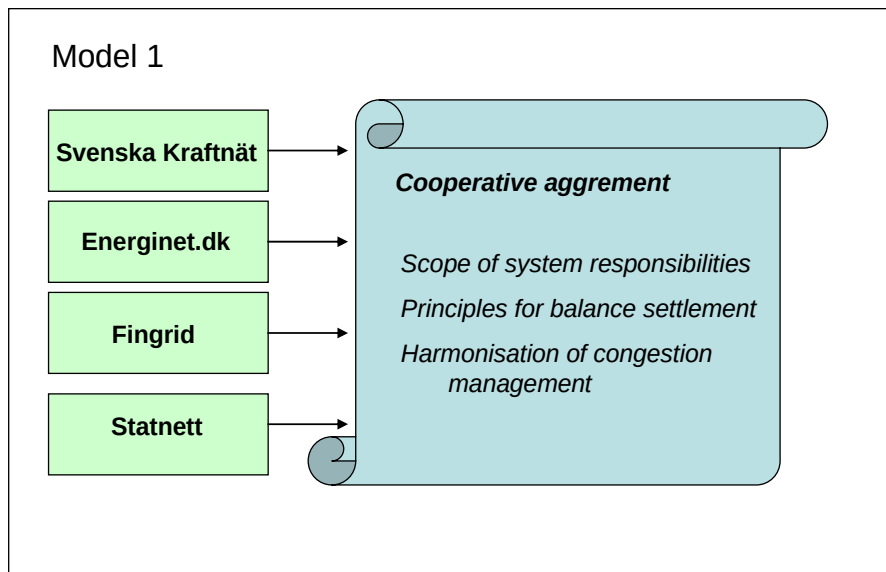
Measure	Points (1- very important, 6-not important)
Harmonized balance settlement	
Harmonization of tariff model design	
Creation of a single end-user market	
Design mechanism or establish new entity to ensure completion of priority inter-connector projects	
Common market for capacity reserves	
Common principles for bottleneck management	

Section C: Alternative organization models

In this section we describe five alternative models for the organization of the Nordic market.

Model 1: Model based on Nordels recommendations

Nordel recommends improve cooperation in three key areas and keeping the organizational structures of the TSOs intact. The three cooperative areas are common definition of scope of system responsibilities, principles for balance settlement and harmonization of congestion management.



Q5: To what extent does the proposed model solve the six issues listed in table 1?

Points (1- very important, 6-not important)

Comments:

Q 6: What are the advantages and disadvantages of the proposed model?

Comments:

Model 2: Joint Nordic ISO

A new joint Nordic ISO is established with no direct or indirect ownership of any Nordic grid assets. The organisation will solely be tasked with ensuring the reliable operation of the interconnected Nordic power system. Some of the key organisational characteristics of a joint Nordic ISO are presented in table 1.

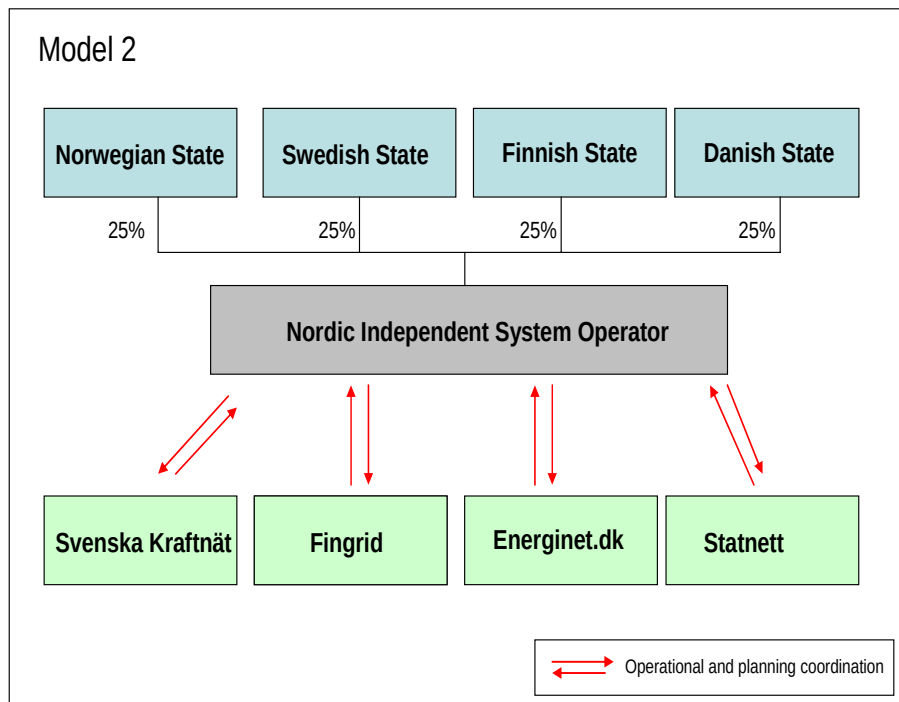


Table 2 Organisational characteristics of a Nordic ISO

Ownership structure	New organisational entity will be owned in equal shares by the four Nordic states.
System operations	Responsibility for overall system operations and coordination of the four transmission owning companies.
Grid maintenance and expansion	Will not complete any grid investments but should be the overall system planner and must ensure that transmission owners expand the grid according to Nordic system development plans.
Financing mechanism	The new entity would operate as a non-profit organisation, an administration and system operation costs would be financed through a <i>system operation fee</i> levied on all market participants.

Q7: To what extent does the proposed model solve the six issues listed in table 1?

Points (1- very important, 6-not important)

Comments:

Q8 What are the advantages and disadvantages of the proposed model?

Comments:

Model 3: Joint Nordic TSO

The four national TSOs are merged together to create a joint Nordic TSO. As grid owner, the company will have to ensure adequate maintenance and expansion of the main Nordic grid. As system operator, the company will also be charged with the overall operational responsibility of the Nordic system. Some of the key organisational characteristics of a joint Nordic TSO are presented in table 2.

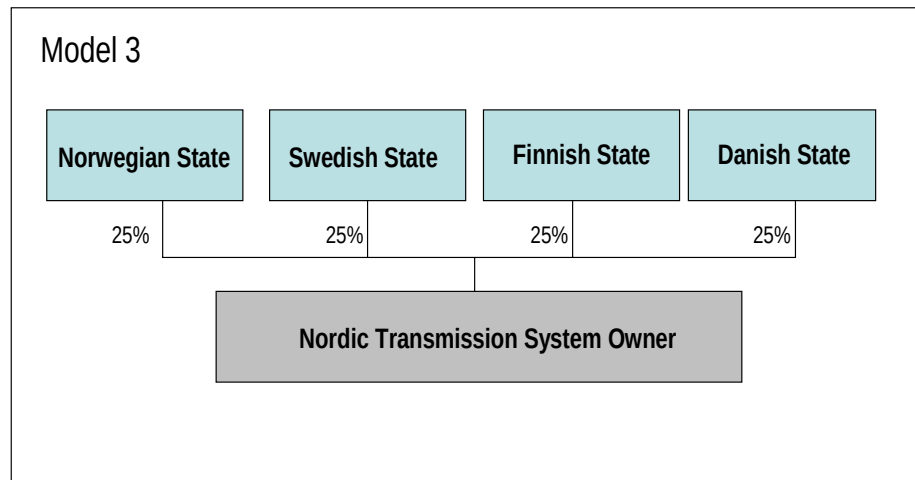


Table 3 Organisational characteristics of a Nordic TSO

Ownership structure	New organisational entity will be owned in equal shares by the four Nordic states.
System operations	Minimum function would be simply to ensure short term operational reliability. However, as Nordel has previously pointed out, proactive measures in terms of the long term security situation should also be adopted.
Grid maintenance and expansion	Responsible for developing system plans for grid maintenance and expansion at the regional, national and Nordic level.
Financing mechanism	The new entity would operate as a non-profit organisation, an administration and system operation costs would be financed through a <i>system operation fee</i> levied on all market participants.

Q9 To what extent does the proposed model solve the six issues listed in table 1?

Points (1- very important, 6-not important)

Comments:

Q10: What are the advantages and disadvantages of the proposed model?

Comments:

Model 4: Nordic Interconnector Company

Establish a multi purpose holding company could be established with the mandate of planning, financing and ensuring completion of interconnector projects

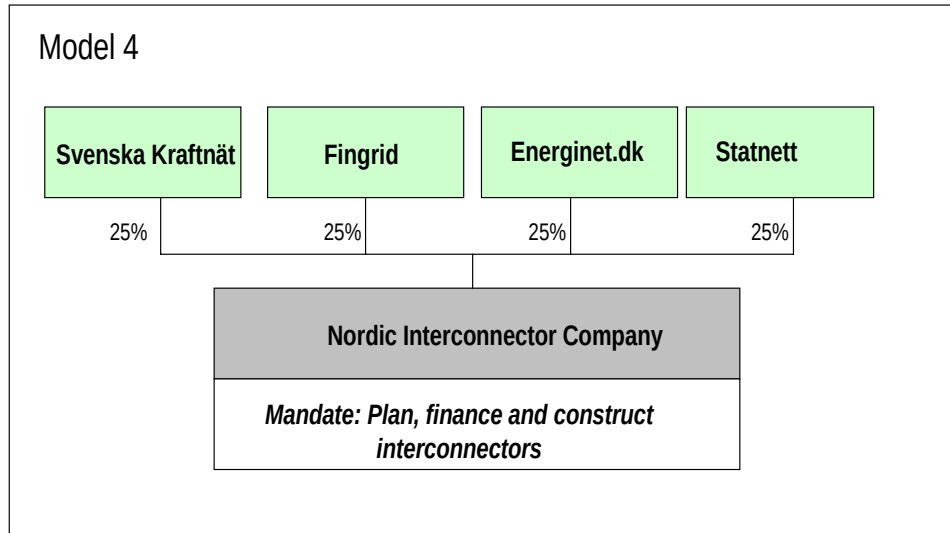


Table 4 Organisational characteristics of a Nordic Interconnector company

Ownership structure	New organisational entity will be owned in equal shares by the four Nordic states.
System operations	The entity will have no responsibility for system operations.
Grid maintenance and expansion	Overall system planner and must ensure that transmission owners expand the grid according to Nordic system development plans.
Financing mechanism	Earmarking of cross-border bottleneck revenues.

Q 11 To what extent does the proposed model solve the six issues listed in table 1?

Points (1- very important, 6-not important)

Comments:

Q 12: What are the advantages and disadvantages of the proposed model?

Comments:

Model 5: Nordic Market Operator

This model is an extension of *model 2* but with the system operator having a much broader mandate. This broader mandate includes operation and ownership of the Nord Pool Exchange, as well as responsibility for setting Nordic market rule setting and development.

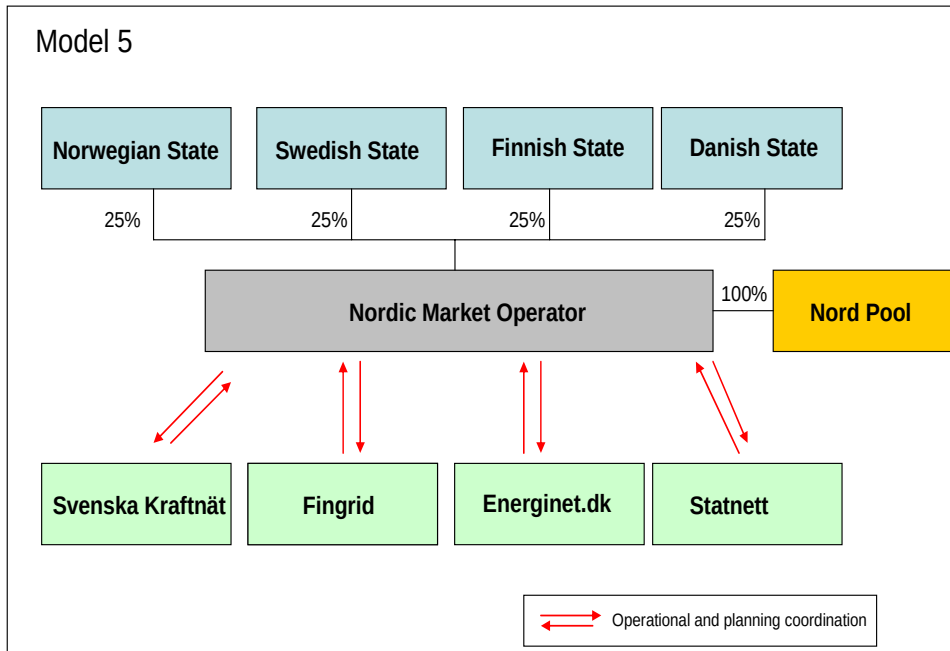


Table 5 Organisational characteristics of a Nordic Market Operator

Ownership structure	New organisational entity will be owned in equal shares by the four Nordic states.
System operations	Responsibility for operational reliability of Nordic power system and optimal functioning of Nordic power exchange.
Grid maintenance and expansion	Sole focus will be on completing priority interconnector projects. Actual construction of interconnectors could be sub- contracted out to the TSOs.
Financing mechanism	Earmarking of cross-border bottleneck revenues.

Q 13: To what extent does the proposed model solve the six issues listed in table 1?

Points (1- very important, 6-not important)

Comments:

Q 14: What are the advantages and disadvantages of the proposed model?

Comments:

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Q 15: Based on your answers in section 1 rank the alternative organization models in terms of which model leads to optimal resource allocation.

Organisational model	Rank (1= best, 5 = worst)
M1: Implementation of Nordel recommendations	
M2: Joint Nordic ISO	
M3: Joint Nordic TSO	
M4: Nordic Interconnector Company	
M5: Nordic Market Operator	

Additional comments

Q 16: Any other comments?

A1.2 Send list

Company	Respondent	Added to list*	Answered
Svenska Kraftnät	Jan Magnusson	2005-10-20	Yes. At interview
E.ON Sverige	Curt Lindqvist	2005-10-20	Yes
AGA	Fredrik Kopp	2005-10-20	Yes
Vattenfall	Gunnar Lundberg	2005-10-20	Yes
Statkraft	Hakon Egeland	2005-11-04	Yes
Energitilsynet	Jacob Erik Holmblad	2005-10-20	Yes
Confederation of Finnish Industries	Jouni Punnonen	2005-12-13	Yes
Finnish Energy Industries	Juha Naukkarinen	2005-10-20	Yes
Stora Enso	Mikael Hannus	2005-10-20	Yes
Plusenergi	Mikael Jednell	2005-10-20	Yes
Fortum	Mikael Lilius	2005-10-20	Yes
Outokumpu	Mikko Rintamaki	2006-01-04	Yes
NVE	Marit Lundteig Fossdal	2005-10-20	Yes
Statnett	Odd Hoelseter	2005-10-20	Yes
Energiakolmio	Pasi Valoranta	2005-12-13	Yes
Energinet.dk	Peder Andreassen	2005-10-20	Yes
Svensk Energi	Per-Olof Granström	2005-10-20	Yes
Energy Market Authority, Finland	Ritva Hirvonen	2005-10-20	Yes
Kraftaktörerna	Tommy Karlsson	2005-12-20	Yes
Finnish Forest Industries Federation	Stefan Sundman	2006-01-11	Yes
Hydro	Petter Longva	2005-10-20	Yes
Fingrid	Timo Toivonen	2005-10-20	Yes. At interview
Energimeklarit		2005-12-13	No
Nuon		2005-12-20	No
Dansk Energi		2005-10-20	No
Energi Danmark		2005-12-20	No
Oberoende elhandlare		2005-10-20	No
Markedskraft		2005-10-20	No
Energy Agency, Sweden		2005-10-20	No
Energipolar		2005-12-20	No
Eka		2005-10-20	No
UPM-Kymmene		2005-12-20	No
Energi E2		2005-12-20	No
PIL		2005-10-20	No
EBL		2005-10-20	No
PVO		2005-12-13	No
Hafslund		2005-12-20	No

* This is the date when the respondent was added to the list. In some cases other respondents within the same organization have received the questionnaire at an earlier date.

A1.3 Results

Published from 20.10.2005 to 24.01.2006

18 responses (18 unique)

1. How important is harmonization for the improved functioning of the Nordic power market? [Please give a score from 1 - 6 (1- very important, 6- not important)]

1	11	61,1% of total 18
2	4	22,2% of total 18
3	1	5,6% of total 18
4	0	0,0% of total 18
5	1	5,6% of total 18
6	1	5,6% of total 18

2. Comments: (TEXTFIELD)

Comment 1: Even if the nordic market is very harmonized compared to other cross border markets there is a need for further harmonization, eg. system responsibilities. balance settlement and congestion management. There would also be a value having a similar regulatory model for distribution tariffs.

Comment 2: Adequate harmonization is necessary for the creation and development of the regional market area

Comment 3: The Nordic Countries form an integrated regional market. Both general efficiency of the market and secure and predictable market operation under extreme or unexpected situations, require that market design, operational rules and regulatory framework are harmonised to a high degree. The benefits of harmonisation presuppose that harmonisation is based on best practice solutions.

Comment 4: Of vital importance both regarding security of supply and conditions conducive to a well functioning electricity market

Comment 5: Harmonisation as such is not a prerequisite for well-functioning market but compatibility is more crucial: different solutions must be compatible with each other, compatibility can be seen as a first step for integrated markets leading to gradual improvement in market integration and in the end integrated market (usually harmonised to extent needed)

Comment 6: It's important but most important is of course the possibility to have the same freedom to establish new production in any country that is acting on the same market. As an example nuclear can be built in Finland but not in Sweden (even if the consumer side is interested to invest.) Another problem is the 'wall' between grid- and power market. From a total cost (power+grid) respect we as consumers are more interested to invest in new production-units as an alternative

to invest in a stronger main national grid. The new production will in some cases contribute to an increased pressure on the power market price to a higher extent than a higher cost for the main grid. This should and could the TSO encourage by showing a higher feed-in benefit. Money used for investments for 'only' reducing the risk of bottlenecks and separated price areas doesn't bring any new power capacity to the market!

Comment 7: At least key activities (operations, de-bottlenecking...) shall be (mandatory) harmonised.

3. What are the most important issues that need to be harmonized? (List issues in box below:) (TEXTFIELD)

Comment 1: Balance settlement on the consumption side

Comment 2: Bottleneck management, Capacity reserves (effektreserv på svenska)

Comment 3: Common Nordic process concerning transmission system investments and financing. Reduce physical bottlenecks by investing in additional capacity. Common Nordic principles for handling peak-load. TSO should guarantee capacity on price area borders.

Comment 4:

- Congestion management methods.
- TSO roles
- balance settlement
- peak situations, capacity reserve market

Comment 5: TSO operations, grid investment principles, subsidies, different types of support mechanisms, general investment possibilities, treatment of different type of actors

Comment 6:

- Congestion management and capacity allocation
- Network planning and investment decisions
- Peak load and reserve mechanisms
- Balancing markets
- Settlement of volumes in the market
- Retail market framework
- Network tariffs and access conditions

Comment 7:

- Balance settlement
- Bottleneck management
- completion of priority inter-connector projects

Comment 8:

- Principles for handling congestion management and exchange capacity
- A Nordic grid development and the establishing of a Nordic model for financing of investment
- Harmonization of the Nordic Balance Management (includes both Balance Control and Settlement)
- Nordic Market for operational reserves

Comment 9: The Nordic Transmission System (electricity and gas)**Comment 10:**

- Bottleneck management
- Common system and investment planning and decisions'
- Common market for capacity reserves
- Harmonization of balance settlement and tariff model designs

Comment 11:

- Common congestion management procedures and principles
- (Harmonisation according to EC CM guidelines also to other regional markets - not only Nordic)
- Common market for reserves (as far as possible without risking
- SoS issues

Comment 12:

Utgångspunkten är harmonisering av

- gemensam nordisk hantering av kontinuerlig analys, beslut, princip för finansiering och planering av investeringar i nya transmissionslinjer inom och till/från Norden
- gemensam nordisk princip/hantering av flaskhalsar
- gemensam nordisk princip/"lösning" avseende effektfrågan

När man tittar närmare på frågan handlar det om att (precis som ett av uppdragen från ministrarna) tydligt definiera vad systemansvariga skall göra/vilket ansvar de skall ha. Man hamnar sedan nästan helt och hållet i frågan om "operational reserves"; definition, hur mycket, när skall de användas, vad skall priset vara, hur lägga ut på marknaden och hur kanalisera kostnaden. Här kommer också självklart balansavräkningen in som en viktig faktor. I och med den nya visionen/ambitionen en gemensam nordisk slutkundsmarknad blir frågan om vad som skall prioriteras än mer intressant. Här kan man se att många andra faktorer kommer att vara helt avgörande i ett harmoniseringsperspektiv:

- Balansavräkningen!, mätning, standarder för märkning av anläggning och kundbyten, mätning och rapportering, osv.

Comment 13:

Prinsipper for modhandel, Fælles nordisk marked for systemtjenester

Comment 14:

Taxes/steering supports: In addition do we need harmonized taxes for production (the Swedish CO2-tax lucky on its way out..) and harmonized benefit for new capacity on the market. The Nordic market has strong links to the European market. As an example do new CHP-units in some counties (like Holland, Belgium...) get great national support for the power produced, regardless if the fuel is based on bio- or gas. All different support/extra values for power production from bio-fuels in Sweden must be carefully monitored since it make it more valuable to just burn high quality fibres instead of full fill the whole national value-chain with producing paper and board.

Balancing: On the consumer side (at least) do we need the one-price system for balancing power. This will bring consumer closer to the market but without creating 'wild regulation' out of controls from the TSOs. By this can also the effect market take off (consumer will be more engaged...) – with no obligation for the TSOs to make sure that there is enough reserve capacity active on the market.

CO2-effects: The most important 'harmonization'-question is of course to take the CO2-market (ETS) away from price setting mechanism we have on the power-pools top day. Use a model more similar to the Swedish el-certificate model. The effects we notice to day (due to CO2) have started to ruin Europe – and the tremendous extra incomes (not corresponding to average increase in costs) the power companies get are not used to increase the sustainable and/or renewable production. It's a shame!!

Comment 15:

- Managing transmission constraints
- pursuing de-bottlenecking (TSO price area income -> investments)
- Common Balancing market
- Common reserves (short term & long term, taking both hydro & condensing into account)

Comment 16:

- Bottleneck management
- Nordic balance settlement
- Common market for capacity reserves
- Nordic end-user-market

Comment 17:

- Creation of a single Nordic end-user market
- Ensure completion of priority inter-connector projects
- Bottleneck management

Comment 18:

- There shouldn't be large area price differences between the countries
- balance settlement and balance power pricing should be common

4. Advantages of increased harmonization: (TEXTFIELD)

Comment 1: Hopefully better competition?

Comment 2: Easier to aggregate volumes in different price areas for the consumers

Comment 3: System responsibility: Clear role for all TSO's Balance settlement: Needed to create a Nordic retail market. Congestion management: Support liquidity Regulatory model for distribution: Give stability and investment incentives for DSO's and should stimulate efficiency to the benefit of customers.

Comment 4: Better functioning market. Increased transparency and increased credibility. Increased competition give benefits for customers

Comment 5: Enlarged and more stable market area. Better ability to answer to customer needs and expectations. You can also find best practices from other countries

Comment 6: Better functioning market, higher competition, better services for customers, improved overall efficiency

Comment 7: Increased efficiency in the regional market. Increased competition in the Nordic market. Economy of scale can be more easily exploited

Comment 8: If there should be only a "system price" (no price areas) and harmonized balance settlement there would be a strong foundation for inter Nordic competition and best possible liquidity in the market.

Comment 9: Securing competition in the Nordic electricity market also in the future. Maintain adequate security of supply at a low cost.

Comment 10: Goes without saying. The Nordic Market is from a functional perspective one market

Comment 11: Better utilization of the Nordic power system, and also better investment signals

Comment 12: Operation of TSO is seen by market participants as a one function - fostering in this way integrated market

Comment 13: Kundens förtroende för marknad och prisbildning, effektivitet, konkurrens, nytta och kostnad för samhället, enkelhet, förståelse, ...

Viktigt - allt för ofta är man generellt positiv till harmonisering men utan viljan att själv kompromissa. Om ni har möjlighet - tydliggör vikten av att ge för att få - man kan inte både ha kakan och äta den. Det handlar ju om att välja vilka faktorer som skall/behöver harmoniseras. Min erfarenhet hittills är att viljan till harmonisering egentligen är större än vad som kommer fram i debatten, då motståndet i de allra flesta fall handlar om att man inte förstår varandra,

har misstolkat något eller egentligen menar samma sak. Här har ni också en stor utmaning i projektet - definition, samma språk, enkelhet ger ett bättre beslutsunderlag. Om det finns en möjlighet skulle det också hjälpa att "avnationalisera" vissa företeelser och hitta mer neutrala sätt att beskriva dem på. (en jämförelse är politiska budskap - inte ens partiledarna själva (gäller de flesta riksdagspartier) kan i efterhand peka ut vilka uttalanden om det framtida Sverige som är deras egna eller kommer från det motsatta politiska blocket).

Comment 14: Advantage: Same set of possibilities for consumers/producers to establish them self (from a power point of view) regardless country chosen to act in.

Comment 15:

- Better functioning market
 - > less short term price volatility
 - > less price area diffs => better price reference
- Producer market dominance reduced
- More efficient operations -> reduced costs

Comment 16:

- Common Nordic market
- More effective competition
- More players in the market

5. Disadvantages of increased harmonization: (TEXTFIELD)

Comment 1: There is a risk that the consolidation process among the producers might gain momentum: "It is a Nordic market, so if company A buys company B does not matter. A still just 40% of the total market...."

Comment 2: No disadvantages

Comment 3: There should be no tariff harmonisation. Tariffs should be based on national cost bases. There is a risk for bad compromises in order to get decisions.

Comment 4: Lot of work for the change

Comment 5: No major disadvantages. In some cases may delay the integration process

Comment 6: Strong focus on harmonisation can mean that best practice solution is not chosen (second-best solutions may be easier to negotiate agreement around). Harmonisation required on different levels; rules, organisation, responsibilities, regulation.

Comment 7: A consequence of Nordic Harmonization and a better functioning Nordic Market is that we will not have preferred Norwegian solutions only. May loose partly national control.

Comment 8: ...perhaps a difficult decision process - national pride!

Comment 9: More costs, harmonised procedures are not good or efficient to markets because of 'compromises'

Comment 10: Genom att i samtliga frågor resonera utgående från att nästa steg i processen handlar om att knyta den regionala nordiska marknaden till andra regionala marknader - detta måste gå effektivt - så tror jag att man kan hålla en bra linje genom arbetet.

Comment 11: To high harmonization ambitions draw attention away from more urgent matters, such as encourage and bring more competitive production into the market

Comment 12: Possible bad decisions. Loss of national decision power (maybe not disadvantage at all?).

6. How important are the measures listed in Table A for the improved functioning of the Nordic power market? [Please give a score from 1 - 6 (1-very important, 6- not important)] (MATRIX)

6.1 Harmonized balance settlement

1	8	44,4% of total 18
2	6	33,3% of total 18
3	1	5,6% of total 18
4	1	5,6% of total 18
5	1	5,6% of total 18
6	1	5,6% of total 18

6.2 Harmonization of tariff model design

1	1	5,6% of total 18
2	5	27,8% of total 18
3	6	33,3% of total 18
4	1	5,6% of total 18
5	3	16,7% of total 18

6	2	11,1% of total 18
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6.3 Creation of a single end-user market

1	5	27,8% of total 18
2	5	27,8% of total 18
3	4	22,2% of total 18
4	1	5,6% of total 18
5	3	16,7% of total 18
6	0	0,0% of total 18

6.4 Design mechanism or establish new entity to ensure completion of priority inter-connector projects

1	7	38,9% of total 18
2	5	27,8% of total 18
3	4	22,2% of total 18
4	1	5,6% of total 18
5	1	5,6% of total 18
6	0	0,0% of total 18

6.5 Common market for capacity reserves

1	7	38,9% of total 18
2	5	27,8% of total 18
3	3	16,7% of total 18
4	2	11,1% of total 18
5	1	5,6% of total 18
6	0	0,0% of total 18

6.6 Common principles for bottleneck management

1	14	77,8% of total 18
2	3	16,7% of total 18
3	0	0,0% of total 18
4	0	0,0% of total 18
5	0	0,0% of total 18
6	1	5,6% of total 18

7. To what extend does model 1 reduce the need for additional measures for increased harmonisation of the factors listed in Table A? Points (1- to a large extent, 6-not at all)

1	0	0,0% of total 18
2	4	22,2% of total 18
3	3	16,7% of total 18
4	5	27,8% of total 18
5	5	27,8% of total 18
6	1	5,6% of total 18

8. Comments: (TEXTFIELD)

Comment 1: If the TSO start to cooperate in a more structured way, the problems will be solved. How the do it is of no importance

Comment 2: The answer dependent on that cooperation deliver

Comment 3: A Nordic mandate and authority and a permanent secretariat is necessary in this case for conducting Nordic system planning, finance Nordic investments harmonize TSO operations

Comment 4: Rather low level of cooperation.

Comment 5: This model requires separate processes on all issues of importance. The focus will easily be on harmonisation of each separate process. This may slow down the process, can give to much focus on the different existing national solutions, and run the risk that the different negotiated co-operate solutions for processes/areas are not working together as a good overall market design.

Comment 6: The system gives too much room for "egoistic" behaviour among the different TSOs

Comment 7: Strengthening co-operation and making agreements binding is the lightest way of improving the market functioning (step by step approach is favoured) - co-operation will naturally evolve in medium/longer term to some form of common TSO function, first on operational and then in planning and investments.

Comment 8: Allt beror på vilka ramar detta arbete får. Erfarenheterna hittills talat för att bara denna samverkan inte skulle räcka men som sagt om förutsättningarna och kraven blir tydliga så.

Comment 9: In order to succeed with 'light' Co-op model, an agreement between the states government is needed to define the scope and give instruction to co-operate. (And inter-governmental group to monitor [the one which ordered this study?])

9. Advantages: (TEXTFIELD)

Comment 1: It is simple and not so politically sensitive.

Comment 2: Fast implementation of prioritized issues to harmonize

Comment 3: No big changes in comparison to now

Comment 4: Easy to achieve.

Comment 5: Easy to accomplish

Comment 6: Easy to start up with

Comment 7: The more harmonization the better

Comment 8: Easy to accomplish. Least common multiples

Comment 9: Better than today

Comment 10: Probably easy to establish

Comment 11: Co-operative approach based on voluntary agreements and common objectives. Regulation of TSO activities lies within each country - needs more co-operation between Nordic regulatory authorities.

Comment 12: Enkelt, det kan gå snabbt att nå fram, en informell lösning hjälper också till att inte locka fram prestige och gammal nationell syn på frågor som kan motverka syftet.

Comment 13: Respekterer gældende "governance". Model 1 har historisk produceret gode resultater (Norden et foregangsland for markedsåbning mm)

Comment 14: Usage of same (one-price!!) balance settlement – involving more active consumer.

Comment 15: With this model it's possible to combine the mandatory, coordinated area, where functions are integrated, however having room for national decision making at other areas. (security of supply, social aspects/end users etc) It's demanding, though.

Comment 16: No extra expenses

10. Disadvantages: (TEXTFIELD)

Comment 1: Risk that needed investments will not be done

Comment 2: Slow working cooperation. Difficulties to come to common decisions

Comment 3: Not a real change.

Comment 4: Only loose co-operation, principles and mechanisms for grid investments not defined

Comment 5: But difficult to reach clear decisions and commitments. Runs the risk of providing “fragmented” solutions

Comment 6: Still four different companies to handle one electrical system.

Comment 7: Does neither solve the issue regarding common Nordic investments nor the issue regarding Nordic operational reserves etc. Model 1 will give no incentives to keep up the pressure on further Nordic harmonization. Harmonization takes time – needs to be enduring/persistent

Comment 8: Not enough

Comment 9: Basically the solution we have today, which have proven not be satisfactory

Comment 10: Co-operative agreement might not be binding in problematic situations - regulatory framework within Nordic countries has to make the agreements binding

Comment 11: Risken med otydlighet - inga krav på ömsesidighet innebär att man inte når några resultat. Det finns idag en mycket stor divergens mellan de systemansvariga om vad Nordels förslag egentligen betyder (denna divergens är samtidigt ett av skälen till att man verkligen kommit fram till något). När det sedan blir verklighet kan det ha stor betydelse hur hårt styrd man verkligen är för att samverkan skall fungera.

Comment 12: Foudsætter enighed før beslutning. Sværere at høste "high hanging fruits"

Comment 13: Compared with model-2 it's likely that local national interest are still priority one!

Comment 14: Good discipline is needed. If there is no clear and solid commitment of the government (over several election periods) the result may be poor

Comment 15: Weak to influence over the borders

11. To what extent does model 2 reduce the need for additional measures for increased harmonisation of the factors listed in Table A? Points (1- to a large extent, 6-not at all)

1	1	5,6% of total 18
2	8	44,4% of total 18
3	6	33,3% of total 18
4	1	5,6% of total 18
5	0	0,0% of total 18
6	2	11,1% of total 18

12. Comments: (TEXTFIELD)

Comment 1: See previous answer

Comment 2: Model 2 reduce the needs about in the same way as model 1, reason is that an ISO is relatively weak.

Comment 3: Will solve most problems

Comment 4: The ISO split the responsibilities between the SO and the transmission owner. The relationship between these is important and raises many challenges.

Comment 5: A step in the right direction. If the ISO could control the bottleneck revenues to fund them and direct them to projects designed to remove bottlenecks it would be even better.

Comment 6: The ISO model is mainly rejected in Europe. The ISO model has proven to have a lack of suitability to optimize the development of both grid and market.

Comment 7: See 1, but better

Comment 8: Need for additional measures are decreased in balance settlement, reserves and CM issues

Comment 9: Riskerna från föregående sida försvinner.

Comment 10: Udfordringerne i det eksisterende samarbejde skubbes blot et niveau op. Jeg tror ikke det løser fundamentale forskelle.

Comment 11: Pros/Cons same as model-1 BUT this company is probably more likely to work in favour for the whole Nordic market. A total focus only on 'harmonisations-questions' will however redraw the attention from bringing more competitive production into the market.

Comment 12: Surely this would work. It's just as good or bad as political agreement between the countries/governments

13. Advantages: (TEXTFIELD)

Comment 1: Coordination of grid operation and formalisation of system planning compared to what is done in Nordel today

Comment 2: No ownership but operational and planning coordination

Comment 3: This measure would help significantly in handling questions like congestion management.

Comment 4: Deeper co-operation between the TSO's than today

Comment 5: Facilitates coherent responsibility and practice related to system operation across the whole Nordic market – under condition that legal requirements and regulation is harmonised between the countries. A Nordic ISO can be a step towards a common TSO.

Comment 6: Avoid first the transferring of ownership and then agreeing on the company's value.

Comment 7: Better commitment

Comment 8: Establishing a Nordic body, with focus on the Nordic power system

Comment 9: Creates more harmonised measures in balance settlement, reserves and CM

Comment 10: Det gemensamma arbete som definieras i modell 1 stagfästs och uppdraget blir tydligt (vilket det sannolikt inte blir i modell 1).

Comment 11: See above

Comment 12: Company form existence would give structure to decision making

14. Disadvantages: (TEXTFIELD)

Comment 1: The idea with an ISO have been tested in several countries, mainly because it has been impossible to transfer assets because of private ownership

rights. However the ISO have proven to be quite toothless and there is a tendency to go back to the TSO model

Comment 2: No

Comment 3: Congestion mgmt through investments would remain open.

Comment 4: Direct State ownership of separate ISO not needed, TSO's can own the ISO, does not provide clear mechanism for the investments

Comment 5: Relationship (formal, informal) between ISO and network operators/investors raises new problems and challenges.

Comment 6: How to make sure that the ISO's intentions are obeyed by the different TSOs?

Comment 7: Governing of investments is impossible when the ISO do not own grid. Makes it demanding to optimize Nordic investment projects and maintenance of the grid. The Model results in a body that is likely to live its own life distant from the TSOs.

Comment 8: Must likely problems between the Nordic ISO and the national TSO's

Comment 9: One level more in hierarchy - co-operation between ISO and TSO can be problematic e.g. investments and grid ownership. Supervision of Nordic ISO is to be arranged, so that it operates effectively (regulation of non-profit organisation is to be arranged)

Comment 10: Mycket stort motstånd från vissa systemoperatörer att göra detta. Man hamnar lätt i intressanta frågor som var huvudkontoret skall ligga osv. Att föreslå detta skulle kunna lägga en våt filt över allt annat positivt utvecklingsarbete under lång tid. Om man skall föreslå detta måste det göras effektivt och resolut.

Comment 11: See above

Comment 12: A new inter -governmental body with limited tasks, creates more costs. As it is not owner of the grids, its influence to grid companies is uncertain?

15. To what extent does model 3 reduce the need for additional measures for increased harmonisation of the factors listed in Table A? Points (1- to a large extent, 6-not at all)

1	7	38,9% of total 18
2	5	27,8% of total 18
3	0	0,0% of total 18
4	2	11,1% of total 18

5	1	5,6% of total 18
6	3	16,7% of total 18

16. Comments: (TEXTFIELD)

Comment 1: See previous answer

Comment 2: A Nordic TSO would of course be the most efficient way to harmonize. But why should it operate as a non-profit organisation? If so it will be a very different from all other TSO's in Europe causing great difficulties in benchmarking.

Comment 3: Is political impossible. No state will give up its own ownership in a so important infrastructure

Comment 4: Rather unrealistic, national passions.

Comment 5: A Nordic TSO must be regulated through the same principles as national TSOs. A Nordic regulatory institution must be established.

Comment 6: This represents the best possible solution for a well functioning Nordic market.

Comment 7: This preferred model would still need harmonized legislation within the Nordic countries .Need to be specific on the core business for the Nordic body. This model also requires that the power exchange are owned the TSOs, cf. model 5.

Comment 8: See above

Comment 9: Reduces the need for balance settlement, tariffs, investments, reserves and CM

Comment 10: Alla funktionaliteter som önskas kan fås utan att detta steg tas. Även samordningen när det gäller nya investeringar i transmission. En process där näten skall värderas ur ett nationellt perspektiv är helt och hållet oöverblickbar. Detta kan verkligen sätta käppar i hjulet för fortsatt effektiv utveckling och bör undvikas.

Comment 11: Forudsætter fælles nordisk energipolitik

Comment 12: Forget about this model since it will only make Sweden and Finland paying for the very costly national grid in Norway and Denmark. Costs in Sweden/Finland will increase on behalf of lower costs in Norway/Denmark. Norway must carry higher local grid costs due to its topography and Denmark due to its unpredictable wind power.

Comment 13: The true integrated model

17. Advantages: (TEXTFIELD)

Comment 1: One market, one TSO

Comment 2: Clear model and mechanism for investments, easy to harmonize operational practises

Comment 3: Facilitates coherent responsibility and practice related to system operation and transmission investments across the whole Nordic market – under condition that legal requirements and regulation is harmonised between the countries.

Comment 4: No room for nationalistic considerations when operating the system

Comment 5: The model will secure that necessary changes in market design and investments will be carried out as soon as wanted/ necessary. The model will be an efficient tool in order to keep up with the overall market development.

Comment 6: Integrated Nordic system and net operator

Comment 7: Harmonisation of balance settlement, tariffs, investments, reserves and CM

Comment 8: see above

Comment 9: If high level decisions are made, this organisation model can really execute.

18. Disadvantages: (TEXTFIELD)

Comment 1: Difficult to implement, we can't wait with harmonisation until a Nordic TSO is in place. Also a nordic TSO must operate under normal market based rules, return on investments etc, otherwise it will not be possible to compare this TSO with other TSO's

Comment 2: Difficult to achieve, only state ownership

Comment 3: Challenge: Good ownership and regulatory structures have to be established on a Nordic basis.

Comment 4: It is maybe difficult to establish a situation with 25% ownership for each country.

Comment 5: The introduction of this model will require an extensive process within all the Nordic countries regarding adjusting of the national legislation. The national state could be afraid of loosing control over an important instrument in today's energy policy.

Comment 6: Probably very difficult to establish due national interests

Comment 7: Supervision of effective operation of NTSO should be solved. How to regulate and according to which laws? Compatibility with EC legislation

and requirements from 2nd directive. How local issues are dealt - co-operation with DSOs. Ownership structure is like in old days when networks were owned by states.

Comment 8: See above

Comment 9: Still, real problem is commitment of states/governments-> Ministry people impact is needed. The states have, end of day, responsibility to secure the supply. Joint company doesn't match with that. Why new fee, costs should be cut instead (applies to all models)

19. To what extent does model 4 reduce the need for additional measures for increased harmonisation of the factors listed in Table A? Points (1- to a large extent, 6-not at all)

1	0	0,0% of total 17
2	2	11,8% of total 17
3	4	23,5% of total 17
4	6	35,3% of total 17
5	2	11,8% of total 17
6	3	17,6% of total 17

20. Comments: (TEXTFIELD)

Comment 1: See previous answer

Comment 2: To create a new entity just for a number of investment projects is to overdo it

Comment 3: Would only include interconnectors, that should be seen in a larger context.

Comment 4: This model address only one for the many areas where need for harmonisation is identified (ref. Nordel Report to Akureyri).

Comment 5: This represents a step in the right direction but it would be better to give model 2 the same financial muscles as model 4.

Comment 6: The body must be given the responsibility not only for the investments in inter-connectors but also for investments within the different Nordic countries. This because the capacity given on inter-connectors are set as a result of the available capacity set on internal connections.

Comment 7: A step in the right direction, but modest!

Comment 8: Concentrates only for one part of market improvement - interconnector investments

Comment 9: Det denna modell tycks addera till av ökad funktionalitet kan hanteras redan i modell 2.

Comment 10: Could be an interesting company if it can:

- Chose between investment in Grid or use building of new production as an alternative.
- A majority of the company can be owned by power consuming companies.

Comment 11: Interesting one, this makes sense to tackle for de-bottlenecking. Having 'return the money to customers if not used to investments' mechanism.

21. Advantages: (TEXTFIELD)

Comment 1: If any to have a formalised systemplanning

Comment 2: Will give focus on interconnectors and perhaps more investments. Easier to make decisions regarding interconnectors.

Comment 3: Focused responsibility area

Comment 4: Can facilitate common financing of new investment projects on a common Nordic basis.

Comment 5: Reducing bottlenecks is a crucial task. Financing the interconnector capacity by earmarking of bottleneck fees adds credibility to the whole system.

Comment 6: Comparatively easy to develop as model. The model will contribute strongly to an optimal development of the Nordic grid and to create unity for the allocation of cost-benefit. The company can be further developed to get responsibility of other tasks developing the Nordic Market.

Comment 7: Good characteristic regarding establishing new internordic transmission capacity.

Comment 8: Having a separate company for investments would help to make investment decisions. As bottleneck revenues would be earmarked to the entity, the 'wrong money incentive' to TSOs would be removed.

22. Disadvantages: (TEXTFIELD)

Comment 1: Take away relations between system planning and operation

Comment 2: Interconnectors is only a part of the problem - there are many important bottlenecks inside the countries. Will not solve the problems with peak load, harmonization of TSO operations etc

Comment 3: A lot of dispute before and within. It would be very difficult to agree on joint financing principles.

Comment 4: Addresses only the question regarding investments between countries, interconnectors cannot be handled separately inside a regional market

Comment 5: Do not contribute directly towards harmonised system operation."

Comment 6: How to make sure that the intentions of the company are followed by the different TSOs

Comment 7: Do only solve parts of the Nordic challenges. The model can lead to the creations of antagonism between parent- and daughter company.

Comment 8: Will not solve all the other system operation relations

Comment 9: Financing of investments. Co-ordination with national TSOs

Comment 10: naturally there will be struggle...

23. To what extent does model 5 reduce the need for additional measures for increased harmonisation of the factors listed in Table A? Points (1- to a large extent, 6-not at all)

1	1	5,6% of total 18
2	4	22,2% of total 18
3	6	33,3% of total 18
4	1	5,6% of total 18
5	3	16,7% of total 18
6	3	16,7% of total 18

24. Comments: (TEXTFIELD)

Comment 1: See previous answer

Comment 2: See answer on ISO. Since the ISO will be weak it is not for sure that it is an advantage to have the ownership in Nordpool there.

Comment 3: Is political impossible. Will take away too much decisions from the national level

Comment 4: Our evaluation of Model 5 is similar to evaluation of model 2.

Comment 5: Of course this model promises a lot, but as far as we are concerned the market operation should be carried out detached from the grid operation.

Comment 6: See comments given for model 3

Comment 7: Should only serve as a first step towards one of the other models.

Comment 8: Market facilitator role is increased here - it should be avoided to mix market and system operation functions. Model 2 is preferable

Comment 9: Jag svarar med lågt intresse för detta av det skälet att jag inte tror att detta går att diskutera om ens. Åtminstone inte nu.

Comment 10: The pool should be operational totally independent from the grid owners. If the market is not happy with Nordpool can actors create a new pool-platform(s). Model-5 will likely shortly lead to a situation where consumers always are forced to secure their need for power through the pool.

Comment 11: real "Nordic" model

25. Advantages: (TEXTFIELD)

Comment 1: Compared to model 2 no advantages.

Comment 2: The NP Spot would be in an ideal position in this context.

Comment 3: Same as model 2

Comment 4: See comments given for model 3

Comment 5: Integrated Nordic system operation and Nordic pool in a Nordic body

Comment 6: Gives better possibilities to impact Nordic market

26. Disadvantages: (TEXTFIELD)

Comment 1: Risk of losing Nordpool's stability if a weak ISO is the owner. Also a risk to move the ownership of Nordpool closer to the states with increased risks of political interventions

Comment 2: There is no need to change the role of NordPool. It works very well today.

Comment 3: No clear role for the market operator, unclear interface and responsibilities between TSO and ISO and the power exchange

Comment 4: I can not see that ISO ownership of NordPool makes any important difference from model 2. I may however be questioned if an ISO as a non-profit ideal organisation with limited equity is the best owner of a power exchange operating in a commercial environment.

Comment 5: The credibility of the MO can be doubted.

Comment 6: See comments given for model 3

Comment 7: The TSO will not necessarily accomplish the actions which this Nordic body sees as necessary

Comment 8: Mixing monopoly functions (network) with market facilitator does not set clear tasks for NMO. How this entity is regulated - is only part of it regulated. Responsibilities of actors might not be clear

Comment 9: NMO would be NP (NPS or also the Financial side????). Existing owners would like to cash? Would lead to political decision making instead of market?

27. Rank (1= best, 5 = worst)

27.1 1

Model 1: Increased Cooperation	4	23,5% of total 17
Model 2: Joint Nordic ISO	3	17,6% of total 17
Model 3: Joint Nordic TSO	7	41,2% of total 17
Model 4: Nordic Interconnector Company	0	0,0% of total 17
Model 5: Nordic Market Operator	3	17,6% of total 17

27.2 2

Model 1: Increased Cooperation	3	17,6% of total 17
Model 2: Joint Nordic ISO	6	35,3% of total 17
Model 3: Joint Nordic TSO	3	17,6% of total 17
Model 4: Nordic Interconnector Company	4	23,5% of total 17
Model 5: Nordic Market Operator	1	5,9% of total 17

27.3 3

Model 1: Increased Cooperation	3	18,8% of total 16
Model 2: Joint Nordic ISO	3	18,8% of total 16
Model 3: Joint Nordic TSO	0	0,0% of total 16

Model 4: Nordic Interconnector Company	3	18,8% of total 16
Model 5: Nordic Market Operator	7	43,8% of total 16

27.4 4

Model 1: Increased Cooperation	1	6,3% of total 16
Model 2: Joint Nordic ISO	3	18,8% of total 16
Model 3: Joint Nordic TSO	3	18,8% of total 16
Model 4: Nordic Interconnector Company	7	43,8% of total 16
Model 5: Nordic Market Operator	2	12,5% of total 16

27.5 5

Model 1: Increased Cooperation	6	37,5% of total 16
Model 2: Joint Nordic ISO	2	12,5% of total 16
Model 3: Joint Nordic TSO	3	18,8% of total 16
Model 4: Nordic Interconnector Company	2	12,5% of total 16
Model 5: Nordic Market Operator	3	18,8% of total 16

28. Any additional comments and/or viewpoints? (TEXTFIELD)

Comment 1: It does not matter how the TSOs are organised. The big hurdle is to come to model 1. System planning should be included in that model. If any of the models 2 - 5 were to be implemented, the time needed to solve all the political issues that those models involve would be very long. This will hurt the already shaky market function. To focus on the organization rather than on the practical issues is wrong!

Comment 2: Reasons for the ranking: Model 5 risk of political interventions. Model 4 too much for too little. Model 2 ISO's normally weak. The Nordic TSO would of course give the best harmonisation and serve as a good example for the rest of the world, but don't underestimate difficulties to implement it. Even if regulation of DSO's is outside of the scope it would be desirable to have the same regulatory model in all Nordic countries.

Comment 3: A Nordic TSO may be unachievable.

Comment 4: Improvement potential exists in the various models presented

Comment 5: If the rank in the above list was not predetermined we would have set the following list;

model 1 - rank 4

model 2 - rank 5

model 3 - rank 1

model 4 - rank 3

model 5 - rank 5

Additional: In order to secure a realistic, step-by-step approach, we find it logic to create a common investment company that over time will be given more responsibility / authority by the national TSOs.

Comment 6: In all models having common Nordic organisation as a model there is a need for model of legislative and supervision issues. Even with non-profit organisation the effective operation of organisation has to be guaranteed.

Comment 7: Modellerna med nätägande tror jag inte alls på i dagsläget. Jag tror att det kan finnas goda skäl att noga analysera vad skillnaderna blir mellan modell 1 och 2. Om modell 1 kan tydliggöras så att maknadsaktörerna verkligen möter en (om än virtuell) systemoperatör oberoende av land och att tillräcklig ansträngning görs för att fungera som en enda systemoperatör kan modell 1 räcka. I annat fall ...

Comment 8: Introduce one-price balance settlement (at least for the consumers). Let the market itself take care of the future effect market (the present centrally secured effect-reserve only hides the real price signals). This can not be done without first introducing one-price balance settlement (se above). Create such high feed-in benefit, different in different regions, that new production capacity will be attracted to the market – and thereby avoid unnecessary grid-investments.

Don't let the low costing national grids in Sweden/Finland be used for subsidising the real grid costs in Norway and Denmark Let the TSOs take the lead for introducing a model where real costs for the ETS-market is handled outside the price setting mechanism at Nordpool. Real costs, that of course, should be paid by all power consumers, connected to the grid.

Comment 9: My view is based mainly on my understanding how well the models would work, i.e. results and efficiency. If I would only want to maximise the effects in accordance with table A, (whatever it costs), my answer would be different.

Comment 10: From the point of view of electricity intensive pulp and paper industry the most important issues in electricity transmission systems are economic efficiency and reliability. To our knowledge there are differences in the functioning and transmission costs of national grid systems between the Nordic countries. As there are differences and the need for bottleneck or other investments in the national grid systems is different in each of the countries, it is important that the needed investments are financed nationally.

Nordic TSO will not be the best solution in developing the markets. Instead we support the Nordel recommendations to improve the cooperation between TSOs concerning rules and regulations and market opening to a wider context etc. The Nordel cooperation has proved to be useful in practice.

More focus is needed to intensify increase of new electricity capacity in the Nordic market and especially by new investments.

Annex 2: Interviews with TSOs

A2.1 Energinet.dk

Minutes from meeting with Energinet.dk

Telephone meeting: Tuesday, 17 January 2006. 14:45-15:20

Participants:

Energinet.dk: Peder Ø. Andreasen (CEO), Lene Sonne (Director of Market), Peter Jørgensen (Director of Planning)

ECON: Bo Andersson and Niclas Damsgaard

Background

Energinet.dk has previously answered a Questback survey (QB). This meeting takes these answers as a starting point, with the purpose of developing and clarifying the position and views of Energinet.dk

Broad perspective on harmonization

Harmonization is seen as important (in the QB survey given a 2 on a scale 1-6 where 1 is very important). The most important issue is harmonization of bottleneck management, which is of crucial importance with respect to a well-functioning market and to give the correct incentives for investments (in production) where it gives the largest economic benefits (to society).

The Nordic market is however one of the most well-functioning electricity markets, which is important to have in mind when further harmonization is considered.

One problem with harmonization is that there are differences in the structures between the Nordic countries (production mix, grid etc.). Harmonization may imply giving up what is optimal for a single country/TSO.

Recommendations for improved resource utilization in the Nordic market

Harmonized balance settlement (given a 3 in the QB survey – clarified as perhaps closer to a 2)

This is an area where it probably is more benefits for the market participants than disadvantages for the TSOs (in terms of giving up national solutions). It is however not the most important area.

Harmonization of tariff model design (given a 3 in the QB survey)

There is work to be done in Nordel. This is not very important on the consumption side (will probably not have much effect on behaviour), but of greater importance on the production side. Tariffs are however not that important, compared for instance with price area differences. From the Danish perspective it is as important to be harmonized with the rest of Europe. Energinet.dk needs to look as much south as to the rest of Nordel.

Creation of a single end-user market (given a 4 in the QB survey)

The low score for this reflects the expectations on what a single end-user market can bring about in terms of improved competition. It is hard to see that the right conditions are there. For instance language barriers may create problems with a single market – at least for the domestic customers.

There is also a belief that the costs may be substantial, for instance for investments and changes in communication technology and structures.

Design mechanism or establish new entity to ensure completion of inter-connector projects (given a 5 in the QB survey).

This still means that there are four units (TSOs). All their competencies (regarding decisions) will most likely not be transferred to the new common unit. Thus, there are no strong expectations that this can work well and it does not solve any fundamental problems.

Capacity reserves (given a 1 in the QB survey).

Energinet.dk clarifies that their understanding is that this relates to operational reserves and system services in general. They also point at the importance of being very precise in the wording: Peak load capacity (which fundamentally is a market issue) and operational reserves (part of core system services).

Independent of which the exact needs are these kinds of services should be acquired on a common market.

It is not the responsibility of the TSO to keep peak load capacity, but there should be incentives for this in the market. However, if a TSO sees it as necessary to procure (or otherwise secure) peak load capacity it is most correct to do this on a common market. A TSO that wishes a peak load capacity reserve should get this where it is most cost efficient and not discriminate between different actors depending on country (given that the physical requirements are met).

Bottleneck management (given a 1 in the QB survey)

It is very important to have the same principles for bottleneck management in order for the market to get the right signals. This is also the area where the large money lies.

Differences in principles mean that the problems in one area are pushed to other parts of the system.

Models

As a general comment to all the suggested models:

The reasons why the problems are hard to solve are related to:

- National energy policy
- Differences in production system (thermal/hydro, grid)

The solution to fundamental energy policy issues and structural issues is not different organizational solutions.

In addition if the corporate governance and ownership differs there will be problems with finding a common denominator for such an organizational solution.

If energy policy and the other issues are harmonized to some degree the models could be interesting to discuss (but then not certain it is needed). If these more fundamental issues are not harmonized the different organizational solution will only push the problems/conflicts some step upwards/downwards in the system. The fundamental challenges will not be solved.

Given this the preferred model is a continuation with a deepened cooperation within Nordel (model 1). This cooperation does however need to be strengthened. Nordel's board needs to become more effective and more competent to make decisions.

The work in the board need to become more professionalized and the decisions must be fact based. The Nordel board need to give more clear directives for the work in the Nordel committees.

The drivers for mergers between the TSO is not to solve the fundamental problems, but cost savings and increased efficiency. The savings will however not be very large and it will not be seen in the tariffs (disappears in the rounding). For Denmark the newly merged TSO will lead to cost savings in the order DKK 40-50 million/year, but this is too little to affect the Danish tariffs.

Energnet.dk are sceptical towards ISO solutions. There are synergies in keeping the ownership of the grid and system responsibility together.

A2.2 Fingrid

Minutes, meeting Fingrid 31/1-06

Meeting at Fingrid head office, 31 Januari, 2006

Participants:

Fingrid: Timo Toivonen (President and CEO, Matti Tähtinen (Director)

ECON: Bo Andersson, Niclas Damsgaard

Presentation by Fingrid

Timo Toivonen started the meeting with giving a presentation of Fingrid's view on the Nordic market, cooperation between the TSOs and Fingrid's role.

An initial comment was that it is difficult for the other TSOs, perhaps especially Norway and Denmark to see as far as Finland. Fingrid and Finland is a bit different. This both relates to Fingrids organization (ownership structure etc.), geographical position and the structure of the power sector.

There is always a historical background which have created differences. The differences we (Fingrid) have are positive and this is seen in several benchmarking systems – Fingrid performs well (1-3) in almost all areas.

The Nordic area is an area with high consumption and the market functions well (market splitting etc). There is a mixed power generation which has both advantages and disadvantages. The large variations in hydro production (due to variation in inflow) means that a lot of capacity is needed which is costly. This also means that grid investments are needed.

The Nordel is becoming more and more nation based. Fingrid's position is to try to find common solutions, even in situation when it is "bad" for Fingrid.

It took a long time for Fingrid to become part owner in Nord Pool. Fingrid wanted a common Nordic market and Nord Pool is an important tool. If Elspot and Elbas functions good the errors in the actual hours will be smaller which makes it easier for the TSO. Fingrid is not interested in the financial market since that is not a TSO responsibility.

When it comes to bottlenecks within the Nordic area the troubles are not between Finland and Sweden (refer to map showing share of time with bottlenecks during. From Sweden to Finland there were congestions 8% of the time, which came during maintenance. From Finland to Sweden during 1%. Fingrid has put a lot of money into this. The problems are in the southern/western part of the Nordic area and within Sweden (internal). The latter has also led to reduced capacity on the border Fin-Swe.

But the real problems to get a "common Nordic grid" are in the southern/western parts and especially in Norway. It is understandable that the Norwegian grid is "weak". Generation and consumption is spread all over the country and it has not been the same need of a strong grid. Previous there were restrictions on the export of electricity from Norway and the interconnectors were for that reason weak. Between Finland and Sweden the situation is different. Previously there was a long term agreement with Vattenfall and this has resulted in a situation where 20% of consumption in average situation can be imported from west. This has also been increased during Fingrid's lifetime (8 years?)

Nordel has defined the core activities in a report to NCM. Other activities may be needed in some countries but are still not core activities. It is important to have the

same definition of the core activities. Legal differences between the countries create some difficulties in getting the same core activities (or defined in the same way).

Fingrid has only the core activities and does not want any more. Others have tried to give them additional tasks, but no one can force them since it is not a state organisation). The law specifies the tasks and the core tasks as defined by Nordel are consistent with Fingrid responsibilities.

Priority interconnectors (Nordel).

There is a lack of capacity in Norway and according to Statnett's grid investment plan 15 billion NOK is being invested to strengthen the grid in the coming 10 years. It is therefore understandable that Statnett fights for common investment company. Fingrid has made the similar investments.

About Fingrid

State and private industry always "competed" in Finland both in generation and grid. When the grid needed to be separated from generation, state and private sector participants created separate grid companies which. These had the same tariffs, until Fingrid was created and took over the grids.

At that time there were discussions regarding the organizational structure of Fingrid. It was clear that if you own something you can not be forced to sell and therefore a voluntary agreement with the private sector participants was needed. There were discussions about the ownership shares and there was a desire to get a balanced ownership:

- PVO agreed to to a private company. Should not be a tool for the state to govern the market.
- Can't be used for political purposes or "taxation".
- Decision. Two former owners PVO and IVO got 25% each. State 12% and private investors 38% (put in money and get a secure dividend – 6%. Since this was a market based solution it was revealed what was the necessary dividend level).

They did not want a state group that as the biggest actor in the market, but wanted a separate fully unbundled grid organization (including ownership). In Sweden and Norway the TSOs are part of state group. If ownership means something there is a difference.

The ownership structure gives Fingrid independence. If the parliament passes new laws that change the situation for the private companies they will have to compensate and the state can thus not intervene so easily.

It is often said that half of the ownership belongs to producers, but these are very different actors. PVO is a company that produces electricity for there owners and it is different compared with Fortum, which sells to the market.

According to Fingrid's charter six persons (out of seven) in the board need to agree. This means that three owners (PVO, Fortum, State) need to agree the same

opinion. If the state (or any of the other two big owners) says no Fingrid can't go forward. This could potentially be a problem. For instance, if creating a single price area with Sweden would be against the interest of Fortum they may resist. But we have not seen this. On the contrary they are pushing for further integrations of the markets.

Fingrid has a close interaction with customers and they are involved in setting tariffs. Fingrid always discuss tariffs with the customers first in a smaller group. When these discussions are finished and an understanding has been reached it is taken to the board. The board handles the income level, equity ratios etc, but do not go to the tariff structure – that is given to management. The close involvement with the customers is beneficial for Fingrid. If the customers are satisfied and don't complain to the regulator Fingrid is in a good position. And no one has yet complained (except some complaints from Russia). The regulator is thus not very important for Fingrid, but it is still satisfied.

Fingrid has been given strong tools by the authorities, but have chosen to create a system where money (incentives) talks. If you leave an error balance it will be costly. Fingrid pays the producers for power reserves, although Fingrid have the possibility to take it without paying but don't think that is the right way.

There is a very high customer satisfaction, which actually may be difficult to keep at such a high level. One reason for the high satisfaction is of course that Fingrid is the cheapest in the world (ETSO Benchmarking, 2002). In nominal terms they have decreased the transmission prices and in real terms they have been reduced by 25% since 1998. Fingrid has the possibility to increase prices in 2007, but it is uncertain if it will be used.

Security is the most important thing for Fingrid, and it is always a priority before "market". Fingrid has a high quality with low level of outages (example from one benchmarking study, ITOMS, is shown)

Fingrid is allowed to take out a higher profit than it does according to the authorities.

Common Nordic TSO would mean a much higher price level (double compared with today), which is not in the interest of Fingrid customers. The investment programmes are much larger in other countries. The industry owners are not interested in this. The State may have a different view on this. Fortum would like to see a larger organization but on Fingrid's basis.

Additional questions

Following the presentation.

Q: How is the Nordel cooperation working?

A: It works, but it is becoming more and more national. The organisations (TSOs) want to have more than "their share". Fingrid's attitude to Nordel cooperation has been very positive; even in cases when they know that they want to get the money back from the neighbours. The law also stipulates that Fingrid should contribute to improving the functioning of the market.

It is important to realize that there are differences between the countries, which are not always fully recognized by all TSOs. The thermal production in Finland means that the conditions are fundamentally different compared with Norway. It takes much longer to get the thermal plants running (compared with hydro) and therefore there is a need for a different structure in Finland compared with Norway.

It is difficult to find solution in certain areas:

- Core responsibilities (everyone has the same opinion – waiting for the authorities)
 - Fingrid not responsible for enough capacity. Does not belong to core.
- Bottleneck management. Takes time to invest. Different opinions. Fingrid much for counter-trading. Taken bottlenecks away by building lines.
- Financing of investment. Division of bottleneck incomes. There are crazy ideas that those who don't have capacity ought to have all the income, while those who have already built should not have anything.
- Keep thermal (condensing) power in use. Peaking power. Four different ways of doing that in the different countries. Fingrid does not pay anything, SvK pays something... Very rarely used. Also takes time to get the units online.

These are the main areas. There are other smaller things as well.

Organizational models

Only **state owned** organizations in our suggestion. Fingrid made the point clear that they do not want state companies (and also that EU prefers fully unbundled company). It is very difficult to make it a state-owned company. The private owners can not sell to the state, but Fortum or the state can sell to private. Thus, the state share can not increase. Still, the private owners can not dictate due to the ¾ decision rule.

Fingrid emphasized that Fortum and PVO are not treated more favourable since they are owners – rather on the contrary.

Q: Looking aside from the ownership issues, would a joint Nordic TSO improve the coordination?

A:

- In principle off course, but there are lots of practical problems. The UCTE system in Europe would be “better” if it was one. And the same thing would apply to the Nordic system – at least the synchronous area.

- In practice: The HQ will not in Helsinki and the solutions will not be Finnish. Stockholm might be ok since SvK do some extent have similar views as Fingrid.
- A more rapid process within the Nordel could be to come to agreements with Sweden and then ask the others to join. In many cases Norway does not affect much since interconnections are weak. Practical solutions need to be found – not ones dictated by principles.
- In Denmark the government is concentrating the power to a few. In Norway there are restrictions for foreigners to buy hydro power plants. Statnett is also getting bigger, but it is hard to get a good overview what they really own.
- In principle it would be advantages, but it would mean higher prices for Finland. Roughly the size of €200 million more, which Finland can not get back.
- 90-95% of the harmonization work is already done. That could be jeopardized by doing large structural changes.
- From a Finnish point of view it does not make much sense to get a joint TSO. Unlikely that it will be based on the Finnish model.
- Political streamlining, or lack of, is more important.
 - Differences: Nuclear, declaration from the new Norwegian government (even more difficult for foreigners to get in – perhaps against EU rules).
 - Making legislation at the same level in all countries
 - Regulation. Finland light-hand (no complaints they are satisfied, although make their own studies as well). In Norway the regulator is much more interventionist and regulatory approval is needed. Fingrid does not need that, but report to the regulator.

Q: What could be done for improved cooperation?

A: It is important that if agreements are made, that these are also fulfilled. Example: The five interconnectors that have been agreed on should come. Fingrid is not fully certain that this will be the case. There are no binding commitments.

The cooperation should be given a higher priority by the TSOs. Nordel produces good papers, but there is less action. Still Nordel has solved quite a lot:

- Common regulation market. Not much money but important in principle.
- If attitude is positive much can be done.

The organizational process is not that important, but seems to be for others. Waiting for new organizational solutions, will not be the answer. Changes in organizations also take time.

Q: Comment on the other models?

A:

The ISO is not preferable:

- Decoupling of assets and system responsibility. It is a “crazy” organization. Most black-outs have been with ISOs (Italy – ISO did not know how to maintain grid). The right model is where the grid ownership and system responsibility is integrated.
- Have already good cooperation on operational side. Functions as one, although there are four system control centres. 99% of the time it functions quite well.

Spot organization ought to be different. Nord Pool ASA as the owner of the spot market is not right. The spot market ought to be a tool for the TSO. Nord Pool is not a transparent organization and the rules ought to be clearer. Also, when decisions are made they should be followed.

It is important to enhance the commitment. One organization of course takes care of that – but it is a hard way. Fingrid is also an owner of Nord Pool spot so they are part responsible.

There is much to do to make Nordel more effective, but it still works quite well and that’s why it is not realized by the market. As was mentioned previously Nordel has become more “nationalistic” (investment, political push).

Still no one can say it is not functioning. January 19-20th was a serious situation for Finland, but it was handled. The only thing that did not function was the Russian border.

A2.3 Statnett

Minutes from meeting with Statnett

Meeting at Statnett head office, 6 December, 2005

Participants:

Statnett: Odd Håkon Hoelsæther (President and CEO), Øyvind Rue (Executive vice president, grid development), Siw Anethe Rinker (advisor, market design)

ECON: Kristin L. Munthe, Paul J. Sørheim

The agenda of the meeting was as follows:

- 1) Introduction of background for and scope of project.
- 2) Statnett`s additional comments to Questback survey answers
- 3) Next stages of project

Statnett’s main comments to point 2 on the agenda are given below.

Harmonisation itself is important, but only if done in the correct manner.

Given we have a Nordic power system; common Nordic solutions must be adopted.

Interconnector investments are also a key priority. At the moment there are differing investment philosophies amongst the Nordic TSOs. TSO makes investment plans from a national perspective first, and a Nordic perspective second.

Common socio-economic investment criteria must be developed. Such criteria will enable a more optimal development of the Nordic grid.

With a *common market for reserves* the total system will be able to utilise the cheapest available reserves. Within the current system, there are significant cost differences in providing such reserves in the Nordic countries (e.g. rapid regulating hydro-capacity is very cheap). Making headway on *bottleneck management* is a crucial prerequisite for developing an efficient Nordic reserves market. All Nordic countries bar Sweden agree on how this matter should be dealt with.

Tariff levels will be difficult to harmonise (due to differences in cost structures resulting from a.o.t. differing topographical and climatic conditions). However, one should work towards harmonising the **principles for tariff design** to foster competition in the Nordic market.

Continued Nordel co-operation (Model 1) is not capable of delivering the solutions that market actors demand.

Norway has had 60 years experience with the *ISO model (Model 2)* (Samkjøringen) with little success. Experience from abroad with this model is also disappointing.

The fear that countries will lose national control with *TSO model 3* is unfounded. Through this ownership model governments will have more direct say in how the Nordic market is developed.

As model 3 might be difficult to achieve in the interim, *model 4 (Interconnector company)* is at least the first step in the right direction.

A2.4 Svenska Kraftnät

Minutes from meeting with Svenska Kraftnät

Meeting at Svenska Kraftnät head office in Stockholm, 21 November, 2005

Participants:

Svenska Kraftnät: Jan Magnusson, Director-general

ECON: Bo Andersson, Niclas Damsgaard

The interview followed the questionnaire sent out to various stakeholders.

S1: Recommendations for improved resource utilization in Nordic market

Text from questionnaire: Efficient system operation and a well functioning market are the two central prerequisites for efficient resource utilization in the Nordic market. Rank the recommendations listed below in terms of the extent to which they contribute to a more efficient utilization of resources in the Nordic market.

Harmonized balance settlement

Jan Magnusson: This is not important by itself. It is important as part of creating a single end-user market, but it is not important to change any systems only to harmonize the balance settlement.

Harmonization of tariff design

Jan Magnusson: Does not have a large value by itself. The Nordic market has coped with some differences in the central grid tariffs and there has not been much critique of this. There are many other differences that are much bigger.

Creation of a single end-user market

Jan Magnusson: This was put forward in the Nordel report after the Akureyri meeting. It is probably important, but there have not been any proper studies of this. A good step forward.

Design mechanism or establish new entity to ensure completion of priority interconnector projects

Jan Magnusson: Nordel has showed that we are able to deal with this within the existing system. If new entities are to be established one must find models for financing these, which is not necessarily simpler. Furthermore, all important connections are not interconnections between countries.

Common market for capacity reserves

Jan Magnusson:: (Central) capacity reserves should not be needed. However, if they are needed it is of interest to solve it jointly. Comparisons could also be made with the disturbance reserve and the views differ on how far it is possible to go in terms of joint solutions.

Common principles for bottleneck management

Jan Magnusson: There are different starting points and traditions. In Norway there is a strong belief in price areas, and in Sweden there is a strong support of keeping the country as one price area. It is unlikely that we end up in the same model throughout the Nordic countries. A combination is more likely, with price areas where this is appropriate and counter-trading where this is appropriate.

S2. Alternative organisation models

Model 1: Nordels recommendations

Text from questionnaire: Nordel recommends improve cooperation in three key areas and keeping the organizational structures of the TSOs intact. The three cooperative areas are common definition of scope of system responsibilities, principles for balance settlement and harmonization of congestion management.

Jan Magnusson: This works fairly well. It is positive with the joint financing plan and the chosen model seems logical and correct: Correct method and a good symbolic issue.

Model 2: Joint Nordic ISO

Text from questionnaire: A new joint Nordic ISO is established with no direct or indirect ownership of any Nordic grid assets. The organisation will solely be tasked with ensuring the reliable operation of the interconnected Nordic power system.

Jan Magnusson:

The ownership shares will by itself be a problem (1 country – 1 vote, or according to size). Furthermore, it is likely that national considerations will lead to increased costs (compare SAS).

If the joint operation of the system did not function well it would be motivated to ask whether it should not be done within one organisation. Today, mostly due to their size, geographical position and the existence of hydro power, the Nordic system is to a large extent operated by Statnett and SvK.

With an ISO the questions on who has the responsibility will arise and the interdependence between planning and operation will be an issue. The important question is whether there is something wrong with how the system is currently operated? I (JM) do not think so! The congestion management could possibly be one issue.

Currently there is a very far reaching system operations agreement between the TSOs, which means that we in practice are not very far from what would be achieved by a joint ISO – it is an open issue which alternative is preferable.

Model 3: Joint Nordic TSO

Text from questionnaire: The four national TSOs are merged together to create a joint Nordic TSO. As grid owner, the company will have to ensure adequate maintenance and expansion of the main Nordic grid. As system operator, the company will also be charged with the overall operational responsibility of the Nordic system.

Jan Magnusson:

There are important differences between the countries and a joint TSO is completely unrealistic. It is not possible as long as the legislation differs so much as they do.

One has to remember that the TSO are monopolists and that they also to some extent are responsible for the exercise of public authority. Earlier SvK studied the

conversion of SvK into a (fully state owned) company, and it is clear that it would not be simple to let the company SvK be responsible for the exercise of public authority. And it will not be simpler to leave that responsibility to a joint Nordic TSO.

It is also clear after September 2003 (blackouts) that the politicians want a national responsibility.

Conclusion: Some functions could in principle be put into a joint organisation, but how do one separate the operations (which could be Nordic) from responsibility issues (which should be national)?

Model 4: Nordic Interconnector Company

Text from questionnaire: Establish a multi purpose holding company with the mandate of planning, financing and ensuring completion of interconnector projects

Jan Magnusson:

This could be an alternative if it was not possible to ensure that important investments are made, but this is not the case. It works rather well

It was possible to find a balanced package to finance investments, in which each party took its share. The division was to a reasonable extent according to size, and according to the needs. The model for (part) financing is now a time limited agreement (18 months), but it can hopefully be extended or made permanent (and in the longer run allocate the revenues to different important objectives). One issue is who really owns the bottleneck revenues (not an easy legal issue).

Model 5: Nordic Market Operator

Text from questionnaire: This model is an extension of model 2 but with the system operator having a much broader mandate. This broader mandate includes operation and ownership of the Nord Pool exchange as well as responsibility for Nordic market rule setting and development.

Jan Magnusson:

The thought to put more functions in to Nord Pool (and make it a more general market facilitator) has been around, but it has never got a strong support. Probably since the need has not really been there, but no one has analysed this properly either.

One possibility is to put settlement into Nord Pool. There is a potential for rationalizations there, but fairly small amount of money.

One issue is how to strike the balance between operational security and market access. There are occasions when the system (in Norway) has been run on an N-0 basis to get in enough capacity. Currently the TSO is always responsible for the operational security: No tension between a company that supports the market and one that protects the operational security. The latter is placed above the market operations (a matter of priority). It is difficult to build a market operator with any

authority without reducing the authority of the TSOs (and otherwise it will only be a service organisation).

Rank the alternatives

Jan Magnusson:

The current model works quite well and does not motivate jumping into something completely different.

Before the agreement on building (and financing) the priority interconnectors there was a perception that things moved very slowly. This was however an unfair picture since these are difficult questions.

After the agreement the picture is also different (at least in Sweden). The industry in Sweden is positive towards Nordel's work, which is also the case in Finland. In Norway there does not seem to be the same harmony and uncertain on the situation in Denmark.

Annex 3: Ancillary services

The operating reserves are important part of ancillary services. The different parts of the reserve are described in Table X.

The System Operation Agreement contains fairly detailed and far-reaching requirements on the TSOs of the different Nordic sub-system. According to our opinion there are no strong reason to believe that increased harmonization of the Nordic interconnected system will significantly contribute to improving the operational security of the system, and this as also not been suggested in the interviews, questionnaires and consultations done throughout this project. This question left is thus if increased harmonization can contribute to improving the economic efficiency of the handling of the operational reserves?

The System Operation Agreement provides some restrictions on the localization of the reserves. These are however mainly technical in nature. It is specified that 2/3 of the frequency controlled reserves should be localized within the TSOs own system in the event of splitting up and island operation.

Table A3.1 Reserves

Automatic active reserve	The automatic active reserve is divided up into the frequency controlled normal operation reserve, the frequency controlled disturbance reserve and the voltage controlled disturbance reserve.
<i>Frequency controlled normal operation reserves</i>	At least 600 MW at 50.0 Hz for the synchronous system. Shall be regulated within 2-3 minutes in the case of rapid change in frequency and completely activated at ± 0.1 Hz. Distributed between the TSOs in accordance with annual consumption the previous year and at least 2/3 within its own system.
<i>Frequency controlled disturbance reserves</i>	There shall be a frequency controlled disturbance reserve of such magnitude and composition that dimensioning faults will not entail a frequency of less than 49.5 Hz in the synchronous system. The frequency controlled disturbance reserve shall be activated at 49.9 Hz and be completely activated at 49.5 Hz. When setting the transmission capacity, localization of the frequency controlled disturbance reserve must be taken into account. Each subsystem shall have at least 2/3 of the frequency controlled disturbance reserve within its own system. In the event of a frequency drop to 49.5 Hz caused by a momentary loss of production: • 50 % of the frequency controlled disturbance reserve in each subsystem shall be regulated upwards within 5 seconds • 100 % of the frequency controlled disturbance reserve shall be regulated upwards within 30 seconds.
<i>Voltage controlled disturbance reserves</i>	
Fast active disturbance reserves	The fast active disturbance reserve shall exist in order to restore the frequency controlled normal operation reserve and the frequency controlled disturbance reserve when these reserves have been used or lost, and in order to restore transmissions within applicable limits following disturbances. The fast active disturbance reserve shall be available within 15 minutes. The fast active disturbance reserve shall exist and be localized to the extent that the system can be restored to normal state following faults. The system operators have secured,

	through agreement or ownership, a fast active disturbance reserve. This reserve consists of gas turbines, thermal power, hydropower and load shedding. Whenever required, a subsystem can hold a certain amount of fast active disturbance reserve for another subsystem, if there is idle transmission capacity for this purpose. This can, for instance, be relevant in the event of major transmissions on the links between the subsystems. The keeping of such reserves is to be agreed upon between the concerned subsystems' system operators upon each occasion.
Slow active disturbance reserves	The slow active disturbance reserve is active power available after 15 minutes.
Reactive reserve	Within each subsystem, there must be a reserve of reactive power which is constituted in such a way with regard to size, regulation capability and localization that dimensioning faults will not entail a system collapse.

Source: System Operation Agreement

In addition to these ancillary services the following ancillary services are included in Nordels definitions: ramping, black start, secondary control of HVDC connection (West Denmark only), automatic and manual load shedding, fast forecast reserve, fast counter trading reserve and peak load reserve.

Annex 4: Legislative framework

The main legislation which forms the basic framework and operational guidelines for the respective TSOs obligations are given below.

Finland

- Energy Market Act (1995)
- Chapter 4: Systemansvar, balansansvar och balansavräkning (332/1998)
- Chapter 5: Byggande av elnät

Denmark

- Electricity Supply Act (2001): Chapter 5 System responsible entity
- Ministerial order concerning the service of the system operator
- Energinet Danmark Act

Sweden

- Electricity Act (1997:857) (§1- §2 b, Instruction from the Government regarding Svenska Kraftnät)
- Act on Power Reserve

Norway

- Electricity Act (1990) - §5A-1 Regulation on Power System Operation
- Regulations on economic and technical reporting, income regulation for network undertakings and tariffs

The establishment of a new organizational entity will likely require a significant change in existing legislation.