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NEMESYS Subproject A: System Analysis

FINAL REPORT

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nemesys

Disclaimer

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Sumicsid AB
Tunbyn 502
S-85590 SUNDSVALL, SWEDEN
www.sumicsid.com

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Summary

This first interim report from the NEMEYS project on the Nordic Regulation Model is devoted to a Regulatory System Analysis. The sub-project first reviews the current regulatory approaches, industry structure and the dynamics of industry development and regulation in the four Nordic countries. Second, the subproject presents a careful analysis of the goals and objectives of different stakeholders of electricity distribution. Important stakeholders have been identified and data has been collected by interviews and a web survey. Based on the review of the situation in the Nordic countries and the interview and survey data, the goal of the sub-project has been to define the common and conflicting goals of the stakeholders and to analyze the degrees of freedom in the institutional and industrial setting in the Nordic countries. This part takes into account the situation in each of the four countries and the integrated energy market directives and other EU measures.

The results reveal strong alignment in the energy policy priorities in the Nordic are. Economic and quality issues surface as the most important aspects in a well functioning regulation system. The security of supply was rated as the most important single aspect. Equity issues are slightly less important, seen primarily as base-level performance of regulation. The social and environmental aspect are considered important in general, but not necessarily part of the energy regulation.

Open information exchange between the regulators has not lead to natural harmonization of the systems. The bases of the regulation systems are defined in the legislation, and the countries have chosen different approaches. Hence the harmonization would require a more formal attempt and involvement of the ministries and even political decision makers. IEA in their country analysis of the Swedish energy policy applauds the overall success towards high-level objectives, but suggests further harmonization of the network regulation e.g. through the Nordic council or similar. The European Regulation Forum on Electricity Reform also highlights the need and readiness for harmonization in Northern Europe, using e.g. the Norwegian regulation as an example of modern incentive regulation for both efficiency and quality. Finally, the new provisions for regulatory delegation in the Directive and the strong promotion of regulatory coordination by the European Commission clearly signal that harmonization is on the EU agenda.

Despite the inherent conflicts in the goals of the stakeholders, the most challenging issue in the harmonization of the Nordic regulation models is the creation of common commitment to the process. This would require a situation where all the key stakeholders in all the countries see the process as beneficial.

Table of Contents

1. Introduction

Nordenergi, the industry association for electricity sector in the Nordic countries, has commissioned an international study to analyze the possibilities for a common regulation model for electricity distribution in the Nordic region (NordPool region).

The goals of the study are to:

- Evaluate the advantages and disadvantages of a pan-Nordic regulation model and benchmarking tools viewed in all perspectives of the stakeholders, i.e. customers, society, regulator, owner and distribution system operator.
- Identify the most critical factors in the harmonization of regulation and benchmarking
- Propose a common model for regulation and benchmarking of electricity distribution companies.

In addition to the stakeholder objectives and the critical factors, the proposed common model should also reflect anticipated European electricity directive changes as well as the national regulatory objectives. Implementation of a common model will imply harmonization of national legislation.

In addition, the proposal must address the general challenges related to the economic regulation of natural monopolies. Thus, the ideal regulation model should provide:

- Incentives for efficiency improvements
- Incentives for tariff reductions
- Incentives for customer oriented quality improvements
- Incentives for sound industry structural changes
- Capital recovery and competitive return for owner-financers of network assets
- Long-term regulatory commitment on principles
- Optimal allocation of decisions and information to avoid micro-management.
- Objective firm-level performance assessment.

The proposal should also address the Nordic sector-specific challenges like systematic cost differences, environmental factors and differences in accounting principles and legislation.

The objective of the study is to adequately and convincingly address these issues to achieve a regulation model with a socially and economically acceptable compromise among the conflicting criteria, such that no other model can unilaterally improve on all criteria.

This interim report presents the result of the first sub-project (Subproject A) that has been named Regulatory System Analysis. This sub-project first reviews the current regulatory approaches, industry structure and the dynamics of industry development and regulation in the four Nordic countries. The review is based on a common shared framework that has

been developed on the basis of scientific literature on regulation. Second, the subproject presents a careful analysis of the goals and objectives of different stakeholders of electricity distribution. Important stakeholders are identified and data is collected by interviews and a web survey. Finally, the goal of the sub-project is to define the common and conflicting goals of the stakeholders and to analyze the degrees of freedom in the institutional and industrial setting in the Nordic countries. This part takes into account the situation in each of the four countries and the integrated energy market directives and other EU measures.

The report is structured as follows. Section 2 presents the framework and methodology used in the regulation system and stakeholder analyzes. Sections 3-6 review the institutional and regulatory environment in the four countries and section 7 presents a corresponding analysis for the EU level. Section 8 summarizes the country and EU analysis. The stakeholder analysis is presented in section 9. Finally, section 10 analyzes the key success factors of a pan-Nordic regulation model and presents the conclusions of this sub-project.

2. Framework for the analysis

2.1 Country analysis

The country analysis is based on structured data collection on the industry structure, regulatory framework etc. The following sub-sections introduce the framework for the analysis.

Institutional environment and industry structure

Description of the institutional environment includes the following dimensions.

- History of deregulation
- Structure of the industry (number of companies etc.)
- Key legislation behind the current regulatory model, and changes in the legislation
- Key players/institutions in the regulation (ministries, regulator, courts) and their interaction and power
- Description of the current regulation system and the development path
- Discussion on the incentives the current model provides
- Discussion on the public interest and drivers for change in electricity distribution and regulation

Regulation system

In the country analysis sections, the current national regulatory mechanisms will be described on a level that gives an overview of the elements and mechanisms included in the regulation system. In addition to the descriptions of the systems, these are characterized based on the classifications or traditional regulatory schemes introduced in scientific regulation literature. The following basic list of approaches (that starts with low power schemes and moves towards higher powered) will be used as a basis for the classification:

- Light handed or self regulation
- Cost-plus
- Rate of return
- CPI-X
- Yardstick

In addition to the basic approaches behind the regulation systems, there are differences in the actual ways of implementing regulation. Here the discussion concentrates on the decision rights and the level of delegation (e.g. how detailed aspects the regulator can supervise), the time lag (ex-ante vs. ex-post parts of regulation), level of discretion or the commitment to the regulation principles, and the information needed for making the decisions.

In the description of the regulatory mechanisms, separate systems that are independent of the main regulatory system are also introduced. These can be related to for example quality issues, but there might also be certain fundamental issues that are regulated with concession granting, and other issues with economic mechanisms. One example of this type of separate mechanism is standard compensation schemes for interruptions.

Discussion on the regulation systems

Based on the description of the current regulation mechanisms, the text will discuss the incentives that the system provides. The following dimensions will be used as a guide line in the description of the incentives:

- Efficiency improvements
- Tariff changes
- Quality and security
- Changes in the industry structure
- Long run investments

The discussion on incentives provides a bridge to the comparison of the national regulation systems in the four countries and further to the analysis of stakeholder objective, which is based on the empirical data collected during the project.

In order to provide a basis for the discussion on the future of the regulatory systems and the possibilities for harmonizing the national regulation systems, the text discusses also the drivers – both issues and institutions – of change in each country.

Sections 3-6 include a separate description for each of the four countries based on the framework discussed above.

Analysis of the EU level in section 7 uses the same framework as far as possible. The discussion on the EU perspective is linked to the discussion of the national level, as these are interlinked. In this report, EU directives etc. are mainly seen as a framework that the regulation need to be compatible with, and the political process and EU level goals are not covered comprehensively in the stakeholder analysis part.

2.2 Stakeholders

The first step in the stakeholder analysis is to identify all the stakeholders that are relevant for the study. For practical purposes, the stakeholders are divided into two groups.

The first group is key stakeholders. Their objectives and limits are analyzed on the basis of interviews, and the basic principle is that representatives of all these groups will be interviewed in each country. The interview data will be complemented with a web survey so that we will be able to collect the views of the different sub groups of the key stakeholders.

The following actors are identified as key stakeholders.

- Customers (different groups like industry, services, public organizations, households with electric heating, other households, energy producers)
- Regulators
- Distribution companies (urban vs. rural; public company vs. municipally owned) – The industry association will be the main contact point here

In addition to the key stakeholders, electricity distribution has a number of other stakeholders. Their views will be collected primarily using a web survey. In the case where interesting individuals in these groups can be identified, some complementary interviews will be done. This means that representatives of different groups of stakeholders will be contacted in different countries.

The following groups are identified as other stakeholders:

- Owners (municipalities, institutional investors, households)
- Personnel and unions
- Other governmental organizations and authorities (ministries, municipalities, emergency supply agencies, competitions authorities, consumer authorities, etc.)
- Electricity producers (as market players)
- Electricity retailers
- Transmission companies
- NGOs (consumer organisations, environmental organisations)
- Service and material suppliers of the distribution companies
- Indirect competitors of electricity distribution

The list of organizations that were covered with the interviews is presented in appendix A. The selection aimed at covering all relevant subgroups of key stakeholders on the Nordic level and it mainly relied on the availability of suitable individuals in the groups.

All the interviews followed a predefined interview protocol that included both structured and semi-structured parts. The protocol was divided into three parts:

- General questions on regulation like general reasons why regulation is needed, characteristics of a well functioning regulation system, limitations for changing the current regulation system.
- Detailed questions on the importance and implementation of various aspects in regulation. The aspects were divided into four group namely economic, quality, equity and fairness, and social and environmental issues.
- Prioritization and independence of the groups of aspects.

The last two parts of the interview followed the contents and the structure of the web survey (see the next sub-section), but it included more detailed discussion on the motivation and included e.g. questions on the implementation and role of technical questions in regulation.

Interviews were done by the consortium members – face to face or by telephone. Each interview was documented as a separate memorandum. The aim was not to represent the discussions literally but to summarize the opinions and point made in the discussion. The quantitative data collected during the interviews was included in the data analysis in which the survey data was analyzed.

In addition to the formal interview, the country analysis work included less formal contacts to the regulators etc.

The second part of the data was collected using a web survey that was targeted to both the key stakeholders that could not be interviewed and the other stakeholder groups. The contact information (names and email addresses) was be collected by the consortium members responsible for the country analysis in each of the four countries. The suggestions provided by the NE WG members served as a starting point and these were complemented based on the list of identified stakeholder groups. The web survey aimed at collecting opinions on the importance of including various economic, quality, equity and fairness, and social and environmental issues in a well functioning regulation system.

Both the individual interview memos and the survey answers are treated confidentially.

Goals and objectives

In order to be able to analyze the goals and objectives, structured tools were developed to guarantee comparable information from different stakeholders and countries. For this purpose, the following dimensions and aspects were identified.

Economic aspects

- Tariffs
- Costs and efficiency
- Profit
- Return on investment

Quality

- Security of supply (interruptions)
- Quality of supply (voltage level etc.)
- Customer service (invoicing, advising, information)
- Additional products and services

Equity and fairness

- Equality of different types of customers
- Geographic equality
- Equality of different distribution companies
- Access to networks and markets (both consumers and producers)

Social and environmental aspects

- Safety
- Environmental effects
- Land use planning
- Aesthetics
- Employment
- Competitiveness of the country and the industry

Regulation

- Cost of regulation (companies and society)
- Compatibility with other legislation
- Markets vs. regulation
- General vs. company specific regulation
- Level of delegation (general vs. detailed regulation)

Technological aspects

- Public and private R&D
- Risks and reliability
- Investments

The four first groups are general and were included both in the interviews and in the survey. The last two are more technical in nature, and were covered only in the interviews. In order to be able to formulate a structured interview protocol and especially a survey, these identified goals will be formulated so that we can describe the relative importance of these.

The implemented questionnaire is introduced in Appendix B. As explained above, the interview protocol was based on a corresponding structure, but also question related to the regulation model and technological aspects were included.

2.3 Summary

The above framework was used for collecting comparable data from the four countries. The purpose was to cover all the dimensions needed in the analysis of the current situation, stakeholder goals and objectives, and possibilities for change. Hence the data from the country analysis covered the current regulatory environment from a number of perspectives like agents, their interactions and agenda.

On the other hand, the data collection on the goals and objectives of different stakeholders was based on common framework that allowed more future oriented description of their opinions. In the analysis phase, the quantitative data from the web survey and the interviews was analyses separately with the help of diagrams and other figures, and descriptive statistical

analysis. The country analysis material and the interviews were used in a qualitative analysis. These provide a basis for understanding the common and conflicting interests related to regulation.

The aim of the framework and the analysis is to provide a basis for conclusions concerning the advantages and disadvantages of a pan-Nordic regulation model and benchmarking tools viewed in all perspectives of the stakeholders, i.e. customers, society, regulator, owner and distribution system operator. These are also used for identifying the most critical success factors in cross-border regulation and benchmarking.

3. Country analysis Denmark

3.1 Introduction

Historical perspective

The first Electricity Supply Act was introduced in 1976. It governed the development and structure of the electricity sector. It did not involve any un-bundling and basically introduced a cost plus regime (or non-profit, hvile-i-sig-selv). The act was amended in 1996 with a particular aim to promote the environmentally benign utilization of energy.

In general, environmental concerns have played a considerable role in Denmark and it has had a significant impact on the way the energy sectors are regulated. Furthermore, compared to Norway and Sweden, other energy forms, in particular CHP and wind mills, are much more important. The electricity sector in Denmark is hereby heavily regulated in some "physical" aspects—*e.g.*, fuel choice, CHP—but rather lightly regulated in some economic aspects.

The deregulation was only initiated in the 1999 Energy Supply Act, aiming for increased unbundling and – in terms of the DSOs – a revenue cap regulation with individual and general efficiency requirements. The revenue cap system was operative between 2000 and 2003.

Problems with the revenue cap regulation as well as other aspects of the regulation[1] lead to a new Political Agreement as of March 29, 2004. Part of the agreement involved the fixation of prices to allow the development of a new and better regulation, to be introduced in 2008. This means that the years 2004-2007 will effectively be what has popularly been referred to a "time-out" allowing the regulator to redefine the regulation.

Industry structure

The transmission industry has involved two transmission companies covering the eastern and western part of Denmark, respectively. The eastern and western net-works are not linked although the establishment of the missing links has been debated for some time and are likely to take place soon. The two TSOs merged as of January 1, 2005, and were taken over by the state, cf. below. The number of DSOs has been reducing over time but there is still quite a large number. In 2003, the total number of DSOs was 120, c.f. Table 3-1, but hereof 48 are so-called transformer companies that are very small and defined by having assets below 1 million Dkr. in 1999.

[1] The TSOs were owned by DSOs and the ownership of the DSOs' equity were ill-defined, cf. below.

Table 3-1. Industry structure 2003[2]

Level	Voltage [kV[	# Concessions	Network length [km][3]
Transmission	400kV	2	1 300
Regional transmission	30-150 kV	11	13 551
Distribution	Below 30 kV	120	262 126

In terms of ownership structure, the Danish DSOs can be classified as in Table 3-2 below. We see that in 2003 municipality and cooperatively owned companies played a predominant role although the joint stock companies are dominant in terms of number of consumers and delivered energy. As suggested by this table, the DSOs vary considerably in size. The ten largest DSOs account for nearly 60% of the entire consumption and of these, the largest account for 25%, cf. Association of Danish Energy Companies (2003).

Table 3-2 Ownership structure 2003[4]

Ownership	Number	Transport GWh	Consumers x1000
Joint stock companies	39	22 939	2 047.1
Co-operative companies	54	2 923	268.5
Municipal companies	16	4 654	505.3
Other	1	0	0.1
Joint stock comp. owned by municipality	10	2 099	239.7

3.2 Legislative framework and key institutions

Key legislation

The Danish Parliament adopted the Energy Supply Act (1999: 375) on 24 May 1999 to implement a new framework for "consumer protection, environmental considerations and security of supply" in electricity. This Act introduced competition into the production and trade of electricity.

Important features of the Act included:

- *Gradual liberalization* for consumers over a three year period

[2] Based on data from DERA(2003), Association of Danish Energy Companies (2003) and Nordel (2003).

[3] Total network length (lines and cables, all voltage levels.

[4] Based on data from Association of Danish Energy Companies(2003)

- *Production and trade of electricity opened up to competition:* generation and "trading" companies are free of price regulation and are allowed to compete for their clients.
- *Regulated Third Party Access* to the transmission and distribution grid.
- *Incentive regulation* introduced for the monopolistic grid and transmission companies' activities: Grid and transmission companies will be subject to a new regulation based on benchmarking of costs and with profit. The provisioning for future capital expenditures ends, with capital expenditures becoming financed through normal methods for limited liability companies.
- *Corporate unbundling is introduced:* licenses for transmission, distribution, supply committed retailing, and system-responsible activities may not generally be granted to the same company. On the other hand, the ultimate ownership structure of the sector is largely unregulated and the companies serving the different roles in an area can belong to the same group.

Compared to Norway, Finland and Sweden, the liberalization in Denmark started later and the unbundling was less complete. In particular, the transmission and systems operations, i.e. the TSOs were not placed under the control of an independent entity. It remained under the ownership of distribution and regional transmission companies and hereby indirectly under the control of local authorities and consumers, who also owned most of and distribution companies, cf. OECD (2000)

The Energy Supply Act (1999:375) has later been amended; cf. Consolidated Act no. 151 of 10 March 2003, as amended by Act no. 452 of 10 June 2003. The basis of the regulation of the grid companies was Executive Order no. 944 of 29 October 2001.

The Energy Agreement of 29 March 2004 impacted both the TSO structure and the regulation of the DSOs. Following the agreement, system operation and overall transmission of electricity will in the future be the responsibility of the state. The agreement involved the formation of "Energinet.dk" that will be responsible for the transmission of gas also. It is set up as a state enterprise with the aim to ensure efficient operation and expansion of the overall infrastructure. The exact means of regulating or controlling Energinet.dk are yet to be determined, but in principle Energinet.dk can include the normal return for grid companies in its tariffs for future investment, including possible purchases of regional transmission grids. The remaining surpluses will be transferred back to consumers.

In order to bring capital relationships in the electricity sector into order, cf. the capital problem below, the differentiation between capital as free equity and tied-up equity is eliminated. The 2004 agreement hereby solved or at least removed "the capital problem" that had been stalling DERA for an extended period.

There is a political consensus that the net-charges cannot be allowed to rise as a result of these changes in the definition of equity and of the establishment of Energinet.dk. This will be ensured through a new price regulation. Revenue caps will thus not increase due to the modified concept of equity.

The Electricity Supply Act (2004: 494) together with Executive Orders (2004: 899), (2004: 1520) and (2005:520) implements part of the Energy Agreement and in particular, it defines how the distributions and regional transmission activities shall be regulated in year 2004, in

year 2005, and from 2006 onwards with additional changes in 2008 (introduction of new quality benchmark)

Institutions

Two authorities are jointly responsible for the economic regulation of the DSOs, viz. the Danish Energy Authority (DEA, Energistyrelsen,) and the Danish Energy Regulatory Authority (DERA, Energitilsynet).

DEA was established in 1976, and is - as of 18 February 2005 - an Authority under the Ministry of Transport and Energy. DEA carries out tasks, nationally and internationally, in relation to the production, supply and consumption of energy. DEA is also responsible for the granting of concession rights in electricity distribution.

DERA is an independent authority engaged in "proactive and forward-looking supervision of monopoly companies in the Danish energy sector: electricity, natural gas and district heating". DERA works to secure efficient and transparent energy markets in Denmark and to ensure the energy required, at fair and transparent prices, and on fair conditions.

To do this, DERA regulates the prices and terms of supply fixed by the monopoly companies – including the terms applying to access to transmission and distribution networks. The Authority also supports structure development and improvements in efficiency within the energy sector. Further, DERA – through its secretariat – plays an active part in Nordic and European cooperation among regulatory authorities, thus contributing to optimal and secure supply of energy to Danish society.

The Energy Supplies Complaint Board (Ankenævnet på Energiområdet) deals with private consumers' complaints regarding energy companies' purchase and delivery of electricity, gas and heat. It was set up on 1 November 2004 at the initiative of the industry, but it is administratively located at DERA.

Complaints about more general issues, e.g. tariff structure and supply conditions, are handled by DERA. Complaints about decisions made by DERA and DEA are handled by the Energy Board of Appeal (Energiklagenævnet). The Energy Board of Appeal is the final administrative appeal body for decisions by public authorities under various laws governing the energy sector. The Board consists of a chairman and deputy chairman as well as a number of experts in energy-related issues. The decisions of the Energy Board of Appeal are final, i.e. they cannot be appealed to other administrative authorities. It is however possible to institute legal proceedings against the Board in the courts.

Summing up, DEA defines the framework for regulation, e.g. as for 2000-2003 a revenue cap with individual efficiency requirements and a fair return on equity reflecting the risk in the industry. However, it is the responsibility of DERA to operationalize the framework by defining a benchmark model, by deciding on details of cost-pass-through, rate of return etc. Also, DERA advises DEA on the choice of overall framework. The present "time-out", for example, is introduced as a response to a request from DERA.

3.3 Regulatory system

Regulatory approaches[5]

The regulatory approaches in Denmark since the deregulation in 1999 have involved a combination of classical rate of return regulation, revenue cap regulation on a part of the income, and more recently a simple price fixation. Although the regulatory approach had some resemblances to the Norwegian in the initial stage (except for model used and some technical details), the Danish regulation has not moved forward to become more comprehensive and output oriented. Rather, the difficulties of the first period have to some extent put back the regulation to the starting point of many de-regulations, including the Swedish one, namely an approach of simple price fixation complemented with a continued publication of benchmarking results to provide information and incentives via the public exposure. The regulation hereby also involves an element of ex-post regulation. This is the case also hen it comes to the regulation of tariff structure, quality etc, cf. below, although the issues do not seem to have been high on the agenda.

Decision rights

Although the first deregulation period had somewhat heavy regulator involvement in the accounting and valuation activities and involved considerable information exchange duties on part of the DSOs, the DSOs have always retained considerable decision rights.

Tariff setting of individual prices and tariff mechanism design (fixed/variable, two-part, etc) are delegated to the firms. Naturally, some rules apply to the non-discriminatory pricing within an area, e.g. distant consumers cannot pay more, but each concession area is free to set tariffs for each homogenous customer segment independently. Most DSOs apply a system of A, B and C consumers corresponding to the voltage level that they are linked to. Cost allocation of different consumer groups are supposed to reflect underlying costs but there is no specification of which of the many possible meanings this can have.

Quality requirement are also, except for extensive technical regulations, rules to ensure safety etc, left for the DSOs to decide and there are no mandatory compensation for the companies' failure to deliver. Consumers and retail firms can, however, complain to DERA about unfair tariffs, un-equal treatment and unsatisfactory quality such that an element of ex post regulation has been used in these cases.

In addition to the decision rights during the regulated period, the DSOs have had an important impact on the very important opening accounts and equity evaluations.

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[5] Our description and evaluation of the Danish DSO regulations are based primarily on the reading of Acts, Executive Orders, and Political Agreements. We are not aware of more academic literature describing the regulatory approach and mechanisms in much details.

Regulatory mechanisms

We can distinguish between three mechanism or regulatory regimes; the first covering 2000-2003, the second being an intermediary regulation given DERA the necessary time to develop a new regimes, and the third, excepted new regime to be in place from 2008 and onwards. The last two regimes are either very simple or only planned in few details by now, and our main focus will therefore be on the first regulation – and on the problems encountered.

2000-2003 revenue cap regime

In this period, the regulation can best be characterized as a revenue cap with an efficiency incentive and some rate-of-return restriction. It was planned to involve a 4 year review period and a 4 year regulation period (but the initial regulation was based on 1998-1999 data (2000 data from 2002) and the regulation period was cut short when the system was abandoned in 2004). Deviations from the revenue cap in terms of over or under compensation to the DSO should be accounted for in later regulation periods.

The caps were defined as the sum of three elements:

- Costs that were exposed to an efficiency requirement
- Costs pass throughs
- Capital costs

The *cost exposed to an efficiency requirement* was in principle supposed to reflect OpEx. Depreciations however were also subject to an efficiency requirement. The efficiency requirements was determined from two parts, a general one set by Minister (2-3%) and firm specific ones determined in part by a benchmarking model developed for DERA.

The benchmarking model, called the *net-volume model* was based on a linear regression explaining OpEx via some 17 regressors like different network lengths, costumer numbers etc. This initial regression was used in a COLS fashion. The resulting efficiency score was then corrected for a density factor using a linear regression of the efficiency on the costumer density (like in a more traditional second stage analysis).

The revenue cap model in principle prescribed immediate (one year) elimination of the so determined individual inefficiencies. In addition, it required the general productivity improvement. Lastly, the revenue cap model involved an upper bound on extraordinary efficiency gains. In addition there was even an efficiency requirement on depreciations. Based on these elements, the Danish approach seemed very demanding compared to international comparisons, in particular because of the COLS approach and the immediate catch-up requirement. The exact requirements that was given to the individual DSOs were however determined in a negotiation with the industry and in realty the revenue caps did not impose immediate catch-up.

Cost pass-throughs (1-1 costs) were allowed for some cost elements, namely costs that were considered to be outside the control of the DSOs. Non-controllable costs could for example

be the costs of energy advisory services. During the regulation regime, DEA gradually increased the cost elements that were kept outside incentive control.

Lastly, the revenue cap involved a *capital costs* element. The basis for these capital costs was a replacement re-evaluation of the capital equipment of the companies done as part of the regulatory review period. Net-assets were evaluated according to 2000 standard prices, and adjusted for age using a standardized inflation adjustment approach to determine the costs at time of purchase and a standardized linear depreciation pattern to account for depreciation. The asset base in later years was updated taking into account new investments at actual costs. The rate of return on the free equity were set at 7% in each of the years 2000, 2001, 2002 and at 6.2% in year 2003. The return on the tied-up capital were considerably lower (reflecting the idea that it had already been paid by the consumers) and was planned to vary according to the degree of solidity.

Problems during the 2000-2003 regime

The early regime encountered several *problems* that ultimately lead to it being abandoned from the end of 2003.

The problems were in particular related to the

- Opening accounts
- Equity ownership
- Accumulated unused revenue caps

The *opening balance and cost accounts* were based on data from 1998-1999, where the firms were not yet unbundled. This made the basis for the regulation and in particular the benchmarking model uncertain. On the equity side, the initial positions were established by combining asset registers with asset prices and taking into account the age of the different grid elements, cf. above. In practice this turned out to be very complicated in many cases due to restructuring during the investment period and the bundling with other activities. It seems that some companies did not even have up-to-date asset registers. Again, this suggested that the opening balance may not have been precise.

The return on assets was complicated by the desire to distinguish *equity according to ownership*. The idea was that some of the equity was free since it was present in the companies in 1977, when the first Electricity Supply Act was introduced. Equity accumulated during the cost plus (or zero profit) regime 1977-1999, however was tied-up, since it was to a large extent paid by the consumers. While the free equity could require a standard return on assets the tied-up equity could not since it was essentially already paid by the consumers and a normal return on these assets would therefore make the consumers pay twice. The distinction was intended to set the return on equity in the regulation. Also, the distinction were coupled with a requirement that consumers should have the majority vote in the company boards. To ownership problem hereby prevented a normalization of the capital conditions in the sector. To make the capital structure of the DSOs begin to look like that in the rest of business and industry by allowing private investors buying into the sector to have a controlling influence in the company they own, the equity problem needed a solution. Moreover, the decomposition of the equity put heavy administrative burdens on DERA and lead to legal conflicts with the

DSOs. The problem was never solved but rather eliminated via the political Energy Agreements of 29 March 2004

A final problem in the first deregulated period was the under-utilization of the revenue caps. On average, the companies only used 80-85%. This suggest that the regulation may not have been as tight as it looked (with immediate catch up requirement in a linear model) – or that the importance of the consumer preferences in the many cooperatively owned DSOs were not foreseen. Either way, this led to huge *accumulated reserves* by the end of 2003. In return this meant that adjustments in the regulation could have only limited impact since the DSOs could always draw on past revenue cap reserves.

2004-2005 price fixation regime

The Energy Agreements of 29 March 2004 had two important consequences.

First the equity ownership problem was "solved" via a political agreement. The TSOs (Eltra and ELKRAFT) that had been owned by the DSOs were handed over to the state. In return, the DSO was allowed to consider all equity as free.

Secondly, the revenue cap system with individual efficiency requirements was temporarily abandoned and instead a price fixation system (with individual prices) was introduced.

The individual prices of the DSOs were essentially fixed at their realized level from January 1, 2004. This means that DSOs with high prices will be allowed to continue charging high prices while DSOs that have cut prices will have to continue with lower charges. There will be an allowed inflation adjustment of the prices and some allowance for new investments. Lastly, there will be a limit on the maximal return on assets (long bond interest rate + 1%). The determination of the asset base essentially follows that of the previous period, i.e. it is the replacement values according to the opening statement from 2000 with adjustments for later investments and depreciations according to standard depreciation rules.

The idea of the price fixation period is – as mentioned - to allow DERA time to develop a new regulation. In addition it safeguards the DSOs against "expropriation" of the just acquired equity.

2006 — revenue (price) cap regime

The regime to be followed from 2006 and onwards is still only partially defined. It seems clear however that it will continue the price fixation logic of 2004-2005 and that a benchmarking model is only supposed to affect the regulation from 2008 onwards.

The 2006- regime involves the following elements

- Regulation of prices per kWh based on the fixed prices from the last period and with an inflation adjustment
- The regulation price is transformed to a revenue cap based on the budgeted deliveries of the DSO

- A maximal return on (all) equity equals the long-term Danish bonds plus 1 per cent. Excess returns will make DERA reduce the regulation price in the next full period (with a maximal reduction of 2%), e.g. excess return in 2005 calls for a reduction in 2007.
- Differences between the allowed regulation price and the realized prices shall be evened out within the next two years, i.e. the new regime shall avoid the accumulation of large differences. Differences in the favor of the consumers carry a small interest of 1%.
- Adjustment for necessary new investments in those cases, where the return on investments would otherwise be below the long bond rate +1%. Reinvestments cannot motivate an adjustment in regulation prices, but new investments, incl. the substitution of lines with cables, investments done in accordance with the TSO and investments in net assets to serve major new areas can motivate increased prices.
- The DSO can – if it exceeds the rate of return cap – avoid the subsequent reduction in the regulation price c)) if it has accumulated reserves from 2001-2003. Accumulated reserves shall be eliminated before 2010. Accumulated debt to consumers (excess charges) from 2000-2003 has no effect in the new regimes.
- In 2007, DERA shall develop a new benchmarking model based on 2006 data and this shall affect the regulation prices from 2008 and onwards. This benchmarking model shall involve quality aspects and from 2008 DERA shall once again use individual efficiency requirements.

Other rules and regulations

In addition to the main regulation systems above, the companies must adhere to a number of principles regarding tariffs, connections etc. cf. above. The supervision of these aspects is done case-by-case mainly based on customer initiative. In the case of complaints, DERA can oblige the companies to change their terms or tariffs and in some cases also return the excess fees etc. directly to the customer.

Quality

As noted, there has been no mandatory compensation for service interruption but in particular the power cut on Sealand on 23 September 2003 was a reminder that electricity supply is a vital part of modern society. Therefore, a central area for the Danish government is "to establish a stable framework for electricity supply that ensures that the public, businesses, and other sectors in society have access to stable electricity supply", cf. DEA (2004).

In recent energy policy agreements it has been decided to prepare a national action plan for the future infrastructure up to 2010. The official goals are to secure a greater degree of security of supply, to establish well-functioning competitive markets, and to accommodate renewable energy.

3.4 Discussion

The analysis of the incentives provided by the previous and current regulation can be summarized in the following way:

- In the revenue cap and price fixation regimes there are incentives for efficiency improvements as the companies can keep the cost cuts as profit. However, the allowed extra profits have in both regimes been capped, possibly protecting the regulatory system but also limiting the firms short run incentives to reduce costs. The public exposure via yearly benchmarking by DERA also serves to provide incentives for the companies. Lastly, the ownership structure should ideally be considered. The DSOs are to a large extent owned by municipalities and by cooperatives. Hereby the final consumers' interests in low tariffs have a quite direct and in some cases apparently strong influence on the behavior of their DSO.
- The incentives for quality and security are less clear-cut. There is no formalized system making the companies trade off the company costs against consumer costs, but DERA can on a case to case basis make the companies compensate consumers. Also, the revenue cap system with its return on investment system basically compensated the companies for extra assets such that the companies would be compensated for a CapEx based approach to quality. This incentive is partially retained in the price fixation regime since it allows a price increase to compensate for new investments and the substitution between lines and cables, for example. Finally, quality attributes that mainly affect OpEx are not incentivized in the regulations except via the consumer influence.
- Incentives for changes in the industry structure are mixed. Basically, the use of a linear benchmarking model avoids favoring any particular scale or scope. This should foster efficiency improving restructuring. The consumer influence, the equity problem and issues relating to the taxation of municipal gains from selling the companies have however stalled the restructuring. Also, the fact that companies are unbundled in terms of account but not in terms of final ownership suggests that the restructuring of the distribution side may be less driven by distribution gains and more by a desire to buy into production, for example. Lastly, the relatively low rate of return on equity from the point of view of private investors may have reduced their incentives to enter the industry.
- In theory, the changes in the regulatory system and the uncertainty of the future regime suggest that the long run incentives to cut costs and make investments are weak. On the other hand, this may not be a major problem in practice as several stake-holders have suggested, in part because everyone realizes that a regulation is only sustainable if it is satisfactory for all actors in the long run.

In Denmark, the public pressure for distribution regulation is rather moderate. Tariff harmonization across companies and the relative large variation in DSO costs (with some having distribution costs four times higher than the average costs) have not been a major issue in the public debate. The equity problem and in particular the possibility of the state to tax the revenues from sales of municipal DSOs have been the subject of some debate. Still, the general issues of energy saving, environmental impacts etc are much more visible on the political agenda.

4. Country analysis Finland

4.1 Introduction

Deregulation

The reform and deregulation of the Finnish electricity market started in 1995. The new Electricity Market Act (386/1995) entered into force and the major electricity users were allowed to invite tenders from electricity suppliers. The deregulation of the electricity market has taken place in stages, and production, sales and foreign trade have been opened for competition. Since the introduction of the load profile method in autumn 1998, the smaller customers have been able to buy electricity from the competitive market without hourly metering. (EMV, 2005)

The reform has gradually changed the structure of the Finnish electricity industry. Before 1995, the wholesale market and transmission was dominated by the state owned Imatran Voima (IVO). There were however many smaller producers and even a competing industry owned transmission network. Distribution and retail sales were taken care of by local monopolies. Majority of these were owned by the municipalities. In the reform, Finland joined the Nordic electricity market, networks were opened to all the customers, retail sales and distribution were unbundled, and transmission was centralized to one company. The Electricity Market Authority, subordinate to the Ministry of Trade and Industry, was established in 1995 to supervise power network operations. Before that no special bureau ever existed to monitor the electricity industry (Pineau and Hämäläinen, 2000). In 2000, the name of the Electricity Market Authority was changed into the Energy Market Authority (in Finnish Energiamarkkinavirasto, EMV), as it was commissioned with the supervisory tasks of natural gas market.

Electricity Industry

Finnish electricity grid consists of national transmission grid, regional transmission lines, and local distribution networks. Table 4-1 gives an overview of the transmission and distribution activities.

The national transmission company Fingrid was founded in 1997 by merging the two earlier transmission companies. Fingrid is a system operator that is responsible for high-voltage power transmission on the national grid. In addition to the grid comprising the 400 kV, 220 kV and 110 kV power lines, the company owns also cross-border lines and is responsible for production needed for maintaining the short term balance. (EMV, 2005)

The regional transmission companies operate point-to-point transmission lines and power stations that are not part of the national grid.

Table 4-1. Industry structure in 2003 (Source: EMV, 2004a)

Level	Voltage [kV[	# Concessions	Network length [km][6]
Transmission	400 - 110	1	13 879
Regional transmission	110*	13	1 704
Distribution	110** - 0.4	94	354 847

* One regional transmission company has also 400 kV lines

** In total 55 distribution companies have 110 kV network. The length varies from 1km to 1 800 km.

Local electricity companies are responsible for electricity distribution on distribution networks. The networks mainly consist of 20 and 0.4 kV lines. Some distribution companies have 110 kV lines and power stations, and also other voltage levels are used in some cases. Along with the structural development, their number has decreased drastically from the original 200 companies in the past 20 years. At the moment there are 91 distribution network operators (EMV, 2005). Figure 4-2 presents the development in the number and ownership type of the distribution companies after the deregulation. At the moment, Fortum and Vattenfall are the biggest distribution companies.

All the power network operators need a network license issued by the Energy Market Authority. The network operator has an obligation to maintain and develop the power network, to connect to his network electricity consumption sites and power generating installations and to transmit electricity. The distribution companies have the exclusive right to construct distribution networks in a specified geographical area. (EMV, 2005)

In the competitive areas of the electricity industry, there are about 120 companies engaged in electricity generation and about 500 power plants. Fortum accounts for 40% and Pohjolan Voima for about 20 % of Finland's electricity generation. At the moment 75 retail sales companies are listed on the web page of the Energy Market Authority. This number has decreased during the recent years as Fortum and Vattenfall, among others, have acquired local electricity companies and they have conquered a significant share of the electricity retail market. In recent years, also companies that are independent of the traditional electricity companies have entered the retail market, but their market share is relatively low. (EMV 2005)

[6] Total network length (lines and cables, all voltage levels)

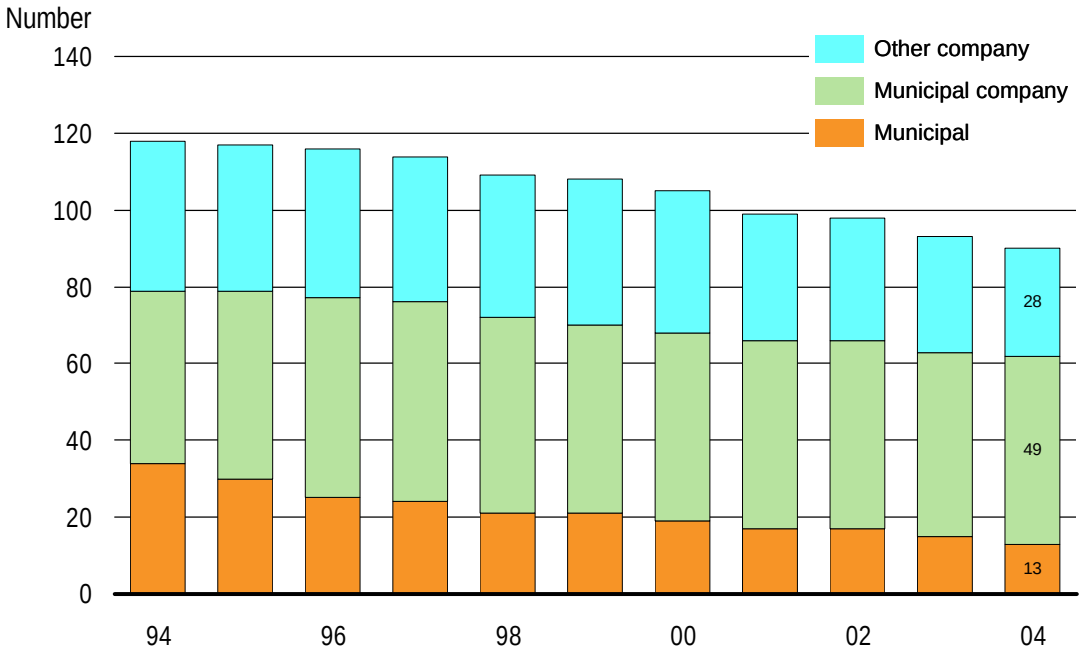

Figure 4-1 Number of distribution network operators (at the beginning of the year) by ownership type. (Source: Adato Energia Oy, 2004)

4.2 Legislative framework and key institutions

The primary purpose of the Energy Market Act (386/1995) is to ensure preconditions for an efficiently functioning electricity market and to secure sufficient supply of high-standard electricity at reasonable prices. The primary means to do this is to secure a sound and well-functioning economic competition in electricity production and sales and reasonable and equitable service principles in the operation of electricity networks. The act entered into force in 1995, and minor amendments were made during the years (1018/1995, 332/1998, 138/1999, 466/1999, 623/1999, 444/2003, 1130/2003). In 2004, the act went through a major reform (1172/2004).

The act (9 - 10 §) obliges the distribution companies to

- Transmit the energy that the customers in the area need against a reasonable compensation
- Connect all the customers – consumers and producers – to the network against a reasonable compensation
- Develop the network in accordance with customer needs and so that sufficiently high quality and reliability are achieved.

In the 2004 reform, the supervision of the distribution moved from yearly case-by-case ex-post approach to partly ex-ante supervision that covers all the companies and is based on regulation periods of 3-4 years. One of the main purposes was to meet the EU requirement of defining the methodology of the regulation in advance and processing times. In the future, the companies are obliged to return to the customers any windfall profit for the completed

regulatory period through pricing in the next regulatory period. Also the rules for unbundling were tightened and the Market Court was introduced as the first step in the appeal process.

The Electricity Market Decree (518/1995, and amendments 451/1997, 438/1998, 182/2004, 1174/2004) includes more specific rules and regulations on the electricity network licenses and responsibilities of the license holders, the construction of networks, retail sale of electricity, and balance responsibility and balance determination. Also the decree was refined in 2004.

In addition to the Energy Market Act and Decree, the Ministry of Trade and Industry has given specific ministerial decrees and decisions on the unbundling of electricity business activities, instruction on reporting obligations, use of load profile system, invoicing, terms of connecting etc.

The key trend since the deregulation of the market has been gradual tightening of supervision. New issues have been added to the regulation system and regulation has become more detailed. The next sub section discusses the actual changes.

The Ministry of Trade and Industry is the key player in the legislation issues. It is responsible for amendments and preparation of government bills. Hence it has the most significant formal power.

EMV has the responsibility of implementing the rules and regulations set by the legislation and the ministry. The authority makes many decisions related to the actual implementation of the regulation system and make decisions whether the companies operate according to the set rules. The operations of the authority are mainly financed by the regulated permit holders. In addition to electricity markets the authority is responsible for gas markets and emission trading. In total, the authority has about 30 employees.

Decisions taken by the Ministry or the electricity market authority under the Energy Market Act may be appealed to the Market Court (or to administrative court in other than tariff supervision decisions) and in the second phase to the Supreme Administrative Court. (Electricity Market Act, 51 §)

Customers have no real role in the regulation of rate of return and costs, as all the companies are automatically supervised by EMV. In other issues, like questions related to fulfilling obligations, and fairness of tariff structures, customers can ask EMV to start a process. However, the customer is not a party to the case and cannot hence e.g. appeal. Only if EMV decides not to start a process the customer can appeal.

4.3 Regulation system

The current regulatory model is based on the guidelines for reforming supervision of electricity and gas network operations that were set out in a report of the Ministry of Trade and Industry working group for reform of regulation of pricing in the energy market. The actual system was developed by the Energy Market Authority and it is introduced in a separate document that forms the basis for the methodology decisions given prior the start of the regulation period. (EMV, 2004b)

The supervision is based on an ex-post rate of return regulation. In addition, the operational costs must be reasonable. This interpretation is based on the Electricity Market Act and its preambles.

The first and still applicable part of the regulation is the rate of return regulation. Initially, the rate of return was supervised based on one year periods. The reasonable rate was based on adjusted financial statements and a Weighted Average Cost of Capital (WACC) model. The first decision on the return level was made in 1999 (case Megavoima Oy) and the Supreme Administrative Court confirmed this decision, and hence the used approach and the power of EMV, in 2000.

After the implementation of the rate of return regulation, EMV developed a model for ex-post yardstick regulation of operational costs. The levels of reasonable operational costs were defined on the basis of a DEA model. Excess costs were interpreted as profit in the early ex-post evaluation of the rate of return. Eventually, this model was used only in cases where the network operators benefited from it, and the system for supervising operational costs was completely reformed in 2004.

In the last reform in 2004 many components of the regulation were changed. The rate of return is regulated based on the same basic principles but many details like rules for depreciation changed. Regulation periods were introduced and the first period is 2005-2007. A new approach to the regulation of costs was introduced, and now the reasonable cost level is based on a cost cap. The new model also includes an obligation to return the excess profit to the customers during the following period instead of just changing the tariffs after the supervision decision. On the other hand, the system allows higher return during the next regulatory period if the return has been below the reasonable earnings level. The reasonable earnings level will be calculated in the basis of amount of capital, reasonable rate of return, and adjusted profit and loss account.

In the beginning of the first regulation period, the amount of capital is defined based on the technical present value (TPV) of the network. This is calculated by multiplying the replacement value of the components by the ratio of the average age and the holding time (i.e. straight-line depreciation). The replacement value is dependent on the type of component and the environment (urban, semi-urban or rural), and the holding time of the component groups can be chosen within certain limits. For the two following years, the technical present value is adjusted based on straight line depreciation and actual investments (valued with standard prices). Other assets related to network business are valued at book value, and financial assets are excluded.

The reasonable rate of return is based on a Weighted Average Cost of Capital (WACC) model. The reasonable rate of return on equity is calculated on the basis of a Capital Asset Pricing (CAP) model, i.e. reasonable rate is risk free rate + levered beta factor multiplied by a market risk premium. In the implemented model, the risk free rate corresponds to the 5-year Finnish government bond (May 2004 average 3.53%), the levered beta is 0.395 or 0.429 depending on the ownership (i.e. taxes) of the company, and the market risk premium is 5%. The reasonable rate for dept is risk free + 0.6%. The capital structure is assumed to correspond to dept/asset ratio 30/70 for all the companies. When the WACC model is applied to the rates and capital structure above, the reasonable rate of return on the total assets is 4.77% or 5.21% depending on the ownership.

The acceptable costs are based on a cost cap, which is defined ex-ante based on the historical operational costs of the company and a CPI-X factor. The X-factor is based on industry level productivity development (frontier shift) and was defined with a DEA based Malmquist analysis. The X factor is 2.2% and the price index (actually industrial production price index) has changed 0.9% p.a. on average in 1995-2002. The reference cost levels in the CPI-X model are the average operational costs in 2000-2003. If the volume of the operations is changed, the cost level is corrected on the basis of the change in the network volume and number of customers.

Information

The network operators are obliged to give the regulator the information that is needed in the supervision. In practice this means submitting financial statements for the unbundled activities and technical information related to the network, energy delivered, customers etc. In the current system, defining the asset base is the most information intensive part of regulation.

Time lag and decision rights

During the regulation period, EMV makes yearly calculations for all the companies, but the official supervision decisions will be made only after the end of the period. Hence the actual decisions that are based on rules described above are made ex-post. In the new system, the case by case discretion has decreased. However, there is still some flexibility in defining the asset base and this is a potential source of conflict.

In the decision, EMV can oblige the company to change its tariffs so that these are reasonable and the windfall profits from the previous period will be compensated for. The company will make the actual decision concerning the tariff levels and tariff structure.

Trends

The current regulation model and the changes that have lead to it can be summarized in the following way. Before the reform in 1995 the industry was mainly self-regulated. In the next step the supervision was based on pure ex-post rate of return regulation. In the recent reform the emphasis moved from pure ex-post towards partly ex-ante, more details were added and less discretion is allowed. The system also moved from one year period to 3-4 year regulation periods, which was considered as a positive fact by all the stakeholders. Hence the current model is based on rate of return regulation and CPI-X based cost cap. The aim is to develop a yardstick approach for defining a company specific X factor in the next regulation period.

In the regulation model described above, quality has no role. (There is a separate compensation scheme, see below). However, EMV has announced that for the next period, the possibilities of including security of supply, quality of electricity and customer service in the regulation model are studied.

In the next regulation period, EMV aims also at introducing a company specific X factor that would reflect the efficiency improvement potential of the company. The calculation of the X factor will most likely be based on a DEA model.

Other rules and regulations

In addition to the main regulation system above, there are number of principles on terms of connecting, tariffs etc., which the companies must adopt in their operations. E.g. the tariffs must be public, they cannot be dependent on the geographic location of the customer in the distribution area and the tariff structure should reflect the real costs caused by different customer groups. The supervision of these aspects is done case-by-case mainly based on customer initiative. In the case of complaints, EMV can oblige the companies to change their terms or tariffs and in some cases also return the excess fees etc. directly to the customer.

There are also a couple of separate obligatory compensation schemes that are related to the quality aspects. These are

- Standard compensation for interruptions longer than 12 hours since 2003. The level of compensation is dependent on the length of the interruption and is proportionate to the fees paid by the customer. The maximum compensation is 700 euro. (Electricity Market Act, 27 f §)
- Standard compensation for the delay in connecting to the network since 1999. (Electricity Market Act, 27 a §)

4.4 Discussion

The analysis of the incentives provided by the current regulation system can be summarized in the following way:

- There are incentives for efficiency improvements during the regulation period as the company can get the higher that CPI-X cost cuts as profit. However the basis for the cost cap in the next regulation period has not been set and there is a fear that cost cuts will directly affect the reference cost in the next period.
- There are strong incentives for tariff changes. This is due to the fact that the companies must return the excess profits to the customers and all the companies will be supervised automatically. There are also clear predefined rules that help defining the acceptable income level.
- There are weak incentives for quality and security. Basically the standard compensation is the only incentive here and it is not very high. The rate-of-return regulation does not take into account quality. However, there are some incentives for investments (see below) and these have an indirect effect in quality.
- Incentives for changes in the industry structure are weak. The current regulation model is indifferent of the scale.
- There is clear incentive for long run investments. Although the allowed rate of return is low, investments increase the amount of capital and the regulation period is now longer. In this aspect the system has improved.
- There are weak incentives for taking care of the obligation of developing the network. Maintenance and repairs are acknowledged only on the cost side of the regulation system.

This may shift the focus from maintenance to investments. In practice e.g. underground cables may become more popular also in the less urban areas.

In Finland, public pressure related to electricity distribution and its regulation has been rather moderate. Tariff harmonization in mergers and acquisition has been discussed in the media, but this and most of the other issues have acquired mainly local interest. Also interruptions after certain major storms have been discussed in the public, but this has been limited compared to e.g. recent Swedish examples. These discussions have had no significant direct influence on the regulation, but probably customer pressure has influenced the introduction of the standard compensation schemes.

What comes to the role of different key institutions in developing the regulation system, it is clear that EMV has significant independence in the actual implementation of the regulation system. It seems that the ministry has no clear political agenda related to the regulation. It mainly responds to the drivers that come from external sources like political decision makers, EU, industry associations and EMV.

5. Country analysis Norway

5.1 Introduction

On June 29, 1990, the Norwegian Parliament (Stortinget) approved a new Energy Act, which would dramatically change the incentives and roles of the Norwegian energy companies. Competition was introduced as the main principle for allocation of production and consumption of electricity, whereas the transport of electricity was recognized as a natural monopoly. Privatization was, however, not introduced, as was the case in the English and Welsh role model.

Until the tariff structure for the transmission grid was modified as of May 1, 1992, nothing really happened in this 'new' market. But from this date, the transmission tariff was independent of 'contract route'; in each node there were charges for feeding into and taking out of the grid. The system was called 'postage stamp tariffs'.

A stepwise introduction of competition was not intended, but was nevertheless the consequence of absence of hourly meters and (no) initial rules regarding load profile billing and 'transaction costs' the local grid companies would charge consumers with new suppliers. The sector regulator, the Norwegian Water Resources and Energy Directorate (NVE), thus quickly introduced the load profile method and maximum charges to cover the network owners' costs when a consumer switch to a new supplier.

Norway has (still) a highly fragmented electricity sector. Municipal companies have played an important role in the 'electrification' of Norway, and have to a large extent maintained their involvement in the sector also after the deregulation. To the extent municipal owners have sold their assets, the state-owned Statkraft SF has been the main buyer. Some assets have also been picked up by foreign companies, in particular by Fortum of Finland and Energi E2 of Denmark. While Statkraft has increased substantially in size and scope, most distribution companies (sales and local network) remain small.

Statkraft was formed after a demerger of 'Statskraftverkene', which from January 1, 1992, was split into Statkraft and Statnett. The former took care of generation and sales of electricity, whereas the latter became responsible for transmission and system operation.

Transport of electricity in Norway is taken care of by Statnett and approximately 170 local and regional distribution networks. The largest distribution company is Hafslund, in which Fortum has a large stake together with the municipality of Oslo. Companies in which Statkraft is the major owner (Statkraftalliansen) represent the second largest group of local grid companies. Whereas the largest companies have some 525 000 customers, the smallest companies have less than 1 000 customers. The average number of customers for the grid companies at the lowest voltage levels is approximately 19 000. Regional grids are in some cases operated on a joint venture basis by the relevant local utilities, and not always by separate regional grid companies.

Table 5-1 Grid Companies in Norway

Level	Voltage level (kV)	Companies	Network length (km)
TSO: Statnett SF	132 – 420	17	10 000
Regional grid companies	66 – 132	60	18 000
Distribution companies	Up to 22	160	287 000

5.2 Legislative framework and key institutions

The purpose of the Energy Act[8] is to ensure efficient generation, transformation, transmission, trade, distribution, and consumption of energy. The two primary means are to ensure efficient competition in both the wholesale and retail market for electricity, and to regulate the activities of the network activities.

The Energy Act is supplemented by a number of Regulations. There is one central, general Regulation (Energilovforskriften)[9], which together with the Energy Act itself creates the legal background for the regulation of the energy sector. The Regulations provide more detailed rules and requirements that apply to the market participants. The Act itself specifies the non-discriminatory physical access to the grid for all consumers and producers, and obligations to comply with Regulations regarding i.e. metering and settlement, technical and safety issues, organisation of trade, etc.

A network operator for voltage levels up to 22 kV needs an 'area license' issued by NVE (områdekonsesjon), in addition to technical licenses. The network operator has an obligation to maintain and develop the power network, to connect all consumers and producers to his network (against fair compensation for connection costs). A distribution company has an exclusive right to construct distribution networks in his specified geographical area.

The central Regulation about regulation of networks[10] specifies both the principles for and elements of the grid regulation (regulatory model) and the other requirements applying to the grid companies. The Regulation recognises NVE as the 'regulator', with the Ministry for Oil and Energy (OED) as the appeal institute. It is OED that decides the Regulation. The actual parameters used in the regulation are set by NVE, including the requirements for improved efficiency.

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[7] Although Statnett is the only TSO in Norway, it is not the sole owner of transmission assets. Some 20 DSO holds transmission components, which are leased and operated by Statnett.

[8] Lov nr 50 av 29/6 1990 om produksjon, omforming, overføring, omsetning, fordeling og bruk av energi m.m.

[9] Forskrift nr 959 av 7/12 1990 om produksjon, omforming, overføring, omsetning, fordeling og bruk av energi m.m.

[10] Forskrift nr 302 av 11/3 1999 om økonomisk og teknisk rapportering, inntektsramme for nettvirksomheten og tariffer.

The legislative process in Norway is rather open and transparent. New legislation is normally initiated by the Government or the Parliament, but could also be the result of initiatives from interest groups. The regulator has its powers from the Ministry. The process of e.g. changing the regulation of grid companies is an iterative process between the regulator, the Ministry, the electricity sector, and other stakeholders.

5.3 Regulation system[11]

The Norwegian revenue cap regime was introduced in 1997. Previously, a rate of return regulation was used. The total accepted tariff revenues equalled annual network costs including a return on the network assets. The return rate was set as the return rate on government bonds plus a risk premium of 1 percentage point (later increased to 1.5 percentage points from 1997 and 2 percentage points from 2002). The return rate was the same for each company regardless of financial structure (shares of debt and equity). Both before and after 1997, the founding principle of the regulation is that the network companies should be able to earn a fair return on network assets provided they operate in an efficient manner. Prior to 1997, though, NVE did not possess the necessary tools for measuring efficiency.

The first regulatory period lasted until 2001. The revenue cap system underwent a substantial revision in 2002. Further revision is planned for the next regulatory period starting in 2007. Currently, the system has the following components:

Revenue caps

Revenue caps are set for a period of minimum 5 years (in practice, 5 years has been used so far). The general principle is that when the revenue caps are set, it is up to the regulated companies to set the tariffs and carry through the required improvements of efficiency.

Initial revenue caps are based on average historical costs with regard to operations and maintenance (including network losses) and capital costs two years prior to the regulatory period.

The regulator collects information about 1) output (delivered energy (MWh), number of connections), 2) input (net assets (NOK, see also below), technical network losses (MWh), staff hours, quality costs (KILE, see below) and other costs (NOK)) and 3) environmental parameters (network length HC and LC, cables and overhead, and expected quality costs (KILE)).

Capital costs consist of depreciations and a nominal before-tax return on the assets base. The return rate (the so-called NVE rate) is adjusted annually, and equals the rolling three-year average return on three-year government bonds plus a risk premium of 2 percentage points.

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[11] This section is based on ECON (2005), which in turn is based on i.a. Agrell and Bogetoft (2003).

The asset base is defined according to the general rules for accounting in Norway. This implies that the book value equals actual historic cost minus depreciation. Depreciation is linear over 30-35 years for literally all grid assets.

Efficiency

The revenue cap is adjusted annually for inflation and efficiency requirements. The efficiency requirement is made up from a general and an individual component. The general requirement, which applies to all companies, is currently 1.5 per cent, while individual requirements may vary between 0 and 5.2 per cent, which lead to a maximum total of 6.7 per cent. Note that this is included multiplicatively in the regulatory model: The percentage cut is based on the previous year's revenue cap and not the initial cap. Finally, the return rate is adjusted annually to account for changes in the risk-free interest rate.

The annual efficiency requirements originate from the efficiency analysis made by NVE. NVE has so far applied a DEA model with VRS. Inputs are man-years, goods and services, network losses, value of network assets and KILE costs (see below). Output depends on the grid level in question. For distribution, the outputs are delivered energy, length of LV and HV network, number of customers, and expected KILE costs. The Norwegian model is run twice for each company, once using the book value of network assets, once using an estimated replacement value. The higher of the two results is chosen as the individual company's efficiency score.

The Norwegian DEA model is used prior to each regulatory period to measure cost efficiency, using average values and values at a particular point in time as inputs (depending on the variable). The time periods for the DEA input correspond to the input data for calculation of the revenue caps. The DEA results are used directly in the calculation of efficiency requirements, which are set so that companies are assumed to catch up with half of the measured inefficiency. In 2002-2006 the maximum individual requirement is 5.2 per cent. In the first regulatory period, the interval was 0-3 per cent. The weighted average individual efficiency requirement is 0.62 per cent in 2002-2006 (the distribution and regional grids seen together, with revenue caps as weights).

Note that the individual requirements were not in force until 1998; one year after the revenue cap regime was introduced. The difference in maximum requirements does not reflect an increase in measured inefficiency, but rather an administratively set limit for the efficiency requirements in 1998-2001 (the average individual requirement has actually been reduced).

New investments

In order to compensate distribution networks for the costs of new investments, an adjustment mechanism has been introduced. The adjustment is based on a growth factor reflecting i) the number of new buildings in each concession area and ii) the electrical energy delivered nationwide, which is multiplied by an estimated replacement value of the network. At the regional and transmission level, companies may apply for individual revenue cap increases when applying for licences for new investments. In 1997-2001, an adjustment mechanism based on energy delivered was used. The revenue cap was increased by half a per cent for each per cent increase in energy delivered (reductions did not lead to a lower revenue cap). This applied to all grid levels.

Quality

In order to give network companies incentives to maintain a high level of quality of supply, the KILE scheme has been introduced (KILE is the Norwegian abbreviation for 'quality-adjustment of revenue caps to account for non-delivered energy', and covers all grid levels). The KILE scheme gives network companies a financial penalty equal to the number of non-delivered kWhs multiplied by the appropriate KILE rate for the relevant customer group (currently there are six different groups). Only interruptions that last more than 3 minutes are included. The KILE rates differ between notified and non-notified interruptions in supply. Note that KILE does not give the customers direct compensation; rather it works through a general reduction of the revenue cap. For certain customers it is possible for the network companies to enter into individual KILE agreements. The affected customers are then compensated directly.

Surplus revenues must be paid back through lower tariffs, with an interest compensation equal to the NVE rate. Deficit revenues may be recouped (with or without interest).

As yet, the details of the regulation from 2007 are unknown. The main principles are, however, already presented. The revenue cap system with 5-year regulatory periods will still be used, but the frequency for updating the efficiency scores is not yet decided. The quality incentives will be strengthened through an expansion of the KILE scheme. Also, the possibility of using efficiency studies and norm models to a greater degree will be considered.[12]

5.4 Discussion

The goal of economic regulations in Norway is generally quite simple: Efficient allocation of resources - from a socioeconomic perspective. Since the recovery after World War 2, socioeconomics has had a strong influence over policymaking in Norway, and this is the primary goal for energy market and energy regulation policies. But in addition to efficiency, there is also recognition that the distribution companies represent important employers and buyers of various services in the regions of Norway with weak employment. Thus there is no political pressure to incentivise mergers among the smallest companies: Most politicians and policymakers respect the owners' decisions to continue operations with rather small companies.

The experiences with the Norwegian regulation model are mixed. The model rewards companies whose current operations are run efficiently and not for operating in the most efficient way. There is therefore no clear relation between the rate of return and efficiency. In addition, some companies lost the profits they made through efficient operations in the first model update in 2002. The model gives weak incentives to reinvest and there is a growing

[12] Prinsipper for regulering av nettvirksomhetens inntekter (Principles for regulation of income for network operations), NVE Report no. 4, 2004.

concern in the industry that the reinvestment level has become to low. The model is also considered to be very complex with complex updating rules both within and between regulation periods. NVE has received several complaints regarding the results from the Data Envelopment Analysis (DEA), but this has not led to any changes. On the other hand, NVE has used the data carefully and decided that only 50% of the measured inefficiency should be regained within the current regulation period. The transition from the 1st to the 2nd regulation period gave most companies an increase in permitted income, which might explain the stagnation with regards to further restructuring.

Electricity consumers are fairly well organised in Norway, and have several active voices in the policy making process. The power intensive industry is organised in PIL (Prosessindustriens Landsforening). NHO (Næringslivets Hovedorganisasjon) represents a significant part of other commercial use of electricity. KS (Kommunenes Sentralforbund) is working in the interest of the Norwegian municipalities, which are both owners of local utilities and responsible for a significant electricity consumption (schools, health care, local public services). The (general) ombudsman for consumers is also quite updated and active on energy policy issues, including grid regulation. Statnett has institutionalised the customer focus with a separate body; the Council of Users, in which both generators, local grid companies, small and large end users are represented. Most of the energy companies are member of EBL (Energibedriftenes Landsforening). Some of the smaller companies are member of FSN (Forum for Strategisk Nettutvikling).

The industry is looking forward to improved rate of return in the 3rd regulation period. They think it is necessary to let companies keep the effects of improved efficiency beyond the current regulation period. Also, the companies hope for somewhat simpler rules to update the revenue cap. Especially the arrangements for taking new investments during the regulation period into account are quite complex according to the companies.

6. Country analysis Sweden

6.1 Introduction

Historical perspective

The deregulation was initiated when the Electricity Act (1902) was replaced 1994 by the Electricity market law (1994:618), primarily to introduce competition in the generation level. The incumbent Tariff Review Board, operating an ex post review of electricity prices since 1939 was replaced with a regulator placed at the Swedish Business Development Agency (NUTEK) under the supervision of Ministry of Industry, Employment and Communication in 01.07.1994. The regulatory authority was transferred to an independent agency, the Swedish Energy Agency (STEM) in 1998 as a direct consequence of the new Electricity Act. After some critique against the effectiveness of the regulation (Statskontoret, 2003), the autonomy of the regulator within the Swedish Energy Agency was further promoted with the creation of the Energy Market Inspection (*Energimarknads-inspektionen*) (SFS 2004:1200) from January 1, 2005.

The institutional design in Sweden after the deregulation 1996 is inspired by a light-handed ex post regulation-by-rights philosophy that also governs other sectors, such as consumer and environmental protection in Sweden (Edin and Svahn, 1998). The regulator enjoyed immediately an independent status, enforcement powers and an ambitious information dissemination program was launched. However, the vagueness of the Electricity Act (1997) did not provide sufficient guidance for the market monitoring and opposition encountered during the first attempts to establish a regulatory discretionary practice using total factor productivity measures in 1996/97 called for a new approach.

Industry structure

Following vertical separation, the structure is illustrated in Table 6-1 below. Currently the Electricity Act implements judicial separation, i.e. distribution and/or transmission cannot be performed by a judicial entity producing or selling electricity[13]. Distribution is defined as area concessions and one distributor can operate multiple concession areas. The 265 concession areas (2003) correspond to around 210 firms (50% private, 40% municipal, 10% cooperative). However, the three largest operators have multiple concessions, leading to

[13] Management separation was proposed by the government in 2001 (Prop, 2001/02:56), according to which the board of a DSO must not have a majority simultaneously serving on the board of an entity producing and/or selling electricity and the CEO of a DSO cannot simultaneously serve as CEO for an entity producing and/or selling electricity. The Parliament rejected the particular provision in the amendment SFS (2002:121) of the Electricity Act, July 1, 2002, but a similar proposal is forwarded in the final report by the Energy and Gas market commission (SOU 2004:129), January 11, 2005.

higher shares of the market (Fortum 15 areas, 17% of total customers, Sydkraft 18 areas, 15% of total customers, Vattenfall 28 areas, 15% of total customers). Thus, while these three companies serve 47 % of the market (total customers), the dispersion is large between the smallest and the larger DSOs (STEM, 2004a).

Table 6-1. Industry structure (STEM, 2003)

Level	Voltage [kV[	# Concessions	Network length [km][14]
Transmission	400 - 220	1[15]	15 665
Regional transmission	150/70 - 20	15	37 989
Distribution	20 - 0.4	263	569 652

The operating conditions are fairly mixed for the DSOs in Sweden, Figure 6-1 below shows a classification in STEM (2004a) based on total line length per customer and installed capacity per distribution transformer. A classification based on the upper and lower quartiles of the ratio yielded 58 areas as urban, 56 rural and 113 mixed.

6.2 Legislative framework and key institutions

The Electricity Act (1997:857) came into force 1. January 1998. The amendment SOU (1999:770) in effect November 1, 1999 introduced consumer load curves instead of hourly metering for clients[16] changing electricity provider. Customers demanding hourly metering may be debited for their metering costs. Another major revision occurred in 2001, when the definition of tariff regulation was changed.

The Act outlines a system based on line concessions (regional transmission networks) and area concessions (distribution). Nontransferable and exclusive concessions are granted for up to 25 years, extendable for eligible candidates. Eligibility is defined from "*a general point of view*" and for the actual concession. Concessionaires are to maintain and submit audited accounts for each concession. The distribution concessionaire enjoys exclusive delivery rights and a universal service obligation. Tariffs for distribution are geographically non-discriminatory.

"Concessionaire shall distribute electricity on behalf of other parties on reasonable conditions. The distribution of electricity shall be of satisfactory quality. A concessionaire is obliged to address deficiencies in the distribution to the extent that the cost to address the deficiencies are reasonable in relation to the damage suffered by the users of network caused by the deficiencies. The Government, or on delegation by the Government, the Regulator may define specific regulations on good quality in electricity distribution."
(Electricity Act 3 § 9, including changes in SOU 2002:121, *author's translation*)

[14] Total network length (lines and cables, all voltage levels)

[15] For historical and technical reasons, one DSO has authorization to operate some 220kV installations.

[16] Maximum power below 135 kW at low voltage, fuse not exceeding 200 A.

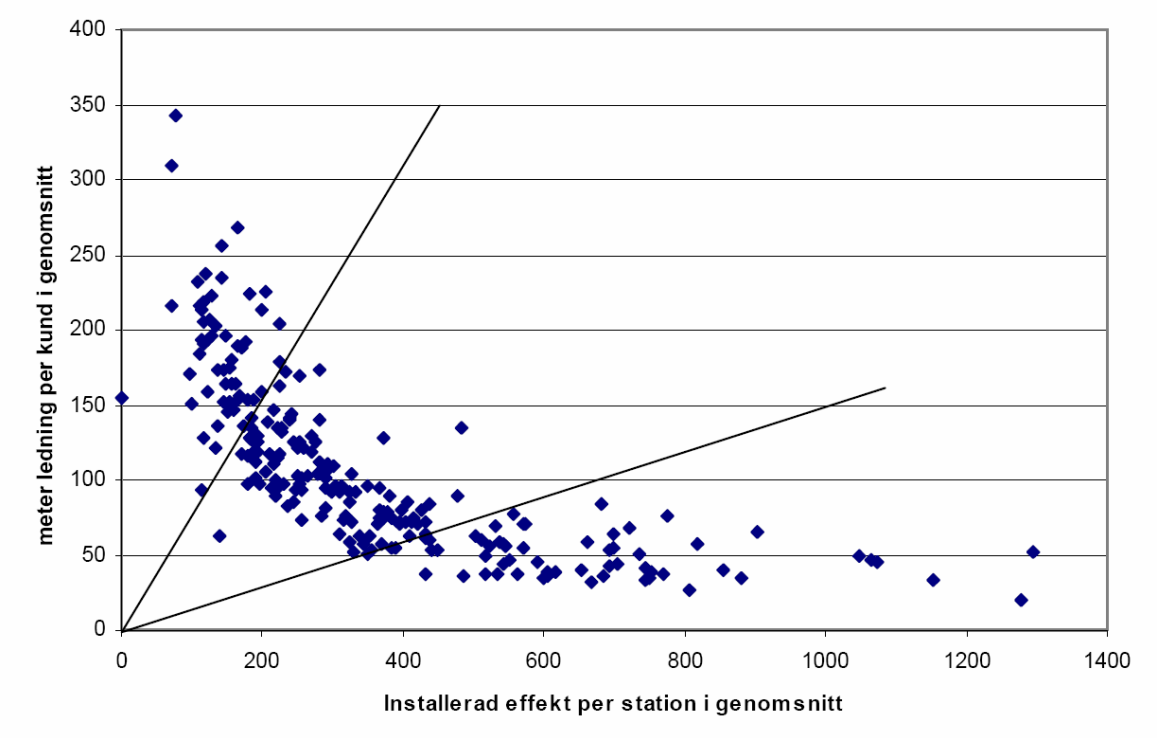


Figure 6-1 Classification of Swedish DSO in urban, mixed and rural conditions STEM(2004a).

The operational definition of "satisfactory quality" is left to the regulator's discretion. The "reasonable conditions" are defined in the preambles to be evaluated by taking into consideration price, payment terms, energy and power delivered.

"The network tariffs shall be such that the total revenues of the concessionaire from the network operations are reasonable in relation to both the objective prerequisites to operate the concession, and to the concessionaire's operation of the network. Network tariffs shall be based on factual grounds."

(Electricity Act 4 § 1, including changes in SOU 2002:121, *author's translation)*

The "objective prerequisites" are exemplified in the preambles as exogenous factors related to the client segmentation, geographic location of clients, load profile, climate and location of higher grid feed-in points. The "factual grounds" for the network tariffs are defined as objectivity, cost-correctness (within category) and non-discrimination (within category). Each concession is entitled to an individual evaluation of reasonability according to the Act. The most recent revision of the Act (2004:875) specifies the procedures for suspension of concession operations, ranging from fiduciary management to expropriation.

Reponding to a ministerial assignment (Feb 3, 2005) on quality provision and regulation, the regulator (STEM, 2005) proposes changes in the Electricity Act to oblige DSOs to resume service after interruptions in at most 24 hours. The changes are proposed to be effective from January 1, 2006.

Institutions

The implementation of the Electricity Act is awarded to the Energy Market Inspection (the Regulator) at the Swedish Energy Agency. The actual implementation of the monitoring of the concession holders is defined by a ministerial decree (NUTFS 1998:1). The regulator has statutory rights to award, renew and repel concessions, to ex ante collect and publish tariffs and contractual conditions, to ex post evaluate individual rates and revenues, and to order windfall profits to be reflected in future rate decreases. The regulator is vested with authority to administer sanctions as fines, revoked or shortened concession contracts and immediate termination, for firms that act against its rulings. At the outset, the Regulator's agenda was filled with numerous consumer complaints to be investigated individually and dispute settlement remains an important task. The staff and competence profile of the regulator were somewhat limited at the outset. However, the human resources of the regulator's office count almost 60 f.t.e., for the regulation of gas, electricity transmission and distribution and national pipeline systems, whereof about half are assigned to the electricity sector. In addition to the network regulation, the Swedish Energy Agency (STEM) also administers the energy policy at large, allocating research financing, technical and economic work on environmental and energy efficiency, green certificates, promoting decentralized energy resources and system analyses. An exception in the 2005 budget, STEM was awarded a 25% budget increase in administration, from 16 M€ in 2004 to almost 21 M€ in 2005, due to enlarged responsibilities in the energy policy area.

From 2005, the energy policy is chaperoned by the new Ministry of Sustainable Development (previously the Ministry of Industry and Commerce), principally devoting its interests to energy generation policy (in particular policy with regard to nuclear power generation and renewable energy sources) and new market issues (green certificates etc). The staff previously assigned to energy have been moved to the new ministry. As the Swedish Energy Agency is vested with the regulatory office (also somewhat reorganized from 2005), the direct involvement by the ministry is very limited. The Ministry has administered inquiries by the regulator into defining electricity service quality and also changes into the concession granting rules. However, personal involvement by several ministers in the aftermath of the January 2005 blackouts did signal some political support for both a more strict concession review procedure (sticks) and improved quality incentives (carrots), see 0.

Appeal procedure

The rulings made by the regulator may be appealed in administrative courts (*County Administrative Courts, Appelate Administrative Courts, Supreme Administrative Court*) and the precedent set by the higher court of appeal is de facto binding for the regulator. The right to appeal is frequently exercised by the regulated firms, leading to long processing times and regulatory uncertainty. However, appeals beyond the first level require a leave of appeal based on substantive reasons. The Supreme Administrative Court, which only grants leave of appeal to a few number of cases (3% of filed requests in 2003), has never tried the Electricity Act.

Changes in Legislation

A government appointed commission SOU (2000:90) advocated moderate changes to operationalize the regulation regime, still under an ex post framework. To expedite the

judicial process of the regulator, the commission suggested changes in the composition of the administrative courts when ruling under the Electricity Act. The definition of "reasonable tariffs" changed to be performance (output) based and previous reference of priority to the consumer interest was removed, suggesting that the regulation takes a more neutral stand with respect to the clients and industry.

6.3 Regulatory system

Regulatory approach

After an intensive period of research and development 1998-2004, the regulator has installed two model-based tools to support the regulation. The actual policy can be deduced from the regulator's vision statement, expressing three main tasks: *concession granting, information dissemination* and *market monitoring* (Figure 6-2).

The *concession granting* is actually an ex ante commitment element to protect the specific assets of the concessionaire in return for the universal service obligation at satisfactory quality and some limits in the intra-concession price discrimination.

The *information dissemination* role is consistent with the light-handed approach as it delegates a maximum of decisions to the industry, including their own restructuring, motivation and learning. This role is supported by the Data Envelopment Analysis (DEA) models (Charnes et al., 1994) below to enable the DSO to identify short- and long-term efficiency potentials. Through public action, it is also intended to apply efficiency increasing pressure towards publicly owned firms that are less sensitive to economic incentives.

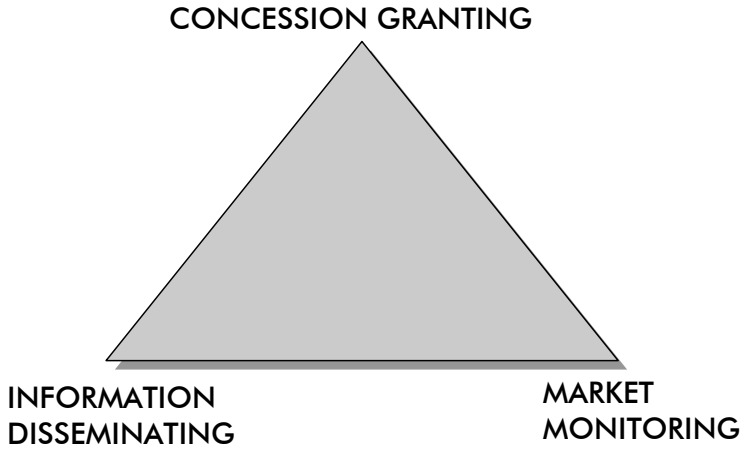


Figure 6-2 Tasks of the Swedish Energy Agency.

DEA Model

The latest annual runs of the DEA models (Agrell and Bogetoft, 2000, 2002) show short term cost efficiency potentials in the order of 21% of the total operating cost and 14% of the total cost base in the long-term perspective (STEM, 2004a). The efficiency targets obtained by the frontier analysis models are published, enhanced with a three-color (green, yellow, red) indication system based on the number of efficient layers ("peels") dominating each firm.

The regulator has acquired skills in the execution and analysis of the efficiency model, although its role in the regulation is primarily supporting self-improvement through relative observations.

Network Performance Assessment Model

The *market monitoring* role is primarily handled using the Network Performance Assessment Model. This complex model is described in Larsson (1998, 2003, 2004) and analyzed more in detail in Agrell and Bogetoft (2003d). In brief, the model produces an annual revenue yardstick by using an exogenous cost function that is based on the greenfield construction of a radial cable grid to all GIS-measured connection points per concession area. Assets included in the artificial network are valued according to replacement value using the EBR catalogue. Acceptable rate of return on the model-based asset base is set to 4.8% (real, annual revision). The annual inflation adjustment is constructed specifically to reflect the cost development of the distributors (STEM, 2004c). No topology is considered and quality is catered for as extra asset investments to prevent shortages less actual interruption costs. The model has been severely criticized by industry for its lack of quality incentives, sensitivity to changes and greenfield logic. Lantz (2003) argues that the model mixes the time horizons of the inefficiency and proposes an alternative decomposition based on fixed and variable costs.

The first run on 2003 tariffs was presented in December 2004. The average tariff-level was calculated to 112% of the norm with a spread between 62% and 177%. 40[17] DSO were selected for ex post tariff-review, all others were approved. Selection criteria were (i) tariffs levels 130% or more, (ii) tariff levels 120% or more and reported interruption costs > 19*expected interruption costs, (iii) administrative reasons (incomplete reports etc).

Quality

A good-will compensation for service interruptions beyond 24 hours was unilaterally launched by the industry association (Svensk Energi, 2002) and did not explicitly enter into the regulation. The latest version of the Network Performance Assessment Model (Larsson, 2004) solves a stochastic network dimensioning problem to determine a standardized quality provision and the new parameters are suggested in STEM (2005). In addition, quality is intended to be explicitly addressed at the concession renewal reviews, but the policy in this respect is not clear. A new law on electrical distribution quality was already proposed in STEM (2003b) to support the discretionary definition in the Act 3 § 9 and iterated in the report to the government following the 2005 storms STEM (2005). In addition, the regulator proposes increased and mandatory compensations for non-delivered energy from 12 hours, mandatory public contingency plans for DSOs and extended interruption reporting (more than three minutes at final connection from 2010).

[17] One small DSO (142% debit level) was exempt due to specific circumstances.

Information

The information necessary for the operation of two regulatory models is extensive and requires a separate electronic interface and detailed instructions (STEM, 2003). The initial cost to code the GIS-locations of the clients may be hefty to smaller DSOs, although larger DSOs already operate similar systems. The regulator screens and publishes the information to stakeholders on paper and on their website, where also the main data files for both models are available. In addition, the Network Performance Assessment Model software is made available to the DSO through the reporting software. The DEA model can be operated using public domain software.

Regulatory lag (ex ante/ex post)

The Electricity Act does not explicitly address the regulatory lag. IEM (2003/54) article 23 states that network tariffs should be approved by competent authority prior to their application. However, the article also opens the possibility to commit to the *methods and calculations* used to approve the conditions for network access and usage. Thus, the application of art. 23 in Swedish regulation has been to specify a non-exhaustive list of objective criteria that currently are used in the Network Performance Assessment Model, i.e. the number of connection points, the geographical location of the connections, total delivered energy, subscribed power, the cost for higher grid connections and the service quality of the distribution. In practice, the regulator (STEM, 2004b) has continued the practice of annual ex post reviews of past year's tariffs.

Role of discretion

The individuality condition, the ex post principle and the information disclosure practice are still respected in the revised Electricity Act. Rulings by appeal courts on the decisions in 1999 (Appellate Administrative Court, 2000) retained as regulatory strategy guidance. STEM (2004b) indicate that a certain level of discretion in the regulation will be necessary to uphold the individuality condition. However, without specifying method or model for the performance assessment, the Network Performance Assessment Model is explicitly mentioned in the preambles. Hence, the main point of the introduction of model-based regulatory instruments is to reverse the burden of proof with respect to efficient costs. Rather than having to pinpoint observed instances of non-admissible costs, which requires an excessive effort on behalf of the regulator, the discretion of the regulator exercised in the application or not of results from an accepted instrument. It is likely that the regulator will continue to exercise high discretion to well utilize available resources and to avoid some judicial friction.

Decision rights

The ex post framework gives consequences with respect to the level of delegation to the regulated firms. No ex ante reviews of investments, operating conditions and offered service levels are prescribed. Further, tariff setting of individual prices and tariff mechanism design (fixed/variable, two-part, etc) are delegated to the firm. Naturally, some rules apply to the non-discriminatory pricing within an area, but each concession area is free to set tariffs for

each homogenous customer segment independently. Tariff adjustments following regulatory rulings (ex post repayment of revenue) may also be administered by the regulated firms.

6.4 Discussion

The network regulation in Sweden became relatively public in 1999 with increased consumer pressure against the unchanged network connection tariffs. A fairly heated debate made its way into the Parliament several times, leading to three governmental commissions investigating the Electricity Market, the Network Regulation and recently the Network Quality Regulation. The commissions result normally in suggested changes to the legal framework, subsequently prompting for changes in the regulation. Involvement by consumer organizations in public hearings has been high in some periods, like 2000-2001 and following the black-outs in 2005, but the complexity of the debate dampens the desire to engage in public discussions. However, the political influence on the regulatory policy remains relatively strong in Sweden, where governmental controls and signals to try rock the regulatory boat between various demands, usually triggered by consumer complaints.

Incentive effects

Considering the slow structural development and the actual tariff increases under the previous regime, the failure of the light-handed approach to provide efficiency incentives is beyond discussion. The actual incentive effects of the current Swedish regulation are somewhat unclear. Although the technical norm model theoretically should provide strong incentives for cost reduction, uncertainty related to e.g. quality costs or allowed rate of return pose some medium-term risks. Public debate following the 2005 black-outs has questioned the appropriateness and effectiveness of the current regulation to provide quality incentives. Additional uncertainty stems from the paradigm shift itself in the regulation, the extent of which is still to be seen.

Summary

The regulatory policy in Sweden is *de facto* confrontational with on the one side the firms, strategically gathering information to anticipate and potentially neutralize the regulation, on the other the regulator, independently pushing a unique solution to its full implementation, drawing on public dismay, but backing it up with political support. The delayed development of the model was considered with some disbelief by the DSO during the pilot phase, only to be turned publicly hostile to its implementation. The critique by the DSO has mainly focused at the weak quality provision incentives and the high administrative costs for small operators. The judicial endorsement of the Network Performance Assessment Model is here a focal point. Any ambiguity in the rulings by appellate administrative courts would seriously damage the regulatory policy.

7. EU analysis

Introduction

Below, we offer a limited overview and analysis of the decision making, position and competence of the European Commission (EC) and its associated organs with respect to DSO regulation. The analysis differs from the stakeholder analysis to the respect that the EC is

Historical perspective

The liberalization of the energy markets (electricity first by the Directive 96/92/EC, gas in 1998) was made through fixing minimal levels of market opening, third-party access (TPA) and unbundling, but leaving all but the main objectives to the member states' discretion. Energy regulation, besides some particular cases related to competition law in the generation market, was seen as a national responsibility. However, despite some encouraging results in Scandinavia and the UK, the actual implementation of the directive 96/92/EC turned out to be slow, incomplete and partially counterproductive, mainly because the directive failed to identify the cornerstones of a successful contestable market. To address the situation, a new legislation was passed 2003 on electricity, gas and cross-border trading (CBT) mechanisms.

7.1 Key legislation

Revamped directive (2003/54/EC) entered into force 1. January 2004 in most countries, with a final deadline 1. July 2007 for countries that have not yet unbundled retail and distribution (read: France and Germany).

The Role of the DSO

Chapter V of the Directive is devoted to DSOs. It specifies that tariffs should be non-discriminatory and cost-reflective and should take into account the marginal avoided network cost from distributed generation and demand-side management. A regulator may choose not to impose unbundling on DSO with less than 100,000 customers. The more detailed interpretations are provided in the EC (2004b), which is primarily devoted to the residual retail tasks of the DSO (information, supplier switching, metering, and supplier of last resort). The universal service obligation is emphasized. The EC notes the necessity to impose quality regulation through incentives and penalties for DSOs. However, the specific regulations pertaining to DSO all concern the non-discrimination of customers through tariff structure, information disclosure, meter changes, fees or delays, service conditions and payment terms.

The Role of the National Regulator

Concerning the national regulator, the Directive requires its existence and some minimum competence, including ex ante tariff approval, conflict resolution and monitoring or contractual terms for TPA. Preambles (EC, 2004a) to the directive outline the tasks and

competences of the regulator. Regulators do not need to be unique within or for a given country, i.e., member states may delegate regulation to inter-regional regulators. An effective national regulation should be enforced with clear sanctions for lack of compliance, e.g. in unbundling and transparency. The EC notes that suspension of concession or license to operate is conceivable in extreme cases, but warns for the unnecessary regulatory risk that might result from unconstrained discretion.

The crucial passage on regulation system design merely states a limit for the discretion, based on ex ante decision that may be appealed.

"The regulatory authorities shall be responsible for fixing or approving, prior to their entry into force, at least the methodologies used to calculate or establish the terms and conditions for: (a) connection and access to national networks, including transmission and distribution tariffs. These tariffs, or methodologies, shall allow the necessary investments in the networks to be carried out in a manner allowing these investments to ensure the viability of the networks..." (Directive 2003/54/EC, 23 § 2a)

EC (2004a) defines the ex ante provision to extend to (i) the regulatory asset base (RAB) and any investments during the period, (ii) the allowable rate of return on the RAB, (iii) allowable depreciation rates on RAB, and (iv) operating costs (sic!). The methodology for the ex ante evaluation should be based on a "*comprehensive understanding of the cost drivers of the regulated businesses*".

Three methodologies are mentioned in EC (2004a), without any claim for exhaustiveness:

- Ideal network models
- National yardstick regimes
- International benchmarking (yardstick) regimes

The role for *ex post* regulation is delimited to dispute settlement, monitoring of actual revenues and technical regulation of network access and installations.

7.2 Institutions

DG TREN

The Directorate General for Energy and Transport (DG TREN) was created in 2000 by merging the directorates for energy and transport. Headed by a Director General, it reports in energy issues to the Commissioner for Energy within the Commission. DG TREN is responsible for developing and implementing European policies in the energy and transport field. Its mission is to ensure that energy and transport policies are designed for the benefit of all sectors of the society, businesses, cities, rural areas and above all of citizens. DG TREN operates mainly through monitoring, preparation legislative proposals and program management, including the financing of projects (e.g. TEN-E infrastructure projects).

EGREG

The European Energy Regulators Group for Electricity and Gas (EGREG) is an official advisory group instituted by the European Commission (2003/796/EC). Its members are all

regulators from the EU including observers from new Members States and EEA. EGREG will help ensure a consistent application in all Member States of the recently adopted new electricity and gas directives as well as the new Regulation on cross-border exchanges of electricity. The group will provide a transparent platform for co-operation between national regulatory authorities and between these authorities and the Commission. All market participants, consumers and end users will be able to provide input to its activities

CEER

The Council of European Energy Regulators (CEER) consists of the energy regulators from all EU member states and EEA. CEER resulted from the informal cooperation among regulators in the Florence forum, initiated by the European Commission 1998. Gradually becoming more instrumental in the coordination of the IEM implementation, CEER operates DSO benchmarking (cf. Jamasb and Pollitt, 2001), quality benchmarking (CEER, 2001) and interacts closely with ETSO and DG TREN in the design of CBT mechanisms. Internally, CEER is organized in six working groups, whereof the Electricity WG and Information, Training and Benchmarking WG touch on DSO. The South-East European WG coincides largely with the Athens forum, initiated by DG TREN. The work in the working groups is organized in task forces (TF). Since the conception of EGREG, CEER has taken on a more informal role, collaborating with US regulators.

Interactions within the Commission

Besides DG TREN, the Directorate General for Competition (DG COMP) and the Directorate General for Research (DG RES) have interaction with the member states and regulators. DG COMP is primarily addressing issues related to market power in the generation market, but their rulings are increasingly dependent on effective regulation of TSOs. Successful creation of contestable markets at the generation and retail level depends heavily of the regulation of e.g. tariff principles at the TSO lever and rules at the DSO level regarding metering and procedures for switching supplier.

DG RES finances several important research programmes (SESSA, SUSTELNET, EU-DEEP, RELIANCE) related to the electricity sector and its regulation. However, the internal communication has been poor and haphazard, leading to substantial double work and incomplete conclusions. Not only is the information distributed, the competences and interests of the agencies are unclear in relation to e.g. regulation of distributed energy resources and renewables.

7.3 EU and national regulation

To correctly understand the potentials and limitations of future European initiatives in the area of electricity distribution regulation, we briefly introduce two governance principles with bearing on the discussion, the subsidiarity principle and the Meroni doctrine.

Subsidiarity principle

Art 5 in the EC Treaty[18] states that EU should only take action if and only if a common objective cannot be achieved by the member states themselves. The corollary proportionality principle says that EU should apply the instrument that has the least centralizing effect.

Meroni doctrine

The Meroni doctrine (European Court of Justice, 1958) prohibits the delegation of executive powers to independent agencies. This means that agencies attached to the Commission may not exercise discretion, initiate or implement regulation or rules under a European legislation. De facto exceptions are found in specific areas (EEA, EMEA), but the statues of these agencies still reflect their limited power and their influence can partly be explained by mutual consent among the member states (Majone, 1997).

Comitology

An important part of the Commission's work on preparing regulation and future legislation is made in ad hoc committees composed by EC officials and representatives from member states, comitology. The procedure guarantees some continuous influence on and insight into the Commission's work, but the outcome is to some extent dependent on the personal interests and knowledge of the representatives.

Interaction Regulators-DG TREN

DG TREN has previously had surprisingly sporadic contacts with the national regulators, in particular in issues related to regulatory practice. However, with a gradual increased understanding of the crucial role of the national regulators for the implementation of the IEM and the effectiveness of European programmes such as TEN-E, the contacts have been intensified and structured. The mini-fora in December 2004-February 2005 on the IEM and the formalization of the EGREG role are signs of this tendency.

7.4 Discussion

The IEM Agenda

The overshadowing objective of the EU is to implement the market opening of the Directive as a logical consequence of the free mobility principle. The national resistance to its implementation and the lack of good will among the participants in some countries to adhere to its principles came as a surprise to the Commission. Given its important socio-economic

[18] The subsidiarity principle, matters should be handled by the lowest competent authority, was actually developed by Pope Leo XIII in 1891 and is a key principle in the Catholic social thought.

impact, the question surfaced to highest political priority after the California blackouts. EC realized that a failure to coordinate and incentivize the integrated electricity market could potentially lead to market collapse and ensuing market closure. At worst, this could have repercussions on other infrastructure markets as well, such as road and rail transport. As concluded in the DG TREN successive "benchmarks" (2001, 2002, 2004c), the two key players on the market are the regulators and the TSO, hence a particular interest for them and their interactions.

Future options

Egenhofer and Gialoglou (2004) launch three policy options for the future energy regulation: (i) an independent regulator ("Eurenergy") organized as an EU-agency directly under the Parliament, (ii) a division of the Commission ("European Commission Directorate General for Network Industry Regulation – DG NETREG") or (iii) a gradual integration of national regulators into EU policy making (EGREG). As discussed above, the first alternative is unlikely as it contradicts the Meroni doctrine and the necessary consensus to change the Treaty would be hard to mobilize on the delicate energy issue. The second alternative might be imaginable or even a likely threat should the regulatory divergence continue. The 2003/54/EC directive with its preambles is sufficiently detailed to permit a more in-depth monitoring by EC, in particular related to key policy issues of transmission system operations, TPA and CBT. However, the current signals between EC and EGREG suggest that the third alternative is the preferred, as it is compatible with subsidiarity principle.

Interdependencies in the decision making

The issue of European interference in regulation is a hot issue that is even more complex when considering the interdependencies of the systems in Figure 7-1 below. Even within the framework of a directive, the EC interacts with member states, not directly with national regulators. The national governments may have more or less independent regulators, but they are all interfacing, regulating and serving exclusively their national industries and clients. The interface between EC and the regulators is in form of EGREG, but its importance as official reference should be put into perspective with the presence of other powerful organizations such as Eurelectric and ETSO around DG TREN. Finally, the comitology within the EC closes the loop as the member states then interact directly in the operations of the Commission.

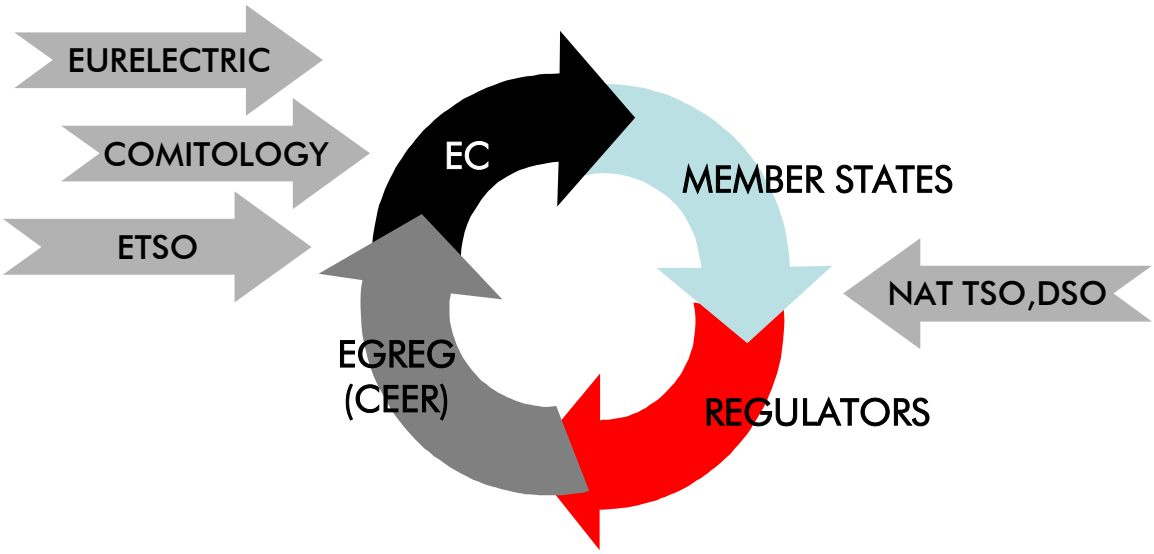


Figure 7-1. The European regulatory game (simplified version)

Analysis

Clearly, harmonization of regulation, standards, operating conditions and business practices is not only in line with the EC policy, but actively promoted. Although DSO regulation as such may be a fairly uncontroversial national competence, the pressure is clearly mounting against the regulators to demonstrate their effectiveness. The new provisions in the directive already push in the direction of harmonization by resolving some methodological issues (ex ante/ex post) and by opening for the recognition of regional regulators. As the Nordic countries already stand out among the landmarks in deregulation, a closer collaboration between e.g. the Nordic Council, Forum of Nordic Energy Regulators (FNER) and Nordenergi on the promotion of a common regulatory model would surely be more than welcome in Brussels. Strategically, this might also be a wise preemptive move in case EC later would be forced to establish some more detailed directives on regulation along the lines outlines above.

8. Summary of country and EU analysis

Comparison of the regulation systems

The country and EU analysis section reveal that the role and tasks of the regulators vary. EU presents base level requirements for regulators and puts emphasis e.g. on the role of settling the disputes between the customers and the DSOs. The Nordic legislation and regulators a clear emphasis on guaranteeing efficient markets etc. Furthermore, the Danish and Swedish regulators see also information dissemination as one of the cornerstones of their activities. Their policy is demonstrated by the fact that while the current price regulation in both countries is independent of the benchmarking model, the regulators keep on reporting, updating and publishing the results.

When the regulation systems are analyzed on the regulatory mechanism level, we can easily see that the current systems are based on many different approaches. The regulation systems in each country can be summarized as follows:

- Denmark has abandoned the somewhat complicated revenue cap and rate of return regime, and moved to a temporary price fixation scheme that is complemented with rate-of-return regulation. A new price cap system is under construction.
- In Finland the first implemented component was an ex-post rate-of-return model. Since 2005, the system has been refined, shifted towards ex-ante, and complemented with a CPI-X type of cost cap ex-ante component. At the moment the system does not include a company specific X factor, and the DEA benchmarking results are not included in regulation.
- Norway has adopted a CPI-X type of revenue cap approach with clear ex-ante emphasis. The system is established and stable. DEA benchmarking (yardstick) is used for defining the company specific X factors.
- Sweden has moved from the light handed ex-post regulation (and de facto price fixation) to use of ex-post technical norm model (NAPM). Concession granting is seen as a long term component in the regulation. These are complemented with DEA based benchmarking, that serves information dissemination purposes.

We can conclude that even though the systems aim at pretty much common goals (creating markets in production and sales, and guaranteeing reasonable tariffs), they are philosophically and technically somewhat different.

An illustrative example of the various approaches is the use of DEA models in benchmarking. Finland, Norway and Sweden have developed DEA models for benchmarking purposes. However, the use of these models has been different. While the Norwegian model is used for defining the company specific X factors, the Swedish models is used for information dissemination purposes and encouraging self improvement, and the Finnish model – which was abandoned in the latest reform and is now used for information dissemination purposes only – aimed at defining the cost yardstick for the companies.

The main philosophical difference is probably between Sweden relying on a light-handed ex-post philosophy and Norway relying on a somewhat heavy-handed ex-ante regulation. Still, there are similarities as well even between these extremes. Sweden uses a DEA based benchmarking model quite similar to the Norwegian one although mainly for information dissemination.

Technically, the main difference is probably between the Swedish Network Performance Assessment Model and the empirical frontier models used in the other countries. Again, however, the complementary DEA model in Sweden has many similarities with the benchmarking model in the other countries, even the Danish that relies on a simple variant, the so-called COLS approach.

Table 8-1 summarizes the different approaches used in regulation in the four countries.

Table 8-1. Summary of regulatory approaches used

	Denmark	Finland	Norway	Sweden
Rate-of-return	X	X		
CPI-X		X (Costs)	X (Revenue)	
Yardstick			X (X-factor)	X (Revenue)
Technical norm				X (Revenue)

In addition to the actual differences between the systems, we can notice that the countries are on very different stages in the implementation of the regulation systems. Both Sweden and Denmark have experienced problems with their regulation systems, and this has resulted in changes in the regulation principles. Norway has proceeded relatively consistently with the same approach. The Finnish situation is somewhere between the extreme cases. Table 8-2 summarizes the historical development and implementation of regulatory systems in the four countries.

Table 8-2. Summary of historical development of regulation systems

	Denmark	Finland	Norway	Sweden
Deregulation	1999	1995	1990	1996
First regulation system	2000-2003 Revenue cap	1996-2004 Rate-of-return	-1996 Rate-of-return	-2002 Light handed *ex post* (and interim price freeze)
Subsequent regulation systems	2003- Temporary price fixation + rate-of-return	2005-2007 Rate-of-return + cost cap (CPI-X)	1997-2001 Revenue cap (CPI-x) 2002-2006 Revenue cap (CPI-X) + quality (KILE)	2003- Technical norm yardstick for revenue

The country and EU analysis show that despite of the Nordic regulation systems being advanced compared to many parts of Europe, the latest changes in the directives have had an effect also on the Nordic regulation models. Especially in Sweden and Finland the emphasis

has shifted towards ex-ante approach. However, we can notice that the effect concentrates on the procedure and mechanism level, and EU development is not a key driver on the policy level. For example unbundling has been implemented long before the EU requirements. This is a clear difference in comparison e.g. to Germany and France where EU has been a strong policy driver.

We can conclude that the information exchange between the regulators has not lead to natural harmonization of the systems. On the contrary, the countries have chosen different approaches. These decisions take place on a higher level and the regulators are just one stakeholder in this process. Hence the harmonization would require a more formal attempt and involvement of the ministries and even political decision makers. IEA (2004) in their country analysis of the Swedish energy policy applauds the overall success towards high-level objectives, but suggests further harmonization of the network regulation e.g. through the Nordic council or similar. The European Regulation Forum on Electricity Reform (SESSA, 2005) also highlights the need and readiness for harmonization in Northern Europe, using e.g. the Norwegian regulation as an example of modern incentive regulation for both efficiency and quality. Finally, the new provisions for regulatory delegation in the Directive and the strong promotion of regulatory bodies as EGREG by the European Commission clearly signal that harmonization is on the EU agenda.

As the basis of the current systems is pretty much written in the legislation and the preambles, harmonization would probably require some changes in the legislation. Also at the practical level, the regulators and even the companies have invested a lot of work in developing and understanding the current regulation systems. Some transaction costs can therefore be expected – and they must be weighted against the possible gains from a harmonized approach - if the countries would start harmonizing the models. This is true especially if the implementation time is supposed to be short. Any attempt to harmonize the regulation of DSO must consequently have a long term perspective for the implementation phase.

Harmonization could naturally take place on a more practical level despite the differences in the overall systems. On the more technical level e.g. the asset base or allowed rate-of-return could be defined in a common way. Currently, Norway use both book value and replacement value approaches while the others use replacement value of the grid. Table 8-3 summarizes the differences in the rate of return and asset base. Furthermore, the common technical questions like the asset base play very different roles in the current systems. However also in this area the different use of the results may prevent harmonization.

Table 8-3. Summary of the allowed rate of return and asset base in the four countries

	Denmark	Finland	Norway	Sweden
Rate of return	long bond + 1%	5-year state bond + 1,98% or + 2,14% for equity (70%) and + 0,6% for dept (30%) (4,77% or 5,21% in 2005)	3-year state bond (3-year average) + 2%	6-year real state bond + 1,6 % (after tax) for equity (30%) and 0,6 % for dept (70%). (4,58% in 2003)
Asset base	Technical value from actual components and standard unit prices and age correction. New investments based on actual costs.	Technical value from actual components and unit prices and age correction based in linear depreciation. Non-grid assets based on book value	Book value (actual investment cost + linear depreciation over 30-35 years) (Note that the DEA model uses replacement value as an alternative)	Replacement value from NAPM network and standard unit prices

There are also more practical differences even on the information collection level. Due to historical reasons, division between transmission, regional networks and distribution differs (voltage levels) varies. There are also many other smaller differences in the ways the key indicators are defined. As the time lags in the collection of data are long, this is one practical issue that hinders harmonization and even less formal benchmarking etc.

Due to the different approaches and stages of implementation, the regulation systems provide quite different incentives for DSOs. The incentives for efficiency improvements depend heavily on the possibility to have the improvements that exceed expected level as additional profit. In Finland and Norway this is possible during the regulation period, but the effect on the base line for the next period gives a mixed signal. The effect on the tariff level depends on the tightness of regulation, the clarity of the requirements ex-ante, and the obligation for return excess profits to the customers. E.g. in Finland the last two aspects have been changed and the incentive for tariff changes has increased significantly. None of the countries offer very clear incentives related to security of supply or other quality issues. This reflects the fact that historically the quality issues have been on a very good level. None of the current models provide any clear (wanted on unwanted) signals for consolidation. Furthermore, the possibly too low incentive for investments is a common concern in all the countries.

9. Stakeholder analysis

9.1 Data and methodology

As described in section 2, the analysis of stakeholder opinions is based on both interview data from the key stakeholders and complementary web survey data. The data consists of both quantitative data that describe the importance of various aspects in a well functioning regulation system, and qualitative information that clarifies and motivates the expressed ratings and describes other dimensions related to regulation. This section is structured so that is reflects the structure of the data. The potential aspects that could be included in a regulation system are divided in four categories, Economic, Quality, Equity and fairness, and Social and environmental. Furthermore, the priority and independence of these four groups is discussed separately. In addition to these issues, the text discusses the general motivation for regulation, the characteristics of good regulation system, and discusses shortly the role of technical aspects in regulation. The last issues were covered by the interviews.

Qualitative data from the interviews

The qualitative stakeholder analysis is based on interviews of different stakeholder groups in Denmark, Finland, Norway and Sweden. In every country, one person from the key-stakeholder group, i.e. regulator, distribution company and customer, was selected to be interviewed. The other stakeholder groups were covered by selecting one or two representative(s) either from Denmark, Finland, Norway or Sweden. The customers were selected so that they covered different types of customers, i.e. households, service sector and industry.

In total 17 people were interviewed and this number includes 4 interviews from Denmark, 5 from both Finland and Norway, and 3 from Sweden. The list of organizations covered by the interviews is presented in Appendix A.

Quantitative data from the survey and the interviews

Table 9-1 gives a summary of the number of answers included in the quantitative analysis classified by stake holder group and country. These numbers include both the data collected in the interviews and answers to the web survey.

In the survey, the respondents were divided into five categories: Customers (electricity consumers or electricity producers to the distribution network), Energy or public utility companies, Investors, Public organizations (e.g. ministries, government agencies, local authorities), and Non-governmental organization (NGO) (e.g. industry associations, trade unions). For the analysis purposes, the classification was somewhat refined by separating DSOs and other energy companies, and by including NGOs in the group the organization or the individual respondent represents. Regulators and other public organization have been analyzed as one group. For international organization the respondent have been classified on the basis of the nationality of the respondent

Table 9-1. Number of answers by country and by stakeholder group

	Denmark	Finland	Norway	Sweden	Total
DSO	7	16	8	9	40
Other energy	3	9	3	1	16
Customer	1	3	1	2	7**
Government	1	6	2	1	10
Investor	1	1	1	-	3
Total	13	36*	15	13	77*
Response rate	23 %	52 %	14 %	19 %	26 %

* One Finnish answer does not belong to any of the groups
** Three of the answers represent household customers and four industrial and service sector customers.

Although the total number of responses is reasonably high for a highly focused study like this, the data sets some limitation to the analysis. E.g. the number of responses does not allow analysis of the different stakeholder perspectives in each country separately or analysis of the differences between similar stakeholder groups in different countries. Hence the analysis was completed by analyzing the differences between the stakeholder groups on Nordic level and the overall differences between the countries. Also the differences between DSOs and the other stakeholder groups in each country are discussed in some cases. Furthermore, the data does not allow us to separate urban and rural DSO, because most of them have indicated that the company operates both in urban and rural areas.

9.2 General regulation issues

Need for regulation

The interviewees were unanimous that regulation is needed due to monopoly nature of electricity distribution business. Especially customers must be protected from overpricing due to both inefficiency and potential monopoly profits of the companies. Also the equal access of consumers and producers to the electricity grid and market was mentioned by many interviewees. Only one had the view that tariffs would have been lower without regulation, as many owners would not have claimed a high return on the equity without the regulatory regime. Anyhow, we can conclude that the need for regulation is accepted by all the stakeholder groups.

Characteristics of a well functioning regulation system

The opinions on characteristics of a well functioning regulation system varied to some extent. Most of the interviewees preferred a general level regulation model that has clear incentives to develop electricity distribution in the long term. In some cases, it was pointed out that the model should be on the general level as asymmetric information makes the detailed regulation dysfunctional. However, some also claimed that too general regulation is ineffective.

In general, many interviewees argued that there are trade-offs across all the dimensions (general vs. detailed, cost vs. output orientation, economic vs. quality, short vs. long term, ex post vs. ex ante). The opinions considering ex-ante versus ex-post regulation were contradictory but many interviewees thought that this is a secondary issue.

A majority of the interviewees think that sector wide regulation should be the starting point for fair regulation. There were some contradictory opinions on whether (and to what extent) firm specific issues must be included in regulation model. It is acknowledged that it is a challenging task to consider how, e.g. density of population, climate, geography and consumption patterns, can be considered in the regulation model.

There was almost unanimity that regulation must have focus on long term issues as the many assets are for 30 years or more. The short term regulation may lead to sub-optimization. We note, however, that the current schemes leave the DSO with a rather short time horizon.

For the purpose of setting the results in a wider context, it is interesting to compare these observations to a study by EURELECTRIC (2005). This surveyed the opinions of financial analysts on the importance of transparency, neutrality, clarity and efficiency in the regulation of electricity sector. Transparency was clearly the most important issue. On the other hand efficiency and also clarity were seen as important issues by many, but two fifths and one fourth of the respondents saw these issues irrelevant. Neutrality was seen as the least important issue.

When compared to the results of our study, it is important to note that the survey or the interviews did not pay specific attention to the general clarity, efficiency or transparency of the model. These are all general good characteristics of a well functioning regulation model, and the survey sheds additional light on the importance of these aspects. However, other stakeholder groups would probably emphasize e.g. neutrality more since they are more closely tied to one specific electricity company.

Limitations for change

Considering the limitations and conditions to regulation model the stakeholders had very few comments. It was pointed out that even legislation can be changed, if it is compatible with EU directives. Some interviewees pointed out political constraints, e.g. rural policy and employment concerns, as well as public sector tradition as a limitation in the development of regulation. However, one interviewee claimed that the limitations are overstated and due to the conservative attitude of the industry.

9.3 Economic aspects

The economic aspects focused on customer tariffs, costs and profits of the companies, operational efficiency as well as return on investment (ROI). For the tariffs, profit and ROI, the level and stability of the dimensions were separated.

Importance of the economic aspects in regulation

Figure 9-1 presents a summary of the average rates given by the stakeholder groups on the relative importance of the various economic aspects is a well functioning regulation system. It is clear that customers, and regulators and other government representatives put more emphasis on low tariffs than the other groups. However, all the groups value stability more then (or at least as much as) low level of tariffs, profits and ROI. With respect to the tariffs the DSOs seem to be balancing between the customer/regulator and investor perspective.

All the groups see the stability of the tariffs and ROI as important aspects, although government perspective gives most emphasis on low ROI and least emphasis on stable ROI.

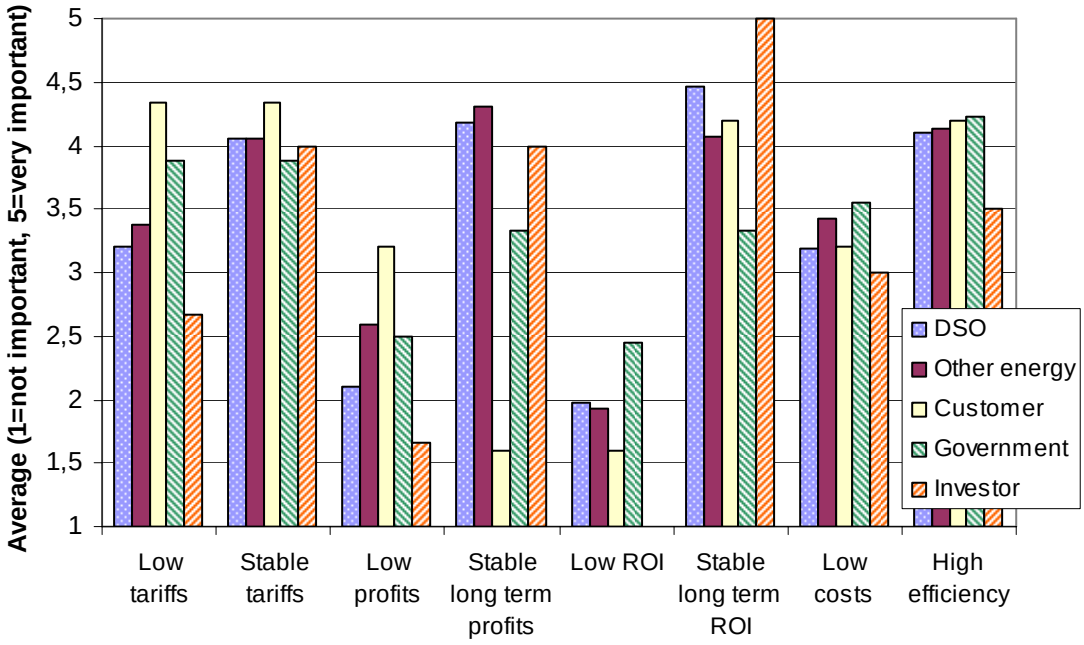


Figure 9-1 Relative importance of economic aspects in a well functioning regulation system

The analysis on the differences between the countries reveals that the differences between the countries are small. Finland and Sweden put slightly more emphasis on low tariffs, and Sweden (even the DSOs) to low profits. Contrary to the other countries, in Denmark DSO put less emphasis on the stability of return than the other groups, and that low profit and ROI are more important. Danish and Swedish DSOs would emphasize low ROI as a goal more than Finnish and Norwegian.

The qualitative analysis supports the view that for the majority of the stakeholders, the stability in general was the most important issue due to long term nature of the electricity distribution business. For consumers stable prices and for owners stable return on investment (especially for municipal owners stable cash flow) are extremely important.

Motivation and practical aspects

Comparing the opinions on customer tariffs, profit and return of investment, the majority accepted that low tariffs for customers is the natural goal of regulation – unambiguous and verifiable. In practice, low tariffs are achieved by regulating either revenue, profit or rate of return. Many interviewees, especially distribution companies and owners, criticized the regulation of the rate of return because they thought that sufficient rate of return guarantees stable and high quality operation in a long term. In general, Norwegian interviewees tend to put more emphasis on 'correct' rather than 'low' tariffs.

On the operational level, the regulation model should have incentives to improve the operational efficiency and cut costs. This is important issue in company's management. Without true incentives that are compatible with good management it is hard to motivate company's management.

A practical issue that was pointed out was the different accounting principles and practices. Also the different ownership structure may cause difficulties to build up economical incentives.

Possibility of bankruptcy

The interviewees were also asked to express their opinion about the statement "Electricity distribution is like any other business, inefficient firms that cannot keep up with the competition may go bankrupt and leave the field to other firms." The majority said that companies cannot go to bankrupt but there were also opinions that distribution companies cannot have any privileges, and thus, it should be possible that more efficient companies replace inefficient companies.

9.4 Quality aspects

The quality of electricity distribution covers many issues, e.g. security of supply (interruptions due to grid failures), technical quality of electricity (voltage level etc.), proper customer service including invoicing, guidance, information etc. as well as additional products and services for customers.

Importance of the quality aspects in regulation

Figure 9-2 present a summary of the relative importance of different quality aspects. The differences in the opinions of the stakeholder groups regarding the quality aspects are smaller than for the economic aspects. Regulation of technical quality is, to some extent, emphasized by the customers (note that household customers are minority in the dataset) and seen as less important by the energy sector. DSOs see additional products and services more important than the other groups.

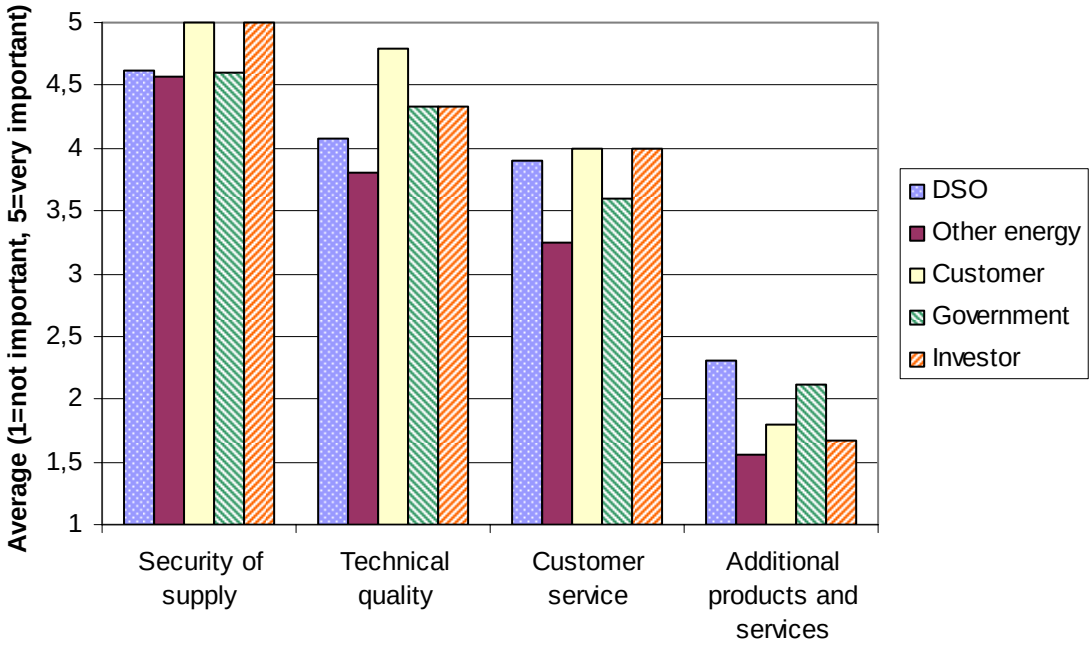


Figure 9-2 Relative importance of quality aspects in a well functioning regulation system

The differences between countries are very small. The only significant observation is that technical quality is emphasized more in Denmark than other countries. Possibly, this reflects the high share of wind power and the technical questions related to this.

In line with the survey data, the interviews show clearly that the high security of supply was considered the most important issue related to quality aspects. The modern society is dependent on supply of electricity. However there is difference between customer groups and some of them cannot tolerate any interruptions while in, e.g. in rural areas, some customers are more used to tolerate short interruptions.

The technical quality of electricity is also, important especially in industrial sector. However, the requirements of various customer groups are different although there is a standard for the technical quality of electricity.

Considering additional products and services the main message was that these are separate issues and should not be included in regulation.

Implementation of quality regulation

In practice, technical quality and interruptions are relatively easy to measure, and hence to include in regulation, but the registration of quality parameters must be reliable and verifiable. Some interviewees argued that it might be sufficient to include security of supply (interruptions) as the technical quality would then follow as a consequence of the same efforts.

The interviewees were asked to express their opinion about the statement "General quality regulation is useless, the regulator is always lagging in information and stalls development. Individual contracts between clients and firms can better cater for quality provision, such as service guarantees and compensations for service interruptions." The clear majority of interviewees said that quality issues should be regulated because the majority of customers have no power to negotiate fair contracts. However, some comments indicate that for industrial customers it might be possible to make special contracts on quality issues and allow quality differentiation.

9.5 Equity and fairness

One motivation for regulation is to guarantee the equality between various stakeholders, such as equity between different customers, geographic equity, equal access to networks and markets (both consumers and producers), and fairness for small and big distribution companies. The design of a regulation system can influence these issues directly if these are included in the regulation system of indirectly through the other aspects.

Importance of the equity and fairness issues in regulation

Figure 9-3 summarizes the importance of various equity and fairness aspects to the stakeholder groups. It is easy to see that access to networks and markets is, in total, the most important aspect in a well functioning regulation. In general DSOs, government representatives and investors see equity and fairness issues more important than especially the customers. When interpreting the results, it must be kept in mind that fairness can – depending on the perspective – mean different things.

With respect to equity and fairness, the differences between the countries are also very small. Norwegian respondents see the geographic equity of the customers and the fairness of the regulation w.r.t. small and big companies on average less important than the other countries. However, we need to keep in mind the ambiguity of the word fairness.

The interviews show that the importance of various equity and fairness aspects naturally depends on the stakeholder group. Almost all the interviewees agreed that equality and fairness are cornerstones of the regulation although it is not necessarily easy to implement a perfectly equal and fair regulation model. In some interviews were noted that equal treatment of different groups of customers does not mean that all the groups of customers are treated in a similar way. This applies also to the distribution companies. For example, geographical issues are something that companies cannot affect and thus the regulation model should not punish for these issues.

The EURELECTRIC (2005) survey shows that neutrality is not an important issue for the financial analysts. This is a very different result than our results on the fairness of the model, and even the opinions of the investors. The difference may be related to the fact that those investors that the analysts are serving are not committed to any individual distribution company and may be willing to change their investment portfolio.

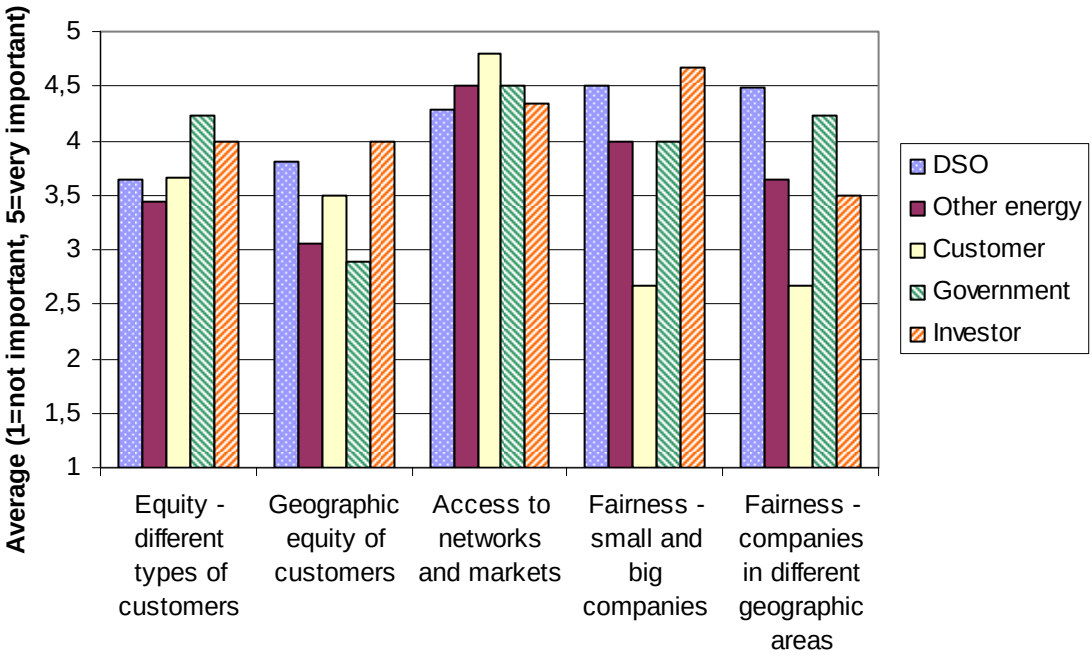


Figure 9-3 Relative importance of equity and fairness aspects in a well functioning regulation system

Equity and fairness in practice

The measurement or parameterization of equity and fairness issues was considered to be very difficult. Thus, it might not be sensible to include some kind of equity or fairness parameters into the regulation model but rather check that the regulation model is equal and fair for different types of consumers, producers and distribution companies.

Any definition of a 'fair' regulatory regime would tend to be subjective and even political. And whereas some might be of the opinion that a certain arrangement is fair, other groups might consider the same arrangement as everything but fair. Furthermore, political definitions of 'fair' are not necessarily stable over time.

9.6 Social and environmental aspects

Electricity distribution has direct and indirect effects on environment and whole society. There are issues such as safety, environmental effects, social and cultural impacts, effects on land-use planning, aesthetic issues, employment and competitiveness of country and industry. Most of these aspects are subject to separate rules and regulations. However some of them might need to be part of the regulation system.

Importance of the social and environmental aspect in regulation

Figure 9-4 summarizes the relative importance of different social and environmental aspects in a well functioning regulation system. Note that the figures cannot be directly compared to the figures above since the importance of the four groups was analyzed separately, and the overall importance of this group is lowest. Inside this group, safety issues were the most

important. Employment was not seen as an issue in the regulation. As in the previous section, the notion of competitiveness may vary depending on the perspective.

Environment, aesthetics and to some extent also compatibility with land use planning and safety are on average more important to Danish respondents than the others. In Sweden, DSOs put more emphasis especially on safety but also to all the other aspects in this group than other stakeholders in Sweden.

The interviews are consistent with the survey results and safety was considered the most important issue in this group. The safety of both workers and consumers should be put in high priority. Many interviewees said that safety could be a part of the regulation and there should be incentives to promote safety issues

Competitiveness of country and industry is an important issue and it is a goal that regulation aims at. However there is no special need to include these issues in regulation model. Furthermore, competitiveness clearly means different things.

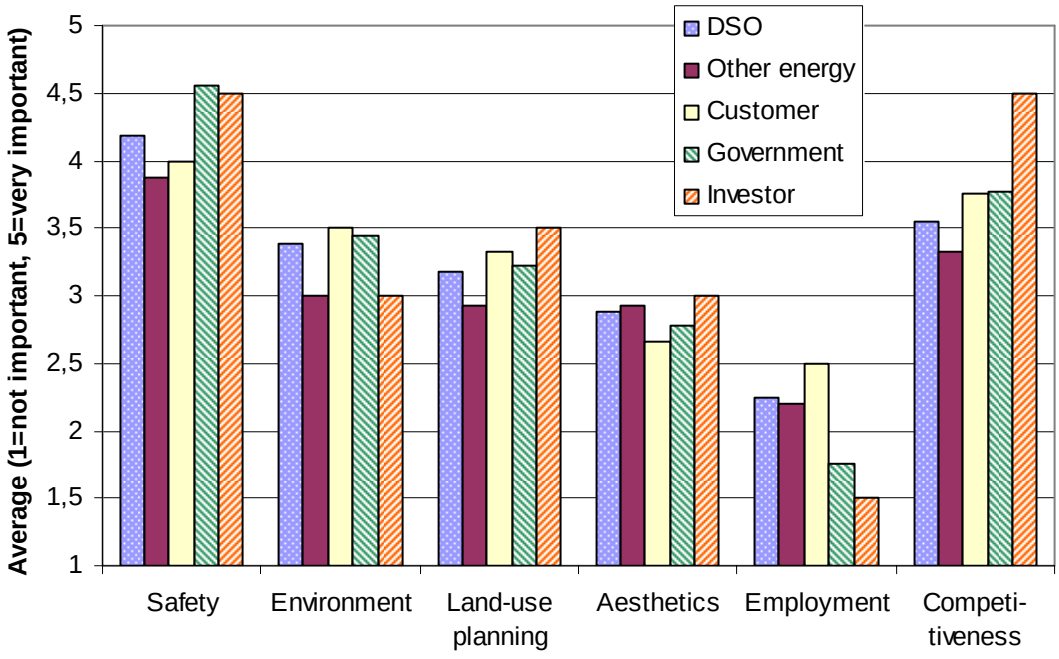


Figure 9-4 Relative importance of social and environmental aspects in a well functioning regulation system

Not a part of regulation

The environmental effects, land-use planning, aesthetic values and high employment were considered issues that must not be included in the regulation model. There are other authorities taking care of these issues. However, when grid companies comply with such 'external' rules, they might induce higher costs (e.g. if aesthetic performance is costly), which should be recognized by the regulatory system.

9.7 Technical aspects

The electricity network is a complex technical system that needs to be maintained and improved constantly. Taking into account the above mentioned aspects requires that several technical issues to be taken care of, such as improvement of reliability and risk tolerance of the technical system, long-term planning and investment policy and practice, and research and development. For this reason, the interviews aimed at clarifying the role of technical aspect in regulation.

The interviewees mainly argued that the role of technical issues in regulation model is crucial. However, this does not mean that regulator should favor any technical solution but merely should give incentives to develop better electricity network, especially in terms of quality. The companies should make the decisions on the technical level.

Research and development are important issues and the regulation model should have incentives to develop distribution business, e.g. security of supply. The clear majority of interviewees said that the regulator should not directly interfere with this issue but let the companies to decide actions on operational level by themselves.

New additional services like broad band internet should not be included in regulation model, but it is important that there is clear boundary between the core distribution business and additional services. In practice this means that there may not be any subsidies between the businesses.

9.8 Priority and independence of the groups of aspects

In the regulation the dimensions discussed above need to be balanced in order to guarantee balanced incentives. For example, the level of customer service may worsen, if only costs and not the customer service output are taken into account in regulation. In order to give appropriate weight to various aspect groups (economic, quality, equity and fairness as well as social and environmental) the respondents and interviewees were asked to give a priority for the aspects.

Importance of the groups of aspects in regulation

Figure 9-5 summarizes the priorities given to the four groups of aspects. The highest importance is given to the economic and quality aspects. These are approximately equally important for all the groups, except for the investors, who have clear focus on the economic issues. Equity and fairness issues are less important than economic and quality, and social and environmental issues are – on average – the least important ones. However, the lower average importance is also connected to higher variance, i.e. the respondents have to some extent various opinions on the importance.

There are only minor differences between the overall average opinions in the four countries. However, there are some interesting differences inside each country. Danish DSO see the economic issues less important than the other groups, while in Finland and Norway there is a minor difference to the other direction. Furthermore, especially in Sweden and Norway the DSO put more emphasis on the social and environmental aspects than the other groups.

The interviewees shared the unanimous opinion that economic and quality aspects were most important issues and they definitely must be included in a well functioning regulation model. Many of the interviewees also said that economic and quality issues are heavily linked and thus must be analyzed simultaneously.

The interviews support the view that equity and fairness issues are extremely important but they are more or less hygiene factors that need to be taken care of when constructing a regulation model. Hence these are not a direct factor in a well functioning regulation of DSOs, but an underlying principle in this, and a subject for a separate regulation by a relevant authority.

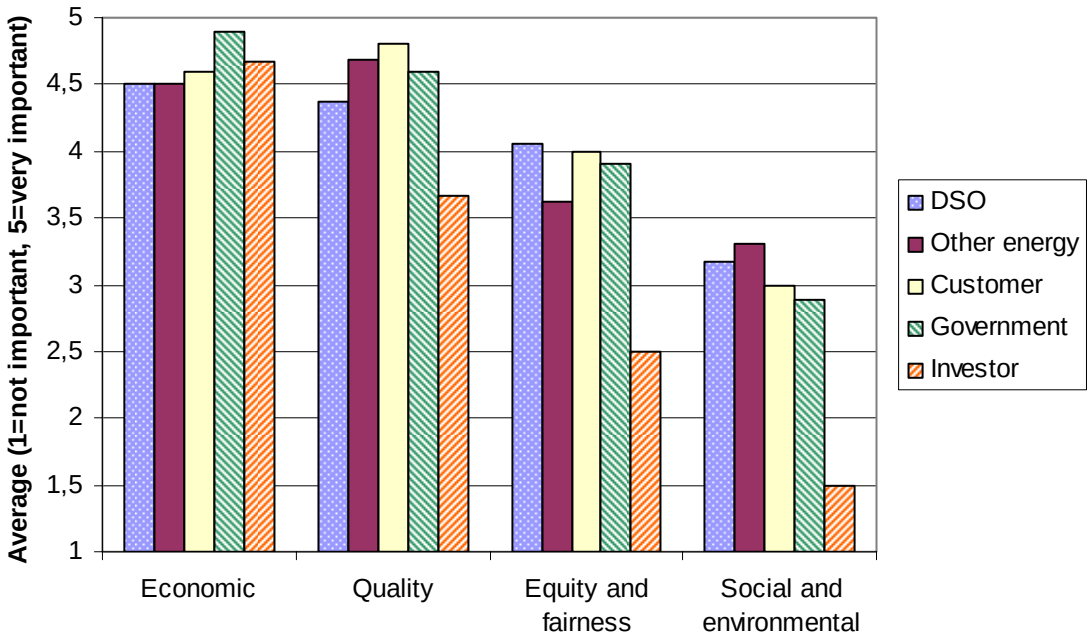


Figure 9-5 Relative importance of the four groups of aspects in a well functioning regulation

The comparison of the results to a recent study by TNS Gallup (2005a and 2005b) 'Energybarometer' that surveyed the opinions of approximately 1000 Norwegian households confirms the importance of quality issues. Whereas the main concern among the Norwegian consumers for several years has been the electricity prices, the recent study in the 1st quartal of 2005 reveals an increasing orientation towards customer service and reliability of information from the sector. Only 17 % of the customers were satisfied with the service level and the way they are treated as customers. And only 19 % finds the information from the sector's communication reliable and trustworthy. Furthermore the study shows that many customers are unfamiliar with the use and basis of the distribution tariffs and suspect that the distribution prices may be too high. The clear message to the sector is to improve information, service and ensure acceptable electricity prices. It must be said, however, that the customer complaints revealed by this study relate to the generation and retail business also, and not only the network companies.

Environmental and social issues were mainly considered to be taken care of by other authorities than energy market authorities, or by companies themselves as a part of good

corporate citizenship. However, the majority said that safety issues related to both workers and consumers are so important that it should be included in regulation model.

Two interviewees questioned the whole focus on regulation of distribution, referring to harmonized regulation at the TSO level as much more important to ensure future efficiency in the electricity market, than harmonization at the DSO level.

Motivation behind the opinions

The comments in the rating of the aspect reveal very unanimous argumentation behind the answers. The cost of service and quality of service are seen as interrelated issues and hence equally important. As many of the aspects mentioned are seen important, it has been difficult to name the most important ones. Hence there is a wish for balance between the different perspectives.

Some of the respondents see the economic aspects, especially profit controlling very important, because electricity distribution is monopoly business. On the DSO side many companies emphasize the need for sufficient profit so that the business is interesting for the investors, but some DSOs emphasize their role as public utilities that provide highest quality with low price. The importance of quality aspects also has a link to the incentives for investments. This illustrates that there may also be conflicting goals between the companies and the investors.

One explanation behind the emphasis on economic and quality issues is that these are in the focus of energy policy. This raises their importance on the policy makers' side. On the other hand, social and equity issues are not driven by the ministries responsible for energy issues. Hence the regulation systems will always reflect also the sectorial responsibilities of the ministries. The has importance especially for the changes in the regulation system.

Independence of the aspects

The interviewees had very contradictory opinions whether these different aspects should be taken into account simultaneously or separately. Almost everyone noticed that these aspects have interdependencies (especially economic and quality aspects) and they are linked together. Despite of that many interviewees thought that, in practice, it would be better to analyze these aspects separately.

10. Critical success factors and conclusion

This section summarizes the critical success factors of a pan-Nordic regulation model. Hence, it presents the conclusion from the regulatory system analysis phase. The first subsections discuss the common and conflicting goals based on the stakeholder analysis and the last sub-section combines these with the results from the country analysis.

10.1 Economic issues

Economic issues, together with quality, are the most important group of aspects. Hence, it is important both as a common objective and as a potential natural source of conflict between stakeholders.

In the economic issues, stability is in general emphasized as an important part of a well functioning regulation system. Especially stability of tariffs is one area where the groups are unanimous.

Potential conflicts are related primarily to the level of tariffs and profits. The conflict arises from the fundamentally different interests of the stakeholder groups. Among all the stakeholders, low ROI is most important and stable ROI least important for the authorities. Although the regulators and other authorities put a lot of emphasis on low tariffs and low profits, there is some reluctance to accept bankruptcy as a potential consequence. A clear concern is that regulators do not recognize the DSOs' need for being competitive in the capital market.

In general, the opinions of the regulators and other authorities seem to be closer to the opinions of the customers than other groups. The results suggest that DSOs try to balance between the conflicting objectives of the other stakeholder groups.

The written comments, however, emphasize the importance of right balance especially between economic and quality issues. This is clear challenge for the regulation systems that should be able to balance the economic inputs and less tangible outputs related to quality aspects.

The viewpoints are largely shared in the Nordic countries, but there are some small differences in orientation between the countries. For example, in Denmark, less emphasis is put on low tariffs and high profits, and Norwegians emphasize the correct level of tariffs, rather than low. There may also be conflicts between the countries in setting the political agenda and not just between the stakeholder groups.

10.2 Quality

Quality is as important – and security of supply even more important than any of the economic aspect as economic aspects. The current regulation models do not put high emphasis on the quality issues, but the results suggest that the importance is rising. This finding is supported also by European work on regulation such as SESSA (2005) and EC (2004b).

Quality in general and especially security of supply is an important dimension in regulation for everybody. Thus it is, per se, not a source of conflict. However, there is a clear link between the quality and the economic aspect. Consequently, the conflict in the quality issues would most likely be reflected in the economic issues.

Although customer service has been emphasized in the discussions e.g. in Finland during the recent years, it was seen less important issue than security of supply or technical quality by all the groups. This probably reflects the fact that normally customers are rarely in contact with their DSO. Also the recent news on blackouts in e.g. Sweden may have affect the results.

Although there is very strong consensus on the importance of the quality issues, the motivation behind the opinions may vary. It seems that companies see quality also as a balancing factor against the economic criteria while customers see it as a clear goal based on their needs. However, the consensus clearly reflects also the fact that the modern society is heavily dependent on the security of electricity supply.

In practice the security of supply and technical aspects of quality are relatively easy to implement in the regulation system. Probably, even rather simple models will provide sufficient incentives here and no complicated models would be needed. However, customer service is much more difficult issue, introducing some complexity on the practical and implementation level.

The results suggest that additional services and products should not be included in the regulation system. However, in consequence of the non-discrimination rules in the Directive the monitoring of the unbundling and equal conditions is always of actuality.

10.3 Equity, fairness and social and environmental issues

Access to networks and markets is acknowledged as the most important principle. Other equity and fairness aspects are also important characteristics of and basic principles behind a regulation system, not so much goals that the system should direct towards. There is general agreement that regulation should be fair, but there is potential conflict on what fairness means in practice. For example, is it fair that some company operates on a suboptimal scale, and maintains higher tariffs and at the same time tries to keep the local employment high? This is to a large extent a political question that deserves attention from relevant authorities.

Furthermore, although many of the social and environmental issues are indeed important – low environmental effects, compatibility with land-use planning, etc, they are not necessarily limited to energy policy, but subject to separate rules and regulations. Out of these issues, safety is the most important aspect that potentially could be a part of the regulation system.

10.4 Challenges related to system change

As there is practically unanimous consensus on the need for regulation, the key challenges are related to the implementation and change of implemented system(s). Practical concerns call for balancing between long and short term focus, economic and quality orientation, clarity and level of details, etc. The only clear message is that regulation should not direct the technical choices directly.

The country analysis show that the current regulation systems in the Nordic countries are well aligned towards common goals (creating markets in production and sales, creating efficiency and quality incentives in networks and guaranteeing reasonable tariffs), but they are philosophically and technically somewhat different. Furthermore, the countries are at different stages, but all have some sunk investments in the particular instruments used. Based on this observation, it is evident that political agenda needs to serve as a basis for changes. There is a need for finding a common commitment between the countries and this is an issue that cannot be solved at the regulators' level.

Changing legislation is a long process, but this cannot be seen as a major challenge for the harmonization. The biggest issue is the political commitment. The willingness to commit to big changes may be limited. Furthermore, the mindsets in each of the countries are reflected in the incumbent regulation, and resistance to e.g. introducing market mechanisms seems to be high.

The analysis also shows that at the moment the driver for change in the Nordic countries is not the EU policy, but rather national interests. In the long term, it is evident that EU favors harmonization, but is not actively enforcing it at the moment. Proactive work might be used in influencing the development at the EU level, which seems to actively welcome this kind of regional initiatives.

In addition to the policy makers, also companies may object changes in the regulation system. Also they have invested time for learning the current system etc. The DSOs want to see that the new pan-Nordic model offers something better for them. As stability and predictability are clear goals, the creation, or mere discussion, of a pan-Nordic model may be seen as introducing some regulatory uncertainty.

Harmonization strategy

Given political commitment, the harmonization would in practice need to be a long stepwise process. A very difficult question is what the first step might be. Following the European logic above, one may outline three alternatives.

The *least radical alternative* would be a continued micro-level collaboration between regulators on the one hand and the industry partners on the other. The collaboration could involve improved data collection procedures, streamlined voluntary compensation schemes, technical and information harmonization.

An *intermediate option* would be to foresee an intensified process propelled by the Nordic Council, following up the Reykjavik declarations on TSO missions by a similar on DSO tasks, inspiring a "mid-level" political pressure to initiate regulatory reform. This process could already address some principal issues regarding the need for centralized versus decentralized regulation.

A *top-down solution* would involve the formal establishment of a common Nordic regulator (NordReg) in the sense of the Directive, likely along the creation of a single Nordic TSO for the NordPool area. This solution relies on strong economic and coordination arguments, vividly forwarded in the harmonization discussion at the European level, but rarely voiced at national level.

Whatever solution chosen, it is primordial to create a win-win situation for the stakeholders to forward the pan-Nordic idea. Nobody changes a winning team and in the current debate the national systems are, behind some modesty, proud over their achievements in the energy sector. This project must thus pass forward the hot potato to the next subproject on Mechanism Design to draw on the strengths from each system to find a feasible and attractive system. Although the time may be ripe, the detailed features of a potential pan-Nordic system are still to be defined.

Appendix A: Interviews with stakeholders

Denmark

- Copenhagen Energy
- Danish Energy Regulatory Authority (DERA)
- Forening af slutbrugere af energi (Association of Final Energy Users)
- HSH Gudme Bank

Finland

- City of Tampere
- Energy Market Authority (EMV)
- Energy Industry Association
- Fortum Corporation
- Forest Industry Association

Norway

- Hafslund Nett
- Kommunenes Sentralforbund (KS)
- NVE
- OED
- Skagerak Energi

Sweden

- Avgifter.com
- Elbruk, Svensk Elbrukarförening
- Swedish Energy Agency (STEM)

Appendix B: Survey Questionnaire

Nordic survey on the regulation of electricity distribution

Contact information

Please give the name of your organization and you personal contact information.

Note that this information is only collected in order to keep record of who has responded. This information will be treated confidentially and it will not be made public or linked with the individual answers given.

Organisation

Name

Email

Phone number

Type of stakeholder

Please indicate the type of your organisation or your position relative to electricity distribution.

- ○ Customer (electricity consumer or electricity producer to the distribution network)
- ○ Energy or public utility company
- ○ Investor
- ○ Public organisation, e.g. ministry, government agency, local authority
- ○ Non governmental organisation (NGO), e.g. industry association, trade union
- ○ Other, please specify below

If you chose other, please specify

Specifics of the type of stakeholder

Please specify the type of customer by ticking/checking all the ones that apply.

- [ ] Industry
- [ ] Service sector
- [ ] Public organisation
- [ ] Household
- [ ] Electricity producer

Specifics of the type of stakeholder

Please specify the type of activities you represent by ticking/checking all the ones that apply.

- [ ] Electricity distribution in an urban area
- [ ] Electricity distribution in a rural area
- [ ] Electricity production
- [ ] Electricity sales
- [ ] Electricity transmission
- [ ] District heating
- [ ] Gas business
- [ ] Other, please specify below

If you chose other, please specify

Specifics of the type of stakeholder

Please specify the type of organisation by ticking/checking all the ones that apply.

- [ ] Institutional investor, e.g. an insurance company or a bank
- [ ] Energy company
- [ ] Other, please specify below

If you chose other, please specify

Specifics of the type of stakeholder

Please specify the type of public organisation by ticking/checking all the ones that apply.

- ☐ Regulator
- ☐ Ministry
- ☐ Municipality
- ☐ Emergency supply agency
- ☐ Competition authority
- ☐ Consumer authority
- ☐ Owner of a energy distribution company
- ☐ Other, please specify below

If you chose other, please specify

Specifics of the type of stakeholder

Please specify the type of organisation by ticking/checking all the ones that apply.

- ☐ Consumer organisation
- ☐ Environmental organisation
- ☐ Industry association
- ☐ Trade union
- ☐ Other, please specify below

If you chose other, please specify

Country

Please indicate the country or countries where your unit or organisation is present

- ☐ Denmark
- ☐ Finland
- ☐ Norway
- ☐ Sweden

Overall importance of different aspects in regulation

A variety of aspects can be included in the regulation of electricity distribution. In this survey we have divided these aspects into four groups.

1. **Economic aspects** include for example customer tariffs, costs and profits of the companies and the operational efficiency of the companies.
2. **Quality aspects** include security of supply (interruptions), technical quality of the electricity, level of customer service etc.
3. **Equity and fairness aspects** include the equity between different customers, and fairness of the regulation for different types of distribution companies.
4. **Social and environmental aspects** include safety, environmental effects, employment etc.

How important it is to include these groups of aspects **in a well functioning regulation system?** Please indicate the **relative importance** of these general groups on a scale 1=not important … 5=very important.

Economic

Not important 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ Very important Do not know ☐

Quality

Not important 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ Very important Do not know ☐

Equity and fairness

Not important 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ Very important Do not know ☐

Social and environmental

Not important 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ Very important Do not know ☐

Please explain briefly the motive behind your selection of most important aspect(s).

Please explain briefly the motive behind your selection of the least important aspect(s)

Importance of economic aspects

Given the overall importance of economic aspects, how important it is to include the following economic aspects or measures **in a well functioning regulation system?** Please indicate the **relative importance** of these aspects on a scale 1=not important … 5=very important.

Low tariffs for customers

Not important 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ Very important Do not know ☐

Stable tariffs for customers

Not important 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ Very important Do not know ☐

Low annual profits of distribution companies

Not important 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ Very important Do not know ☐

Stable long term profits of distribution companies

Not important 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ Very important Do not know ☐

Low return on investment (ROI) of distribution companies

Not important 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ Very important Do not know ☐

Stable long term return on investment (ROI) of distribution companies

Not important 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ Very important Do not know ☐

Low costs of distribution companies

Not important 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ Very important Do not know ☐

High operational efficiency of distribution companies

Not important 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ Very important Do not know ☐

Other (please specify below)

Not important 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ Very important Do not know ☐

If you selected other, please specify:

Please explain briefly the motive behind your rating or give potential other

comments related to economic aspects.

Importance of quality aspects

Given the overall importance of quality aspects, how important it is to include the following aspects **in a well functioning regulation system?** Please indicate the **relative importance** of these aspects on a scale 1=not important … 5=very important.

High security of supply (e.g. minimum interruptions)

Not important 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ Very important Do not know ☐

High technical quality of electricity (e.g. voltage level)

Not important 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ Very important Do not know ☐

Good customer service (e.g. few complaints, short waiting time in phone services etc.)

Not important 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ Very important Do not know ☐

Additional products and services for customers

Not important 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ Very important Do not know ☐

Other (please specify below)

Not important 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ Very important Do not know ☐

If you selected other, please specify:

Please explain briefly the motive behind your rating or give potential other comments related to quality aspects.

Importance of equity and fairness aspects

Given the overall importance of equity and fairness, how important it is to include the following aspects **in a well functioning regulation system?** Please indicate the **relative importance** of these aspects on a scale 1=not important … 5=very important.

Equity between different types of consumers and producers

Not important 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ Very important Do not know ☐

Geographic equity between customers

Not important 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ Very important Do not know ☐

Equal access to networks and markets (consumers and producers)

Not important 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ Very important Do not know ☐

Fairness of the regulation for small and big distribution companies

Not important 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ Very important Do not know ○

Fairness of the regulation for companies in different geographic areas

Not important 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ Very important Do not know ○

Other (please specify below)

Not important 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ Very important Do not know ○

If you selected other, please specify:

Please explain briefly the motive behind your rating or give potential other comments related to equality aspects.

Importance of social and environmental aspects

Given the overall importance of social and environmental aspects, how important it is to include the following aspects **in a well functioning regulation system?** Please indicate the **relative importance** of these aspects on a scale 1=not important … 5=very important.

High safety of customers and workers

Not important 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ Very important Do not know ☐

Low environmental effects

Not important 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ Very important Do not know ☐

Compatible with land-use planning

Not important 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ Very important Do not know ☐

Aesthetic value

Not important 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ Very important Do not know ☐

High employment

Not important 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ Very important Do not know ☐

High competitiveness of the country and the industry

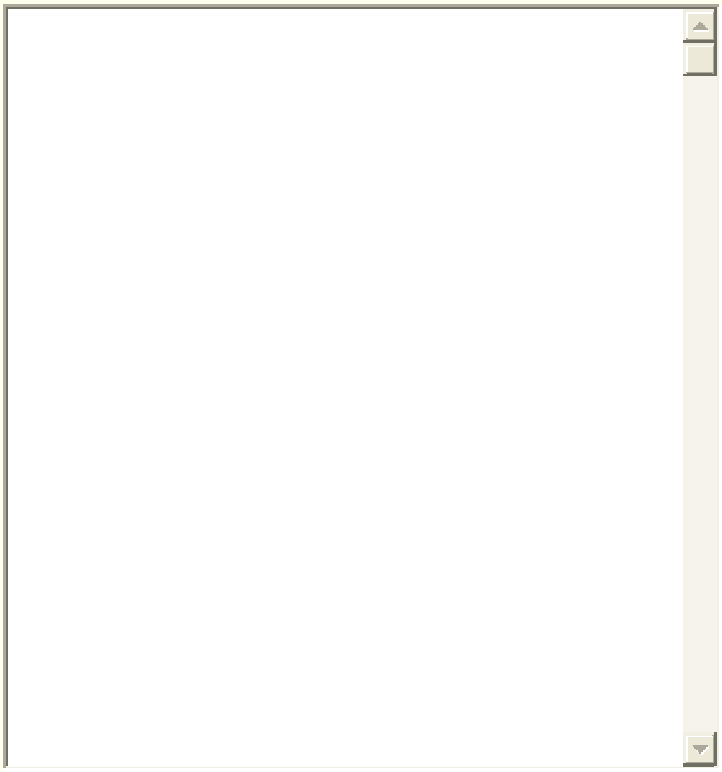
Not important 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ Very important Do not know ☐

Other (please specify below)

Not important 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ Very important Do not know ☐

If you selected other, please specify:

Please explain briefly the motive behind your rating or give potential other comments related to social and environmental aspects.



Independence of the groups of aspects

The four groups of aspects (economic, quality, equity and fairness, and social and environmental) can be taken into account with a system that covers all the dimensions simultaneously, or with separate schemes for each dimension.

Example: Both low tariffs and high quality may be important. If the level of quality needs to be taken into account when making a judgement on the level of the tariffs, these two need to be evaluated simultaneously. On the other hand, a sufficient quality may be defined independently of the price, and a fair tariff level may be independent of the quality level. In this case these two aspects can be analysed separately.

Do you think that the four general groups of aspects should be analysed separately and independently of each other?
Please mark your answer on a scale
1 = Yes, these should be analysed completely separately … 5 = No, all of these should be analysed simultaneously

Yes 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ No Do not know ☐

If you think that the aspects should be analysed simultaneously, please explain briefly which of the aspects need to be taken into account simultaneously and why.

Other issues

Please write any additional comments on the groups of aspects, or comments on the way of implementing a regulation system?

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nemesys

The Nordic Efficiency Model for Electricity distribution SYStems (NEMESYS) aims at developing a common regulation model for electricity distribution in the Nordic region (NordPool region). The project contains three major subprojects:

A) Regulatory System Analysis

Based on an established methodology for regulatory approaches, a careful analysis is performed of the interactions implied by the integrated energy market directives and the degrees of freedom in the institutional and industrial setting in the Nordic countries. This phase also includes a forward and outward looking review of regulatory systems, industry performance and the dynamics of industry development and regulation.

B) Regulatory Mechanism Design

Based on the structured methodology in A, the mechanism design subproject develops a regulation framework that addresses the current and future challenges and that has the potential to accommodate the country specific factors in a systematic and objective manner.

C) Efficiency Model Development

In parallel with A and B, the project performs analysis and development of a performance measurement platform that corresponds to the regulatory standards and information requirements. The process includes estimating the data and processing needs and to demonstrate its applicability in the entire region using representative industry data. The model explicitly addresses the horizon, investment and quality dimensions of the service, in addition to operating cost and task complexity.

The NEMESYS project is commissioned by Nordenergi and staffed by SUMICSID AB as project coordinator and EC Group AS, Gaia Group OY, SKM Energy Consulting AS and RR Institute of Applied Economics as project partners.

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