

**The Swedish Energy  
Markets  
Inspectorate's report  
as per EC Directives  
for the internal  
markets for  
electricity and  
natural gas, 2008**



## **Foreword**

On the instruction of the Government, the Energy Markets Inspectorate has prepared a report in accordance with the reporting requirements pursuant to Article 23.1, second paragraph of the Electricity Market Directive (2003/54/EC), and Article 25.1, second paragraph of the Natural Gas Market Directive (2003/55/EC) and Article 5 of the Directive 2004/67/EC concerning measures to safeguard security of natural gas supply. The reporting comprises regulation matters, competition matters and matters related to security of supply.

The report also includes a presentation of the Swedish Competition Authority assignment to report on certain competitive issues on the electricity market in accordance with Article 23.8, second paragraph of the Electricity Market Directive. This presentation is in section 2.2.3 of the report.

The report follows the structure for the national report drawn up in cooperation with other European regulatory authorities and the EU Commission. The purpose of the reporting structure is to specify the information that shall be included in the reporting by the member states in accordance with the Electricity and Natural Gas Market Directives.

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# 1 Summary

## 1.1 Basic organisational structure and competences of the regulatory agency

The Energy Markets Inspectorate was established as an autonomous authority on 1 January 2008. In the past, the Inspectorate was a partially independent part of the Swedish Energy Agency. The purpose of separating the Inspectorate from the Swedish Energy Agency was to clarify the roles of the supervisory authority and promotion authority for conversion of the energy system respectively.

The head of the Energy Markets Inspectorate, the Director General, is appointed by the Government. The Government has decided that there shall be an Insight Board at the Inspectorate. The Board shall exercise insight into the operations and give advice to the Director General. The Director General is the Chairman of the Insight Board and keeps the Board informed of the activities of the Inspectorate.

The orientation of the Inspectorate operations is guided by the Government by means of instructions to the Inspectorate.<sup>1</sup> Guidelines for the running work is regulated in the annual appropriation directions. The Inspectorate shall issue an annual report on the operations of the Inspectorate, which shall be submitted to the Government.

The Inspectorate has collective responsibility for the performance of the electricity, natural gas and district heating markets. The work of the Inspectorate is pursued in four general areas:

- Customer matters
- Competition matters
- Efficient utilization of resources by the energy networks
- Long-term dependability of electricity, natural gas and district heating supplies

The Inspectorate exercises supervision, draws up rules and appraises permits in accordance with the Electricity Act, Natural Gas Act and the Act on Certain Pipelines.<sup>2</sup> The new District Heating Act came into force on 1 July 2008, in which the Inspectorate also has supervisory tasks. The Inspectorate is also responsible for monitoring and analyzing developments on the electricity, gas and district

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<sup>1</sup> Ordinance (1007:1118) with instructions for the Energy Market Inspectorate

<sup>2</sup> Electricity Act (1997:857), Natural Gas Act (2005:403 and Act (1978:160) on Certain Pipelines

heating markets. If necessary, the Inspectorate shall propose amendments to the regulations and other measures, so that the performance and efficiency of these markets will be improved.

The supervisory tasks include the Inspectorate granting permits known as concessions for new construction and use of electricity networks and natural gas pipelines, and to examine the tariffs of the network companies, so that the companies will not impose unreasonable charges. The Inspectorate also exercises supervision of the quality of supply, meter reading and supplier switching. The Inspectorate also assesses matters in the event of disputes concerning electricity connection charges.

The Inspectorate can issue injunctions for exercising its tasks of supervisory authority. A directive may be subject to penalties. Appeals against decisions taken by the Inspectorate can be lodged with the administrative courts.

The electricity, gas and district heating markets are supervised by monitoring the development on the respective markets, analyzing the performance and efficiency of the markets, and suggesting improvement measures.

There are a number of regulatory authorities that supervise different parts of the electricity and gas markets. Apart from the Energy Markets Inspectorate, there are the Swedish Competition Authority (Konkurrensverket), Svenska Kraftnät (the Swedish Transmission System Operator), the Swedish Consumer Agency (Konsumentverket) and the Swedish Electrical Safety Board (Elsäkerhetsverket). The Swedish Competition Authority is the authority that monitors the compliance of companies with competition legislation, which includes companies in the electricity and gas markets. Svenska Kraftnät is the authority responsibly to ensure that the balance is maintained between production and consumption of electricity, along with the input and withdrawal of natural gas in the national natural gas system. The Swedish Consumer Agency is the authority entrusted with preserving the interests of consumers. The Swedish Electrical Safety Board supervises the safety of electrical installations and strives to prevent personal injury and damage to property by electricity. According to the natural gas act the Energy Markets Inspectorate is responsible for supervision the security of supply for the customers in the natural gas market during a disturbance in the natural gas supply. In addition, the Swedish Financial Supervisory Authority (Finansinspektionen) supervises the Swedish members of the Nord Pool power exchange financial market. Nord Pool is located in Norway and is under supervision of the Norwegian Kredittilsynet (Financial Supervisory Authority of Norway).

## **1.2 Main developments in the electricity and gas markets**

### **1.2.1 Electricity market**

#### *Wholesale market*

The Nordic countries had a common price for 28 percent of the time during 2007. During the remainder of the time, the prices differed due to limitations in the transmission capacity between the Nord Pool electricity spot areas. The corresponding figure in 2006 was 33 percent.

Trade on the Nord Pool spot market amounted to 292 TWh during 2007, which is a 16 percent increase on 2006. Physical trade thereby corresponded to 69 percent of the electricity consumption in the Nordic countries. This figure in 2006 was 61 percent. Trade on the Nord Pool financial market also increased in 2007 – 1060 TWh compared with 766 TWh the year before, representing an increase of 38 percent. The total volume of traded and cleared emission rights and credits (EUAs and CERs) increased by 60 percent compared to the year before.

The three largest electricity generators in Sweden – Vattenfall, E.ON and Fortum – accounted for 85 percent of the electricity generation in Sweden in 2007. The corresponding figure in 2006 was 87 percent. There are three electricity-generating companies with at least 5 percent of the total installed power generation capacity in Sweden.

Electricity generation in Sweden in 2007 amounted to 145 TWh – an increase of 3 percent compared the year before. The increase was attributed mainly to favourable weather for hydropower generation, which increased by 7 percent compared to 2006. Electricity consumption in 2007 amounted to 146.3 TWh, which was on a par with the consumption in 2006.

#### *Retail market*

The market opening on the Swedish electricity market has been 100 percent since 1996.

Around 10 percent of all electricity customers in Sweden changed their electricity supplier in 2007. The number of supplier changes increased by 24 percent in 2007 compared to 2006.<sup>3</sup>

Variable electricity price agreements are becoming more common on the electricity market. In January 2008, 16 percent of the customers had a variable electricity price, compared to 10.2 percent in January 2007. The proportion of

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<sup>3</sup> Statistics are gathered for two categories of electricity customers: Household customers and Other customers (excluding households).

customers with so-called open-ended contracts (default price if the customer has not yet been active on the market) is decreasing and amounted to 38 percent in January 2008, compared to 45 percent in 2007.

The prices of electricity increased to all household customers during the second half of 2007, compared to the first six months. The electricity prices to larger customers also increased, except to customers with the lowest electricity consumption, to whom the prices remained unchanged.

Electricity network tariffs remained relatively stable between 2006 and 2007. Most customers enjoyed a marginal real reduction in electricity network tariffs.

The number of electricity suppliers that sell electricity to domestic customers amounted to 125 in 2007.<sup>4</sup> In 1996, there were around 220 electricity suppliers. The reduction is due principally to take-overs and mergers, whereby many municipalities decided to sell their electricity suppliers or otherwise link these mainly to the large energy groups Vattenfall, E.ON and Fortum. A new entry took place on the retail market in 2007, when the German supplier Yello Strom established itself in Sweden.

The three largest electricity generators in Sweden - Vattenfall, E.ON and Fortum - are also the largest suppliers on the Swedish retail market. Vattenfall has around 30 percent of the retail market, E.ON has about 12 percent, and Fortum roughly 8 percent.<sup>5</sup>

From 1 January 2007, electricity suppliers are legally required to report their prices and agreement terms for electricity to the Energy Markets Inspectorate. This information is published on the Inspectorate website ([www.elpriskollen.se](http://www.elpriskollen.se)), with the aim of helping consumers to compare electricity prices.

#### *Transmission capacity*

At the end of 2007, the Swedish Transmission System Operator (TSO), Svenska Kraftnät, decided to build the South West Link, which represents a strengthening of the transmission capacity between southern and northern Sweden and between Sweden and southern Norway. The link on the Norwegian side is financed by the Norwegian TSO, Statnett. The project is positive from the competition perspective, since the link eliminates, to some extent, the bottleneck between the West Coast of Sweden and southern Norway. The project is part of the agreement between the Nordic TSOs to invest in the expansion of the transmission capacity in the Nordic countries.

The existing transmission link between Sweden and Finland – Fenno-Skan – is supplemented with a new DC cable in parallel with the existing cable and is

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<sup>4</sup> The figure is based on the number of electricity suppliers that are obliged to report their prices and agreement terms to the Energy Markets Inspectorate.

<sup>5</sup> The figures are based on volume sold to own end customers during 2006.

scheduled for completion at the end of 2011. The new cable will increase the transmission capacity between the countries by 40 percent to a maximum of 800 MW.

### *Regulation/unbundling*

The Energy Market Inspectorate was assigned by the Government the task of investigating the effects of unbundling of supply and generation of electricity. The analysis was intended to give answers to questions such as the structural effects of increased separation, effects on the competitiveness of individual companies, and effects on the competition on the Swedish, Nordic and European electricity markets. The Inspectorate made the collective assessment that the positive effects of vertical integration outweighed the negative effects. The Inspectorate considers that no form of legal requirement on separation between electricity generation and electricity trading should be introduced in the present situation. However, if the matter is to be investigated further, this should be done at a Nordic or European level.

The Inspectorate considers that legal requirements on ownership separation create better conditions for more equal competition between electricity suppliers. However, the positive effects that more equal competition between electricity suppliers would yield must be weighed against the negative effects of legal requirement on ownership separation. The principal reasons for not suggesting national regulation is that such a requirement would basically make it impossible to pursue intra-group trade, which would cause increased transaction costs, poorer opportunities for good long-term risk management, and also that it would make it more difficult for vertically integrated groups to establish themselves in Sweden, and would make it more difficult for Swedish companies to establish themselves in the remainder of the EU, where no such requirements are made. The Inspectorate also considers that a Swedish introduction of legal requirements on ownership separation would probably be in conflict with the provisions of the EC legislation on the freedom of movement of goods and services, and on freedom of establishment.

### *Security of supply*

The electricity generation capacity in the Swedish power stations was increased by 443 MW in 2007. At the same time, the loss of capacity amounted to 186 MW, and the net increase therefore amounted to 257 MW. The highest increase took place in wind power, where 208 MW were added in 2007.

The additional electricity generation capacity from projects that are currently in the course of construction and that will be commissioned in 2008 – 2010 amounts to more than 1100 MW.<sup>6</sup> These plants together are estimated to generate around 5700 GWh annually. Out of the total, about 420 MW consists of wind power, 700 MW consists of CHP generation, and hydropower accounts for only 14 MW.

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<sup>6</sup> According to statistical information from EME Analys. It cannot be guaranteed that the statistical information contains the exact number of projects in the course of construction.

The storm “Per” occurred during 2007 and caused power cuts to an estimated 440 000 electricity users for up to ten days. However, the crisis management after the storm was much quicker than after the storm “Gudrun” that occurred two years earlier. After the Gudrun storm, new rules were introduced in the Electricity Act on power cut compensation to electricity customers who were without electricity for longer than 12 hours. In 2011, a functional requirement will be coming into force in the Electricity Act, which states that a power cut must not last more than 24 hours. At the time of the Per storm, around 50 percent of the part of the electricity network to which it was considered important to give attention were either buried or insulated.

#### *Assessments by the Inspectorate*

The Inspectorate considers that the present ex-post regulation of the electricity network tariffs is not sufficiently effective, and the Inspectorate is therefore positively disposed to the coming ordinance with advance appraisal of the reasonableness of the tariffs, known as ex-ante regulation.

The review by the Inspectorate of the 2003 tariffs results in 5 percent of the electricity network companies having to repay a total of SEK 212 million to customers. In many cases, electricity network customers must wait a long time for repayment of the tariffs, due to the fact that it now takes a long time for the administrative courts to decide in network tariff cases. The Inspectorate therefore considers that it is important to change the present process.

The Inspectorate agrees with the EU Commission assessment that it is necessary to harmonize the various rules of the member states concerning matters such as competition and market integration in the third legislative package for energy. The Inspectorate is generally positive towards the proposed rules on ownership separation between transmission and generation/trading as an element in safeguarding effective competition.

### **1.2.2 Natural gas market**

#### *Supply*

Sweden has no natural gas production of its own. All natural gas consumed in Sweden is imported through the pipeline running between Denmark and Sweden.

A number of plans for further supply routes in the Swedish natural gas system has been presented in recent years. Fortum, in cooperation with AGA and Nynas Refining, is planning to build a Liquefied Natural Gas (LNG) terminal. According to the plans, the LNG terminal will be located just north of the Nynas Refinery in Nynäshamn. The intention of the project is to have the plant in operation in 2010. There are no plans for connecting the plant to the existing natural gas network. On 26 May 2008, the Environmental Court approved the application for the construction of the LNG terminal.

The Skanled project for industrial cooperation between Sweden, Norway and Denmark is planning to build a natural gas pipeline from Norway to Sweden and Denmark. The pipeline will be laid on the seabed, and the existing Swedish national gas network is scheduled for connection to the new pipeline through three branch pipelines on the West Coast. The application for permission for the Swedish part of the pipeline was received by the Inspectorate in January 2008 and is currently in the course of preparation.

#### *Retail market*

The Swedish natural gas market has been 100 percent open since 2007. There are around 55 000 natural gas users in Sweden, of whom around 2600 are business users and the remainder are domestic customers.

In 2007, there were seven natural gas companies in Sweden, of which six sold gas to household customers.

The prices to end customers dropped somewhat to all customer categories between 2006 and 2007. However, comparing the 2007 prices with the prices four years ago, the picture is different. From 2004 to 2007, the prices of natural gas increased by between 20 and 50 percent. The natural gas price is also linked to the price of oil, and the increased world market price of oil has therefore also contributed to natural gas price increases. Increased taxation of fossil fuels has also contributed to the prices to end customers gradually increasing.

#### *Reliability of supply*

The Swedish and Danish natural gas systems suffered a serious disruption for one day on 8 – 9 November 2007. The disruption was due to a serious storm in the Nord Sea, which caused high waves that imperilled the safety of the natural gas platforms. For safety reasons, production was therefore stopped entirely or partially for one day. The supply to the Danish natural gas network was therefore cut off for the same period of time. The Danish TSO, Energinet.dk, declared an emergency supply situation, when special rules come into force for the Danish natural gas system. This was the first time that a critical stoppage occurred in the supply from the North Sea to the Danish and Swedish natural gas systems. For Sweden, the emergency supply situation meant that the supply of gas by the suppliers to the Swedish system was substantially restricted as a consequence of the Danish TSO having substantially restricted delivery by the commercial players to the Danish storage facilities. The Swedish players therefore adopted measures for reducing the consumption, above all in plants that could be operated with other fuels. The production stoppage was carried out with a lead time of a few hours, and both the Danish and Swedish systems could thus be prepared for the shortage situation.

#### *Assessments by the Inspectorate*

The market opening carried out on 1 July 2007 has improved the conditions for an efficient natural gas market in Sweden. However, the Energy Markets

Inspectorate considers that competition must be improved. No new gas suppliers appeared on the market during the year, and there is still only one supply pipeline to the Swedish natural gas market. Long-term contracts that tie customers to one natural gas supplier for long periods still occur, even though a certain displacement towards shorter contracts could be discerned after the gradual market opening.

The Energy Markets Inspectorate is favourably disposed towards the EU Commission third legislative package, although the proposal for expanded unbundling means that great changes will be required to the present performance on the Swedish natural gas market.

### **1.3 Major issues dealt with by the regulator**

The Energy Markets Inspectorate operation plan for 2008 gives a number of priority areas. A general objective is that supervision by the Inspectorate shall be well planned, predictable and characterized by openness.

During the year, the Inspectorate shall also prepare for a coming ex-ante regulation of the electricity network tariffs. The Inspectorate has participated in a government investigation into a new regulation model for network tariffs. The task of the investigation was to submit proposals for changes to the legislation and other regulations that are necessary for introducing a new order, in which the Inspectorate decides or approves the methods of the electricity network companies for pricing the electricity network tariffs before they come into force, known as ex-ante regulation. The background to the investigation is that the present regulations have proved to be insufficient and do not allow for efficient supervision. The Inspectorate is positively disposed towards the proposal for advance assessment of the tariffs of the electricity network companies. However, an efficient ex-ante regulation of the tariff is dependent on the fact that it is quicker than now to produce a valid practice by legislative court decisions. The Inspectorate therefore supports the proposal of the investigation to improve the efficiency of the court process, with the aim of significantly shortening of the processing times in the courts. The Inspectorate also wants clearer regulations than the present framework legislation in the Electricity Act. A clear law facilitates the work of the courts, and the processing times are shortened.

Another priority is to achieve a long-term solution to the peak load reserve that is now regulated by an interim law that will remain in force up to 2011. A proposal for a solution will be presented to the Government no later than December 2008.

During 2008, the Inspectorate will decide on a method of supervision of the quality of supply in the electricity network. Monitoring of the quality of supply will also be started during the year in accordance with the method developed. In addition, an annual report on delivery quality will be drawn up once a year, starting at the end of 2008.

The last step in the liberalisation of the natural gas market was taken on 1 July 2007, whereby all natural gas customers can choose their natural gas supplier. The Inspectorate will make an analysis of the natural gas market in order to study how the market opening has affected the players on the natural gas market. The analysis is expected to be completed in the autumn of 2008.

A method for supervising the transmission tariffs for natural gas is now being prepared by the Inspectorate and is expected to be completed in November 2008, when monitoring of the natural gas tariffs will also start.

An effort to expand the information to electricity and natural gas customers is another priority area, principally by work on the Inspectorate website.

The Inspectorate is actively working in the NordREG cooperation on harmonizing the regulation of the retail market in the Nordic countries, with the aim of eventually creating a common Nordic retail market for electricity. As an element in this, NordREG is working on a number of questions aimed at creating harmonized rules for balance settlement and other rules that the balance providers in each Nordic country shall follow.

## 2 Electricity market

### 2.1 Regulatory issues

#### 2.1.1 General matters

The Swedish retail market has been 100 percent open since 1996. In practice, the market was opened in 1999, when the requirements for hourly metering of customers with electricity network subscriptions below 63 ampere was abandoned, and profile calculation was introduced instead for these customers. According to the Electricity Act, hourly metering is required for plants with a subscribed rating in excess of 63 amperes.

#### 2.1.2 Transmission constraints and mechanisms for handling them

The need to transmit electricity within Sweden and within the Nordic countries is traditionally mainly affected by variations in access to hydro power and seasonal variations in consumption. In recent years, the flows have increasingly become controlled by price differences – mainly between hydro and thermal power-dominated areas.

The Swedish national grid is not designed to be able to meet the need for power transmission at all times, and transmission capacity congestion may therefore occur. Transmission constraints in the Swedish national grid normally occurs at high hydro power generation rates in the north, which leads to a high demand for transiting southwards<sup>7</sup> (to Denmark, Poland and Germany) or at high transiting northwards from Denmark and the Continent to the Swedish West Coast and onwards to southern Norway.<sup>8</sup>

Through collaboration within Nordel, the Nordic TSOs have agreed on common principles for transmission capacity calculation within the Nordic market.<sup>9</sup> Transmission limitations between the Nord Pool electricity spot areas are handled principally by market splitting. This means that transmission limitations are solved by price signals, whereby the price in a shortfall area will be higher than the price in a surplus area. The Nordic market is currently divided into eight

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<sup>7</sup> Through the constraints that limit in a direction from north to south. Constraint 1 between Lule River and Skellefte River, constraint 2 north of Dal River and constraint 4 south of the nuclear power plants in Ringhals and Oskarshamn.

<sup>8</sup> Through the constraint that limits in a direction from south to north, known as the West Coast Constraint in the Gothenburg region.

<sup>9</sup> System Operation Agreement and “Principle for determining the transfer capacity in the Nordic power market”.

electricity spot areas.<sup>10</sup> Sweden is one electricity spot area. An electricity spot area may form its own price area or may form a joint price area together with one or more electricity spot areas. In such a situation, the system price expresses the uniform Nordic price that would have applied if there had been no transmission limitations. The system price also serves as a reference price for the financial market and for bilateral contracts. In view of Sweden's central geographical location within the Nordic countries, the country forms a joint price area with at least one other electricity spot area at virtually all times. During 2007, the entire Nordic market had the same price for 28 percent of the time.

Two different methods are used for dealing with transmission limitations in Sweden – countertrade and reduction of trading capacities. In order to optimize the utilization of the national grid, Svenska Kraftnät guarantees capacity according to the prevailing operating situation, i.e. Svenska Kraftnät sets certain limitations for the guaranteed transmission capacity to adjoining electricity spot areas that can be provided to the market. Countertrade is used if conditions should change between trading in the spot market and operating hour, since Svenska Kraftnät does not change the predetermined trading capacities. Countertrade means that system operators order upward regulation of generation in the shortfall area and/or downward regulation of generation in the surplus area. The countertrade costs are borne by the system operator and give signals for whether the network needs to be strengthened.

The available trading capacity, i.e. the capacity placed at the disposal of the spot market for trading between the Nordic countries, is determined bilaterally by the system operators of the countries the day before the operating hour. The basis for determining the available trading capacity is that the criteria for safe system operation are followed. These criteria are included in the Nordic system operation agreement.

The system operator in each country assesses how much capacity may be available for trading. On the basis of this assessment, the system operators decide the available capacities between the electricity spot areas. On the Nordic electricity market, all allocation of trading capacity takes place in conjunction with trading on the Nord Pool Spot, known as implicit auction.<sup>11</sup> Unutilized capacity in the spot market can be utilized for trading at a later stage via Elbas or on the so-called regulating power market.<sup>12</sup>

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<sup>10</sup> Norway consists of three areas (north, central and south), Denmark consists of two, and Sweden and Finland of one each. There is also the German Kontek area.

<sup>11</sup> That trade is implicit means that trading in electricity and transmission capacity takes place in an integrated process. An alternative to this are explicit auctions on which electricity and capacity are traded separately

<sup>12</sup> Elbas is a short-term market that opens when the spot market has closed and that stays open up to one hour before the operating hour. The regulating power market is Nordic and is administered by the Nordic system operators. On the Nordic regulating power market, supply and delivery are adjusted during the operating hour by bids for upward and downward regulation.

Table 1 show the proportion of the hours in 2007 when certain price areas in the Nordic countries had a common price. In 2007, the whole of the Nordic area had a common price during 28 percent of the total number of hours of the year.

**Table 1: Proportion of the total number of hours of the year when the price was the same in 2007 on the Nordic electricity market**

Percentage of hours	Areas with a common price
95 %	SE and FI
65 %	SE, FI, NO1, NO2, DK East
38 %	SE, FI, NO1, NO2, NO3, DK East
28 %	SE, FI, NO1, NO2, NO3, DK East, DK West

Source: Nordel

Note: NO1=South Norway, NO2=Central Norway, NO3=North Norway

### 2.1.3 Regulation of transmission and distribution companies

The Swedish electricity network consists of three levels: National grid, regional network and local network.

- *The national grid* consists of 220 kV and 400 kV transmission lines.
- *The regional networks* are connected to the national grid and are at a lower voltage, usually 40-130 kV. The regional networks carry electricity from the national grid to the local networks and, in certain cases, directly to major electricity consumers.
- *The local networks* are connected to the regional networks and supply electricity to households and most industrial plants. From the local networks, at up to 20 kV, power is transformed within the distribution areas to the normal domestic voltage of 400/230 volt.

The Swedish electricity network consists of 528 000 km of conductors, of which 268 000 km are underground cables and 260 000 km are overhead lines.

The national grid is owned by the State through the Svenska Kraftnät public utility, which is also the transmission system operator (TSO) in Sweden. Svenska Kraftnät handles the operative running of the national grid and is responsible for the short-term balance in the electricity network. Five companies pursue regional operations, and 171 companies pursue local network operations.

The electricity network companies must apply to the Energy Markets Inspectorate for permission to build and use electricity networks, known as a network concession. A network concession can be granted for an area and for a line. It is the Inspectorate that appraises and grants permission (concession) for local, regional and grid networks. A network concession for the national grid is always

prepared by the Inspectorate, although the concession is decided in certain cases by the Government. A network concession is valid only for a certain period of time, and the electricity network companies must apply to the Inspectorate for renewal of the concession. The network company must then demonstrate that it runs the electricity network in an acceptable manner. Network concessions are aimed at safeguarding rational expansion of the electricity networks and ensuring that they have limited impact on health, the environment and nature.

According to the Electricity Act, the electricity network companies are obliged to connect to their networks anyone who wishes to be connected. The cost of this is payable by the customer, and the charge for a new connection shall nominally correspond to the cost that the network company has incurred for the new connection. The charge varies with factors such as fuse rating, whether the customer lives out in the country or in a built-up area, and the distance between the customer's dwelling and the network of the electricity network company. The customer may apply to the Inspectorate for determining whether the connection charge is reasonable. The electricity network companies determine their own connection charges and the appraisal can take place only after the connection has been made. An appeal can be lodged with the Administrative Court against the Inspectorate decision.

#### **2.1.4 Supervision of the distribution network tariffs**

The Electricity Act (1997:857) specifies that the revenues from the network operations shall be reasonable in relation to the performance of the network company and the objective conditions for the company to pursue network operations. The objective conditions are those that the company cannot influence, such as the number of customers, the geographical locations of the connection points, the amount of energy transmitted, the climate, and the costs payable to the supplying network. The network tariff shall also be objective and non-discriminating.

Pursuant to the Electricity Act, it is the electricity network companies themselves that determine the tariffs according to the general guidelines in the Act.<sup>13</sup> The tariffs of the network companies or the methods of setting the tariffs are thus not approved in advance by the Inspectorate, and conformance of the tariffs to the provisions of the Electricity Act is examined in arrears. The question has been raised as to whether this procedure agrees with Article 23.2a of the Electricity Market Directive as regards the terms for the distribution and transmission charges. The Government has therefore set up a special investigation in June 2006 into the possibility of changing over to advance assessment of network tariffs. This Energy Network Investigation submitted its report in December 2007.

According to the present regulation ordinance, the Inspectorate carries out ex post regulation of the distribution network tariffs. The supervision method consists of

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<sup>13</sup> The network tariff consists of the charges and other terms for the transmission of electricity and for connection to a conductor or conductor network (Chapter 1, Section 5 of the Electricity Act).

the Network Performance Assessment Model, supporting economic analyses in the form of calculation of the capital cost reference, cost/revenue analysis and analysis of the cost effectiveness, and technical review of the imaginary reference network.

The Network Performance Assessment Model is a reference network model, which means that the model for the respective network company designs an imaginary reference network based on coordinates for the supply, delivery and boundary points in the company's actual network. The model determines the annual regulated revenue (revenue ceiling) that consists of a cost component calculated on the basis of a real annuity<sup>14</sup> of the annual new acquisition value of the imaginary network, and a variable cost component consisting of, for example, the operation and maintenance costs and the administrative costs. The operating costs are calculated on the basis of standard costs of cost setters, such as delivery point and capital value of the imaginary network components. The costs payable to the supplying network are obtained from the reporting of the respective network company, since these costs are not considered to be controllable by the individual company and are therefore accepted in their entirety.

The regulated revenues determined for the respective network company are set in relation to the actual revenues of the company. If the actual revenue exceeds the regulated revenue, the Inspectorate decides whether the network company is to adjust its tariff for the current supervision year.

#### *Acquisition of technical and economic data for tariff supervision*

Data collected per calendar year from each network company for the Network Performance Assessment Model calculation of the regulated revenue consists of technical and economic information from the company's supply, delivery and boundary points and for the total network operations. This data is collected on the basis of a regulation produced by the Inspectorate.<sup>15</sup> The quality of the reported data is examined by the Inspectorate before it is used in tariff supervision.

Technical data contains, for example, coordinates, transmitted and supplied energy, subscribed power and voltage levels for the supply, delivery and boundary points. In addition, data is collected on the transmission quality of the network companies in the form of interruption frequency and average interruption time, divided onto notified and unnotified interruptions, and interruption frequency and average interruption time for notified and unnotified interruptions in the supply network and the generation plants.

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<sup>14</sup> Real annuity =  $g/1-(1+g)^{-A}$  where  $g$  = annual cost of capital determined by a WACC model.  $A$  = depreciation period

<sup>15</sup> Regulations and general advice concerning submission of certain information for appraising the reasonableness of the network tariffs (STEMFS 2003:3 revised through STEMFS 2005:2)

The economic data includes data on revenue and expenditure from transmission and also reimbursement to generation plant owners. On inspection, the economic data is periodized to revenues and costs that are obtained from financial annual reports. In an annual report, each electricity network company shall annually report on its operations to the Energy Markets Inspectorate. The annual report shall be drawn up in accordance with NUFTS 1995:1<sup>16</sup>.

The annual report data is also used for the supporting economic analyses. Annual reports contain comprehensive profit and loss accounts and balance sheets. The annual report shall be submitted by each network company to the Energy Markets Inspectorate no later than seven months after the end of the financial year. The annual reports shall be checked by the auditors of the corresponding network companies, with the aim of ensuring that the separate accounting has been correctly done and checked by the Energy Markets Inspectorate before it is used for network tariff supervision.

#### *Use of collected data*

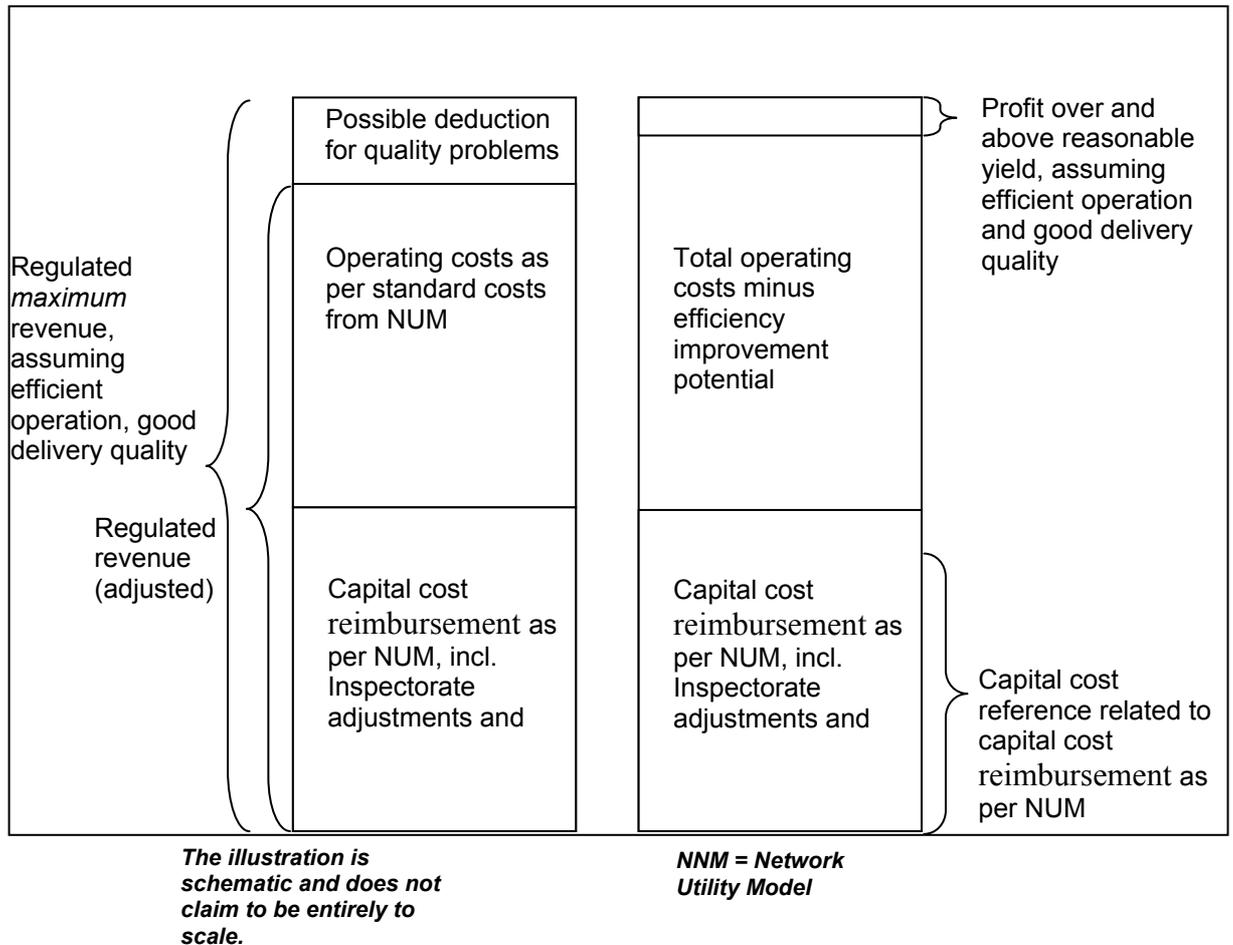
Technical data is collected to enable the Network Performance Assessment Model to design and size an imaginary reference network for each network company. The imaginary network serves as a basis for calculating the regulated revenue. The calculated regulated revenue is validated on the basis of the supporting technical and economic analyses and is adjusted if necessary. Technical validation involves carrying out a technical comparison of the imaginary network with the actual network in order to determine whether the Network Performance Assessment Model takes into account company-specific considerations, such as objective requirements on construction engineering and network sizing.

Economic validation involves checking the ability of the network company to pursue its network operations with a reasonable yield within the framework of the regulated revenue. This means that the capital cost of the Network Performance Assessment Model is validated by relating it to a capital cost reference based on the book values of the network company's material plant assets for electricity distribution, and a cost/revenue analysis in which the regulated revenue of the respective network company is set in relation to the company's capital cost in accordance with the Network Performance Assessment Model, provided that the company has good transmission quality, and to the company's actual operating costs, provided that the company has efficient operating costs.

Figure 1 shows schematically the procedure in the validation of the regulated revenue.

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<sup>16</sup> "National Swedish Board for Industrial and Technical Development regulations and general advice (1995:1) on reporting of network operations" revised by NUFTS 1998:1.



**Figure 1: Schematic illustration of the procedure for validation of the regulated revenue**

### *Benchmarking*

Benchmarking in the Network Performance Assessment Model is based on comparison between the actual network company and the imaginary network company based on the reference network. The regulated revenue assigned to the actual company is based on capital cost return, including reasonable yield and operating cost calculated for its imaginary competing company. If the revenues of the actual company exceed the regulated revenue, the Inspectorate takes the decision that the network company shall adjust its tariffs by an amount corresponding to the surplus part of the revenues. On the other hand, the network company can make a profit in excess of the reasonable return by pursuing its operations more efficiently than the imaginary competitor. This means that the actual company has a strong incentive to improve the efficiency of its electricity network and operating costs.

In the supporting economic analysis, known as the cost/revenue analysis, the effective operating costs of the actual network company are set in relation to the

regulated revenue, after deduction for the capital cost of the Network Performance Assessment Model. The effective operating costs have been calculated by multiplying the actual operating costs of the network company by an efficiency improvement potential. The efficiency improvement potential of the respective network company has been calculated by means of a DEA model. The applied model carries out an estimate of the relative efficiency of the network companies based on the relationship between the operating costs that are controllable in the short-term, and production. Cost and production data are obtained from the annual reports of the network companies.

### *Quality control*

In calculating the annual regulated revenues, the Network Performance Assessment Model takes into account the transmission quality that the electricity network company has had in its network during the supervision year. Based on the interruption statistics acquired by the Energy Markets Inspectorate, the System Average Interruption Duration Index (SAIDI) and the System Average Interruption Frequency Index (SAIFI) are calculated. These two indexes serve as a basis for the valuation of the costs that the interruptions in the network of the network company have caused its customers. The valuation of the interruptions is based on a study of the willingness of customers to pay in order to avoid interruptions, where both notified and unnotified interruptions are included. The cost of the interruption is set in relation to the expected interruption cost to the customers, which is individual to the network company and is based on the willingness of customers to pay in order to avoid interruptions. The study of the willingness of electricity customers to pay was carried out by Swedenergy in 1994 and was updated in 2003.

Table 2 shows the electricity interruptions in the local networks between 2000 and 2006.<sup>17</sup> The figures show average values per customer, and are classified into notified and unnotified interruptions.

**Table 2: Electricity interruptions in the local networks, average values per customer**

	2000	2001	2002	2003	2004	2005	2006
<b>Average number of interruptions per customer</b>							
Notified interruptions	0.26	0.24	0.26	0.21	0.22	0.20	0.25
Unnotified interruptions	0.93	1.13	0.92	0.93	0.75	0.96	1.05
<b>Average interruption time per customer, min</b>							
Notified interruptions	37	34	37	25	30	21	22
Unnotified interruptions	81	143	86	98	51	309	88

Source: Energy Markets Inspectorate

<sup>17</sup> Latest available statistics

The reference network that the Network Performance Assessment Model builds is determined for a radial network based on the coordinates for the supply, delivery and boundary points, and also a redundancy. The magnitude of the redundancy is determined by the willingness of customers to pay for avoiding interruptions. If the cost incurred by customers for interruptions is higher than the expected cost, the difference corresponds to a deduction made to the regulated revenue of the network company. However, the deduction is limited by the fact that it is not allowed to exceed the capital cost of the redundancy, i.e. the network companies are always guaranteed to receive a capital cost reimbursement corresponding to the radial network.

#### *Investment incentive*

The capital cost reimbursement in the Network Performance Assessment Model is based on a capacity-preserving perspective based on an imaginary reference network, and the model thus does not give direct investment incentives. However, since the model is based on an imaginary reference network, it provides the incentive to build and operate efficient and rational networks. The capacity-preserving perspective of the model means that it gives capital reimbursement that provides scope for making annual investments for maintaining the technical standard and scope of the network, and that the network companies receive capital reimbursement regardless of the age of the individual plant components as reflected through the reference network. Since the actual age of the individual plant components does not affect the capital cost reimbursement, the network companies have no incentive to replace these with new components before it is no longer profitable to operate them. However, due to its design, the Network Performance Assessment Model provides reimbursement for the operating and maintenance costs that are matched to a relatively newly purchased network, and that the model contains a quality deduction from the regulated revenue if the transmission quality drops below the quality expected by the customers. This means that the model limits the scope available to the network companies for operating old plants in a profitable manner. The model thus provides investment incentive by limiting the time that the network companies can operate older plant assets profitably. However, the point in time at which the incentive comes into force is individual to each network company.

#### **2.1.5 Supervision of tariffs in the transmission network**

The national grid consists of around 15 000 kilometres of conductors at voltages of 200 kV and 400 kV. In its capacity of system operator, Svenska Kraftnät is responsible for setting the transmission tariff in accordance with the guidelines in the Electricity Act. The tariff method should be designed so that the tariffs are objective and non-discriminating, and that the electricity generators pay a smaller proportion of the total network revenues than the consumers. The network tariffs shall be set so that the collective revenue of Svenska Kraftnät for the network operations is reasonable in relation to the objective and subjective conditions in running the network operations. The transmission performance of Svenska

Kraftnät shall be assessed totally for all conductors in the country. However, the tariff must be drawn up with due consideration to the location of the connection point.

The Energy Markets Inspectorate obtains annually economic and technical data from Svenska Kraftnät in the form of an annual report.<sup>18</sup> The annual report shall contain a comprehensive account of the network operations, with profit and loss account and balance sheet. The annual report shall be submitted to the Inspectorate no later than seven months after the end of the financial year. The report shall have been examined by the auditor of the network company with the aim of ensuring that the separate accounting has been correctly carried out. In addition, when the report is handed in, the Inspectorate carries out a quality examination of the separate accounting in the report.

The Inspectorate does not have a finalized method for reasonableness examination of the national grid tariffs. However, the aim of the Inspectorate is to finalize a supervision method no later than 2009. However, the Swedish Government decides on annual yield requirements on the operations of Svenska Kraftnät.

#### *Handling of bottleneck revenues*

In accordance with Directive 1228/03, Svenska Kraftnät together with other Nordic national grid operators within Nordel decided to use revenues from bottleneck handling for investments aimed at strengthening the national grids and the links between the countries. However, as a result of the budget legislation in force, Svenska Kraftnät, being a State public utility, is unable to allocate financial resources between years for investments. The Inspectorate does not consider that the handling of bottleneck revenues is sufficiently transparent, and has therefore initiated work in 2008 together with Svenska Kraftnät with the aim of clarifying the structure in the handling of bottleneck revenues.

#### **2.1.6 Level of current network tariffs**

Table 3 shows the average network tariff for three typical customers (according to the Eurostat classification) as per 1 January 2008. The network tariff includes the cost of transmission on the grid. The tariff also included official charges that amount to EUR 5.73 annually for low-voltage subscribers (Dc and lb) and EUR 379.58 annually for high voltage subscribers (lg). For every electricity subscriber, the State levies annually three different charges, known as official charges, from the electricity network companies. The charges are used for financing the State operations for electrical safety, electrical preparedness and activities for supervising the network monopoly.

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<sup>18</sup> This is done on the basis of the "National Swedish Board for Industrial and Technical Development regulations and general advice (1995:1) on reporting of network operations" revised by NUFTS 1998:1.

**Table 3: Network tariffs, average for January – December 2008**

	Number of electricity network companies	Network tariff, EUR/MWh		
		Ig <sup>1</sup>	Ib <sup>2</sup>	Dc <sup>3</sup>
Transmission	1	-	-	-
Distribution	174	7.64	28.54	48.81

Source: Statistics Sweden

<sup>1</sup> Industrial customer with an annual consumption of 24 GWh and maximum power demand of 4000 kW.

<sup>2</sup> Industrial customer with an annual consumption of 50 MWh and maximum power demand of 50 kW.

<sup>3</sup> Domestic customer with an annual consumption of 3500 kWh.

Note: EUR 1 = SEK 9.4235 on 1 January 2008

The Inspectorate collects statistics on network tariffs every year. Statistics are collected for around twenty typical customer groups in order to simplify the comparison of the network tariffs charged by different electricity network companies. The Inspectorate compiles every year the collected network tariffs from the electricity network companies. In this year's compilation of the network tariffs for 2007, it was found that the real network tariffs for most of the typical customers have dropped during 2007. This is largely due to the fact that almost half of the electricity network companies have not raised their tariffs since 1 January 2007, while the consumer price index has risen by 3.2 percent. However, more than half of the electricity network companies have raised their electricity network tariffs during 2007. The electricity network companies that have raised their network tariffs have been requested to give their reasons for the rise. Some of the most common explanations were: investments in remote reading systems, increased cost of network losses, general cost increases, new requirements on increased reliability of supply, and increased investments in the network. The Inspectorate has not made any in-depth investigations into the reasons behind the rises or reductions in the network tariffs.

The network tariffs for the three most commonly used typical customers in Sweden, i.e. apartment customers (2000 kWh/year), single-family house customers (5000 kWh/year) and single-family house customers (20 000 kWh/year) are shown in Table 4.

**Table 4: Median prices, electricity network tariffs as per 1 January 2008**

	Median EUR/MWh	Full-year median for 2007, EUR	Change, % compared to 1 January 2006
Apartment customer 2 MWh/year	50.83	101.66	-1.6
Single-family house customer 5 MWh/year	43.72	218.60	-1.1
Single-family house (20A) 20 MWh/year	24.72	494.00	-0.7

Source: Energy Markets Inspectorate

Note: EUR 1 = SEK 9.4235 on 1 January 2008. The prices shown exclude VAT.

The electricity network tariffs usually consist of one fixed and one variable part. For an electrically heated single-family house (20A, 20 000 kWh/year), the fixed part represents roughly half of the network tariff. The second half of the network tariff is variable. During the past five years, the distribution of the network tariff between fixed and variable parts has not changed significantly. The customer can influence the variable part by reducing his consumption. One electricity network company has introduced only variable network tariffs for apartment customers and the smallest single-family house customers.

Customers with low consumption have few tariff alternatives. Most of the electricity network companies offer only one tariff type – the simple tariff. In the simple tariff, the customer pays the same amount for using the network regardless of the time of day when the electricity is consumed. The alternative to the simple tariff is a time tariff. The customer then pays a different tariff depending on when the electricity is used. The price is usually lower at night and higher in the day.

Increasing numbers of electricity companies have introduced something that is akin to power tariffs for domestic customers. The network tariff then consists of a smaller part at a fixed price linked to the fuse rating. The fuse rating determines the maximum possible power available. In addition, a power charge is debited and this depends on how the household utilizes the electricity network. The network tariff is differentiated within a given fuse rating, and different prices may be applied at different times of day and at different seasons of the year.

The network tariffs may vary widely between electricity network companies, e.g. the difference between the highest and the lowest network tariff for apartment customers is no less than EUR 163 over one year. This means that customers with the highest network tariff pay more than three times as much as those with the lowest network tariff. For a single-family house with electric heating (20A, 20 000 kWh), the network tariff varies between EUR 240 annually and EUR 809

annually between the lowest and highest network tariffs reported to the Energy Markets Inspectorate.

The network tariff that the electricity subscriber pays to his local electricity network company consists of costs that arise in the national grid, regional network and local network. The local network price comprises costs for the transmission of electricity, administration, operation and maintenance of the network, and also metering and reporting. In addition, it includes the costs payable to the supplying networks, i.e. the regional network and national grid.

For every electricity subscriber, the State levies an official charge every year from the electricity network companies. The charges are used for financing the State operations for electrical safety, electrical preparedness and activities for monitoring the network monopoly.

### **2.1.7 Balance regulation**

Balance regulation takes place by primary regulation and secondary regulation. Primary regulation means that fine adjustment is carried out to the physical balance in the electrical system by the generation in a number of hydropower stations being automatically increased or decreased. Secondary regulation involves manual upward or downward regulation in order to reset the primary regulation, and this takes place through the Nordic regulating power market.

The legal base for balance regulation is included in the Electricity Act.<sup>19</sup> According to the Electricity Act, electricity suppliers or other players who supply electricity to end customers must have a valid balancing responsibility agreement with the TSO. A balancing responsibility agreement means that a player accepts economic responsibility for ensuring that the amount of electricity taken from the network is balanced by an equal amount of energy supplied, since the electricity network must always be in balance. The player who accepts economic responsibility for the electricity network being in balance is known as balance provider. The electricity supplier may be the balance provider itself or may purchase this service from some other player.

Balance providers (and other players) can trade on the Electricity Spot Market when planning their balances. After the Electricity Spot Market has closed, the players are notified of the trading that will take place. At no later than 4 pm, the balance providers shall send their plans for generation, consumption and trading to Svenska Kraftnät. These plans must be in balance for every balance provider. A new calculation of the transmission capacity is then made and the Elbas intra-day market opens. On Elbas, the players can adjust their balances up to just before the operating hour. The final plans of the balance providers must be reported to Svenska Kraftnät before the operating hour begins.

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<sup>19</sup> Chapter 8 of the Electricity Act (1997:857)

Balance providers who are able to change their generation or consumption during the operating hour can submit bids to Svenska Kraftnät for upward or downward regulation. The bids are normally submitted no later than 30 minutes before the operating hour begins and they specify the prices and quantities. Regulation bids are submitted for predetermined regulation objects consisting of one or several generation objects or consumption objects of similar type that are grouped together. It shall be possible to put regulation bids into practice at short notice, i.e. within 10 minutes.

The Nordic TSOs cooperate on a common Nordic regulation power market in order to manage balance regulation as effectively as possible. The TSOs in Norway and Sweden are jointly responsible for maintaining the frequency constant in the Nordic synchronous system, whereas every TSO is responsible for safe operation in its system responsibility area. The agreement also comprises a joint Nordic regulation list in which all regulating power bids are arranged in cost order in a common list. Assuming that no transmission limitations occur, the least expensive Nordic regulation bid will thereby be given priority.

Svenska Kraftnät produces every year a standard contract for balance provider agreements. According to the Electricity Act, the contents of the balance provider agreement shall be objective and non-discriminatory. Svenska Kraftnät cannot conclude balance agreements before the methods and processes on which the balance agreement terms are based have been approved by the Energy Markets Inspectorate. If a balance provider makes a complaint concerning the balance provider agreement, the Inspectorate must decide whether the provider has been treated objectively and in a non-discriminating manner. Balance provider agreements are valid for one year from November up to and including October<sup>20</sup>. Before a standard contract for balance provider agreement is produced, Svenska Kraftnät discusses possible changes with the balance providers, and discussions are also pursued between Svenska Kraftnät and the Energy Markets Inspectorate. According to the Electricity Act, the Inspectorate shall give approval if the methods can be assumed to be objective and non-discriminating. The method decisions are valid with immediate effect. The standard contract for balance provider agreement is public and is published on the homepage of Svenska Kraftnät.

A process is currently in progress for harmonizing the terms for the balance providers in each Nordic country, with the aim of making it simple to maintain a common Nordic retail market. The Nordic system operators have decided in an agreement to harmonize, as a first stage, the rules for “gate closure” for final plans, cost base for balance settlement, methods of calculating imbalances and methods of pricing imbalances. The harmonizing process is supported by the supervisory authorities in the Nordic countries, and this first stage in the process is

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<sup>20</sup> However, it is not specified that the agreements shall be of one-year duration

expected to be implemented on 1 January 2009. The implementation of the first stage towards a harmonized balance market requires no changes to the Swedish legislation.

In their comments on the reform, the Nordic supervisory authorities have added a condition, in addition to the criteria given in the Electricity Markets Directive and implemented in national law, whereby the new proposals should lead to making it attractive for even smaller electricity suppliers and certain customers to take on balance responsibility.

### *Balance settlement*

The cost of imbalances of the balance providers is calculated by Svenska Kraftnät in arrears in the so-called balance settlement. The purpose of the settlement is to calculate the costs of the imbalance of every balance provider between the measured and the planned generation/purchase on the one hand and consumption/sales on the other, and to distribute the costs of balance regulation that Svenska Kraftnät has made between the balance providers who have contributed to the imbalance in the system. Balance settlement takes place for every hour of the day and for the whole of the year. Balance settlement is made per balance provider for Sweden as a whole, based on the metered values per settlement area.

For regulation objects above 63 ampere, the settlement shall be based on hourly values. For objects below 63 ampere, the settlement shall normally take place in accordance with the profile method. Hourly metering shall always be employed for generation objects.

Electricity network companies are responsible for metering and reporting the hourly and profile metered values to Svenska Kraftnät. The Energy Markets Inspectorate has issued regulations for how metering and reporting shall be carried out.

Balance settlement is carried out in two stages. The preliminary imbalances are first determined for every hour. Since the consumption of profile customers is measured only once a year, final settlement is carried out after 13 months.

The balance providers pay a charge based on the volume of generation and/or consumption and a charge based on their imbalances. The charges include the costs of the automatic balance regulation (primary regulation) and also part of the costs of disturbance reserves, and the costs of operation and administration of the system.

On the regulation market, the regulation price is set by the highest activated upward regulation bid during an upward regulation hour (and vice versa for downward regulation). The pricing of imbalances is carried out in accordance with a two-price model. According to the two-price model, the player who has

imbalance in the same direction as the total imbalance pays a regulation price for the electricity he purchases, while if the imbalance is in the opposite direction compared to the total balance, the player pays instead the spot price for the imbalance. These prices are published by Nord Pool for every hour.

The Energy Markets Inspectorate supervises whether the electricity network companies follow the regulations for metering and reporting, while Svenska Kraftnät checks that the balance providers follow the rules in the balancing agreement.

### **2.1.8 Effective unbundling**

#### *Transmission*

The Svenska Kraftnät grid operator is the transmission system operator in Sweden and is owned by Swedish State. Svenska Kraftnät is ownership unbundled from competitive operations.

#### *Distribution*

At distribution level, a requirement was introduced in Swedish legislation on 1 January 1996 for legal unbundling of network operations and competitive operations (electricity generation/trading in electricity). According to the Electricity Act, a company that pursues network operations may not pursue generation of electricity or trading in electricity.

On 1 July 2005, tightened-up requirements for unbundling of electricity distribution operations from electricity trading and/or electricity generation operations were introduced in the Electricity Act. According to the new requirements, in a company conducting network operations and which is part of a larger group that has an electricity network with a total of more than 100 000 electricity users, a Board member, the Managing Director or authorised company signatory may not, at the same time, be a Board member, Managing Director or authorised company signatory in a company that pursues generation of or trading in electricity. Most Swedish network companies are not covered by this requirement, since they have less than 100 000 customers. Six groups have electricity networks with more than 100 000 customers. These groups have more than 60 per cent of the total number of customers in Sweden.

There is no requirement in Swedish legislation that a network company may not be included in a group that pursues trading in or generation of electricity. Network companies that are part of a group that carries out generation of or trading in electricity use in most cases the group name, with the addition of “electricity network” or similar to distinguish the network operations from the generation and supply operations. If a network company is part of a group whose business is generation and/or trade, the same logotype is generally used, and the group website is most often divided into electricity network and electricity trading.

According to the Electricity Act, all electricity network companies are obliged to produce an annual report that is a separate financial report for the network operations. The annual report also contains a special report comprising technical data, including information on the power cut frequency in the company's electricity network. The report must be signed by the Board of Directors and be examined by an auditor. The report is public and must be submitted to the Energy Markets Inspectorate. The Inspectorate has the possibility to open supervision of network companies that fail to comply with the provisions of the Electricity Act or with the regulations of the Inspectorate. As an example, network companies may have to pay a delay charge if they submit their annual reports too late. The Energy Markets Inspectorate can also direct a network company to take action in order to meet the requirements of the Electricity Act. Failure to observe the directive may be punishable by a fine.

On 1 July 2005, a requirement was introduced in the Electricity Act that all network companies must prepare a compliance programme. The purpose of the compliance programme is to ensure that the network owner acts objectively and does not unduly favour any other player on the market. In this compliance programme the company must state what measures are being taken to counter discriminatory behaviour against other players in the electricity market. The network owner shall annually produce a report that describes the measures taken in accordance with the compliance programme. The report shall be sent to the Energy Markets Inspectorate no later than 15 March every year.

## **2.2 Competition issues**

### **2.2.1 Description of the wholesale power market**

The Swedish wholesale power market is part of an integrated Nordic market.<sup>21</sup> Swedish electricity generation is based principally on nuclear power and hydropower. During a normal year, these sources account for more than 90 percent of the total electricity generated in the country. The remaining 10 percent are provided by fossil-fired and biofuel-fired generation, and by wind power.

There are three electricity generation companies that provide at least 5 percent of the total installed electricity generation capacity. Vattenfall, E.ON and Fortum jointly have 78 percent of the total installed electricity generation capacity in Sweden. Table 5 shows that there is a big gap between the three largest companies and Skellefteå Kraft, which is the fourth largest electricity company in Sweden in terms of installed generation capacity.

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<sup>21</sup> The term Nordic denotes here Sweden, Norway, Denmark and Finland (i.e. not Iceland)

**Table 5: The five largest electricity companies in Sweden in terms of installed generation capacity. 1 January 2008**

Company	Installed power, MW	Proportion (%) of the total installed power
Vattenfall	13 888	40.7
E.ON	7 102	20.8
Fortum Power & Heat	5 823	17
Skellefteå Kraft	805	2.3
Mälarenergi	569	1.6
<b>Sum</b>	<b>28 187</b>	<b>82.4</b>

Source: Swedenergy

The five largest electricity generators in Sweden accounted for almost 88 percent of the total electrical energy generated in Sweden in 2007 (see Table 6). The largest three of these, i.e. Vattenfall, E.ON and Fortum, together accounted for 85 percent of the total electricity generated in Sweden in 2007.

**Table 2: Electrical energy generated in Sweden by the five largest generating companies, TWh**

Company	2006	2007
Vattenfall	63.8	64.8
E.ON	30	31.9
Fortum Sverige	27.1	26
Skellefteå Kraft	3.1	3.4
Statkraft Sverige	1.2	1.3
<b>Sum</b>	<b>125.2</b>	<b>127.4</b>
<b>Total electrical energy generated</b>	<b>140.3</b>	<b>145</b>
<b>Proportion of the total elec. energy generated by the 5 largest companies, %</b>	<b>89.2</b>	<b>87.8</b>

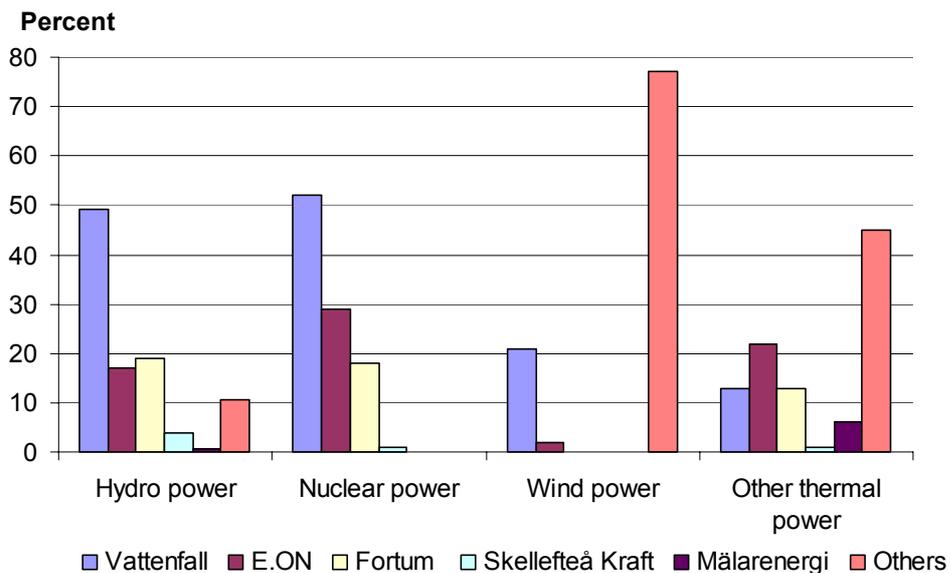
Source: Swedenergy

Vattenfall is owned by the Swedish State and is the largest generator in Sweden. In 2007, Vattenfall generated 45 percent of Sweden's electric power, which was more than the total power generated by E.ON Sverige and Fortum Sverige during the year. About 55 percent of E.ON Sverige is owned by the German quoted company E.ON AG and around 45 percent is owned by Statkraft AS. E.ON Sverige is a member of the E.ON Group. In October 2007, E.ON and Statkraft signed a letter of intent whereby E.ON will take over the part of E.ON Sverige that is currently owned by Statkraft. Fortum Sverige is a member of the Fortum

Group, the parent company in which the Finnish State has a 60 percent holding. Skellefteå Kraft is wholly owned by Skellefteå Municipality.

Figure 2 shows the generation capacity of the five largest electricity generators in January 2008, classified per energy source. The figure shows that the two largest electricity generators in Sweden, i.e. Vattenfall and E.ON, have generation capacity in all of the energy sources shown. The generation capacity of Vattenfall consists of around 50 percent hydropower and 50 percent nuclear power.

All of the five biggest generation companies are represented in hydropower and other thermal power, with the exception of Mälarenergi that owns no nuclear power. Ownership in the field of wind power is not dominated to as high an extent by the large companies. The ownership structure is more varied, demonstrating that foreign owners are also interested in investing in Swedish wind power. As an example, a wind power project in the inland area of Norrland is financed by capital from British pension funds and German commercial banks. Many forestry companies also see opportunities for higher profitability by leasing their forestland to wind power companies rather than pursuing forestry.



**Figure 2: Electricity generation capacity per energy source and company in Sweden in January 2008**

Source: Swedenergy

In 2007, the Energy Markets Inspectorate investigated the driving forces and obstacles to investments in electricity generation and the extent to which future investments could change the concentration on the wholesale market.<sup>22</sup> In the report, the Inspectorate states that there are good market conditions for new investments, although the high concentration on the electricity generation market will persist. Although many wind power investments are being made by smaller companies and investors, this will not affect the prevailing market structure to any significant extent. The three largest electricity companies - Vattenfall, E.ON and Fortum – will continue to have about 86 percent of the Swedish electricity generation capacity. The report also finds that the prevailing legal restrictions preserve the ownership concentration and that the complicated concession processes obstruct investments.<sup>23</sup>

#### *Trading volumes on Nord Pool and bilaterally*

The total volume of traded and cleared contracts on Nord Pool amounted to 2369 TWh in 2007. The physical trading increased by 16 percent, which is equivalent to 69 percent of the total electricity consumption in the Nordic countries. The volume of transactions on the Elbas market also increased and amounted to 1.6 TWh compared to 1.1 TWh the year before. However, the value of the turnover on the physical spot market decreased by one third in 2007 in relation to 2006, due to the lower prices on the spot market.

Financial trading increased substantially in 2007, reaching a record volume of 1060 TWh, which represents an increase of 38 percent compared to the year before.

The total volume of traded and cleared emission rights and credits, EUAs and CERs, increased by 60 percent compared to the year before. Nord Pool is thus the second largest trading place for emission rights and emission credits in Europe (EEX is biggest).

Table 7 shows the turnovers of Swedish players on the Nord Pool market, and bilateral trade cleared on Nord Pool.

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<sup>22</sup> Report: "Investments in electricity generation – Importance of new and smaller players for reducing the concentration", Energy Markets Inspectorate 2007.

<sup>23</sup> Swedish legislation does not allow construction of nuclear power reactors and construction of large-scale hydropower plant.

**Table7: Turnover by Swedish players on Nord Pool and bilaterally, TWh**

	<b>Volume bought in the Sweden area on Elspot<sup>1</sup></b>	<b>Turnover on electricity derivatives market<sup>2</sup></b>	<b>Bilateral OTC/clearing of electricity derivatives trading<sup>3</sup></b>
2005	60.8	327	491
2006	110.8	272	433
2007	134.3	406	381

Source: Nord Pool

<sup>1</sup> Relates to the total volume purchased in the electricity spot area of Sweden. In the period between 2002 and 2006, the corresponding sales volumes were 34.1 TWh, 32.6 TWh, 67.8 TWh, 64.9 TWh and 105.6 TWh, 129.5 TWh. The difference during one year gives a net import/export between the Swedish electricity spot area and the adjoining electricity spot areas (in Norway, Finland and Denmark).

<sup>2</sup> Relates to the turnover by Swedish players on the electricity derivatives market.

<sup>3</sup> Relates to the bilateral financial trading by Swedish players, which has been cleared on Nord Pool.

There are 306 players on the Nord Pool spot market, of whom 129 are direct members and 177 are clearing members. There are 63 members on the Elbas market. There are a total of 416 players on the Nord Pool financial market.

#### *Electricity generation and consumption in Sweden*

Swedish electricity generation is based principally on nuclear power and hydropower. In a normal year, these sources account for more than 90 percent of the total electricity generation in the country. The remaining 10 percent consist of fossil-fired and biofuel-fired generation, and wind power. In 2007, the total electrical energy generated in Sweden amounted to more than 145 TWh, which represents an increase of 3 percent on 2006. Hydropower accounted for 45 percent and nuclear power for 44 percent of the total electricity generated in the country. The electricity generation increase during the year is due to a better hydrological situation than in the year before, and electricity generated by hydropower increased by 7 percent compared to the previous year. The precipitation during 2007 was 8 percent higher than normal. Electricity generated by wind power increased by 45 percent compared to 2006. The electricity generated by nuclear power decreased by 1 percent compared to 2006, even though 2007 was not as turbulent for nuclear power as 2006. Due to the good water situation, net imports to Sweden amounted to 1.3 TWh of electrical energy during 2007 compared to 6.1 TWh the year before.

Sweden has a relatively high proportion of electric space heating at around 30 TWh, two thirds of which are dependent on the outdoor temperature. Temperature therefore has a relatively high impact on Sweden's electricity consumption. The general economic climate and growth in society are also of significance to electricity consumption. The total electrical energy consumption in Sweden in

2007 amounted to more than 146.3 TWh, which is on a par with the consumption in 2006. Using temperature-corrected data, the electrical energy consumption in 2007 was 148.9 TWh, compared to 148.4 TWh in 2006. Dwellings and services accounted for almost half of the electricity consumption during the year, while industry accounted for 40 percent.

The highest power consumption in 2007 amounted to 26 200 MW and occurred on 21 February.

During 2007, Sweden's net import of electricity was just over 1.3 TWh compared to a net import of 6.1 TWh in 2006.

Table 8 shows the electricity balance in Sweden in the years between 2003 and 2007.

**Table 8: Sweden's electricity balance in 2003 – 2007<sup>1</sup>, TWh**

	2003	2004	2005	2006	2007
<b>Generation in the country</b>	132.5	148.8	155.0	140.3	145.0
Hydropower	53.1	60.1	72.0	61.1	65.5
Nuclear power	65.5	75.0	69.8	65.0	64.3
Other thermal power	13.3	12.9	12.3	13.3	13.8
Wind power	0.7	0.9	0.9	1.0	1.4
Pumped storage	-0.06	-0.06	-0.05	-0.05	-0.03
<b>Electricity consumption in the country</b>	145.3	146.7	147.6	146.3	146.3
<b>Network losses</b>	10.7	11.1	12.4	11.0	11.9
<b>Imports</b>	24.3	15.6	14.6	20.5	18.5
<b>Exports</b>	-11.5	-17.7	-22.0	-14.4	-17.2
<b>Net balance</b>	12.8	-2.1	-7.4	6.1	1.3

Source: Statistics Sweden

<sup>1</sup> A minus sign before a figure indicates export

### 2.2.2 Description of the retail market

Unlike the wholesale market, the retail markets in the Nordic countries are principally national. This is explained by the fact that the balance responsibility is linked to the customer's supply point. A foreign electricity supplier must therefore be a balance provider, either on his own or by agreements with others, for all customers in the countries in which electricity is sold. Since conditions in the Nordic countries differ, balance responsibility may be both expensive and technically complicated. Swedish end users therefore normally purchase electricity from electricity suppliers who are established in Sweden and have balance agreements, either directly or through intermediaries, with Svenska Kraftnät.

The number of electricity suppliers in Sweden has decreased since the electricity market reform. In 1996, there were more than 220 suppliers in Sweden. By 2007, the number had dropped to around 125.<sup>24</sup> Out of these, 96 companies sell electricity to consumers in the whole of the country. The reduction in the number of suppliers is due principally to takeovers and mergers.

In October 2007, a German player, Yello Strom, made an entry into the Swedish electricity market. The company is owned by EnBW (Energie Baden-Württemberg AG), which is one of the largest electricity generators in Germany.

Table 9 shows the market concentration on the Swedish retail market for electricity on the basis of the number of customers and the sales volumes during 2006. The table shows that Vattenfall is the player that has the largest sales volumes on the Swedish electricity retail market. The three largest electricity suppliers, i.e. Vattenfall, E.ON and Fortum, had a market share of around 43 percent in 2006, based on the number of customers in the electricity suppliers of each group. Only these three companies have market shares that exceed 5 percent.<sup>25</sup>

Most electricity suppliers are members of groups of companies that also own electricity generation plants. Less than half of all suppliers are members of groups without electricity generation. Foreign ownership of electricity suppliers in Sweden is around 40 percent.

**Table 9: Market concentration based on the number of customers and the quantity of electricity delivered in 2006**

	Market share <sup>1</sup>	Market share <sup>2</sup>	Market share <sup>3</sup>
<b>E.ON</b>	16.4 %	11.8 %	14.6 %
<b>Fortum</b>	13.5 %	7.6 %	13.6 %
<b>Vattenfall</b>	12.8 %	30.4 %	36.3 %

Source: Swedish Competition Authority, Background Memorandum Ref. No. 408/2006

<sup>1</sup> Based on the number of customers

<sup>2</sup> Based on the quantity sold (volume delivered) to own end customers

<sup>3</sup> Based on the total volume delivered by the Group

<sup>24</sup> The figure is based on the electricity suppliers who, according to the Electricity Act, must report the price of electricity to the Energy Markets Inspectorate. The figure is from June 2008.

<sup>25</sup> Swedish Competition Authority (2006), Reference No. 408/2006

### *Price of electricity to end customers*

The total cost of electricity to households can be divided as follows:

- cost of electricity supply
- cost of electricity network
- taxes (energy tax and VAT)

The share of electricity supply in the total cost of electricity has increased. For a domestic customer who lives in an electrically heated single-family house, the cost of electricity supply amounted to 43 percent on 1 January 2008, compared to 39 percent a year earlier. The network tariff accounted for 17 percent, while the energy tax and VAT together accounted for 40 percent.

Table 10 shows the distribution of the total price of electricity to the end customer as per 1 January 2008 according to the Eurostat classification of customers.

**Table 10: Price of electricity to end customers, Euro/MWh as of 1 January 2008**

	lg <sup>1</sup>	lb <sup>2</sup>	Dc <sup>3</sup>
Electricity network <sup>4</sup>	7.64	28.54	48.81
Electricity trading <sup>5</sup>	40.85	43.82	70.78
Tax and charges	0.53	0.53	27.22
<b>Total (incl. tax) <sup>6</sup></b>	<b>49.02</b>	<b>72.89</b>	<b>146.81</b>

Source: Statistics Sweden

<sup>1</sup> Industrial customer with an annual consumption of 24 GWh, and maximum power demand of 4000 kW.

<sup>2</sup> Industrial customer with an annual consumption of 50 MWh, and maximum power demand of 50 kW.

<sup>3</sup> Domestic customer with an annual consumption of 3500 kWh.

<sup>4</sup> including official charges

<sup>5</sup> including cost of electricity certificates

<sup>6</sup> excluding VAT

Note: EUR 1 = SEK 9.4235 on 1 January 2008.

The typical customers in Sweden are different from the Eurostat classification.<sup>26</sup> For these typical customers, the prices of electricity rose during the fourth quarter of 2007 compared with the same quarter in 2006.

The price of electricity varies between different electricity suppliers. A comparison between the highest and lowest price in variable price contracts shows that the difference is more than 10 öre per kWh. For a one-year contract (fixed price), the difference is somewhat higher and amounts to 11 öre per kWh.<sup>27</sup>

The most common type of electricity supply contracts in Sweden are for the open ended contract (default contract), variable price, fixed price 1 year, and fixed price 3 years. The proportion of customers with open ended contracts is dropping but is still the most common type of contract, with 38.6 percent. An open ended contract is the contract that the electricity customer usually pays if he has not made any active choice of supplier or contract. The price for an open ended contract is usually higher than the prices in other type of contracts. The proportion of customers who pays a variable price is increasing, now amounting to 16 percent.<sup>28</sup> A variable price is a price based on an average of the spot price on Nord Pool plus the supplier's mark-up. 19.7 percent of the customers have a 3-year or longer fixed price of electricity, and 19.6 percent of the customers have a fixed price for up to 1 year.

### *Supplier switching*

More electricity customers switched supplier in 2007 than in 2006. The number of supplier changes increased by 24 percent during 2007 compared to 2006.<sup>29</sup> A total of around 10 percent of all electricity customers in Sweden switched to a different electricity supplier during 2007. A total of around 55 percent of the electricity customers in Sweden have been active at some time since the electricity market reform, either by switching to a different electricity supplier or by renegotiating their agreements.

A customer who wants to change his electricity supplier signs an agreement with the new supplier, who then notifies the customer's network company of the

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<sup>26</sup> Statistics Sweden collects statistics for the following typical customers: Typical customer 1: Apartment with an annual consumption of 2000 kWh. Typical customer 2: Single-family house (without electric heating) with an annual consumption of 5000 kWh. Typical customer 3: Single-family house (with electric heating) with an annual consumption of 20 000 kWh. Typical customer 4: Subscriber who runs agricultural or forestry operations and an associated household with an annual consumption of 30 000 kWh. Typical customer 5: Commercial operations with an annual consumption of 100 MWh. Typical customer 6: Small industrial plant or equivalent with an annual consumption of 350 MWh.

<sup>27</sup> The figures are based on the prices that electricity suppliers are required by the Electricity Act to report to the Energy Markets Inspectorate and concern a user who consumes 20 000 kWh/year. The figures are from March 2008.

<sup>28</sup> Information from January 2008.

<sup>29</sup> Statistical information is gathered for two customer categories: Domestic customers and Other customers.

supplier change. Since 1 January 2007, electricity suppliers are obliged to notify the network company of the change and submit information no later than the 15th day of the month before the month when the supplier change is to take place, against one month required previously. The purpose of the amendment to the legislation is to speed up the process of supplier switching in order to make it simpler for electricity users to be active on the electricity market. No charge is payable by the consumer for changing his electricity supplier.

### **2.2.3 Measures aimed at preventing the exercise of market power**

#### *Supervision of the electricity market*

Several authorities and bodies cooperate in the supervision of the Swedish and Nordic electricity markets with the aim of taking various measures in order to create a smoothly performing electricity market and prevent the exercise of market power. The Energy Markets Inspectorate has collective responsibility for the Swedish electricity market. The Swedish Competition Authority has the responsibility for applying the competition rules. The Swedish Financial Supervision Authority exercises supervision of the Swedish players on the Nord Pool financial market. Comprehensive internal supervision of the trade and actions of the companies is also carried out within Nord Pool. The Nord Pool, which has its seat in Norway, is supervised by the Norwegian Water Resources and Energy Directorate (NVE) and the Financial Supervisory Authority of Norway. The Swedish Consumer Agency is also involved in the supervision of the electricity market and has participated in drawing up the general terms of agreement of the industry, with the aim of safeguarding reasonable terms of agreement for the consumers on the electricity market.

#### *Responsibilities of the Swedish Competition Authority and its activities on the electricity market*

The Swedish Competition Authority is the authority that exercises supervision to ensure that companies on the Swedish electricity market do not infringe any of the bans against competition limiting behaviour specified in the Competition Act<sup>30</sup> and the EU Treaty.<sup>31</sup> The Competition Act is aimed at eliminating and counteracting obstacles to effective competition in the production of and trading in goods, services and other commodities. Either on its own initiative or after notifications from companies and the general public, the Competition Authority can actively intervene in competition-limiting cooperations between companies and against companies that abuse their dominant position on the market by exercising their market power. The Competition Act also includes rules on the monitoring of corporate concentrations. The Competition Authority shall also contribute to effective competition by submitting proposals for changes to rules and other measures aimed at eliminating existing competition obstacles. Another

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<sup>30</sup> Competition Act (1993:20), Section 6 and 19.

<sup>31</sup> Articles 81 and 82.

task of the Competition Authority is to contribute funds to Swedish research in the fields of competition and procurement.

Since 1 September 2007, the Competition Authority has been responsible for application of the laws on public procurement – the Public Procurement Act

(LOU) and regulations concerning procurement in the so-called supply sectors, the Act on procurements in the fields of water, energy, transport and postal services (LUF).<sup>32</sup> Supervision takes place on the basis of the Authority's own initiative, investigation of complaints received, and contacts with auditors and other players involved in the procurement field, etc. For activities in the supply sectors, the procurement rules are somewhat more flexible. As an example, operations that are pursued on an entirely open and competitive market may be exempt from LUF. The Commission assesses whether conditions exist for such exemption. According to a decision of the Commission, companies that generate and sell electricity in Sweden need not conform to the provisions of LUF.<sup>33</sup> On the other hand, electricity network operations and any market within the fields of heat or natural gas are not covered by this exemption.

*Application of the competition rules and other measures for improving competition on the electricity market*

In June 2007, the Competition Authority concluded an extensive investigation into possible infringements of the competition rules on the electricity market. The investigation was started in 2006, partially because electricity customers and other market players aired suspicions of competition-limiting behaviour on the electricity market. Above all, suspicions were levelled at the likelihood that the three large electricity generators, Vattenfall, E.ON Sverige and Fortum, who jointly own the Swedish nuclear plants, had acted in a competition-limiting manner, which has affected the supply and pricing on the wholesale market.

The investigation by the Swedish Competition Authority showed that production planning for nuclear power plants had earlier taken place, to some extent, jointly at meetings between the part owners and the nuclear power companies. However, the planning process in the jointly owned nuclear power plants had been gradually changed with the aim of minimizing the risk of insight into the business circumstances of the respective part owners. Even if the earlier coordination of generation contravened the competition rules, the relevant limitation rules provided no grounds for the Competition Authority to take legal action.

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<sup>32</sup> Act (2007:1091) on Public Procurement (LOU). A separate law, the Act (2007:1092) on Procurement in the Areas of Water, Energy, Transport and Postal Services (LUF) applies to procurement in the supply sectors. The laws are based principally on EC Directives 2004/18/EC and 2004/17/EC

<sup>33</sup> EUT L 287/18, 1.11.2007.

In conjunction with the decision not to take action in this matter on the basis of the Competition Act, the Competition Authority submitted a memorandum to the Government.<sup>34</sup> In the memorandum, the Competition Agency drew attention to the risks of joint ownership of electricity generation resources and other circumstances that could obstruct or limit the competition on the electricity market. The memorandum contained proposals for action that the Government could take, above all in its role as owner of Vattenfall, the largest company on the market, in order to restrict joint ownership and other cooperation between competing companies on the Swedish electricity market. The Competition Authority suggested that joint ownership of the nuclear power companies should be entirely dissolved, if possible, and the present reactors should be distributed among the owning companies. If this were not possible, the nuclear power companies should be made more independent of the owner companies. Consideration should also be given to the possibility of some State-owned plants being sold or being given a broader ownership circle.

Joint ownership in Swedish electricity generation above all involves risks of inappropriate exchange of information between competing companies. In this case, the risks of negative effects on competition are particularly serious since the generation plants are owned jointly by the three leading competing companies on the market. Both the Swedish and the Nordic wholesale markets are oligopolic, with significant access obstacles, and the jointly owning companies basically meet no competitor with equivalent generation resources. The community of interests by joint ownership can affect, directly or indirectly, the willingness of and incentive for the companies to compete. The risk of coordinated behaviour can increase, and the conditions can also facilitate the likelihood of the companies exercising market power in various situations. Joint ownership also generally reduces the confidence in the market function.

Against this background, the Competition Authority views positively the fact that the Government has appointed two negotiators in the spring of 2008 to investigate, on behalf of the State, the conditions for solutions that minimize the risks of competition limitations due to joint ownership. In its decision, the Government emphasizes the importance of an efficiently performing electricity market, and that it is important to eliminate the risks of competition limitation to which joint ownership of the nuclear power industry could give rise. The assignment will be completed no later than 31 January 2009.

#### *Research project into market power*

The Competition agency has commissioned a research project into the importance of market power on the Nordic electricity market. The project had two objectives – to analyze the potential for market power on the Nordic electricity market and to study the exercise of market power on the electricity market. The project was partially financed by the Norwegian competition authority, Konkurransetilsynet.

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<sup>34</sup> Competition conditions on the electricity market, 7 May 2007, Ref. No. 408/2006.

In the first part of the project, study was devoted to the potential for the generators on the Nordic electricity market to raise prices by exercising market power. A so-called game theory model was developed within the framework of the project. The model was used to analyze the scope available for the players to raise prices by strategic bidding. The results showed that the prices could be raised significantly – by between 11 and 27 percent in the various Nordic market areas. The results indicated lowest price increase in Norway, Finland and Sweden, and highest in Denmark. The prices in Sweden were estimated to be able to increase by 14 percent. This potential for market power is not based on any form of cooperation between the companies, and only on every player being able individually to maximize his profit. In other words, there are strong reasons for expecting that, if there were such cooperation, it would also produce effects on the market.

The second part of the project was devoted to studying whether it could be determined that the potential market power had actually been exercised. By modelling the electricity market on the assumption of perfect competition, a base was obtained from which the actual prices on the market were compared. If the actual prices were systematically higher than the modelled prices, this would indicate that market power was actually exercised. Hydropower generally involves a difficulty when this type of study is to be implemented for the Nordic market. Hydropower generation is not determined by variable costs in the power stations, but by the expectations of what payment could be obtained for generation in the future, which is known as the water value. If the water value calculated in the model does not agree with the assessment the generators have previously made, the possibilities would naturally be reduced of determining the extent to which market power may have been exercised.

Three periods were studied in the project. The autumn of 2001 was a normal period. The autumn and winter of 2002/03 were characterized by shortfall and very high prices around the 2002/03 turn of the year. The autumn of 2006 was also characterized by shortfalls. The results of the analysis do not support the possibility of electricity prices being affected upwards to any significant extent by the exercise of market power. The average actual prices for two of the periods studied were instead below the modelled prices. For the third period – the autumn of 2006 – the actual prices were somewhat higher than the modelled prices.

The conclusion arrived at by the project is that there is significant potential for exercising market power on the Nordic electricity market. However, the results of this study indicate that, for some reason, the electricity generators do not appear to put this market power to use. A more detailed study was not carried out into why the generators do not utilize the potential, but this may be due to factors such as it being more difficult than indicated by the model to carry out this in practice, or that there may be other considerations that the companies make.

Market power can be exercised in a number of ways on the Swedish and Nordic electricity market. As an example, no study was made in the project of whether there may be strategic considerations that cause investments in new power generation capacity to be held back, or whether opportunities were available for the jointly owned Swedish nuclear power companies to increase the generation rates, without impairing the standard of safety, by shortening the overhaul shutdowns. There are also other markets – in the first place, the electricity certificates market – on which there may be significant risks of market power being exercised.

#### *Nord Pool regulations – price-affecting information and market supervision*

All players on Nord Pool are obliged to follow the regulations of the electricity exchange. These regulations concern, for example, the handling of price-affecting information. Players (generators and other players) are obliged to notify Nord Pool immediately in the event of the following (price-affecting information):

- All company information that may have a substantial effect on price. On the other hand, this does not include the company's own plans and strategies for trading.
- The following information on generation plants, consumption, transmission in or in direct connection with the Nordic electricity spot area:
  - Planned maintenance or generation limitations that involve more than 100 MW during the coming period of six weeks.
  - Planned maintenance or generation limitations that involve more than 400 MW of plants for generation, consumption or transmission during the current year or the three coming years.
  - Breakdown comprising generation capacity in excess of 100 MW, as soon as possible although no later than 60 minutes after the breakdown has occurred (the 60-minute limit does not apply between 2000 or 0700 hours). The player involved shall notify Nord Pool within 4 hours of the reason for the breakdown occurring and the estimated outage duration.

A market player who has access to some form of price-affecting information may not trade on Nord Pool. This applies to both trading in electricity on the physical market and trading in financial contracts on the forwards market, and trading in Swedish electricity certificates and emission rights within the EU trading system for emission rights (EU ETS). However, if there is price-affecting information in one unit of a supplier, trading may take place if the company can document to Nord Pool that there are physical or other obstacles to the transfer of information between the various units of the company ("Chinese Walls"). The regulations also include confidentiality provisions for employees and boards of directors within the companies, banning them from revealing to outsiders any price-affecting information of which Nord Pool has not been notified.

Nord Pool publishes information on matters such as supply, demand, and transmission capacities between electricity spot areas, and also prices for different areas and of different products. As regards transmission capacity, Nord Pool has been publishing since the spring of 2007 both the allocated transmission capacities, and the type of reason and the nature of transmission limitation that may have caused a reduction in capacity. Nord Pool also reveals a limited part of bid curves (buy and sell bids with different volumes) and the so-called price cross for the system price for each individual hour. The reporting is updated once a week, and the information is published with a delay of one week.

Nord Pool regulations contain provisions for bidding on the spot market. In order to supervise bidding and create confidence in the pricing, Nord Pool has a special market supervision function that continuously follows the trade. All transactions are therefore followed up to ensure that the players submit the information that they are obliged to submit in order to prevent insider trading, price manipulation or exercising of market power. The players are also obliged to provide Nord Pool, as soon as possible, with all information that Nord Pool considers relevant for being able to supervise trading. The market supervision unit regularly publishes reports on the Nord Pool homepage on investigations made into suspected breaches of the regulations. If infringement of the regulations is determined, there is a sanction system that includes warnings, penalties and withdrawal of trading permit.

## 3 Natural gas market

### 3.1 Regulatory issues

#### 3.1.1 General matters

On 1 July 2007, the last stage was implemented in the opening of the natural gas market in Sweden, when all natural gas customers became eligible to choose their supplier, which has been possible since 2005 only for non-domestic customers. See Table 11 for particulars of the gradual opening of the natural gas market.

**Table 11: Gradual opening of the natural gas market**

	Limit value (Nm <sup>3</sup> /year)	Part of volume open to competition
1999		0 %
2001	25 million Nm <sup>3</sup>	N.A.
2003	15 million Nm <sup>3</sup>	50 %
2005	Non-domestic customers	95 %
2007	0	100 %

Nm<sup>3</sup> = m<sup>3</sup> at normal temperature and pressure

#### 3.1.2 Transmission limitations and mechanisms for handling them

The available capacity of the Swedish transmission system is around 15 TWh/year. During 2007, consumption was around 11.7 TWh.<sup>35</sup> About 2 percent of Sweden's energy demand is met by natural gas. There are currently no transmission limitations in the Swedish transmission system, neither nationally nor on the import link from Denmark. There is no secondary market for transmission capacity in Sweden on which unutilized primary capacity would be made available for trading. With the market model employed on the Swedish natural gas market today, a secondary market would not be relevant.

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<sup>35</sup> Calculated on the higher calorific value

### **3.1.3 Regulation of transmission and distribution companies**

The Natural Gas Act (2005:403) specifies that the tariffs for the transmission of natural gas shall be reasonable, objective and non-discriminating. When the tariffs for the transmission of natural gas are set, special consideration shall be given to the number of customers connected, their geographical locations, the amount of energy transmitted, the subscription costs for the supplying pipelines, the reliability of supply and the pipeline pressure. This provision in the Natural Gas Act is aimed at ensuring that the tariff shall be based on the costs that the network company incurs in its operations.

According to the Natural Gas Act, the owner of a natural gas pipeline must not apply network tariff before the methods used for setting the tariff have been approved by the Energy Markets Inspectorate. Special guidelines for method application have been drawn up by the Inspectorate. The check of the methods on which the setting of the tariff is based is aimed at safeguarding that the tariff is objective and non-discriminatory. However, the method involves no appraisal of the reasonableness of the tariffs. According to the present regulation ordinance, the Inspectorate carries out annual ex post regulation of the network tariffs. There is currently no proposal for changing over to advance assessment of the reasonableness of the tariffs.

#### *Collection of technical and economic data for tariff supervision*

Supervision of the reasonableness of the tariffs will require special acquisition of data. In the initial stage, a thorough valuation of the plant assets of the network companies will have to be made. This means that a plant register will have to be prepared for each network company, and this shall include information on the year the plant assets were purchased and their purchase value. The plant register will be updated annually with the investments and write offs for the year.

All operating costs of the network company will be collected and these will then be distributed onto different activities in order to facilitate the benchmarking of the operating costs of the companies.

According to the Natural Gas Act, network companies are obliged to prepare separate accounting for the transmission, distribution and storage operations in the form of an annual report. The annual report shall be submitted to the Inspectorate no later than seven months after the end of the financial year and shall contain comprehensive profit and loss statements and balance sheets for each of the operations. The annual reports are examined by the auditors of the network companies and are checked by the Energy Markets Inspectorate before the data is used for supervision of the network tariffs.

### **3.1.4 Balance regulation**

As far as possible, imbalances are handled with market mechanisms by Svenska Kraftnät. If a commercial solution is not adequate, Svenska Kraftnät instructs the

pipeline owner to restrict or interrupt the transmission of natural gas to customers. This is regulated in the Natural Gas Act.

Svenska Kraftnät concludes agreements with natural gas companies concerning balance responsibility, with the aim of maintaining short-term balance in the natural gas system. According to the balance responsibility agreement, the balance provider shall plan for balance between his supply and delivery of natural gas. A balance plan shall be sent to Svenska Kraftnät no later than 1400 hours on the day before the delivery day. Balance settlement by Svenska Kraftnät is done as a daily settlement no later than 11am on the day after the delivery day, and this is based on the reported metered values from the network owners and reported trading values from the balance providers.

The balance provider has a balance account in which imbalances are accumulated. If the balance in the balance account exceeds the permissible maximum limit or is below the permissible minimum limit, the difference is balance gas. The pricing of the balance gas is based on the basic balance price calculated through the weekly trading carried out every week with the balance provider, plus a penalty charge. The purpose of the penalty charge is to give the balance providers the incentive to carry out such planning that the accumulated imbalances will be within the permissible range.

The permissible range for the balance accounts of the balance providers is calculated by Svenska Kraftnät on the basis of an assessment of the limits within which the gas pressure in the transmission network can be varied without causing problems to the users. Operating restrictions and operating safety assessments are taken into account in the calculation.

Differences between the preliminary metered values reported by the network owners after the delivery day and the final values reported after the delivery month are regulated with correction gas. Before regulation with correction gas is carried out, reading of customers with monthly metering is performed and the calorific value is determined. This is carried out on final settlement with the balance providers done by Svenska Kraftnät no later than the 25th of the month after the delivery month.

Invoicing is done once a month and comprises balance gas, correction gas and a consumption energy charge of 0.9 SEK/MWh.<sup>36</sup> Balance provider companies submit securities for the credit exposure that may occur to Svenska Kraftnät by the company's running activities.

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<sup>36</sup> The cost is based on consumption measured as the higher calorific value.

### **3.1.5 Effective unbundling**

#### *System responsibility for the natural gas market*

Svenska Kraftnät has been the authority responsible for the system on the Swedish natural gas market since 2005. System responsibility means that Svenska Kraftnät is responsible for short-term balance being maintained in the Swedish natural gas system. However, system responsibility does not include operation of the Swedish natural gas system. Responsibility for operation, maintenance and expansion of the pipeline system rests with the owners of the respective natural gas pipelines.

#### *Transmission and distribution*

According to the Natural Gas Act, a company that pursues a transmission of natural gas must not pursue trading in natural gas within the same company (legal separation). The accounting for these two commodities shall be kept separate.

In a company that has a concession for a natural gas pipeline, a member of the board of directors, the managing director or an authorized signatory may not simultaneously hold these posts in a company that pursues trading in natural gas. However, there are no requirements in Swedish legislation that a gas network company must not be included in a group of companies that pursues production of or trading in natural gas.

According to the Natural Gas Act, natural gas companies are obliged to prepare separate annual reports for the transmission, distribution and storage operations. The annual report is financial separate accounting. The annual report is signed by the company's board of directors, and the report is also examined by an auditor. The annual report is a public document and is submitted to the Energy Markets Inspectorate. If a natural gas company does not follow the provisions of the Natural Gas Act or the regulations issued by the Energy Markets Inspectorate, the Inspectorate is entitled to open supervision of the company. The Inspectorate can instruct the company to adopt measures aimed at conforming to the regulations. Failure to conform to an instruction may be punishable by a fine. If the annual report is submitted too late, the company must pay a delay charge.

As from 1 July 2005, the Natural Gas Act includes rules requiring companies that pursue transmission of natural gas to draw up a supervision plan. In addition, the companies shall publish in their annual reports the measures they have adopted according to the plan. The purpose of the supervision plan is to safeguard that companies will act objectively and will not unduly favour any player on the market. The supervision plan shall describe the measures the company will take in order to counteract discriminatory behaviour in relation to other players on the market. During 2006, the Energy Markets Inspectorate has drawn up regulations on the contents of the supervision plan and the publishing of the annual report.

## 3.2 Competition issues

### 3.1.6 Description of the natural gas market

Sweden has no production of natural gas. All natural gas used in the country is imported through the pipeline running between Denmark and Sweden. From Denmark, pipelines run to the Continent, and Sweden is thus interconnected with the Continental system. In 2007, Sweden consumed around 11.7 TWh<sup>37</sup>, which corresponds to about 2 percent of Sweden's total energy consumption.

Two companies, E.ON Sverige and Dong Energy (formerly Dong Sverige AB), sell natural gas on the Swedish wholesale market. No information is available on the market shares of the companies in 2007, although there is nothing to show that any major changes have occurred since 2006. During 2006, E.ON Försäljning Sverige AB (a wholly owned subsidiary of E.ON Sverige AB) sold around 5.3 TWh on the wholesale market. This represents a market share of 48 percent. However, the figure does not take into account the fact that part of this volume was sold to companies in the E.ON Group, which, in turn, resold the natural gas to end customers. Table 12 shows the development on the Swedish wholesale market.

**Table 12: Development on the wholesale market**

	Total consumption (TWh) <sup>1</sup>	Production	Import capacity (TWh) Total	Number of companies with >5% generation and import capacity <sup>2</sup>	Number of companies with >5 % of gas market
2001	9	0	15	1	4
2002	9.5	0	15	1	4
2003	9.5	0	15	1	4
2004	10	0	15	1	5
2005	8.9	0	15	2 <sup>2</sup>	5
2006	9.2	0	15	2 <sup>2</sup>	5
2007	9	0	15	N.A	N.A

<sup>1</sup> Consumption expressed in higher calorific value

<sup>2</sup> Sweden has no own production of natural gas. There are two natural gas importers.

<sup>37</sup> Expressed in higher calorific value

The Danish State has a 73 percent holding in Dong Energy, E.ON Nordic has a 55 percent holding in E.ON Sverige and Statkraft has a 45 percent holding, while other natural gas companies are owned by Swedish municipalities. Swedgas has a holding of about one third in E.ON Ruhrgas, which is a member of the E.ON Group.

### 3.1.7 Description of the retail market

There are roughly 55 000 natural gas users in Sweden, of whom 2 600 are corporate customers and the remainder are domestic customers. The number of customers has remained relatively unchanged in recent years.

More than thirty municipalities in Sweden have access to natural gas. In the municipalities that are connected to the natural gas network, natural gas accounts for around 20 percent of the energy supply.

During 2007, roughly 50 percent of the natural gas was used in industry, and around 30 percent in CHP and district heating plants. Dwellings accounted for only 2 percent of the total consumption during 2007. Other commercial and industrial operations accounted for the remainder of the consumption.<sup>38</sup>

Table 13 shows the development on the retail market in Sweden.

**Table 13: Development on the retail market**

	Total consumption (TWh) <sup>1</sup>	Number of companies with >5% of retail market	Number of independent gas suppliers	Market share of the three largest gas suppliers (%)
2001	9	N.A	0	N.A
2002	9.5	N.A	0	N.A
2003	9.5	N.A	0	N.A
2004	10	5	0	78
2005	8.9	5	0	81
2006	9.2	5	0	88
2007	9	N.A	0	N.A

<sup>1</sup> Consumption expressed in higher calorific value

<sup>38</sup> The figures are based on preliminary information from Statistics Sweden

### *Market concentration*

Since the introduction of natural gas in 1985, the Swedish natural gas market has been characterized by a small number of players and a high degree of vertical integration. In 2007, there were six natural gas companies that sold gas to end customers. No data is available for 2007, although there is nothing to indicate that any major changes have taken place since 2006. In that year, the three largest gas suppliers (E.ON Sverige 53 percent, Dong Energy 21 percent and Göteborg Energi 14 percent) accounted for around 88 percent of sales to end customers. No new natural gas supplier has established himself on the Swedish natural gas market since 1 July 2005, when all non-domestic customers became entitled to choose their own gas supplier. Dong Energy sells natural gas only to corporate customers.

### *Change of supplier*

Collection of statistics of supplier changes on the natural gas market began on 1 January 2008.<sup>39</sup> During the first quarter of 2008, 38 domestic customers switched to a different natural gas supplier, while the figure for the other customers was 54.

### *Natural gas price to end customer*

The total cost of natural gas to households is broken down as follows:

- cost of gas supply
- cost of gas network
- taxes (energy tax and VAT)

Table 14 shows the costs payable by three typical customers for the transmission of gas (network tariff) and for the energy (natural gas). Categories I4 and I1 include tax but not VAT, whereas category D3 includes both tax and VAT. The prices of natural gas to virtually all customer groups in both domestic and industrial sectors rose in the second half of 2007.

**Table 14: Average natural gas prices to end customer in July-Dec. 2007, EUR/MWh**

	I4 <sup>1</sup>	I1 <sup>2</sup>	D3 <sup>3</sup>
Network tariff	3.60	16.66	21.86
Natural gas	39.47	56.14	89.56
<b>Total</b>	<b>43.08</b>	<b>66.85</b>	<b>111.42</b>

Source: Statistics Sweden

<sup>1</sup> Industrial customer with an annual consumption of 30 000 - <300 000 MWh . Including tax but excluding VAT

<sup>2</sup> Industrial customer with an annual consumption of <300 MWh. Including tax but excluding VAT.

<sup>3</sup> Domestic customer with an annual consumption of >55 000 kWh. Including tax and VAT.

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<sup>39</sup> Statistics Sweden collects information at quarterly intervals starting on 1 January 2008



## 4 Security of supply

### 4.1 Electricity

#### 4.1.1 Power balance

Since the electricity market reform in 1996, the installed power in the Swedish electricity generation system has been reduced. The capacity margin between supply (including imports) and demand dropped by almost 20 percent between 1996 and 2000. This involves an increased risk of isolation of certain customers in the country if a major power station should break down under severe cold conditions in the winter. Against this background, the Government introduced a peak load reserve act<sup>40</sup> in 2003. The peak load reserve is created by the Svenska Kraftnät TSO concluding agreements with power generators for making further generation capacity available, and with electricity users for making consumption reduction available. The law is temporary and expires on 15 March 2011. The Energy Markets Inspectorate has been instructed by the Government to investigate how a long-term solution to the power reserve issue can be achieved in the future. A report on the assignment will be submitted to the Government in December 2008.

#### *Power balance in the winter of 2007/2008*

Margins were available in both generation and transmission capacity during the winter of 2007/2008. The electrical energy balance was relatively good. The water reservoir levels were somewhat above average and the availability of nuclear power was higher than in the preceding year. Temperatures were normal up to the end of December. After that, the winter was the warmest in a century.

During last winter, there was never any need to activate the power reserve in order to meet the power balance.

The highest electric power consumption during the winter of 2007/2008 was 24 500 MW and occurred on 23 January 2008 at 1700 – 1800 hours. The domestic power generation capacity then amounted to 24 165 MW and the net import was 335 MW. The power peak forecast for the 2007/2008 winter was 27 200 – 28 900 MW. During the 2006/2007 winter, the consumption peak was 26 200 MW.

During the 2007/2008 winter, the transmission capacity of the national grid was normal. No interruptions of major significance occurred during the winter.

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<sup>40</sup> Act (2003:436) on Power Reserve

### *Power balance forecast for the 2008/2009 winter*

Svenska Kraftnät reports annually a detailed forecast for the power balance for the coming winter.<sup>41</sup> The forecast comprises various analyses for the coming winter: consumption, available generation capacity and available transmission capacity. When this has been analyzed, a forecast is made for two scenarios. Scenario A covers a situation with normal consumption and relatively favourable availability of generation capacity and imports. Scenario B is for a situation with maximum electricity consumption at temperatures that can be expected every ten years and factors that lower the availability of the generation system.<sup>42</sup> The two scenarios are shown in Table 15.

The total generation capacity in which consideration is given to the estimated availability is expected to increase by 430 MW during next winter compared to the previous winter. The margins in the Swedish power balance are estimated to increase by around 400 MW compared with the preceding winter, mainly due to the strengthened electricity generation capacity. In the forecast for the maximum electricity consumption in the 2008/2009 winter, no upward adjustment is made from the preceding winter forecast.

**Table 13: Power balance forecast for the 2008/2009 winter, MW**

	<b>Scenario A</b>	<b>Scenario B</b>
<b>Generation</b>		
Hydropower	14 100	13 700
Nuclear power <sup>1</sup>	9 540	9 540
Back-pressure power	3 900	3 700
Condensing power	1 700	1 700
Gas turbines (excl. disturbance reserve)	500	500
Wind power, effective value 6% <sup>2</sup>	60	60
<b>Total generation</b>	<b>29 800</b>	<b>29 200</b>
<b>Import</b>	<b>2 200</b>	<b>0</b>
<b>Total supply</b>	<b>32 000</b>	<b>29 200</b>
<b>Consumption</b>	<b>-27 200</b>	<b>-28 900</b>
<b>Reduction in consumption<sup>3</sup></b>	<b>300</b>	<b>300</b>
<b>Margin</b>	<b>5 100</b>	<b>600</b>

Source: Svenska Kraftnät

<sup>1</sup> Full availability is assumed for the ten nuclear power units in both scenarios.

<sup>2</sup> The effective value is estimated to be 6 % of the installed power.

<sup>3</sup> Included in the power reserve. Provisional estimate.

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<sup>41</sup> Svenska Kraftnät, "The Swedish power balance in the winters of 2007/2008 and 2008/2009"

<sup>42</sup> The 10-year winter is a 3-day period in which average temperatures statistically occur every ten years

### *Conditions for the 2011/2012 winter*

Svenska Kraftnät also carries out a less extensive analysis of the conditions for the power balance for two winters ahead. The power balance in Sweden is forecast to be relatively favourable in coming years. The installed hydropower generation capacity is expected to increase only by a small amount. If all plans for upgrading the nuclear power stations are implemented, the installed generation capacity will increase by around 1 200 MW by the winter of 2011/2012. CHP and industrial back-pressure generation are expected to increase by 800-900 MW by the winter of 2011/2012, and half of the increase is based on biofuels. The installed condensing and gas turbine power generation capacity is expected to remain constant during the period up to 2011/2012. Wind power has not yet come up to the levels necessary for achieving significance in the power balance.

### *Installed electricity generation capacity*

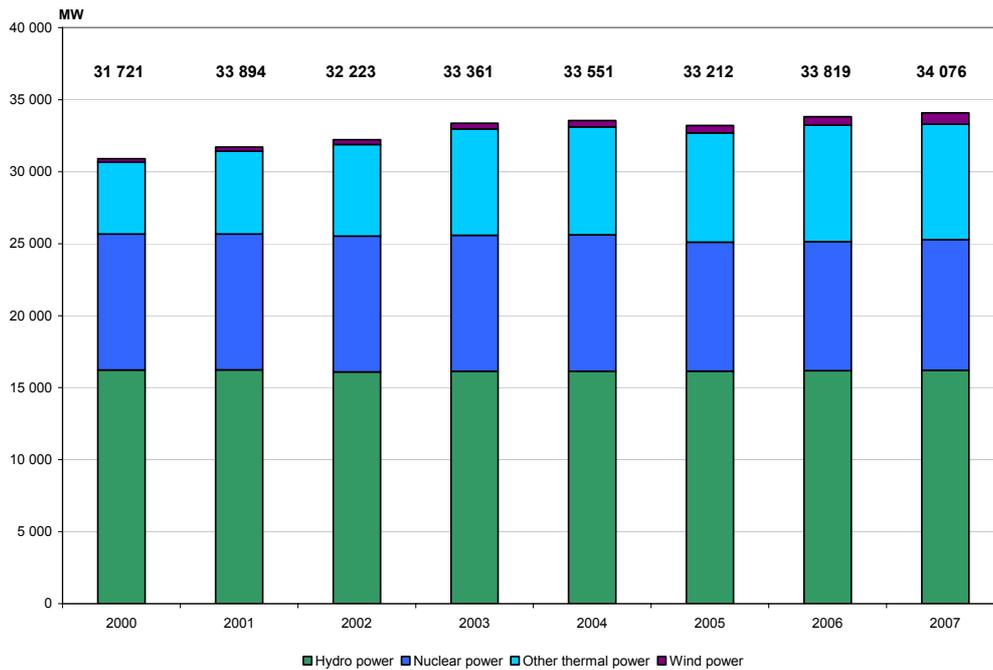
During 2007, the increase in generation capacity in Sweden's power stations amounted to 443 MW, whereas the loss of capacity totalled 186 MW. The net increase thus amounted to 257 MW.

The total electricity generation capacity in Sweden has increased every year since 2000, with the exception of 2005, as shown in Figure 3.<sup>43</sup> The increase in installed power from 2003 and the immediately succeeding years largely consists of plants that were previously mothballed, but have been made operational again as a consequence of the peak load reserve act.<sup>44</sup> The total electricity generation capacity in Sweden's power stations at the end of December 2007 amounted to 34 076 MW.

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<sup>43</sup> The Other thermal power category includes condensing power, CHP generation (industrial and district heating) and gas turbines

<sup>44</sup> Act (2003:436) on Power Reserve. The Act is temporary and has been extended to 2011.



**Figure 3: Installed electricity generation capacity in Sweden**

Source: Nordel

Table 16 shows the installed electricity generation capacity in 2007 and the change in capacity from the preceding year per source of energy. Out of the total net increase in generation capacity in 2007, the highest increase was in wind power at 208 MW. The installed wind power generation capacity has thereby increased by 36 percent from 2006. The net increase in nuclear power generation capacity is 109 MW, but the percentage increase amounts to only about 1 percent. The increase in hydropower generation capacity amounts to 29 MW, which is an increase of 0.18 percent from 2006. On the other hand, the net change in installed electricity generation capacity in other thermal power was a decrease of 91 MW, which is about 1 percent.

**Table 16: Installed electricity generation capacity in 2007 and change from 2006, MW**

	Installed electricity generation capacity on 31 Dec. 2007	2007		Net change from 2006	Change (%) from 2006
		Addition	Loss		
Hydropower	16 209	43	-14	+29	0.18
Wind power	788	217		+208	36
Nuclear power	9 074	114	-5	+109	1
Other thermal power	8 005	78	-167	-91	-1
<b>Total</b>	<b>34 076</b>	<b>+443</b>	<b>-186</b>	<b>+257</b>	

Source: Swedenergy

#### 4.1.2 Investments in new electricity generation capacity and planned upratings

In Sweden, investments in new electricity generation capacity shall take place on commercial grounds. Swedish legislation bans the construction of new nuclear power and large-scale hydropower plant.<sup>45</sup> On the other hand, existing power stations can be uprated, which enables the output of nuclear and hydropower stations to be increased. The currently planned new investments in Swedish power generation capacity mainly comprise CHP generation, wind power and uprating of nuclear power plant.

Additional electricity generation capacity from projects currently in the course of construction and scheduled to be taken into operation in 2008-2010 amounts to more than 1100 MW.<sup>46</sup> These objects together are estimated to generate around 5700 GWh annually.

Figure 4 shows these projects distributed onto energy sources. Out of the total, around 420 MW consist of wind power, which corresponds to 35 percent of the total generation capacity now in the course of construction. CHP generation

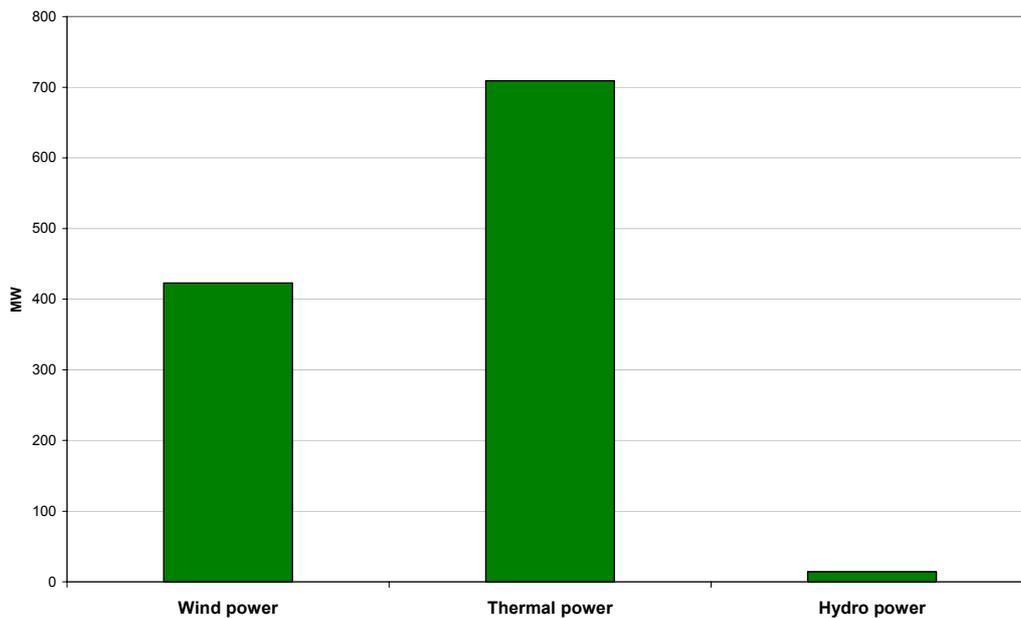
<sup>45</sup> Act (1984:3) on Nuclear Engineering Operations

<sup>46</sup> "Development on the electricity market in the 2007/2008 winter", Energy Markets Inspectorate, 2008. Note that the statistical information cannot be guaranteed to contain the exact number of projects in the course of construction.

accounts for around 700 MW, which corresponds to 58 percent, and hydropower for only 14 MW, which corresponds to less than 1 percent.

The wind power plants now in the course of construction are estimated to generate together more than 1 000 GWh annually, compared to the 1 431 GWh annually

generated by wind power in 2007. In 2010, wind power generation is estimated to amount to at least 2 400 GWh, which is an increase of 70 percent from today's level.



**Figure 4: Projects in the construction phase, with commissioning in 2008 - 2010**

Source: EME Analys

#### **4.1.3 Future investments in electricity generation capacity**

Intensive activity is now in progress in the field of wind power, with many plans for new wind power projects. In spite of the high intensity of project design work for new wind power projects, it is by no means certain that all of these will be implemented. Certain projects may have to be shelved, modified or cancelled altogether. In addition to the general risks of investments in electricity generation, the price of construction materials for wind turbines has risen as a result of the high international demand for wind power. In addition, the permission process for certain projects may take a very long time.

The charted wind power projects in the categories of planning and project design phases with estimated commissioning between 2008 and 2013 are jointly

estimated to generate around 17 000 GWh annually, which corresponds to around 12 percent of the total electrical energy generated in 2007.<sup>47</sup> By way of comparison, wind power generated in 2007 only 1 percent of the total electricity generated in Sweden. See Table 17 for annual breakdown of these projects. However, in all probability, not all of these projects will be implemented, and the information should therefore be viewed with caution. At least 1550 GWh of the total of 17 000 GWh have all received permits for construction, although this does not guarantee that the projects will actually be implemented.<sup>48</sup>

**Table 17: Charted projects in the planning and project design phase category**

	2009	2010	2011	2012	2013
<b>MW</b>	181	4346	851	1223	957
<b>GWh</b>	464	8065	2150	3364	2713

Source: EME Analys

There are many plans for uprating nuclear power in the immediate future. The total planned uprating amounts to 1 302 MW. However, the figure is uncertain, since there are no permits for many of these uprating plans. The planned uprating of the three reactors at Forsmark during 2009 – 2011 will yield a total of 410 MW. Uprating plans for Ringhals will yield a total of 443 MW, and in Oskarshamn, a total of 450 MW.<sup>49</sup>

The CHP projects that are at the planning and project design phases are expected to produce jointly more than 2000 GWh annually, with an installed power generation capacity of almost 400 MW.<sup>50</sup>

### *Transmission capacity*

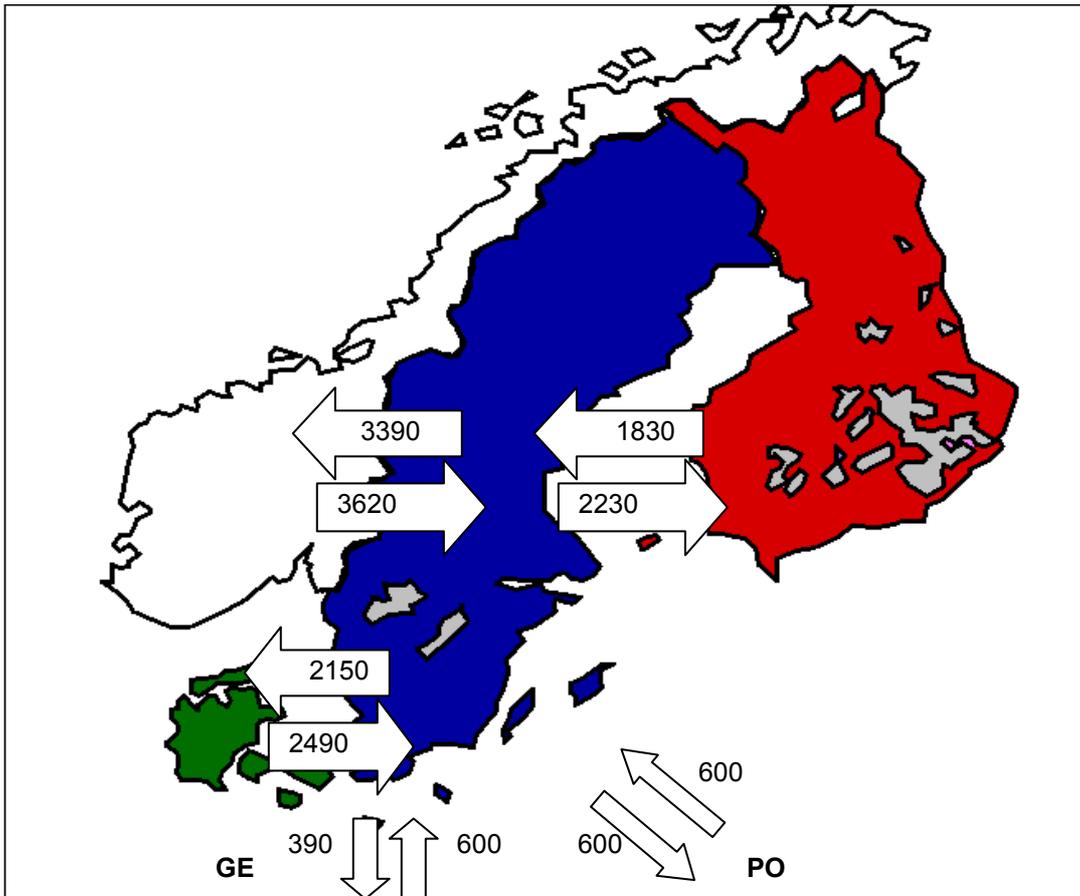
Figure 5 shows the Swedish national grid with transmission capacities in MW with neighbouring countries. Limitations in the connected network leads to the capacities of the links to neighbouring countries varying in magnitude, depending on the direction in which electric power is transmitted. The figure shows only one link with every neighbouring country, although Sweden actually has several links with each country. In 2007, the flow of electricity from neighbouring countries to Sweden amounted to 18.5 TWh. The flow of electrical energy from Sweden increased to 17.2 TWh, which resulted in a net inflow of 1.3 TWh compared with 6.1 TWh the year before.

<sup>47</sup> Source: ENE Analys

<sup>48</sup> Source: Swedish Wind Energy, information from April 2008

<sup>49</sup> Source: Montel Powernews, No. 5 v.10 2008

<sup>50</sup> EME Analys. There are more CHP projects than those that could be identified in this statistical information



**Figure 5: Existing transmission capacities between Sweden and neighbouring countries**

Source: Svenska Kraftnät

In order to increase the capacity and reliability of the Nordic power system, the Nordel cooperation body for the grid system operator companies in the Nordic countries has identified five prioritized electricity links that should be strengthened. The status of these links is briefly presented below.

**The South-West Link** will be built in three parts with a junction point in Jönköping, and is estimated to have a capacity of 1200 MW. Three links will leave the junction point. One link will run south to the Skåne region, the other will run north to Hallsberg, and the third will extend westwards to Norway. Svenska Kraftnät will build the Swedish part of the link. The part that will be built in Norway will be financed by Statnett, which is the national grid company in Norway. The link is expected to be in operation by 2012 at the earliest.

Svenska Kraftnät and Statnett will build a new national grid line between Järpströmmen in Sweden and Nea in Norway. Permits have been granted and

construction will begin in the summer of 2008. The **Järpströmmen-Nea** link is estimated to be ready for commissioning in the summer of 2009.

Svenska Kraftnät and the Finnish Fingrid national grid company have decided to expand the present Fenno-Skan link between Sweden and Finland. The **Fenno-Skan 2** link, which is expected to have a transmission capacity of 800 MW, will have the same run as the existing cable. Permits have been granted and commercial operation is expected to begin at the end of 2011.

The Danish Energinet.dk national grid company is planning a 600 MW cable between eastern and western Denmark. The **Great Belt Link** is expected to be in operation during the first six months of 2010.

Statnett and Energinet.dk have agreed to jointly run a fourth cable, **Skagerack 4**, between Norway and Denmark. The cable is scheduled to have a capacity of 600 MW and will be taken into operation in 2012 at the earliest.

In addition to these ongoing projects, there is a new link between the Netherlands and Norway, which was taken into operation in May 2008. The **NorNed Cable** has a capacity of 700 MW when the maximum capacity of the cable is put to full use.

#### **4.1.4 Quality of the electricity network and its maintenance level**

The Swedish electricity network consists of 528 000 km of conductors, of which 268 000 km are underground cables and 260 000 km are overhead lines. The system can be divided into three levels: national grid, regional network and local network.

The national grid comprises conductors for 400 kV and 220 kV, which interconnect the generation plants, regional networks and electricity networks in neighbouring countries. The regional network consists of power lines at between 130 kV and down to 20 kV, which interconnect local networks and connect certain major industrial customers to the national grid. Local networks can be classified into low-voltage network (400/230V) and high-voltage network (10 – 20 kV).

In 2006, the total length of the regional network was around 30 340 km, and 2 percent consisted of underground cables.

In 2006, the total length of the local networks was around 479 040 km, 40 percent of which were overhead lines and 59 percent were underground cables.

##### *Reliability of supply in the electricity network*

The reliability of supply is affected by factors such as the type of conductor used. As a general rule, underground cables are safer than overhead lines, since they are less exposed to weather disturbances. The proportion of underground cables in

local networks has increased. However, there are risks involved in underground cables, such as cable failure due to excavation or plant work. In an overhead line network, an insulated conductor is more robust than an uninsulated conductor. Around 83 percent of the overhead lines in the local networks are insulated.<sup>51</sup>

According to the Electricity Act, the electricity network companies are obliged, from 1 January 2006, to carry out risk and vulnerability analyses and to draw up a plan of action that shows how reliability of supply in their own networks will be improved. The purpose of the regulations is to reduce vulnerability in the electricity network and to contribute to conformance to the Electricity Act requirements that, no later than 2011, the duration of power cuts will not exceed 24 hours. The risk and vulnerability analyses and the plan of action shall be submitted to the Energy Markets Inspectorate. The Inspectorate has started the work of drawing up regulations that will be completed by early 2009.

New rules concerning interruption compensation were introduced in the Electricity Act from 1 January 2006 as a consequence of the storm in 2005. According to the new rules, an electricity user whose supply of electricity has been interrupted for at least 12 hours shall have the right to compensation by the electricity network company to which the customer is connected. The compensation shall be payable automatically. The Electricity Act also includes provisions for damages from the electricity network company in the event of personal injury, material damage or damage to property. The Energy Markets Inspectorate issued regulations in April 2007 concerning interruption compensation in accordance with the provisions of the Electricity Act.

In November 2007, the Energy Markets Inspectorate issued regulations concerning the obligation of the electricity network companies to report power cuts in accordance with the provisions of the Electricity Act. From 2011, comprehensive and detailed interruption reporting shall be made at customer level for both short and long interruptions. Long duration and extensive power cuts shall be reported to the Inspectorate as from 1 January 2008. The purpose of the reporting is to make it possible to assess the delivery quality in the electricity networks which serves, among other things, as the basis for assessing the reasonableness of the network tariffs.

The electricity network companies made the voluntary undertaking in 2001 to provide weather protection for all uninsulated conductors through forests, totalling 57 000 km in length. The violent storm in January 2005 led to an increase in the rate of investments in the electricity networks, and roughly half of the investments were completed by the end of 2006.

The electricity network companies have also set up the ELSAM organization for collaboration in the event of disturbances in the electricity network, which

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<sup>51</sup> According to information from 2006

represents a regional division into electricity collaboration areas in the event of disturbances.

#### **4.1.5 Roles of the authorities**

Sweden is now at an investment phase in which there are many plans for building new power generation plants. In Sweden, investments in new power generation capacity shall be made on commercial grounds. In 2003, a market-based support system was introduced in Sweden for renewable electricity generation.<sup>52</sup> The support system has increased the investments in CHP generation from biofuels, and also in wind power. The current legislation in Sweden bans the construction of new nuclear power reactors and large-scale hydropower plants.

No permit from the Energy Markets Inspectorate is needed for building a new electricity generation plant in Sweden. On the other hand, permission is needed in accordance with both the Environmental Code and the Planning and Building Act. The Swedish Parliament decided in 2005 to shorten and simplify the environmental review in Sweden. The new interim laws have been valid since 1 August 2005.

Network connections or the laying of transmission lines or submarine cables to generation plants must not be made without permission, which is known as network concession. A network concession is granted by the Energy Markets Inspectorate or by the Government in the case of links with foreign countries or lines in the national grid.

The Energy Markets Inspectorate bears the responsibility for supervising the development of security of supply on the electricity and natural gas markets in accordance with Article 4 of Directive 2003/54/EC as well as Article 5 of 2003/55/EC and Article 5 of 2004/67/EC.

Being the authority responsible for the system, the Svenska Kraftnät TSO is responsible for maintaining the instantaneous balance between the supply and delivery of electricity in the Swedish electrical system. Svenska Kraftnät is also responsible for the reliability of the national grid for electricity. The responsibility involves maintaining the reliability of the electrical system and procuring a peak load reserve before every winter in accordance with the interim peak load reserve act.<sup>53</sup> The TSO shall also work on relevant measures that can be taken for reducing the risk of power shortage in Sweden, monitoring the availability of high-load capacity in the Swedish electrical system, and acting for high integration and harmonization of the electricity markets in the Nordic countries. In its capacity of being responsible for the system, Svenska Kraftnät also has the authority to order the isolation of electricity users as a last crisis resort in the event of electricity shortfall.

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<sup>52</sup> Act (2003:113) on Electricity Certificates

<sup>53</sup> Act (2003:436) on Power Reserve

Svenska Kraftnät continuously provides information on its homepage on the power situation in Sweden, with an hour-by-hour forecast for the coming 24 hours and an indication for the subsequent days. Information is also given on the measures that Svenska Kraftnät adopts in the event of a difficult power situation. The players on the market are informed by means of a so-called urgent market message (UMM) published on the Nord Pool homepage. The purpose of the UMM is to enable all market players to simultaneously obtain information that may affect pricing. Svenska Kraftnät participates in working groups related to the power issue within Nordel and Etso.

The Swedish Energy Agency is the central administrative authority for the supply and use of energy. One of the tasks of the Agency in the field of secure energy supply is to act towards securing the availability of electricity and other energy in the short and long terms, and to monitor the development of the energy markets and the energy system. The Agency has the coordinating responsibility for the general security of supply in the field of energy in the event of shortage situations. It should be possible to meet a supply crisis in the field of energy by preparing measures for supplying alternative energy, suppressing consumption and informing energy users. The coordinating responsibility also involves training, exercising and reporting to the Government on the security of supply situation in the fields of electricity, heat, oil and natural gas. In the event of a supply crisis, it is also important for the individual electricity users to have good knowledge and take responsibility for their electricity supplies. The Agency has prepared advice and hints aimed at specific target groups for preventing and relieving the effects of failure of electricity and heat supplies. This information is aimed at private persons, property owners, medical care personnel, purchasers of stand-by generators and others.

The Agency also participates in the work of the EU and IEA towards secure oil and gas supplies, and in the field of secure electricity supply at Nordic level within, among others, NordBER. The Swedish Energy Agency has a crisis organization that is trained for being able to deal with various types of energy crises.

#### *Projects for reducing the consequences of power shortage*

If Svenska Kraftnät decides to request isolation of electricity users in an electricity shortage situation, isolation will be made high up in the electricity network, at regional level. This leads to all electricity users in large geographical areas being affected by the power cut. No consideration is given to the needs of electricity users, regardless of how sensitive they are to power cuts. In view of this, the Swedish Energy Agency has been instructed by the Government to draw up a proposal for how isolation can be carried out so that the total consequences will be as light as possible. The Agency has therefore proposed that isolations should be carried out in local networks, which provides the means for prioritizing the electricity users who are to be isolated. The consequences of power cuts are

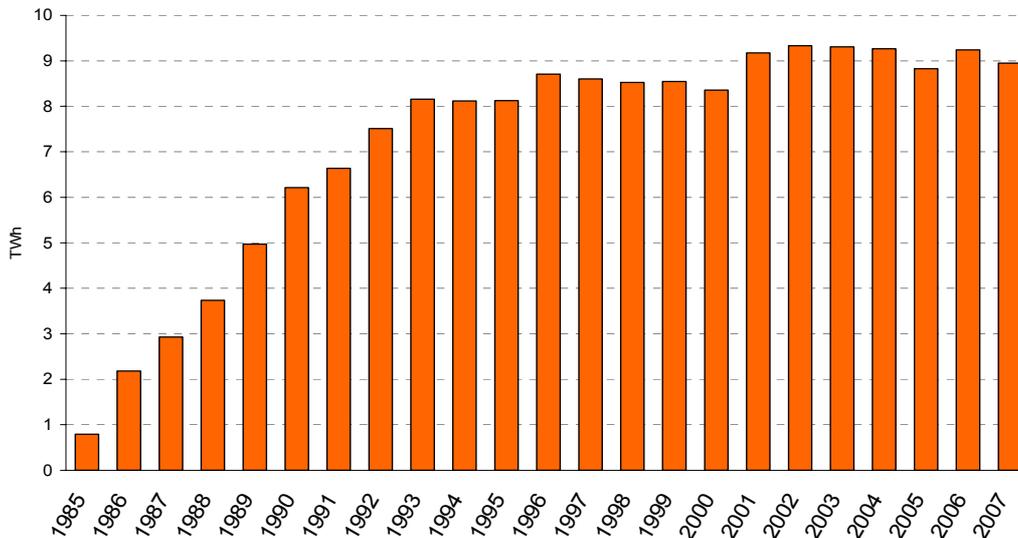
reduced if the users who have the greatest need for electricity can be prioritized and the available electricity can be delivered to them.<sup>54</sup>

Elforsk, the Swedish Electric Utilities' R&D Company, has a research programme code-named Market Design for developing the electricity market. The research programme is engaged on a number of studies related to reducing consumption. An important point of departure in the projects is that the measures shall be profitable to both the electricity supplier and the electricity user. The Elforsk studies generally demonstrate that there is significant willingness and ability of electricity users to reduce their electricity consumption, provided that the incentives are appropriate.

## 4.2 Natural gas

### 4.2.1 Natural gas consumption

Figure 6 shows the development of natural gas consumption in Sweden since its introduction in 1985. In 2007, the consumption was roughly 11.7 TWh, which is equivalent to around 2 percent of Sweden's total energy consumption.<sup>55</sup>



**Figure 6: Sweden's natural gas consumption**

Source: Statistics Sweden

<sup>54</sup> The proposal is presented in the report entitled "Prioritizing of electricity users in the event of electricity shortage", Swedish Energy Agency 2007:38

<sup>55</sup> Expressed in higher calorific value. Expressed in lower calorific value, the natural gas consumption in Sweden in 2007 amounted to about 9 TWh

The Swedish natural gas consumption is expected to increase somewhat in years to come as a result of the Rya CHP plant being taken into operation in the autumn of 2006 and the expansion of the Öresund Power Station. The Rya CHP plant is one of Sweden's biggest individual natural gas users, with an estimated annual consumption of around 3 TWh. In addition, the existing Öresund Power Station in Malmö is being modernized by the installation of a gas-fired CHP plant with a generation capacity of 440 MWh elec. and 250 MW thermal. The plants together are expected to consume around 8 TWh of natural gas annually when fully operational.

#### 4.2.2 Natural gas system

All natural gas consumed in Sweden is imported through the pipeline running between Denmark and Sweden. From Denmark, pipelines run to the Continent, which means that Sweden is interconnected with the Continental system. The Swedish market is concentrated to the west coast along the pipeline network extending from Trelleborg in the south to Stenungsund in the north, with a branch to the Småland region (see Figure 7).



Figure 7: The Swedish natural gas network

Source: Swedish Gas Trade Association

The natural gas system can be classified into transmission and distribution systems and storage facilities. Long-distance transport takes place in the transmission pipelines at high pressure, normally between 50 and 65 bar. Pressure reduction is then carried out before the local distribution network delivers the natural gas to customers. The distribution system is normally designed for a pressure of between 4 and 30 bar, depending on customer needs. In 2007, the Swedish natural gas system consisted of around 650 kilometres of transmission pipeline and around 3 000 kilometres of distribution pipelines.

The existing transmission pipeline between Malmö and Gothenburg has the capacity to convey annually around 22 TWh. The capacity can be increased to around 30 TWh by using compressors. However, since the market demand is not constant over the year, the transmittable energy is around 15 TWh without compressors and 20 TWh with compressors.

#### *Storage of natural gas*

The first Swedish natural gas storage plant was taken into commercial operation on 1 May 2006. The storage plant is owned by E.ON Sverige AB. The plant is located in southern Halland and is principally a demonstration plant. The storage plant is relatively small, with a volume of 10 million m<sup>3</sup> at normal temperature and pressure. In the foreseeable future, Sweden will have to rely on storage facilities in other countries, storage in transmission pipelines (linepack), or may have to adjust the deliveries to meet the consumption variations on the market.

#### **4.2.3 Plans for net supply alternatives**

The following plans for new supply to the Swedish natural system were being considered in 2007:

The Skanled project, which is an industrial cooperation project between Sweden, Norway and Denmark, is planning to build a natural gas pipeline from Norway to Sweden and Denmark. The planned pipeline will be run out at sea, thus providing Norway with a new way of being supplied with natural gas. Industrial plants in southern Norway are now being supplied by ship with natural gas from the North Sea. According to plans, the existing Swedish natural gas network will be connected to the new pipeline by three branch lines on the west coast of Sweden at Lysekil, Stenungsund and Varberg. The natural gas pipeline is also planned to continue to Denmark. The concession application for the Swedish part of the pipeline was received by the Energy Markets Inspectorate in January 2008. The application is currently being processed. Swedgas and Gassco are the principals for the project, together with investments from 13 other companies. These companies have concluded ownership agreements and have undertaken to accept gas through the pipeline. Poland, which also has ownership interests in the gas fields in the North Sea, is also working on building, in the longer term, a direct

connection from Denmark to enable gas to be supplied from the North Sea via Skanled. According to the plans of the players, gas deliveries will begin in 2012.

The Skanled pipeline is important to Sweden from the security of supply viewpoint. All natural gas used in Sweden currently comes from Denmark, but Denmark's production of natural gas will decrease in the next few years as a result of the declining reserves of natural gas in the Danish natural gas fields. Skanled will enable Sweden to receive a supplementary supply of natural gas from Norway, which is estimated to have a natural gas production that can cover the needs of the entire EU for the coming 70 years. The new pipeline will also lead to reduced carbon dioxide emissions from industry, since industrial plants will be able to switch from oil and coal to natural gas.

Fortum, in cooperation with AGA and Nynas Refining, is planning to build a terminal for liquefied natural gas (LNG). According to the plans, the LNG terminal will be located just north of the Nynäs refinery in Nynäshamn. The plant will provide LNG intermediate storage and facilities for gasification before use. The storage volume is scheduled to be around 20 000 m<sup>3</sup>. One of the results of natural gas being handled in Nynäshamn is that it will be possible to replace the naphtha-based town gas in Stockholm with natural gas. The intention is that the plant will be taken into operation in 2010. There are no plans for connecting the plant to the existing natural gas network. On 26 May 2008, the Environmental Court approved the application for the construction of the LNG terminal.

#### **4.2.4 Quality of the natural gas network and its maintenance level**

##### *Transmission system*

The Swedish transmission system consists principally of steel pipelines. The system status is inspected at regular intervals, and defective or worn equipment is replaced. According to the players, the pipelines are expected to have a useful life of at least 40 years, whereas certain supervisory, control and regulation equipment is expected to have a useful life of between 15 and 20 years.

Table 14 below gives a summary of the inspections carried out, the frequency of inspection, and the method used.

**Table 14: Own inspection of transmission system**

<b>Inspection of transmission system</b>	<b>Time intervals</b>	<b>Method</b>
Supervision of work near the pipeline	6 times/year	Inspection from the air
Inspection of safety zone near built-up areas	Once a year	Inspection from the ground
Inspection of Öresund pipeline	Every 3 years	Echo sounding
Inspection of protective coating around the pipeline	Every 8 years	Inspection by "intelligent pig"
Check of pipeline material thickness	Every 8 years	Inspection by "intelligent pig"

Source: Energy Markets Inspectorate

### *Distribution system*

The distribution pipes are mainly made of polyethylene (PE) material. Steel pipes are sometimes used for supplying customers who need gas at pressures higher than 4 bar. Guidelines for the design, operation, care, maintenance, etc. of the distribution network for a maximum operating pressure of 4 bar are given in the Energy Gas Standards (EGN 01) drawn up by the Swedish Gas Trade Association.

#### **4.2.5 Measures for meeting consumption peaks and delivery shortfalls**

Consumption peaks and delivery shortfalls are dealt with principally by the balance providers by the balancing window provided by varying the pressure in the transmission network – a procedure known as linepack. If additional measures are required, Svenska Kraftnät uses market mechanisms as far as possible for dealing with imbalances. Balance providers are then contacted for carrying out regulation gas trading.

In situations in which commercial agreements are not considered to be adequate for dealing with imbalance in the natural gas system, the Natural Gas Act allows Svenska Kraftnät to order the owners of natural gas storage facilities and gasification plants to increase or reduce infeed or delivery on commercial terms. Svenska Kraftnät can also order network owners to limit or interrupt the supply of natural gas to customers. If this is done, the supply to consumers will be assured. Plans for quick, safe and effective isolation in the event of total interruption are now in the course of preparation.

## 5 Consumer matters

### *Labelling for primary energy source*

With effect from 1<sup>st</sup> April 2006, electricity users will be provided with information, either on or in connection with their invoices, and in advertising material, on the proportion of each type of energy source making up the average composition of energy sources used to produce the electricity delivered by the supplier during the previous calendar year. With effect from the same date, electricity users will also receive information on the environmental effects of such power production in the form of carbon dioxide emissions and of the quantities of nuclear fuel waste resulting from production of the electricity.

### *Vulnerable customers*

The Swedish Electricity Act includes a section that regulates consumer protection.<sup>56</sup> This prohibits the disconnection of supplies in the event of a disputed claim for payment, or if there is a risk that such interruption of supply would cause not inconsiderable personal injury or ill-health or extensive damage to property. Before transmission is interrupted, the consumer shall be encouraged to carry out corrections within a reasonable time, and shall be advised that transmission will otherwise be interrupted. If correction is carried out, transmission will not be interrupted. The Electricity Act also specifies that a message on failure to pay shall be submitted to the social welfare committee in the municipality to which the consumer has electricity transmitted. The consumer then has an opportunity to receive assistance from the social welfare committee for paying the debt for transmission. The requirement to protect particularly vulnerable customers is thus met in extension by the regulations in the Social Services legislation.

There is no particular authority that supervises individual cases concerning the disconnection of supplies, and EI does not therefore have any data about disconnection of customers.

### *Implementation of Annex A*

Sweden has implemented Annex A to a certain extent, by the Electricity Act with associated regulations. However, Annex A has largely been implemented by the general terms of agreement.<sup>57</sup> The general terms of agreement are negotiated by the Swedish Consumer Agency and the Swedenergy trade association, and can be considered to be general practice in the industry. The Energy Markets Inspectorate regularly submits views to the parties to the agreement concerning the contents of

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<sup>56</sup> Section 11 of the Electricity Act (1997:857). The term consumer relates to a physical person to whom electricity is transmitted or supplied mainly for purposes that are outside industrial or commercial operations.

<sup>57</sup> Network 2004 K and EL 204 K, terms for the consumer

the general terms of agreement, in order to ensure that they conform to the relevant regulations.

It is important for the consumer to know the general terms of agreement. The Swedenergy trade association has encouraged its member companies to send the terms of agreement to their customers. Most of the electricity suppliers and electricity network companies apply these general terms of agreement. In addition, the Consumer Agency informs municipal consumer guides and the Consumer Electricity Advice Bureau of the general terms of agreement.<sup>58</sup> The general terms of agreement are also available on the Energy Markets Inspectorate homepage.

If a dispute should arise between a consumer and an electricity supplier, the consumer has the opportunity to have the dispute assessed free of charge by the National Board for Consumer Complaints in accordance with Annex A to the Directive.<sup>59</sup>

#### *Prices to end customers*

Electricity is traded on a competitive market. The Energy Markets Inspectorate does not supervise electricity prices. However, from 1 January 2007, electricity suppliers are obliged to inform the Energy Markets Inspectorate of prices and terms of electricity delivery. These particulars serve as a basis for an electricity price comparison aimed at the consumer on the Inspectorate's website [www.elpriskontrollen.se](http://www.elpriskontrollen.se). The Inspectorate follows the general price development, but not for any specific customer category. The Inspectorate exercises supervision of the reasonableness of the network tariffs, since network operations are pursued by local monopolies.

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<sup>58</sup> The Consumer Electricity Advice Bureau is an advisory bureau to which private persons can turn with questions concerning the electricity market. The principals of the Consumer Electricity Advice Bureau are the Energy Markets Inspectorate, the Consumer Agency and Swedenergy

<sup>59</sup> The National Board for Consumer Complaints assesses the dispute, provided that it does not involve a sum below SEK 2000.