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The Energy Market 2004

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Foreword

The Energy Market 2004 is an annual publication that supersedes the earlier Electricity Market annuals. It focuses on the changes that have taken place during 2003 and the spring of 2004. It also provides an overview of the network based energy issues dealt with during the year.

Energy markets are of vital importance to the growth and welfare of society. The Energy Market 2004 presents facts and statistics related to the electricity, gas and district heating markets. The publication is divided into chapters that can be read separately, but that jointly provide an overview of the network based energy markets.

There is an extensive work carried out within the EU, in order to create a common market for electricity and gas. This publication therefore describes the Swedish market with an extension to the Nordic and European markets.

Facts and statistics regarding the development of the entire Swedish energy system are presented in the publication Energy in Sweden.

Eskilstuna, August 2004

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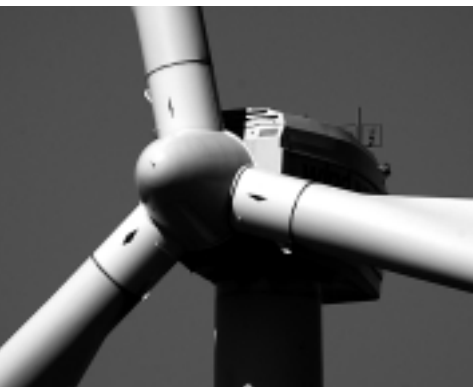


Summary

In The Energy Market 2004, the Swedish Energy Agency presents the markets for network based energy in a joint publication.
The electricity, gas and district heating markets have common features. They are characterized by vast infrastructure investments that are of major significance to the growth and welfare of society. These investments are often also characterized by having a very long economic lifetime and having no alternative use.

Since electrification began in Sweden more than a century ago, society has become increasingly dependent on energy. Dependable access to energy at competitive prices has become an important political issue. The world's biggest electricity market is emerging within the EU. The ambition is to achieve higher efficiency and improved security of supply by linking together the former national markets.

This publication describes the markets for network based energy in a Nordic perspective, with an extension to the EU. The ongoing harmonization of the energy market policy is described in more detail in the sections dealing with energy policy and regulations.

The network based energy markets differ in size, ownership structure and competition. The electricity and district heating markets in Sweden were deregulated in 1996. However, the natural gas market is being deregulated in stages, and will be completely open to competition by 2007 at the latest.

The rules for promoting competition in trading and production on the network based energy markets have therefore been continually changed. The chapters dealing with the markets describe the effects of deregulation and how the market structures have changed.

If a market is to perform well, the consumers must be active. A study performed by "Elkonkurrensutredningen" (Electricity competition committee) shows that switching to a different supplier involves costs that restrict consumer mobility, and that the consumers are not sufficiently well informed. This publication also describes the development of prices and how the trading prices have developed on the competitive market.

The markets for network based energy are in the course of continual development. This report gives a coherents view of the way the markets work and their development from a national monopoly to an open, competitive market. On such a deregulated market, consumers enjoy increased diversity and freedom of choice. This, in turn, has created the conditions for better utilization of resources at the production stage. ■

The past year

2003 has been an eventful year. In this section, we have summarized some of the major events that occurred during the year on the electricity, gas and district heating markets. The various chapters further on give a more detailed description.

2003 was a dry year

2002 as 2003 will go down in history as "dry years". Sweden faced an extreme situation in the autumn of 2002 and winter of 2003, since this period was drier than it had been for at least 20 years. During this period, electricity supply could be maintained without the authorities in the Nordic countries needing to intervene. This was because the high prices of electricity encouraged the use of unutilized generation capacity in the Nordic countries, and also led to extensive net imports from Germany, Poland and Russia to the Nordic countries. The high prices also had a minor damping effect on consumption. Many industrial and domestic customers faced very high electricity prices.

Power cuts

2003 was a dramatic year with extensive power cuts, not only in Sweden. Major power cuts affected the USA in August and Italy in November. During the 2003/2004 winter, Sweden suffered five major power cuts caused by stormy weather. All of these were rendered more difficult by the fact that they occurred in conjunction with holidays. On 23 September 2003, 2.6 million subscribers suffered a major power cut on the national grid, which is the backbone of the electricity distribution network.

The Performance Assessment Model

The Swedish Energy Agency will take the new performance assesment model into operation during 2004. This tool will be used for assessing the reasonableness of the transmission tariffs levied by the local network companies. This work has been in progress throughout 2003, and three pilot tests have been run. In the pilot tests, both the network companies and the authorities have tested routines for data acquisition, reporting routines and assessment of how the model has performed. About 74 percent of the network companies have participated in the latest pilot test that was run during the autumn of 2003. This corresponds to around 81 percent of the total number of subscribers in Sweden. The network charges are examined in arrears. The Swedish Energy Agency will therefore examine the 2003 network charges during 2004.

Adjudication of the Administrative Court of Appeal

In May 2003, the Stockholm Administrative Court of Appeal issued its first verdict concerning the reasonableness of the network charges levied by the network companies in 1999, pursuant to the 1997 Electricity Act. In the 22 judgements, the Administrative Court of Appeal judged in favour of the Energy Agency concerning important fundamental principles. The Court confirmed that it was correct to use the price level when deregulation began in 1996 as a basis, and that the guiding factor price index of the Agency was a reasonable point of departure for the assessment. However, the appeals were allowed in a number of judgements, with reference to there being an uncertainty in the reasonableness assessment, and a certain tolerance frame must therefore be accepted. The interests of consumers were emphasised throughout. Following the adjudication of the Administrative Court of Appeal, the network companies had to refund about SEK 20 million. However, some network companies have appealed to the Supreme Administrative Court against the decision of the Administrative Court of Appeal.

Market-based economic instruments

A tradeable electricity certificate system was introduced in May 2003 with the aim of stimulating electricity generation from renewable energy sources. The introduction of electricity certificates represents a change in the support policy. Sweden switched from a traditional subsidy policy to a market-based support system. Moreover, Sweden is preparing a system of trading in emission rights for greenhouse gases. The system will initially comprise only carbon dioxide, and will begin with a trial period during 2005–2007.

Increased concentration on the electricity market

On the generation side, the electricity market was concentrated further during 2003 by Sydkraft purchasing Graninge. Vattenfall, Fortum and Sydkraft are now the three energy companies that account for almost 90 percent of Swedish electricity generation.

Deregulation of the natural gas market

As from 2003, corporate customers with an

annual consumption in excess of 15 million cubic metres have been free to choose their natural gas suppliers. Other corporate customers will have the same rights as from 1 January 2005. In accordance with the new Gas Market Directive, the market will be opened to all customers on 1 July 2007.

Focus on the consumer on the electricity market

During 2003, the focus fell more clearly on the consumer perspective. The year began by many domestic customers being upset by the way they were treated after the Kraftkommissionen electricity trading company had its electricity supplies suspended. Opinion surveys showed that the confidence of households in electricity companies was exceptionally low. Several electricity companies have demonstrated that they have taken the problems seriously and have set up consumer ombudsmen to look after the interests of customers. In addition, an independent ethics board will be set up by the industry. The Swedish Energy Agency began the work with a 15-point programme entitled "The consumer – in focus or in a jam".

The EU

On the initiative of the EU Commission, the European countries strengthened their cooperation by forming the European Regulators Group for Electricity and Gas (ERGEG). The task of the Group is to advise the Commission on the EU guidelines for cross-border trade. The Swedish Energy Agency has already been actively participating in international cooperation in energy policy matters as member of the Council of European Energy Regulators (CEER).

EU directives

The Electricity and Gas Markets Committee submitted an interim report in November 2003 on the incorporation of the new electricity and gas market directives into Swedish legislation. The proposals of the survey included the requirement for separate managing directors, boards of directors and company signatories in vertically integrated companies, requirement for certification of origin of electricity, proposal for methods of tariff calculation, and a two-month rule for dealing with connection matters.

New CHP taxation

Combined heat and power (CHP) taxation was amended in Sweden on 1 January 2004. The change allows CHP generators to deduct the whole energy tax and 79 percent of the carbon dioxide tax from the heat generated in a CHP plant. In the past, only half the energy tax was deductible.

Expansion of the Swedish natural gas network

In 2003, Nova Naturgas began the construction of a gas pipeline from Gothenburg to Stenungsund. When construction is completed in 2004, natural gas consumption in Sweden is expected to increase by 10–15 percent. This natural gas is expected to replace oil. In addition, the Swedish Energy Agency approved the Sydkraft Gas application for the construction of a new transmission line known as the Baltic Gas Interconnector between Germany and Sweden via Denmark.

District heating study

In 2002, the Government appointed a commission and entrusted it with the task of shedding light on the competitive situation in district heating. In its first report to the Government, the commission proposed that district heating operations should be reported separately and that the separation in relation to electricity trading should be made clearer, in order to avoid the risk of cross-subsidizing.

Programme for energy efficiency improvements

In April 2004, the Government tabled the Council on Legislation report that proposed a new law on energy efficiency improvements. The objective is to promote efficient and environmentally friendly use of energy. The law is aimed at energy-intensive companies that would be allowed an energy tax reduction in return for a commitment to improve the efficiency of energy utilization. ■

Markets for network based energy

The markets for network based energy have different characteristics in terms of distribution, size, ownership and use. By their very nature, the various network based energy forms have their specific fixed installations, and the end users consequently have no access to alternative connection facilities.

The electricity market is Nordic rather than Swedish. The Electricity chapter therefore focuses on a Nordic market and on the questions that arise through the work of creating an integrated European market. Important matters include reliable access to energy at competitive prices, and security of supply. A large proportion of the chapter is therefore devoted to describing the players on the market and the electricity price developments.

Natural gas is of a local nature and only 30-odd Swedish municipalities are connected to the distribution system. All gas is transported to Sweden through an interconnected European gas network. The Natural gas chapter therefore focuses on matters that shed light on developments on the market and on the EU Directive.

The district heating market is made up of a large number of independent local markets. The District heating chapter therefore focuses on competition matters, price development and costs of switching to other energy forms.

The electricity market

Since electrification began in Sweden at the end of the 19th century, society has become increasingly dependent on electricity. When the Swedish electricity market was deregulated in 1996, trading in electricity and electricity generation became competitive markets. But the distribution networks are still operated as local monopolies. On the competitive market comprising more than 200 active electricity companies, free pricing is employed and the price of electricity is determined on the basis of supply and demand on the market. The Swedish electricity market is part of a common Nordic market that includes all Nordic countries with the exception of Iceland.

The natural gas market

Natural gas was introduced in Sweden in 1985. Consumption increased rapidly up to 1992 and then levelled off to a more moderate rate. Natural gas still plays a marginal role in Swedish energy supply and is now used exclusively in the south-western parts of the country. The Swedish natural gas market is not yet fully deregulated. Deregulation is taking place in stages, and the market will be fully opened in 2007 at the latest. Seven active companies operate on the Swedish natural gas market. Sweden does not have its own production of natural gas, and all gas is imported from Denmark. The price of natural gas in Sweden is set in accordance with the cost to the customer of an alternative energy source, usually oil.

The district heating market

Sweden is a pioneering country in the field of central heating of dwellings, and sales of heat from district heating systems began in Sweden on a commercial basis back in the 1950s. District heating now accounts for half of all space heating in multi-family houses and in commercial and industrial premises. The district heating market is not regulated, but when the electricity market was deregulated in 1996, district heating also followed suit. Sweden has more than 200 local district heating companies, most of which are wholly or partially owned by municipalities. Since the heating market affects several energy markets, there is basically competition between different heating alternatives. However, the heating market is sluggish, since it is expensive for the customer to change over to a different heating alternative. This is why the district heating market is usually said to be a local monopoly. ■

Electricity

The electricity market is a competitive market on which much of the price is determined by supply and demand. Other factors that influence the price include taxes, support and electricity certificates. The end-user price consists of electrical energy, network charges and taxes. The price of electricial energy can be influenced by the choice of electricity supplier. Nord Pool is a common electricity market for trading between the Nordic countries. The Nord Pool prices can be used as a reference on the increasingly integrated electricity market.

Energy policy and regulations

More than eight years have passed since the reform of the Swedish electricity market came into force on 1 January 1996. The initial period after the deregulation involved harmonization of the Nordic electricity markets. One element was the formation of Nord Pool – the Nordic electricity exchange that serves as a common marketplace for trading between the Nordic countries. In recent years, the work within the EU of creating an internal market for electricity has also affected the conditions for the electricity market in Sweden. This chapter discusses the way in which developments on the Swedish electricity market are affected by the other Nordic countries and by the EU.

The Nordic electricity market reform

The electricity market in the Nordic countries has sustained major and far-reaching changes since the mid-1990s. The Swedish electricity market was deregulated in 1996 and new rules were introduced for promoting competition in electricity trading and generation. Similar reforms have taken place in all Nordic countries, with the exception of Iceland. Norway deregulated its market in 1991, Finland in 1995 and Denmark in 1999. The objective of deregulation was to increase the freedom of choice for the consumer and to create better conditions for competition and better utilization of the generation resources.

Following the Swedish deregulation, the Norwegian electricity exchange, Nord Pool, developed into a Swedish-Norwegian electricity exchange. Nord Pool is open to electricity generators, electricity traders and major electricity consumers. Nord Pool comprises mainly players from the Nordic countries, although some trading also takes place with countries such as Germany and Poland. The electricity exchange facilitates trade in electricity between countries and thus increases the competition. The power plants can thus be utilized in the most economical way.

Although the Nordic electricity market is now largely integrated, the players in each country are subjected to domestic regulation and domestic supervision. For the integrated electricity market in the Nordic countries to perform well and to develop, it is therefore of major importance for taxes, charges and other types of regulation to be harmonized. The energy policies of other Nordic countries have consequently become of growing importance to Sweden.

Trade in electricity between the Nordic countries has increased since deregulation. The natural conditions for electricity generation in the various Nordic countries are different, which has led to differences in how the countries choose to design their electricity generation systems. Norway and Sweden have a large proportion of hydro power, whereas electricity generation in Finland and Denmark is more combustion-based.

A European market for electricity

Sweden became a member of the EU in 1995. The Electricity Market Directive (96/92/EC) was adopted in December 1996. The aim was to create common rules for the generation, transmission and distribution of electricity.

The directives of the European Parliament and Council concerning rules for the internal market for electricity and gas (2003/54/EC and 2003/55/EC respectively) were adopted in 2003. As a result, the earlier Electricity Market Directive from 1996 ceased to be valid. According to the new Directive, the markets for electricity and gas shall be opened fully to industrial customers on 1 July 2004 and to domestic customers on 1 July 2007. In spite of the ongoing harmonization, there are still differences between the EU member countries. The Nordic countries, Great Britain and Germany are now regarded as being fully deregulated in accordance with the Electricity Market Directive.

Economic instruments and other regulations are adapted to the ongoing deregulation, so that competition will not be distorted and no trading policy obstacles will arise. One of the risks of non-harmonized regulation is that

competition in countries that are not yet deregulated will have the opportunity to employ cross-subsidizing and thus distort the competition in the EU.

Growing environmental awareness is one of the driving forces behind the coordination of the energy policies of the European countries. Similar conditions in the form of, for instance, harmonized environmental taxes and system of charges are necessary in order to ensure that companies in some countries will not be put at a disadvantage. These companies would otherwise not be able to offer competitive prices of environmentally-friendly electricity.

The EU took a step towards a harmonized energy policy on 13 October 2003 by adopting the Directive (2003/87/EEC) on trading in emission rights for greenhouse gases. The objective of the Directive is to contribute in a cost-effective manner to the climate targets of the Union and its commitments in accordance with the Kyoto Protocol.

In addition, the EU Council decided on 27 October 2003, after almost ten years of work, to increase harmonization of the energy taxation, in the form of an Energy Tax Directive. The Directive, which contains common regulations for taxation not only of oils, but also of electricity, coal and natural gas, came into force on 1 January 2004. A harmonized framework is thereby created for energy taxation of all fossil fuels and electricity. The Energy Tax Directive therefore contributes to increased competitive neutrality for Swedish companies that operate in the EU.

Implementation of the new EU Directive in Swedish legislation

In order to adapt the Swedish regulations to the revised Electricity Market Directive, some amendments must be made to the Swedish legislation. The Government therefore appointed a special investigator in February 2003 for the purpose of reviewing the need for amendments to the legislation on the electricity market. The investigator submitted his interim report in December 2003, entitled “Electricity and natural gas markets – European harmonization”.

The report contains proposals for several legislative changes that are necessary in order to incorporate the Directive into Swedish legislation. Among other things, the investigation proposes the introduction of a requirement that electricity suppliers should guarantee the origin of the electricity being sold, either on or in conjunction with invoices and in advertising aimed at electricity users. The information must be based on the average fuel composition in the preceding year. In conjunction with this, the electricity supplier must also submit particulars of the environmental impact in the form of carbon dioxide or radioactivity emissions to which the average fuel composition in the previous year has given rise, by reference to existing sources.

As regards network charges for the transmission of electricity, the investigation proposes that the network company should give special consideration to the number of connection points, the geographical locations of the connection points, the amount of energy transmitted, the subscribed power, the costs for the overhead network, and the quality of the electricity transmitted. In addition, the report suggests that, when determining the once-only connection charge, the network company should give special consideration to the location of the connection and the agreed rating of the connection.

The investigation suggests that the conditions for the provision of balancing services should be objective, non-discriminatory and should reflect actual costs. The provision of these balancing services should be approved in advance by the Swedish Energy Agency.

In order to underscore the separation between network operations and the generation of electricity and trading in electricity, the investigation proposes that no member of the board of directors, managing director or company signatory in a network company may be appointed member of the board, managing director or company signatory in a corporate body that generates electricity or pursues trade in electricity.

During 2004, the investigation has continued the work of submitting proposals for changes to enable the Swedish regulations to be harmonized with the revised Electricity Market Directive. Some of the issues that this stage of the investigation will deal with are matters such as the operation of the Nordic electricity exchange, nuclear power and competition on the electricity market.

The nuclear power issue

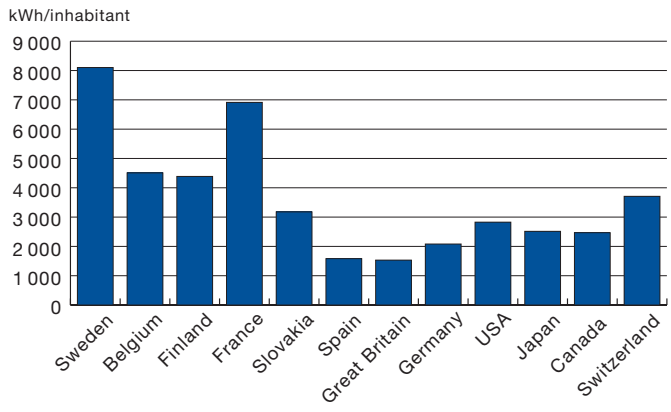
In parallel with international driving forces, Swedish energy policy decisions have had a great impact on the development of the Swedish electricity market. One of the debates concerns the nuclear power issue.

During a normal year, nuclear power accounts for around half of all electricity generated in Sweden. In terms of the energy generated by nuclear power per inhabitant, Sweden is in a leading position internationally, as shown in Figure 1.

In the energy policy agreement of 1997, it was decided that Barsebäck 2 nuclear power plant would be shut down no later than 2001. However, several conditions were set for the shutdown, including that the shutdown would not have a significant negative effect on the power balance, the availability of electricity to industry, the price of electricity, and the climate and environment.

FIGURE 1

Electrical energy generated by Swedish nuclear power per inhabitant in 2001 compared to other countries



Source: Electricity Information 2003, IEA.

In June 2002, the Government appointed a special negotiator whose task was to negotiate with industry on behalf of the Government, with the aim of preparing an agreement concerning a sustainable policy for the continued reorientation of the energy system. The point of departure for the negotiations concerning nuclear power was the "German model". This means that the nuclear power industry would have a generation cap for the total amount of electricity that it would be allowed to generate from all nuclear power plants. The industry itself would then decide the order in which the reactors would be shut down. Total decommissioning of nuclear power is then expected to take 30 to 40 years.

In March 2003, the Government examined for the third time the issue of shutting down Barsebäck 2. The Government decided not to shut down the second Barsebäck reactor, and also decided that the matter ought to be dealt with the negotiations on the remaining ten reactors and the matter of energy supply realignment in its entirety.

If the parties to the negotiations fail to reach agreement on a decommissioning plan, the Government will be able to decide on the shutdown of the reactor on the basis of the Nuclear Power Decommissioning Act (Act 1997:1320). The Act gives the Government the right to decide that the right to operate a nuclear power reactor shall cease at a date specified by the Government.

Economic instruments

The economic instruments used in Sweden are currently undergoing vast changes. Taxes and investment support were mainly used in the past, but the economic instruments now employed are changing to a more market-oriented system. This is clearly illustrated by the tradeable electricity certificate system introduced in Sweden in 2003 and by the EU system for trading in emission rights that will be introduced on 1 January 2005.

In order to avoid distortion of the competition between the Nordic and EU countries, it is important for all economic instruments to be internationally harmonized. Economic instruments that affect electricity supply in Sweden are outlined here.

Taxes and charges

A green tax reform was introduced in Sweden in 1990. This meant that taxes on energy were raised, and the incomes were used for lowering the taxes on labour. A renewed tax reform programme was introduced in 2001, and this is expected to involve a total of SEK 30 billion over a ten-year period. During 2003, the programme amounted to SEK 2.6 billion.

The purpose of the green tax reform is to achieve the environmental targets by increased environmental control via the tax system. Out of the environment-related taxes, it is principally the carbon dioxide tax that has increased. The carbon dioxide tax was doubled during the period between 1 January 2001 and 1 January 2003. Concurrently with the carbon dioxide tax increase, the electricity tax was also increased.

Taxes and charges on generation in Sweden

The sulphur tax and the nitrogen oxide charge are levied on power generation based on the combustion of fuels. The sulphur tax is payable for emissions of sulphur dioxide when fossil fuels or peat are burned, and amounts to SEK 30 per kg of emission from solid and gaseous fuels, and at the rate of SEK 27 per cubic metre for every tenth of one percent by weight in liquid fuels. The nitrogen oxide charge that amounts to SEK 40 per kg of nitrogen oxides emitted from plants with an annual output of more than 25 GWh is refunded in proportion to the total energy generation. The way the refund system has been drawn up makes it of interest to those who are liable for

FACTS

Taxes related to electricity supply in Sweden

Taxes and charges are levied in Sweden on electricity generation and on electricity consumption. Taxes and charges on generation include income tax, property tax, taxes and charges on fuels and emissions to atmosphere, and a tax on the thermal power of nuclear reactors. Taxes on fuels vary depending on whether the fuel is used for heating or for propulsion, and whether it is used in the domestic, industrial or energy sector. Taxes on consumption include principally energy tax on electricity and the associated VAT, and also charges for purposes such as the financing of authorities.

The difference between taxes and charges in Sweden is that funds collected by the State through taxes invariably go to the treasury, regardless of whether this is justified by economic control considerations or by revenue considerations, whereas funds collected by the State through charges are earmarked for specific use. Charges thus give no net inflow of funds to the treasury.

TABLE 1

Electricity taxes payable by consumers in Sweden, öre per kWh

	1996 1 Jan.	1997 1 July	1998 1 Jan.	1999 1 Jan.	2000 1 Jan.	2001 1 Jan.	2002 1 Jan.	2003 1 Jan.	2004 1 Jan.	2004 1 July
Northern Sweden										
Electricity, gas, heat and water supplies	4.3	8.2	9.6	9.5	10.6	12.5	14.0	16.8	18.1	18.1
Industrial operations	0	0	0	0	0	0	0	0	0	0.5
Other users	4.3	8.2	9.6	9.5	10.6	12.5	14.0	16.8	18.1	18.1
Remainder of Sweden										
Electricity, gas, heat and water supplies	7.5	11.5	12.9	12.8	13.9	15.8	17.4	20.2	21.5	21.5
Industrial operations	0	0	0	0	0	0	0	0	0	0.5
Other users	9.7	13.8	15.2	15.1	16.2	18.1	19.8	22.7	24.1	24.1

Source: Tax authorities

the charge to minimize the nitrogen oxide emissions per unit of energy.

As from 1 January 2004, CHP generators are able to deduct the whole of the energy tax and 79 percent of the carbon dioxide tax for fuels used for heat generation in CHP generation plants. In the past, a deduction was allowed for only half the energy tax, while the carbon dioxide tax was payable in full. One condition for the deduction is that the generation of electricity and heat is integrated and simultaneous.

In addition, just like all other Swedish companies, power generation companies are liable to corporate tax at the rate of 28 percent of the profit before tax and property tax at 0.5 percent of the taxable value of the property.

Nuclear power generators are subject to a power tax of SEK 5514 per MW of thermal power of the reactor. The power tax corresponds to an average of 2.7 öre per kWh and is payable regardless of whether or not electricity is generated. The objective of the power tax is to hasten the decommissioning of nuclear power on commercial lines. No other country levies a tax of this nature. In addition, 0.15 öre per kWh delivered is levied in accordance with the "Studsvik Law" (Act 1988:1597) and an average of 0.6 öre per kWh in accordance with the law on the financing of future expenditure for spent nuclear fuel (Act 1992:1537).

Taxes and charges on generation in the Nordic countries

Even though the conditions on the electricity market are becoming increasingly similar in the Nordic countries, there are still differences in the taxation of electricity supply. However, this is not unexpected in view of the differences between the power generation systems of the various countries.

In addition to being payable in Sweden, fuel tax is also levied in Denmark, in addition to sulphur tax and carbon dioxide tax. In Norway, generation tax is influenced by the extensive hydro power generation and includes a generation-dependent concession charge and a generation-dependent natural resource tax. In Finland, taxation in the field of electricity supply is concentrated to the consumption of electricity. There are no generation-dependent taxes on power generation. Unlike the situation in Sweden, no power tax is levied on the Finnish nuclear power reactors. In all Nordic countries, property tax and income tax are payable by the electricity supply companies. The income tax rate varies between 28 and 32 percent on profits before tax.

TABLE 2

Electricity taxes in the Nordic countries on 1 January 2004, öre per kWh

	Denmark	Finland	Norway	Sweden
Households	61.8[1]	6.3	10.3	24.1
Industry	0	3.9	0	0
VAT	25	22	24	25
Others	69.8			
CO_2 charge	12.3			

[1] Electric heating customers with an annual consumption of more than 4000 kWh.
Note: The taxes are specified in Swedish currency converted at the mid-2004 exchange rates (Jan.–April) obtained from the Bank of Sweden.

Sources: www.finlex.fi, www.retsinfo.dk, www.skm.df, www.skatteverket.se

Taxes and charges on consumption in Sweden

From 1 January 2004, domestic customers pay an energy tax on electricity consumption amounting to 18.1 öre per kWh in northern Sweden and 24.1 öre per kWh in the remainder of the country. This is 1.3 and 1.4 öre per kWh respectively higher than in 2003. For electricity consumed in electric boilers rated above 2 MW, the energy tax during the winter half of the year (1/11–31/3) is 20.5 öre per

FACTS

Tradable emission rights

The Kyoto Protocol is an agreement between many countries aimed at reducing the emissions of greenhouse gases.

The Kyoto Protocol comprises three so-called flexible mechanisms, one of which is trading in emission rights. The other two mechanisms are project-based and are known as mechanism for clean development and joint implementation. The purpose of these mechanisms is to improve the cost effectiveness in climate-related measures. The country that invests in emission reductions in another country can include this reduction in its own emission reductions.

An emission trading system sets a ceiling on emissions. Trading gives rise to a price of carbon dioxide on the market. If emission rights are a scarce commodity on a well-performing market, the price of emission rights will correspond to the marginal cost of reducing a further tonne of carbon dioxide in the system. A player whose costs for reducing the emissions are higher than the market price of emission rights will prefer to buy emission rights on the market instead of taking the "expensive" measure. A player whose cost of reducing emissions is lower than the market price of emission rights will choose to reduce the emissions and will sell any surplus emission rights on the market.

kWh in northern Sweden and 24.1 öre per kWh in the remainder of the country. In the vast majority of cases, the electricity supplier acts as tax collector, i.e. is liable for the tax received from consumers through the electricity bills, and pays this tax to the State. No energy tax is levied on electricity consumption in the manufacturing process of industrial operations. As from 1 July 2004, an energy tax of 0.5 öre per kWh will be levied on industrial operations.

Since 1994, the electricity tax has been adjusted in accordance with the consumer price index. The VAT on electrical energy amounts to 25 percent and is charged on the price of electricity.

Taxes and charges on consumers in other Nordic countries

In all Nordic countries, tax at consumer level is in the form of electricity tax or electricity charge and VAT. In Denmark, a net carbon dioxide charge is also levied. In addition, consumers in Denmark are obliged to purchase a certain proportion of their consumption as prioritized electricity (wind power and power from CHP generation based on natural gas). The price of this electric power is included in the tariff and is regarded as a tax on electricity consumers and a form of support for electricity generators.

Trading in emission rights

On 13 October 2003, the EU adopted a new Directive (203/87/EEC) on trading in emission rights for greenhouse gases. The Directive specifies that trading in emission rights, which is initially planned to cover only carbon dioxide, will begin in 2005. The initial period of trading is scheduled to end in 2007 and is a trial period before the 2008–2012 period, when the EU has a commitment concerning emission limitations in accordance with the Kyoto Protocol.

The objective of the Directive is to contribute to meeting the commitments of the Union in accordance with the Kyoto Protocol in a manner that is cost-effective and efficient from the national economy aspect. According to the Protocol, the emissions of greenhouse gases should be reduced by 8 percent up to the 2008–2012 period compared to the emissions in 1990.

On 15 April 2004, the Government tabled a proposal for legislation in the "Trading in emission rights I" draft bill (bill 2003/2004:132). The proposed law will involve introducing a trading system for carbon dioxide emission rights that will begin for a trading period initially for the years 2005–2007. An operator covered by the proposed law must be in possession of a permit to emit carbon dioxide no later than 1 January 2005. The emission rights will be granted on receipt of an application for an allocation for the operations for which a permit for emitting carbon dioxide has been granted and which are thereby included in the so-called trading sector.

In April 2004, the Government submitted Sweden's national distribution plan for carbon dioxide emission rights to the EU Commission for examination. The cap on carbon dioxide emissions from the roughly 500 plants in the energy sector and energy-intensive industry in Sweden was set in the distribution plan at 22.9 million tonnes of carbon dioxide annually. In the plan, the Government proposes that the energy-intensive[1] industries shall be allocated rights that correspond to their average emissions between 1998 and 2001. On the other hand, the allocation to the energy sector corresponds to 80 percent of the emissions in 1998–2001. The reason is that the energy sector is expected to find it less difficult to lower its emissions and that, unlike other sectors, it is not exposed to competition from outside the EU. The plan also allows for allocation for production increases and for new plants that come into operation after 31 March 2004.

The cap for the Swedish emissions specified in the national distribution plan will be examined by the European Commission during the spring and summer of 2004.

Support

Various types of support have been used to stimulate the use of renewable energy sources in Sweden. Up to 2002 inclusive, investment grants were given in order to stimulate the generation of electricity from renewable sources. Grants were paid to biofuel-fired combined heat and power plants, wind power plants and small-scale hydro power plants. Electricity generated by any plant rated below 1 500 kW was awarded a special grant of 9 öre per kWh.

[1] I.e. combustion plants with an installed power of more than 20 MW, oil refineries, plants that produce and work iron, steel, glass and glass fibre, cement and ceramics, and also plants that produce pulp and paper in accordance with the capacity limits specified in Appendix 1 of the Directive.

As from 1 May 2003, Government grants for electricity generation from renewable energy sources were replaced by a tradeable electricity certificate system. The aim of the certificate system is to increase the proportion of electricity generated from renewable sources. For further details, see the section entitled Electricity certificates.

The environmental bonus for wind power will be retained, but will gradually be scaled down and will be entirely replaced by support from the electricity certificate system by 2009. During 2004, the environmental bonus amounts to 12 öre per kWh of electricity generated in land-based wind power plant and 17 öre per kWh of electricity generated in offshore wind power plant.

From 1 April 2004, peat is entitled to electricity certificates in approved combined heat and power plants. The classification of peat as a fossil fuel alters the situation of peat in the Swedish energy system.

Support systems in other Nordic countries

The support granted differs in the various Nordic countries and currently varies between different techniques. The government support forms for electricity from renewable energy sources are being reviewed in several countries.

All Nordic countries have some form of support for electricity generated from renewable sources, either in the form of investment grants or in the form of operating grants. In Denmark, the high government grants for electricity generation based on wind power and biomass have been discontinued and have been replaced by consumer charges. The aim is to replace that system with green certificates in the future. In Denmark, natural gas-fired electricity is subsidized by State generation grants and investment grants.

Electricity certificates

Electricity certificates were introduced as a support system for renewable electrical energy from 1 May 2003. This is a market-based support system in which the price of the electricity certificates is not determined in advance and is the result of the relationship between supply and demand on the electricity certificate market. The aim of the system is to increase the proportion of renewable electricity by 10 TWh by 2010 as compared to the level in 2002. The system involves electricity certificates being granted by the State to generators of electricity from renewable sources in proportion to the amount of electricity generated in the plant. For every MWh of electricity produced the generator is given one certificate that he can sell in addition to the electricity generated. The system thus provides the owner of an electricity generation plant that uses renewable sources with revenue from the sale of electricity certificates, in addition to the revenue he receives from the sale of electricity. As a result, electricity generation from renewable sources will become more profitable to the generators. Electricity generated from wind power, solar energy, peat, certain biofuels and some hydro power plants is entitled to electricity certificates.

Similar support systems also exist in other countries, such as Belgium, Great Britain, Italy, Austria and the USA. The Swedish electricity certificate system currently covers only electricity generated in Sweden. However, the Government (draft bill 2002/2003:40) has declared its intention to allow electricity certificates to be traded internationally in the future. At the present time, Norway is planning to introduce an electricity certificate system, and discussions are in progress with Sweden concerning the forms of electricity certificate trading between the countries.

In order to create a demand for electricity certificates, it is mandatory for electricity end-users (with some exceptions) to purchase a certain number of electricity certificates in proportion to their electricity consumption, which is known as quota obligation. During 2003, the quota obligation amounted to 7.4 percent of the electricity consumed from 1 May to 31 December. The quota obligation will gradually increase up to 2010, when it will be 16.9 percent. The quota period follows the calendar year, and those who have a quota obliga-

FACTS

Time schedule for the introduction of the EU trading system

The EU trading system will be implemented in stages and in accordance with a time schedule that, in some respects, is common to all EU member countries. However, there are still uncertainties concerning the exact implementation dates in Sweden. The time schedule will therefore be successively adjusted.

Spring 2004	The Government submits a national distribution plan to the EU Commission. The plan includes a decision on preliminary allocations to individual plants.
August 2004	The law on emission trading came into force.
Aug.-Sept. 2004	A decision concerning the allocation to plants is prepared by a council consisting of representatives from the Environmental Protection Agency, the Swedish Energy Agency and NUTEK (Swedish National Board for Industrial and Technical Development). Decisions on individual allocations are to be taken by the Environmental Protection Agency no later than 30 September 2004. A national register is developed at the Swedish Energy Agency where all emission rights and all transactions are registered. The Swedish register will be coordinated with other national registers in the EU.
Aug.-Dec. 2004	Decisions concerning permits for carbon dioxide emissions applicable to individual plants. The county administrative board in the relevant region will be notified of the decision.
Autumn 2004	New draft bill for a law for the entire trading system, including the register.
January 2005	The EU trading system begins.
28 February 2005	Last date for issuing emission rights to individual players in the trading sector in Sweden.

FACTS

Electricity certificates

Electricity certificates represent a market-based form of support in the energy sector and are aimed at stimulating electricity generation from renewable sources. The electricity certificate system is aimed at increasing the amount of electricity generated by means of the sun, wind, water, biofuels and peat. Between 2002 and 2010, the proportion of electricity from renewable sources is to increase by 10 TWh. In the electricity certificate system, generators of electricity from renewable sources will receive one electricity certificate from the Government for every MWh of electrical energy generated. The electricity generated in the plant is sold just like ordinary electricity and the generator receives an income from electricity sales. In addition to this, the electricity certificate can be sold as a financial asset, thus providing the electricity generator with further income. By this means, electricity generation based on renewable energy sources will become more profitable.

tion must redeem electricity certificates corresponding to the quota obligation no later than 31 March of every year. Anyone who fails to meet his quota obligation must instead pay a quota obligation charge to the Government. The quota obligation charge amounts to 150 percent of the volume-weighted mean value of electricity certificate price during the period from 1 April of the preceding year up to 31 March of the following year. For electricity certificates redeemed in 2004 and 2005, the quota obligation charge is levied at a maximum of SEK 175 and SEK 240 respectively per non-redeemed electricity certificate. Electricity certificates have an unlimited life and may be saved between quota periods.

Electricity suppliers are responsible for handling the electricity certificate system and quota obligation for their customers, unless the customer declares himself as having a quota obligation. The electricity supplier has the right to recover the cost involved in handling the quota obligation for the electricity user. When the supplier invoices the user for his consumption of electricity, special information must be submitted concerning the cost of this service, known as a electricity certificate price. The electricity certificate price depends on the price the electricity supplier has paid to purchase his electricity certificates and the related expectations, and on the administrative costs incurred by the supplier in handling the quota obligation of his customers. The electricity certificate price therefore varies between different electricity suppliers. The electricity certificate prices of the suppliers are currently in the range of 2 to 4 öre per kWh of electricity consumed (including VAT).

Preliminary statistics show that more than 7 million electricity certificates were issued in the period between May 2003 and March 2004 inclusive. The electricity certificates came from around 1 700 plants. The largest proportion of electricity certificates was issued for biofuel fired electricity generation. Around 74 percent of the electricity certificates come from biofuel-fired generation, while the corresponding values for hydro power and wind power were 18 and 8 percent respectively. The quota obligation for 2003 amounted to around 4.4 million electricity certificates. Those who have quota obligation redeemed almost 3.5 million electricity certificates, which represents a quota obligation fulfilment of around 79 percent (see Table 3). During the period, the average price of electricity certificates was SEK 216.

TABLE 3

Market statistics for the electricity certificate system during the period between May 2003 and March 2004 inclusive.

Weighted mean price	SEK 216
Electricity certificates issued	7 214 927
Quota obligation in 2003	4 430 984
Redeemed electricity certificates	3 489 984
Quota obligation fulfilment in 2003	79 %

Source: Svenska Kraftnät and the Swedish Energy Agency

Electricity system

Electricity cannot be stored and must therefore be generated and consumed concurrently. The generation and consumption of electricity must therefore be in balance at all times. The process is known in the industry as balance control. The components of the electricity system and how balance control works in practice are described in this section.

Electricity generation

Electricity generation in Sweden is based mainly on hydro power and nuclear power. In 2003, hydro power accounted for 40 percent of the electricity generated in Sweden, and nuclear power for 50 percent. The fossil fuel and biofuel based generation accounted for 10 percent. The total electrical energy generated was 132 TWh, which is 11 TWh lower than in 2002 and 25 TWh lower than in 2001. The low electrical energy generated can largely be attributed to the low water inflows into the Swedish water reservoirs. In addition, the electrical energy generated in the Swedish nuclear power stations was relatively low during 2003. This was due to the fact that several reactors were shut down during the autumn for overhaul, and due to technical problems.

Electricity generation varies with the electricity consumption, and generation is therefore high during the winter and low in the summer. Maintenance of nuclear power plants is planned for the summer, since the electricity demand is then at its lowest. The water reservoirs are filled during the spring and summer, and the water stored in them is then used during the winter up to the spring floods..

Electricity generation in Denmark, Norway and Finland

Electricity generation in the Nordic countries

TABLE 4

Electrical energy generated in Sweden, TWh

	1990	1996	1997	1998	1999	2000	2001	2002[3]	2003[3]
Generation[1]	141.7	136.6	145.3	154.7	151.0	142.0	157.7	143.2	132,3
Hydro power	71.4	51.2	68.2	73.8	70.9	77.8	78.4	65.8	52.8
Wind power	0.0	0.0	0.2	0.3	0.4	0.5	0.5	0.6	0.6
Nuclear power	65.2	71.4	66.9	70.5	70.2	54.8	69.2	65.6	65.5
Conv. thermal power	5.1	14.0	10.0	10.1	9.4	8.9	9.6	11.3	13.5
- CHP generation in industry	2.6	4.0	4.2	4.0	3.9	4.2	3.9	4.6	5.2
- CHP generation in district heating system	2.4	7.1	5.6	6.0	5.6	4.7	5.6	6.3	7.6
- Condensing power, incl. gas turbines	0.0	2.8	0.2	0.1	0.0	0.0	0.0	0.4	0.6
Consumption	139.9	142.7	142.6	144.0	143.5	146.6	150.4	148.7	145.1
of which distribution losses	9.1	10.2	10.7	10.9	10.6	11.1	11.9	11.6	10.9
Imports-exports[2]	*-1.8*	*6.1*	*-2.7*	*-10.7*	*-7.5*	*4.7*	*-7.3*	*5.4*	*12.8*

[1] Net generation, excluding in-house consumption
[2] For 1990, imports and exports also include a statistical residual item
[3] The particulars for 2002 and 2003 are based on preliminary statistics
Note: Due to rounding-off, the total sum does not always agree with the sum of the individual items.

Source: Statistics Sweden

is based principally on hydro power, nuclear power and conventional thermal power. In addition, there are some oil-fired condensing power plants, gas turbines and wind turbines. Electricity generation in Denmark is based predominantly on combustion of coal and natural gas in CHP generation plants and in condensing power stations. Denmark has also invested heavily in the construction of wind power. The Finnish electricity generation system is based on conventional thermal power, nuclear power and hydro power. In Norway, virtually all electricity is generated by hydro power.

Electricity consumption

Since the early 1970s, electricity consumption in Sweden has increased at the rate of almost 3 percent annually. The increase was steepest during the 1970s, but the rate of increase subsequently tapered off. During the period between 1990 and 2001, the actual electricity consumption increased by a total of 7.6 percent, but if a temperature correction is applied to the electricity consumption, the actual increase during the period would be 5.8 percent. In 2003, the dwellings, services, etc. sector accounted for half of the total electricity consumption, whereas the proportion consumed by industry was somewhat less than 40 percent.

Electricity consumption in Denmark, Norway and Finland

Electricity consumption in all Nordic countries has increased between 1990 and 2002. The highest increase was recorded in Finland at an average of 2.6 percent annually since 1990. In Norway and Finland, the industrial sector accounts for a large proportion of the total ener-

FIGURE 2

Electrical energy generated in the Nordic countries, TWh, and per capita electricity consumption in 2003, kWh per inhabitant

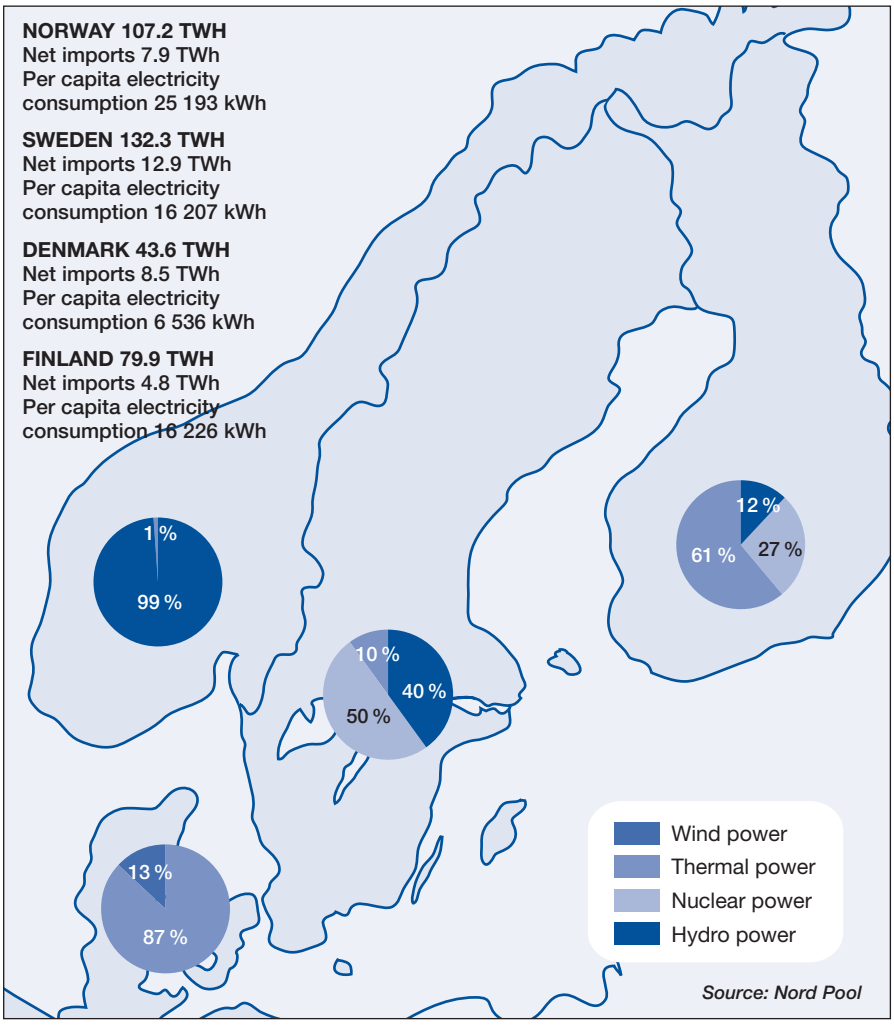


TABLE 5

Electrical energy consumption in Sweden, TWh

	1990	1996	1997	1998	1999	2000	2001	2002[1]	2003[1]
Industry	53.0	51.5	52.7	53.9	54.5	56.9	56.2	55.7	54,9
Dwellings, services, etc	65.0	71.6	69.6	69.9	69.1	69.0	73.1	72.5	72,3
of which electric heating	25.8	27.3	26.1	23.9	21.5	21.4	22.2	22.1	22,1
domestic electricity	17.9	19.3	18.6	19.4	16.9	17.7	19.2	19.5	19,5
commercial electricity	21.3	25.0	24.9	26.6	30.7	29.9	31.7	31.0	30,7
Transport	2.5	3.1	3.0	2.8	3.0	3.2	2.9	2.9	2,8
District heating, refineries	10.3	6.3	6.8	6.6	6.3	6.5	6.3	5.7	4,2
Distribution losses	9.1	10.2	10.7	10.9	10.6	11.1	11.9	11.8	10,9
Total net consumption	139.9	142.7	142.6	144.0	143.5	146.6	150.5	148.6	145,1
Total net consumption, temperature corrected	143.1	141.7	143.3	145.0	144.8	149.5	151.4	149.7	145,6

[1] The figures for 2002 and 2003 are based on preliminary statistics

Note: Domestic electricity and electric heating in 2003 have been assumed to be the same as in 2002, since the statistics for single-family houses, multi-family houses and commercial premises will not be available until the summer of 2004.

Source: Statistics Sweden

gy consumption at 42 and 55 percent respectively. This is because, just like Sweden, Norway and Finland have a large proportion of energy-intensive industry. Denmark has a large agricultural sector, and a higher proportion is therefore consumed by the domestic and services sectors.

In the international perspective, all Nordic countries with the exception of Denmark have a relatively high average per capita electricity consumption. Important reasons for this are the high proportion of electricity-intensive industry and the comparatively cold climate.

Transmission of electricity

The dominating flow of electric power in Sweden is from the north to the south. The grid has been built largely to be able to transmit the electricity generated by hydro power in the north to central and southern Sweden, where the electricity consumption is high.

Electricity is transmitted from the power stations to the users by power networks. The network is divided into three levels: the national grid, regional networks and local networks. The national grid consists of about 15 000 km of 220 kV and 400 kV transmission lines and includes most of the links to neighbouring countries. The regional networks, normally at voltages between 70 and 130 kV and, in certain cases, 220 kV transmit electricity from the national grid to the local networks and sometimes to electricity consumers whose consumption is high, such as large industrial plants. From the local networks, normally at a maximum of 20 kV, power is transformed within the distribution areas to the normal domestic voltage of 400/230 volt.

Balancing service

Every country has a system operator whose function is to maintain balance in the network. By continuously measuring the frequency, the system operator can decide whether or not the system is in balance. If the consumption is higher than the generation rate, the frequency will drop, and if the consumption is lower than the generation rate, the frequency will rise. The frequency is regulated to the permissible level of 50 Hz (±0.1 Hz) by increasing or decreasing the generation rate. Balancing is a very complicated process, since the consumption changes from second to second. The system operator therefore has a number of companies to assist him in measuring and maintaining balance in the electricity network.

The balancing service in Sweden is currently divided into three levels of responsibility.

The first level of responsibility is the balancing service of Svenska Kraftnät (TSO). Svenska Kraftnät compiles consumption forecasts and has access to instantaneously adjustable generation plants in order to even out minor imbalance occurring in the network. The balancing service also has access to disturbance reserves of quick-starting generation plants totalling more than 1 300 MW.

The second level of responsibility consists of balance provider companies that have concluded agreements with Svenska Kraftnät aimed at delivering continuous consumption and generation forecasts.

The third level of responsibility are power suppliers who have concluded agreements with the balance provider companies for handling the balance for them.

Balance control

Balance control is managed by Svenska Kraftnät. The control room, which is located in Råcksta outside Stockholm, is manned around

the clock. Balance control is broken down into primary regulation and secondary regulation.

Primary regulation involves automatic fine adjustment of the physical balance in the electrical system by the generation rate being automatically increased or decreased. A Nordic agreement specifies the regulating power that each country must have available for primary regulation.

Secondary regulation is a manual procedure for raising or lowering the power of controlled objects, and takes place in the form of power transactions with balance providers who have access to generation plants and who have concluded agreements with Svenska Kraftnät concerning participation in balance control. Balance providers who are able to adjust their generation rates during the operating hour can submit bids to the Svenska Kraftnät balancing service for upward or downward regulation. The bids must be submitted no later than 30 minutes before the beginning of the operating hour and must state the price (SEK per MWh) and the power (MW). Svenska Kraftnät then places orders against the bids in price order as required.

Balance settlement

In balance settlement, the costs of imbalance are settled with the balance provider companies. The settlement is based on measurement of generation and consumption made every hour by the network owners and on the trade volumes that the balance provider company has had. Balance settlements are compiled and invoiced twice a month.

Bottlenecks

Due to the wide variations in the generation rate by hydro power, particularly in Norway and Sweden, the transmission requirements of the power system also vary. This has occasionally led to the transmission requirements being higher than the capacity of the Nordic grid.

The Swedish national grid was originally built with the aim of transmitting the electricity generated by hydro power from the north to the south. The transmission network includes certain limiting bottlenecks known as constraints. Constraint 2, on a level with the town of Söderhamn, limits the power that can be transmitted between northern and central Sweden to between 6 700 and 7 000 MW. The transmission capacity in constraint 4 between central and southern Sweden, on a level with the town of Växjö, is between 4 000 and 4 500 MW. Figure 3 shows the power transmission network in Northern Europe.

Bottlenecks on the Nordic electricity market are dealt with by a combination of market splitting, counter-purchases and limitation of imports/exports. Market splitting is used for dealing with bottlenecks between countries and, in Norway, also for dealing with internal bottlenecks.

Counter-purchases are used to a varying extent in all Nordic countries. In Norway, Statnett uses counter-trading during the operating phase when the physical transmission exceeds or tends to exceed the maximum capacity. On the other hand, the constraint from the west towards Oslo is dealt with by limiting exports to Sweden. In Sweden and in Jutland and Zealand, counter-trading takes place after imports/exports have been restricted. Only counter-trading is used in Finland, except in situations involving unscheduled outages. Counter-trading is used between all countries in the operating phase when transmission exceeds or tends to exceed the maximum capacity.

Counter-trade means that the grid operator agrees with players on one side or both sides of a bottleneck to adjust generation so that the need for transmission is adjusted to suit the transmission capacity of the network. This can be done by Svenska Kraftnät ordering a reduction in generation rate on one side of the bottleneck on which there is a surplus, and the opposite on the shortfall side. A power generator in a surplus area is compensated by purchasing a corresponding volume from the grid operator. A power generator in a shortfall area will be compensated for increasing the generation rate by selling a corresponding volume to the grid operator.

Market splitting means that the areas on each side of the bottleneck are priced individually on the Nordic Electricity Exchange, so that trade over the bottleneck will not exceed the available transmission capacity. This is done by the price in the shortfall area being increased in order to stimulate generation and reduce consumption. In the surplus area, the price is lowered in order to prompt reduced generation and increased consumption. This means that the Nordic market is sometimes divided into several price areas.

Other Nordic countries

The grid in Norway is owned mainly by Statnett, which has system responsibility. Other players own around 15 percent of the grid. Statnett is responsible for the operation and extension of the entire national grid, and is also responsible for the links with foreign countries. Statnett handles the balance between generation and consumption.

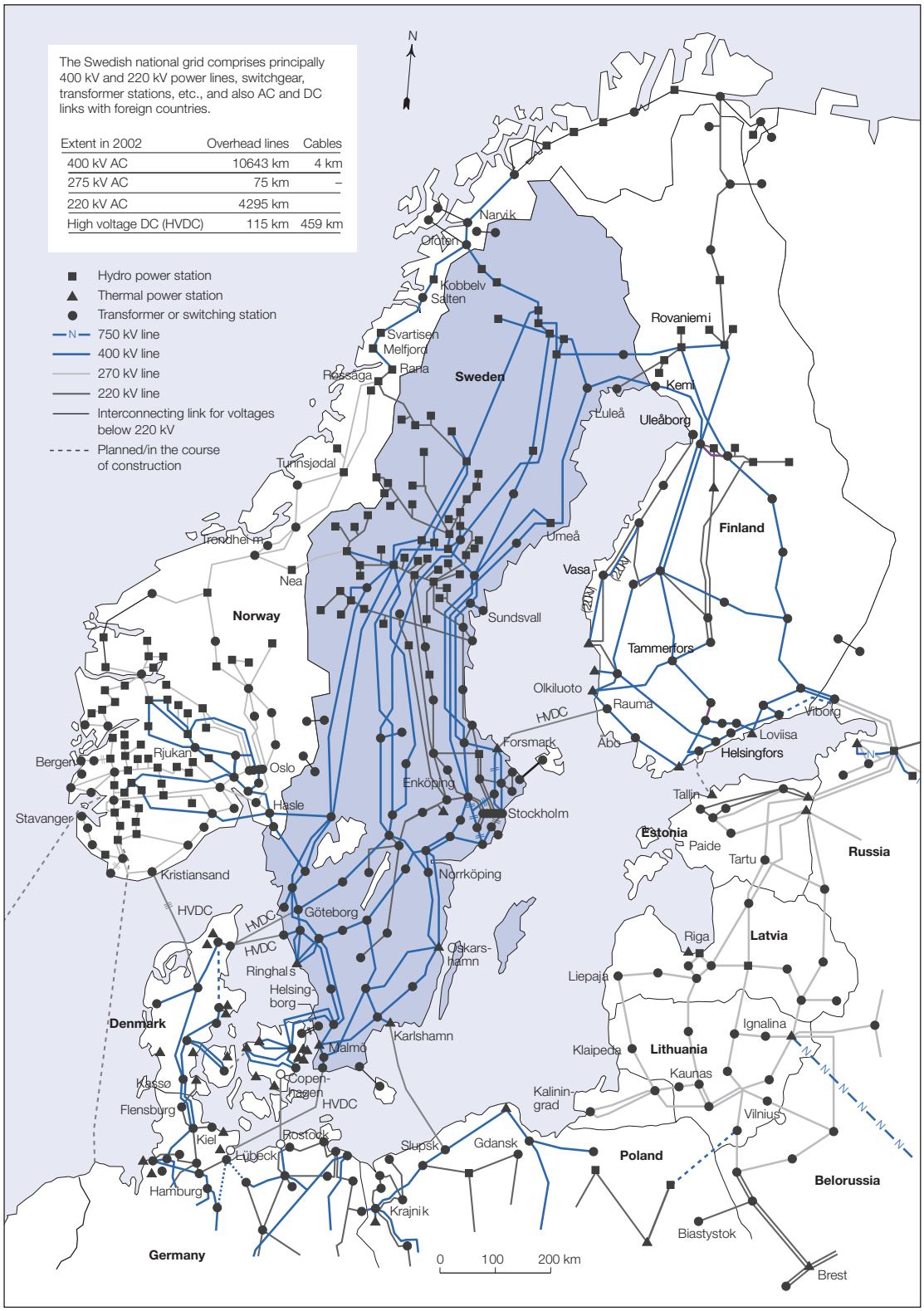
Denmark has two national grid companies with system responsibility, namely Eltra that is responsible for the national grid in Jutland and Funen, and Elkraft which is the national grid company in Zealand. Just like other Nordic national grid companies, Eltra and Elkraft own the 400 kV grid and the links with Sweden and Germany. The transmission line systems of Eltra and Elkraft are not cur-

rently interconnected, although a link is planned.

In Finland, Fingrid bears system responsibility and owns the national grid in Finland, and also the links with foreign countries. Fingrid System Oy ensures that the electricity system in Finland performs well technically, and that reliability is maintained. The company also manages balance control and settlement, and also monitors and plans the operation of the national grid. Every party on the Finnish electricity market is responsible for balance between electricity generation and electricity consumption being maintained at all times. There are currently more than 30 balance provider companies. The conditions for the balance providers

FIGURE 3

Power networks in Northern Europe



are regulated by agreements. In the event of imbalance during the operating hour, Fingrid employs balance control.

The market

The reform of the Swedish electricity market came into force on 1 January 1996. The price on this competitive market is controlled by supply and demand.

The electricity market in Sweden consists of electricity generators, electricity traders, network companies and end users. Electricity traders purchase electricity either on the electricity spot market of the Nord Pool Nordic electricity exchange, or directly from power generators on the basis of bilateral agreements drawn up between the parties.

The price of electricity for the following day is determined on the Electricity spot market. For longer periods, trading can take place on a Nord Pool financial market. In view of the cross-border trading in electricity, the Nordic countries are the geographically relevant market for generated power (i.e. market between electricity generators and traders).

The electricity market in Sweden is characterized by vertically integrated companies. Vertical integration on the electricity market means that a company controls the operations in both electricity generation and electricity trading. Vattenfall, Sydkraft and Fortum are the three large power companies in Sweden in terms of both electricity generation and trading.

The power generation market

When the electricity market was deregulated, seven companies accounted for 90 percent of the power generated in Sweden. Today, three companies account for 86 percent. Vattenfall alone accounts for 46 percent of electricity generation in Sweden. From a Nordic perspective, the three biggest Swedish electricity generators have a market share of about 39 percent of the total Nordic power generation. The largest company was Vattenfall, with a market share of 17 percent. The biggest power generators in Sweden and in the Nordic countries are listed in Tables 6 and 7.

The three biggest power generators in Sweden are Vattenfall AB, Sydkraft AB and Fortum.

Vattenfall AB accounts for around half of the electricity generated in Sweden. The company is the biggest power generator in the Nordic countries and the fifth largest in Europe. During 2003, Vattenfall generated 61.5 TWh of electrical energy in Sweden. The Swedish market is still the biggest for Vattenfall, but sales in Finland and Norway are on the increase. Outside the Nordic countries, Vattenfall also has operations in the Netherlands, Germany, the Czech Republic, the Baltic States, Poland, South East Asia and South America.

FACTS

Electricity market

The electricity supplier sells electricity on the electricity market in competition with other suppliers. Electricity supplier is the collective name for anyone who sells electricity on the market, and includes both electricity generators and electricity trading companies. As a result of the electricity market reform, all consumers have the freedom to choose an electricity supplier, and trade in electricity takes place in competition. However, the network operations remain a regulated monopoly. On today's electricity market, there must be clear separation between network operations, and the generation of and trading in electricity. This means that a corporate body that pursues network operations must not engage in trading in or generation of electricity.

Sydkraft AB is the second biggest Swedish power generator. The electrical energy generated by the Sydkraft Group companies in 2003 amounted to 27.1 TWh. In the autumn of 2003, Sydkraft purchased Graninge, which was then the fourth biggest power generation company in Sweden.

The total electrical energy generated by *Fortum* in Sweden in 2003 amounted to 24.7 TWh, excluding minority shares and sub-contracted power. During 2002, Fortum acquired the remaining 50 percent of Birka Energi.

In recent years, foreign companies acquired significant proportions of the equity in Swedish power generation. Between 1996 and 2001, foreign ownership of Swedish power generators increased from 13 to 40 percent. The increase has taken place mainly by acquisition of municipal operations, such as the takeover of Birka Energi by the

TABLE 6

Sweden's biggest power generators and their electrical energy generated in Sweden, TWh

	2002	2003	Market share in Sweden
Vattenfall	70.3	61.5	46.5 %
Sydkraft	28.5	27.1	20.5 %
Fortum	24.5	24.7	18.7 %
Skellefteå	3.4	2.4	1.8 %
Graninge	2.4	2.4	1.8 %

Note: Sydkraft purchased Graninge at the end of 2003

Source: Swedenergy

TABLE 7

Largest electricity generators in the Nordic countries[1] and their electrical energy generation in the Nordic countries, TWh

	2002	2003	Share in the Nordic countries
Vattenfall	70.6	61.8	17 %
Fortum	46.5	51.2	14.1 %
Statkraft SF	34.0	32.5	8.9 %
Sydkraft	28.5	27.1	7.5 %
Elsam	16.2	18.0	5 %
Pohjolan Voima OY	16.6	18.0	5 %

[1] Excluding Iceland

Source: Swedenergy and annual reports

FACTS

Nord Pool

Nord Pool organizes trade in electricity on a physical market and on a financial market, and also offers clearing services.

The physical market comprises the Elspot and Elbas products. Elspot is a 24-hour market for short-term trading in physical electricity contracts. The system price (spot price) is determined on the Elspot market 24 hours in advance for every hour of the day. The system price is determined as an equilibrium price based on the collective buy and sell bids in the area. Elbas is a physical adjustment market for trading in hourly contracts in Sweden and Finland. Trading can take place up to one hour before delivery during all hours of the 24-hour period.

On the financial market, players can hedge the price of electricity against changes in the spot price. This is done by means of the Eltermin and Eloption products. On the Nord Pool forward market, the players can hedge the price of electricity by means of futures and forwards for a period of up to four years. Trading can take place by 24-hour, weekly, bulk, seasonal and annual contracts. Eloption is a financial instrument for risk management and price assurance of future revenues and costs related to trading in electricity contracts.

In the Nord Pool clearing operations, Nord Pool Clearing acts as the opposite party in power contracts. The financial risk for those who have exchanged contracts is thereby reduced. For this service, Nord Pool Clearing levies a clearing charge and requires the companies to continually deposit a security based on the actual portfolio. This is aimed at covering the risk that the electricity exchange takes by acting as opposite party.

Finnish Fortum in 2002. Moreover, Sydkraft has had two major owners since 2001, namely the German E.ON Energie and the Norwegian Statkraft, which have about 55 percent and about 45 percent respectively of the voting shares.

The purchase of Graninge by Sydkraft during the latter part of 2003 was a widely discussed subject as regards market concentration of electricity generators in Sweden. After Sydkraft made a bid for Graninge at the end of August 2003, the proposed business deal was reviewed by the EU Commission. The review was completed at the end of October of the same year and showed that the purchase would have little effect on competition, since the generation capacity of Graninge was so small compared to that of Sydkraft. The Commission therefore gave its approval for the deal. One reason for the interest of Sydkraft is that the merger could lead to synergy effects, since the plants and distribution facilities of the two companies are located close to one another. Mergers and efficiency improvements would therefore also favour the consumers by leading to lower electricity generation costs.

Views differ concerning the effectiveness of competition on the generated power market. According to the "Competition on the electricity market" study (SOU 2002:7), there are risks of the competition being ineffective and of the companies using their market power to further their own ends. However, the conclusion of the study is that competition performs relatively well.

The Swedish market for generated power (i.e. market between electricity generators and traders) is part of a common Nordic market that includes all Nordic countries with the exception of Iceland. On the Nordic electricity market, electricity is bought and sold through the Nord Pool electricity exchange. During a large proportion of the year, the Nordic countries are a common price area on the Nord Pool electricity spot market. During this period, the large market concentration of Swedish companies on the generated power market has no worrying effect on the competition. This is because, in a Nordic perspective, these companies do not have the market power that would be needed for distorting competition.

However, the electricity network in the Nordic countries has certain transmission capacity limitations known as bottlenecks. As mentioned earlier, bottlenecks in Sweden are handled by counter-purchases. Sweden represents one area on the Electricity spot market and, in the event of bottlenecks in the operating phase, they are handled by counter-purchases, and Sweden is thus not broken up into several price areas, which is also the case in Finland.

In Norway, bottlenecks in transmission are handled by a procedure known as market splitting. This means that the market in Norway is divided into several price areas during periods when the transmission capacity is insufficient for meeting the market requirements for electricity transmission.

Bottlenecks in transmission thus lead to the Nordic electricity market being broken down into a number of smaller markets. Individual power generators may thus periodically have the opportunity to exercise market power. Together with strong concentration on the electricity market, there is thus the risk of the dominating players having a greater influence on the exchange prices than when the market is Nordic.

Table 8 shows the number of hours in percent when the price in an electricity spot area is isolated from all other area prices. As an example, we can see that the area price for Sweden was never isolated from all other prices during 2003.

TABLE 8

Proportion of hours in percent during which one electricity spot area is isolated from all other areas

	1998	1999	2000	2001	2002	2003
Stockholm	3.2	0.6	5.5	0.0	0.1	0.0
Oslo	22.9	33.2	55.0	8.9	25.4	23.8
Tromsö	23.1	36.6	41.7	23.8	21.9	10.9
Helsinki		4.0	15.8	0.9	5.0	29.2
Jutland/Fynen		33.8	44.8	19.1	40.1	48.9
Zealand			7.2	5.4	9.3	2.0

Source: Nord Pool

End customer market

An electricity customer may have one or several terminal points for electricity. For every

electricity terminal point in Sweden, a balance provider must be registered at Svenska Kraftnät. By an agreement with Svenska Kraftnät, the balance provider undertakes to manage the balance, i.e. to ensure that the supply and consumption are equal at the customers for whom he is responsible. The balance provider may be the electricity trader or someone from whom the electricity trader purchases the balancing service. End users may also be balance providers, but this involves high risks and costs. The end user therefore normally purchases his electricity from a company that is established in Sweden and that has an agreement with Svenska Kraftnät. Unlike the generated power market, the end customer market can therefore be viewed in a national perspective.

The number of electricity trading companies on the Swedish end customer market has dropped after deregulation. Just before deregulation, there were about 250 electricity trading companies in Sweden. Today, about 130 electricity trading companies are registered with Svenska Kraftnät.

Several driving forces were behind this development. The electricity trading reform has imposed new requirements and risks on those who want to trade in electricity. The small independent or municipal companies had the choice between some form of merger with other companies or selling its operations to others. At the same time, there was keen interest, mainly from the large companies, in purchasing smaller companies in order to increase their customer base. Owners who sold their electricity trading companies could therefore release capital.

Many companies that are perceived by the customer as competitors may be linked to one another in various ways, either by being wholly or partially owned or by various mutual agreement relationships. The three large power generators (Vattenfall, Sydkraft and Fortum), together with companies linked to them, form three spheres that jointly account for around 70 percent of end customer sales.

An end user market performs well only if the consumers are active. During the early years of deregulation, the demand for installing an hourly meter represented an obstacle to switching over to a different electricity supplier. Since this requirement was removed on 1 November 1999, no major obstacles remain to changing to a different supplier. The change may take place at the turn of the month, but notice must be given at least one month in advance of the change date. On the other hand, no change can take place as long as a time-defined agreement is in force.

A study carried out for the Swedenergy trade organization shows that the proportion of consumers who have switched electricity suppliers or have renegotiated their agreements has increased from 30 percent in 2000 to 45 percent in 2003. Out of this total, 10 percent and 23 percent respectively have switched suppliers, and the remainder have concluded new agreements with their existing suppliers. But a majority of domestic customers have still not actively made a choice of electricity supplier. Those who have changed to a different supplier are mainly companies and other customers with high electricity consumption.

On the other hand, it is not entirely straightforward for a customer to change his electricity supplier. A large flow of information is necessary between several parties. If all particulars are not correct, the process will be delayed and the change may perhaps not be implemented at the intended time. Shortcomings in the communication between the network owner and the electricity trader may result in the customer receiving incorrect bills. Customers also consider that it is difficult to make comparisons between the offers of different suppliers, particularly as regards prices. Moreover, consumers do not consider themselves to be sufficiently well informed of the conditions on the deregulated electricity market. However, the information has been improved. Both the Swedish Consumer Agency and the Swedish Energy Agency publish information material on their home pages. The Electricity and Gas Market Committee has been instructed to propose improvements to the regulations on the electricity market.

Trading in electricity on the power market

Electricity is bought and sold on the Nordic electricity market in competition by means of bilateral agreements or via Nord Pool. At the present time, around 30 percent of all electricity trading in the Nordic countries takes place via Nord Pool.

Bilateral trading

Bilateral agreements do not represent an organized marketplace but are broker driven, whereby power brokers offer their services to the players on the market. In addition to trading through brokers, contracts are also concluded directly between players on the market. The contract price in bilateral agreements is confidential, and the players have no obligation to publish this information.

Nord Pool

Around 30 percent of the total trade in generated power takes place via Nord Pool. The price of electricity at Nord Pool is in the public domain and is published daily. This price therefore serves as a reference for bilateral trading. The price is determined both for the following day and for longer periods. The daily prices are

determined on the Electricity spot market. Long-term agreements are concluded on the forward market. By setting a required electricity price in advance, all parties involved find it easier to plan their economy, i.e. their future revenues and costs.

The benefits of a Nordic Electricity Exchange are that the Nordic power plants can be utilized in an economically optimized manner. First preference is given to operating plants that are least expensive in operation, i.e. hydro power plants and nuclear power plants. This is also beneficial to the environment. If more electricity is required, power plants that are fired with fossil fuels must be started, which is more expensive. Another benefit of trading on an exchange is that the transaction costs are lower than those incurred in trading by bilateral agreements.

The system operators in Norway (Statnett) and in Sweden (Svenska Kraftnät) own Nord Pool ASA jointly and equally. Nord Pool ASA, Svenska Kraftnät, Statnett and Fingrid each have a 20 percent holding in Nord Pool Spot that organizes physical trading in power. The Danish system operators Elkraft and Eltra each have a 10 percent holding in Nord Pool Spot. In 2003, 31 percent of the electricity consumption in the Nordic countries was traded through the Electricity spot market.

The players at Nord Pool comprise power generators, distributors, industrial companies and other end users, as well as portfolio managers. In May 2004, the Nord Pool markets had 362 players, which represents an increase of 13 percent on the same date in 2003. The players are principally of Nordic origin, but the number of players from outside the Nordic countries has increased in recent years. Out of the total, 101 players are Swedish, 44 are Finnish, 168 are Norwegian and 123 are Danish. The remaining 26 players are from eight other countries.

2003 was the first year in the history of Nord Pool that trading on the financial market has dropped. Trade on the financial market during the year amounted to 545 TWh, which is a drop of 47 percent compared to 2002. In addition, 1219 TWh were cleared in standardized bilateral contracts during 2003, which represents a drop of about 42 percent compared to 2002. Nord Pool considers that the decline in trade on the financial market in 2003 was due to the high prices and the volatility of the market during the year. Moreover, the downturn can be regarded as being the result of global economic turbulence. When prices and market uncertainty increase, the players on the market tend to reduce their market exposure. As a result, the total financial trading volume declined.

Unlike the financial market, the trading volume on the physical Nord Pool spot market remained relatively constant from 2002 to 2003. The electrical energy turnover on the physical market during 2003 was 119 TWh, which is 5 TWh lower than in 2002. However, as a result of higher prices, the total value of trade on the spot market increased by more than 30 percent.

Price variations on the Nord Pool Electricity spot market

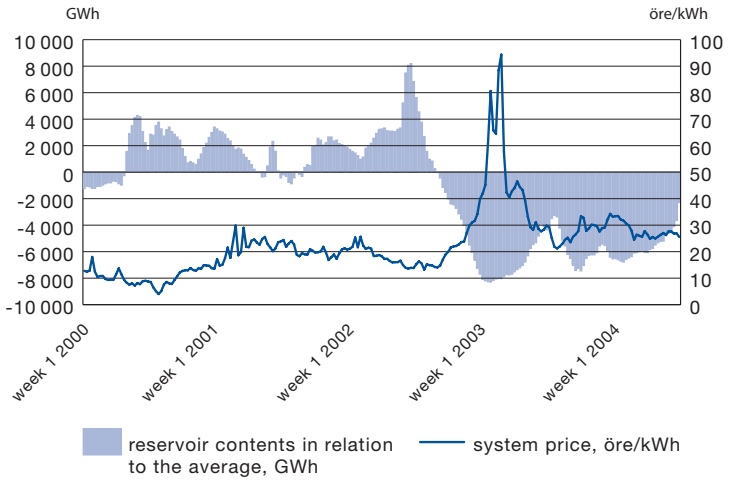
The price on the Nord Pool Electricity spot market varies widely both within a given year and between years. As a result, it is important to point out that these price variations are not unexpected, and that there are logical explanations for the variations.

The Nordic electricity supply system is highly dependent on the hydro power systems in Norway and Sweden. The inflow of water in the two countries is generally well correlated, i.e. low inflow in Norway usually coincides with a low inflow in Sweden. On a Nordic basis, this means that hydro power generation varies widely between dry and rainy years. In a normal year, the total hydro power generation in the Nordic countries amounts to around 180–190 TWh. In 2003, which was a dry year, the total electrical energy generated by hydro power was 168 TWh. Figure 4 shows the link between the development of the system price and the water reservoir contents during 2003.

Hydro power generation has relatively low variable costs in the Nordic electricity supply system and is therefore the generation source that is first to be put to use. On a decrease in the availability of hydro power, other sources of power are then taken into operation in ascending "marginal cost order" (see Figure 5). Although the long-term precipitation is relatively stable, wide variations occur in the short term both within individual years and between years. As a

FIGURE 4

Link between the Nord Pool system price and the water reservoir contents



Source: Nord Pool

result, the cost of generating electricity in Norway and Sweden varies, which in turn results in a fluctuating price on the Nord Pool Electricity spot market. The availability of water or the hydrological balance thus plays a major role in the price level on the electricity exchange.

2002 was an extremely dry year both in Sweden and in Norway. Due to the low hydro power generation rate, more expensive electricity generation sources were taken into operation in the system to meet the power demand, which led to high system prices during the latter part of 2002.

The system price remained at a high level during 2003, and the price did not drop below 30 öre per kWh until the end of March. Compared to this, prices in earlier years exceeded 30 öre per kWh only on a couple of occasions. During the summer, the price was around 20 öre per kWh, and then rose to levels between 25 and just over 30 öre per kWh during the autumn and winter.

Sweden's electricity imports and exports in 2003

2003 was a record year in Sweden for net imports (imports minus exports) of electricity. During 2003, net imports amounted to 13 TWh. Since 1970, net imports never exceeded 6.1 TWh in a full year, which occurred in 1996.

Total imports of electricity in 2003 amounted to 24 TWh and exports to 11 TWh. The highest imports came from Denmark and Finland. The highest exports were to Norway, which is normal for a dry year.

Both Sweden and Norway have high import requirements during dry years. Electricity is imported from Finland, Denmark, Germany and Poland. Finland has facilities for importing electricity from Russia. Figure 8 shows Sweden's electricity imports and exports.

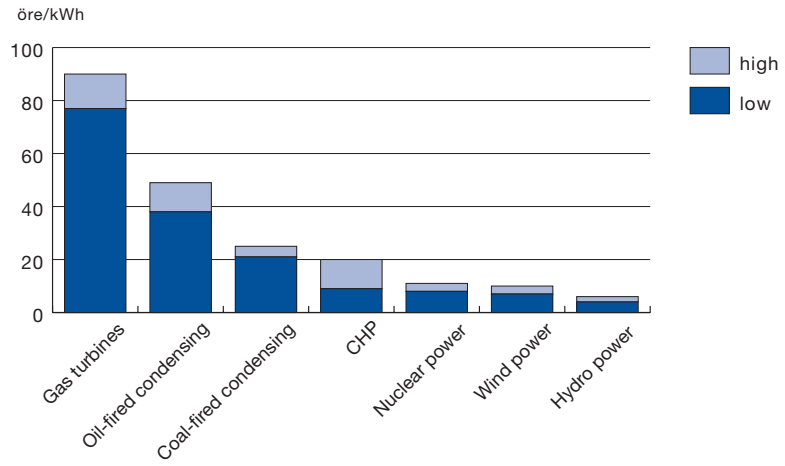
During 2002, the Swedish water reservoir contents dropped below the mean value earlier than those in Norway. The flow of trade went from Norway to Sweden during most of 2002. After a period of low water inflow in Norway, the flow of trade reversed, which took place roughly at the 2002/2003 turn of the year. The flow of trade during 2002 resulted in a net electricity import from Norway of 6.8 TWh. During 2003, Sweden's net exports to Norway amounted to 3.2 TWh. Since the summer of 2002, Sweden has been a net importer but has also transited electricity to Norway, which is the reason for the net exports to Norway.

Electricity prices to end users

The total price of electricity varies between different customer categories, between urban and rural areas, and between countries. This is due to variations in the distribution costs, differences in taxation, subsidies, government regulations and the structure of the electricity market.

FIGURE 5

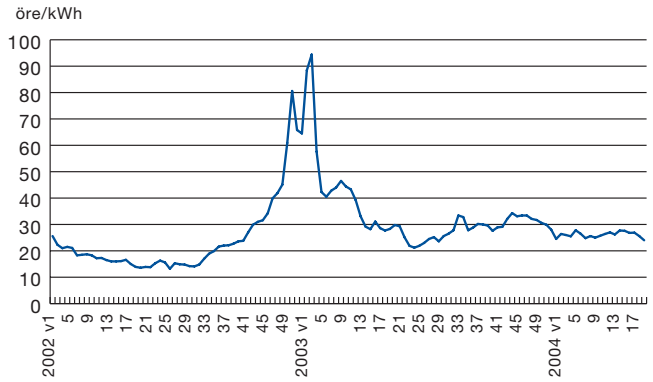
Variable cost of power generation in the Nordic countries in 2003, öre per kWh



Sources: Swedish Energy Agency's processing of information from Elforsk report 03:14, Electricity from new areas in 2003 and fuel prices from ICR Coal statistics Monthly, April 2004, and the Swedish Energy Agency price sheet for biofuels, peat, etc., No. 1/2004.

FIGURE 6

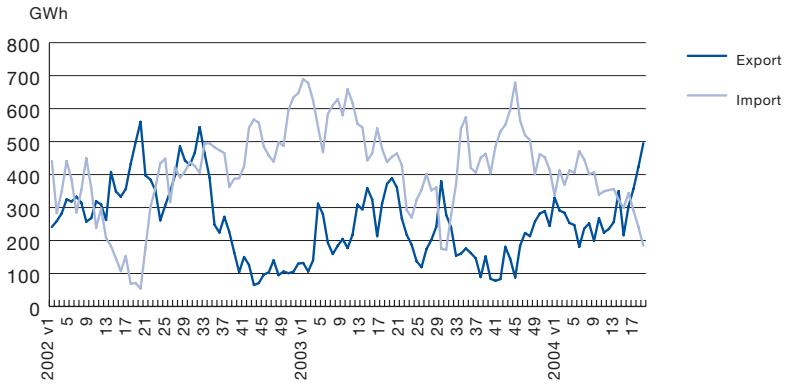
System prices at Nord Pool between January 2002 and April 2004, öre per kWh



Source: Nord Pool

FIGURE 7

Sweden's trade in electricity with foreign countries between January 2002 and April 2004, GWh per week



Source: Swedenergy

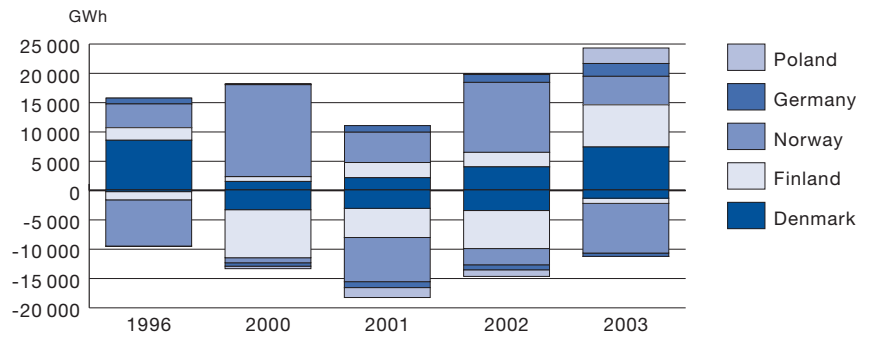
The total electricity price to the customer consists of:
- price of electrical energy
- price of network services (network charge)
- taxes (energy tax and VAT)
- price of electricity certificates

On 1 January 2004, the total price of electricity used for heating consisted of around 40 percent electrical energy price, 20 percent network charge, 40 percent energy tax and VAT, and 2 percent electricity certificate price. By choosing his electricity supplier, the customer can affect the price of electricity and the electricity certificate charge.

Stock exchange prices have varied widely over the years, but end user prices have remained relatively stable.

FIGURE 8

Sweden's electricity imports and exports, GWh



Source: Swedenergy

FACTS

Performance Assessment Model

The Performance Assessment Model is a tool that the Swedish Energy Agency has developed in order to assess whether or not the network charges are reasonable. The performance assessment model enables reasonableness appraisal to be carried out on the basis of the performance of the companies in accordance with the law amendment that came into force on 1 January 2003.

The network companies must report economic and technical information to the Swedish Energy Agency every year. The companies must submit reports that include power, energy transmitted, invoiced sums and the coordinates of all of their customers. On the basis of these particulars, the Performance Assessment Model creates a reference network designed in an economically and technically efficient manner. The model then calculates the value of the reference network, followed by the value of the performance of the company in relation to its customers. The quality of service is also weighted into the performance in the form of the number of power cuts during the year and the duration of the cuts. The economic value of the performance, i.e. the network utility, is then compared with what the company has billed its customers. A debiting degree is then obtained by dividing the invoiced revenue by the network utility. If the debiting degree exceeds of 1.0, the network company has invoiced more than the performance was valued in accordance with the model. This may denote that the network charge has been too high.

The network companies began reporting the particulars on 31 March 2004 for the first appraisal by the Agency in accordance with the rules that the Agency had decided on 1 June 2003.

Deregulation of the electricity market has led to competition in trading in electricity. As a result, electricity trading companies were obliged to adjust their prices, which has resulted in the electricity trading prices dropping steadily since 1996. The trend was broken early in 2001 and in 2002, and prices began to rise as a result of developments on the Electricity spot market.

On 1 January 2004, the price of electricity to customers in apartments and in single-family houses without electric heating was an average of about 8 percent higher in current monetary value than on the same date in 2003. To customers in single-family houses with electric heating, the price increase was 7 percent. These price increases affect principally customers with agreements that are "until further notice".

The prices payable by larger customers, such as industrial plants and agriculture, also increased. However, it is important to point out that larger companies mainly deal in long-term bilateral contracts. As a result, they are not affected to the same extent by short-term variations in the spot price of electricity, and these price particulars are not reported in the statistics. Table 9 shows the electricity prices to customers with normal price agreements, i.e. "until further notice" agreements for the years between 1996 and 2004.

Network charges

Swedish Parliament decided in the spring of 2002 on certain changes to the Electricity Act. One of the changes was an amendment to the criteria for reasonable network charge. According to the new regulations, reasonableness assessment shall be based on the performance of the network company. Performance shall be assessed on the basis of objective conditions for pursuing network operations in the relevant area, and on the manner in which the network company pursues his network operations. The new regulations came into force on 1 July 2002.

In its work of developing the Swedish regulatory model further, the Swedish Energy Agency has developed a new model – the Performance Assessment Model – for assessing the reasonableness of the network charges. In the model, the reasonableness of the network charges is based on the performance of the network companies in accordance with the new definition of reasonableness in the Electricity Act (for further particulars, see the Performance Assessment Model FACTS box). The model is considered to be a more effective instrument that is better suited to the market for regulating the network charges than the present method.

Developments in network charges for various customer groups between 1997 and 2004 are shown in Table 10. Between 1997 and 2004, the median of network charges has in-

TABLE 9

Development of electricity prices, excluding taxes and network charges, for various customer categories between 1997 and 2004, mean values, öre per kWh

	1997 1 Jan.	1998 1 Jan.	1999 1 Jan.	2000 1 Jan.	2001 1 Jan.	2002 1 Jan.	2003 1 Jan.	2004 1 Jan.
Apartment	29.2	29.0	27.1	25.8	27.0	35.6	51.9	55.8
Single-family house without electric heating	27.6	26.8	26.3	23.4	24.2	31.6	47.1	50.7
Single-family house with electric heating	25.9	25.1	24.4	21.8	22.5	29.6	44.7	48.0
Agriculture and forestry	24.9	24.1	23.1	21.4	22.1	29.3	44.5	47.5
Commercial operations	25.8	24.5	23.3	21.0	22.1	28.8	43.6	46.7
Small industrial plant	25.6	24.1	22.8	20.4	22.0	28.5	44.3	45.7

Note: The price statistics from the year 2000 differ from the particulars for earlier years. The latter apply under a delivery concession. As from the year 2000, electricity prices are given for normal price agreements, i.e. agreements "until further notice". See the consumption profiles of various customer categories in the FACTS box.

Source: Statistics Sweden

TABLE 10

Network charges on 1 January 1997 and on 1 January 2004, and their percentage changes, öre per kWh

	UPPER QUARTILE			MEDIAN			LOWER QUARTILE		
	1997	2004	%	1997	2004	%	1997	2004	%
Apartment	47.2	53.1	12.0	41.3	46.2	12.0	33.1	37.5	13.0
Single-family house without electric heating	42.0	45.6	9.0	36.0	40.1	11.0	29.7	34.2	15.0
Single-family house with electric heating	24.6	25.2	3.0	21.3	22.1	4.0	18.6	19.3	4.0
Agriculture and foresty	26.4	26.4	0	22.2	23.7	7.0	19.3	20.8	8.0
Commercial operations	17.6	19.0	8.0	15.4	16.6	8.0	13.2	14.6	11.0
Small industrial plant	18.6	18.9	2.0	16.7	16.6	0	14.2	14.3	1.0
Medium-sized industrial plant	10.6	11.3	6.0	9.3	10.2	10.0	8.0	9.0	12.0
Electricity-intensive industrial plant	6.9	7.4	7.0	5.4	6.3	16.0	4.3	4.5	6.0

Source: Statistics Sweden

creased by 12 percent to customers in apartments and 11 percent to customers in single-family houses without electric heating. For the customer category of single-family house with electric heating, the charge during the same period has increased by 4 percent. The network charges to the agriculture customer category have increased by 7 percent during the period. The customer category of electricity-intensive industrial plants has faced the highest change and increase in network charges. Since 1997, the tariff level has increased by 16 percent.

The task of the Swedish Energy Agency is to monitor that network charges are reasonable and justifiable, i.e. based on the performance of the network companies. Network charges are regularly published in Sweden, Norway and Finland.

FACTS

Customer categories

Apartment	2 MWh/year, 16 A meter fuse rating
Single-family house without electric heating	5 MWh/year, 16 A meter fuse rating
Single-family house with electric heating	20 MWh/year, 20 A meter fuse rating
Agriculture and forestry	30 MWh/year, 35 A meter fuse rating
Commercial operations	100 MWh/year, 50 A meter fuse rating
Small industrial plant	350 MWh/year, 100 kW power demand or 160 A fuse rating
Medium-sized industrial plant	5000 MWh/year, 1 MW power demand
Electricity-intensive industrial plant	140 GWh/year, 20 MW power demand
Large electricity-intensive industrial plant	130 kV, 500 GWh/year, 66 MW power demand

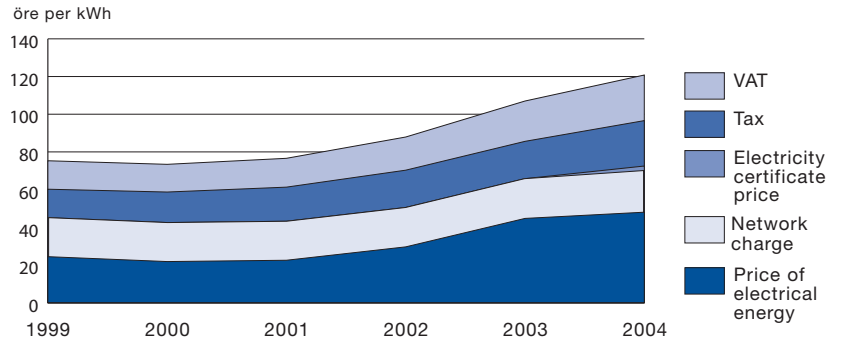
The median is the value of the variable for the middle company when the companies are arranged in the order of magnitude of the variable. Half the companies have a value that is lower than the median, and half have a value that is higher than the median. In a corresponding manner, 25 percent of the companies have a value that is lower than the lower quartile and 25 percent have a value that is higher than the upper quartile.

Electricity prices and network charges in other Nordic countries

Among the Nordic countries, Denmark has the highest electricity prices to all customer categories. Danish domestic customers pay up to three times higher electricity prices than other Nordic domestic customers. This is largely due to the high taxes on electricity consumption. The electricity prices to industrial customers are lowest in Sweden and Norway, whereas the prices to domestic customers are lowest in Finland. However, the prices in

FIGURE 9

Electricity price to a typical domestic customer[1] in relation to tax, VAT, network charge and electricity certificate price, öre per kWh

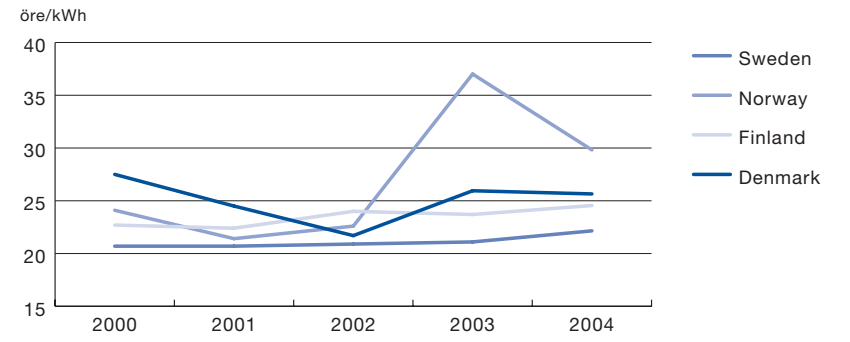


[1] Single-family house with electric heating in southern Sweden

Source: Statistics Sweden

FIGURE 10

Network charges in the Nordic countries[1] payable by a typical domestic customer[2], öre per kWh



[1] Excluding Iceland
[2] "Single-family house with electric heating", 20 000 kWh, median

Source: The Norwegian Water Resources and Energy Directorate (NVE), www.nve.no; Finnish Electrical Energy Association Adato Energia Oy, www.energia.fi; Association of Danish Energy Companies, www.danskenergi.dk

Sweden, Norway and Finland are relatively similar.

In all Nordic countries, there is supervision of the network monopoly. In Norway, the Norwegian Water Resources and Energy Directorate (NVE) handles the supervision. In Finland, the Energy Market Authority is a special supervisory authority set up for this purpose. Since 1 January 2000, Denmark also has a special supervisory authority for network operations known as the Energy Supervisory Board.

In Norway and Denmark, the supervisory authorities determine in advance the total revenues from the network charges (known as ex ante regulation). In Sweden and Finland, network charges are examined in arrears (known as ex post regulation).

The network charges in the Nordic countries vary widely, which is largely due to the different geographical circumstances, the network and corporate structures, tax policies, domestic generation capacity and the consumption patterns of the electricity consumers in the various countries.

The network charges shown in Figure 10 have been calculated on the basis of an annual electricity consumption of 20 000 kWh. The figure shows that the network charges in Sweden were the most stable and lowest during the comparison period compared to other Nordic countries. Finland follows a similar pattern, but at a higher level. The network charges in Denmark and Norway have varied more over the years.

An international perspective

The electricity industry is currently undergoing major changes in many parts of the world. New market conditions are an important component in this process of change, and the growing environmental demands are another.

The conditions on the Swedish and Nordic electricity markets differ in a number of re-

TABLE 11

Electricity prices to industrial and domestic customers in the Nordic countries[1] in 2003, including taxes and VAT, öre per kWh

	Small industrial plant[2]	Medium-sized industrial plant[3]	Large industrial plant[4]	Domestic customer 3 500 kWh	Domestic customer 20 000 kWh
Sweden	64	59	56	124	102
Norway	59	45	35	193	143
Finland	61	55	43	91	57
Denmark	71	-	-	215	184

[1] Excluding Iceland
[2] 1.25 GWh per year, 0.5 MW, 2500 hours
[3] 10 GWh, 2.5 MW, 4000 hours
[4] 70 GWh, 10 MW, 7000 hours
Note: The prices to industrial customers shown in the table exclude VAT, but those to domestic customers include VAT
Note: The rate of exchange is the average rate for January 2003

Source: Electricity prices 1990 – 2003, Eurostat

spects from the conditions in Europe and the remainder of the world. In international comparisons, it is of great importance to bear in mind the specific conditions in individual countries. In the case of Sweden, for example, the high electricity consumption is due to the electricity-intensive industries and the comparatively cold climate.

Electricity generation

The USA accounted for 40 percent of the total electricity generated in the OECD countries in 2001, the former EU (the original 15 countries) accounted for just under 28 percent, and Sweden for about 2 percent. The total electricity generated in the EU countries increased by more than 23 percent between 1990 and 2001. During the same period, electricity generation in Sweden increased by 13 percent.

In the EU member states, half of the electricity is generated from fossil fuels, one third from nuclear power and around 15 percent from hydro power. Biomass accounts for around 2 percent. Compared to the EU, electricity generation from fossil fuels was relatively low in Sweden at about 4 percent in 2001, and the proportion of electricity generated from hydro power and nuclear power was very high at around 90 percent.

Out of the total electricity generated from renewable energy sources in the EU in 2001, 80 percent originated from hydro power and 20 percent from solar, wind, biomass, waste and geothermal power.

Within the EU, Finland had the highest percentage utilization of biomass at 12 percent of the total electricity generated in 2001. The corresponding figure in Sweden was just over 2 percent.

In the EU, Luxembourg and Austria have the highest proportion of hydro power. Within the OECD, Norway and Iceland have by far the highest proportion of hydro power at almost 100 percent of the total electricity generated.

Waste accounts for a relatively high proportion of the electricity generated in Belgium and particularly in the Netherlands, although this source is also common in Denmark and Germany. In Denmark, wind power dominates among the total renewable energy sources at almost 70 percent.

Electricity consumption

Electricity consumption per inhabitant is relatively high in Sweden compared to other countries. In 2001, Sweden was in fourth place in the world, after Norway, Iceland and Canada. In some of the major industrialized European countries, such as Germany, France and Great Britain, the per capita electricity consumption was less than half of that in Sweden. Swedish electricity consumption is about twice as high as the average in the OECD and more than twice as high as the average in the EU.

Between 1990 and 2001, electricity consumption in Europe increased by more than 20 percent. The highest increases were in Iceland, Ireland and Portugal. During the same period, consumption in Sweden grew by more than 2 percent, while that in Norway increased by around 13 percent.

A common feature of several of the countries that have high per capita electricity consumption is that they have access to inexpensive hydro power and have a high demand for space heating due to a cold climate. In Sweden, other natural resources, such as forests and ore, also contribute to specialization of industry in energy-intensive products. If the

FACTS

Network charges

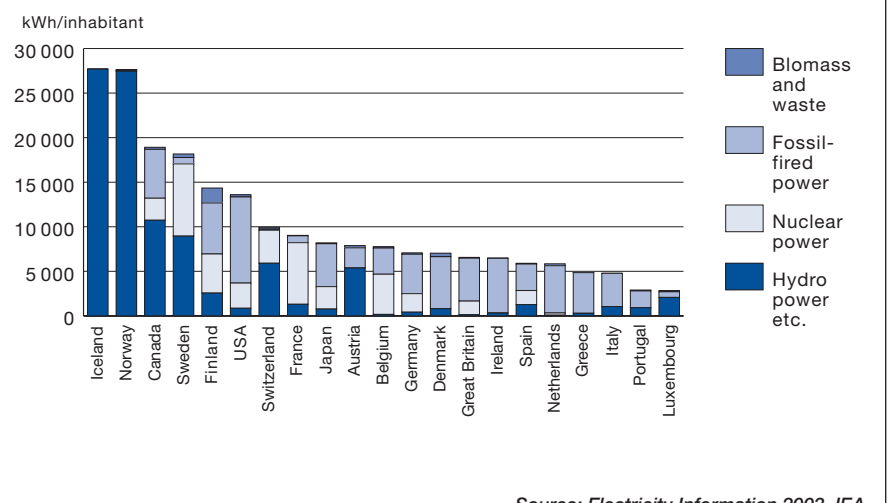
The term network charge denotes charges and other conditions for the transmission of electricity and for making the connection to a power line or a power line network. Payment of the network charge entitles a player to access the whole transmission system and enables him to buy or sell electricity throughout the electricity market area. To customers who buy electricity from a local network, the regional network and grid charges are included.

The network charges are published and supervised by the Swedish Energy Agency. The network charges must be reasonable. After the amendment to the Electricity Act that came into force in July 2002, the charges shall be related to the performance of the network companies. The reasonableness of the charges shall thus be related to customer benefit. The network charges shall continue to be objective and non-discriminatory.

Customers may be classified into groups according to the cost pattern, e.g. customers with electric heating or time tariff. When the reasonableness of a network charge is assessed, special consideration must be given to the interest of the consumers in low and stable prices. However, the charges must not be set differently depending on where in an area the customer is located. The Electricity Act does not specify whether the network charges should consist of a fixed part and a variable part. In recent years, several of the network companies have modified their network charges so that the fixed charge represents the larger part of the total network charge.

FIGURE 11

Electricity generation per capita, with relative distribution by different power sources in 2001, kWh



Source: Electricity Information 2003, IEA

TABLE 12

Gross electricity generation in 2001, TWh, and electricity consumption per capita, kWh

	Hydro power wind power, etc.[1]	Nuclear power	Fossil-fired power	Biomass and waste	Total generation, gross	Imports-exports	Electricitycons.[2] per capita
Belgium	2	46	30	2	80	9	8 651
Denmark	4	0	31	2	38	-1	6 929
Finland	13	23	30	9	74	10	16 264
France	79	421	47	3	550	-68	7 909
Greece	3	0	50	0	54	3	5 128
Ireland	1	0	24	0	25	0	6 483
Italy	60	0	216	0	279	48	5 642
Luxembourg	1	0	0	0	1	6	15 659
Netherlands	1	4	85	3	94	17	6 922
Portugal	15	0	30	2	47	0	2 915
Spain	51	64	120	3	238	3	5 985
Great Britain	7	90	283	5	386	10	6 740
Sweden	**80**	**72**	**6**	**4**	**162**	**-7**	**17 347**
Germany	34	171	364	13	583	4	7 119
Austria	44	0	18	2	64	0	7 908
USA	244	808	2 763	71	3 886	20	13 662
Japan	98	320	613	13	1 043	0	8 198
Canada	334	77	171	7	588	-23	18 171
Norway	124	0	1	0	125	4	28 428
Switzerland	38	26	1	2	67	-7	8 381
Iceland	8	0	0	0	8	0	27 690
Nordic countries	229	95	68	15	407	6	16 997
EU 15	**396**	**891**	**1 335**	**48**	**2 673**	**34**	**7 135**
OECD total	**1 365**	**2 290**	**5 754**	**147**	**9 556**	**12**	**8 404**

[1] Also includes electricity from solar and geothermal sources

[2] The electricity consumption here includes electricity consumption in industry, transport, dwellings and the services sector, and also distribution losses and energy consumption in the electricity industry.

Source: Electricity Information 2003, IEA

electricity-intensive industries are taken into account in the calculation of per capita electricity consumption in Sweden, i.e. if the electricity consumption of electricity-intensive industries is replaced by the average for industry, the per capita electricity consumption in Sweden would be about 20 percent lower. Canada, Norway and Finland also have a high proportion of electricity-intensive industries. These countries contribute to the international distribution of labour, since a large proportion of the electricity-intensive products is exported.

Electricity prices

Electricity prices vary both between countries and between customer categories. Customers with high electricity consumption generally pay lower prices for electricity than customers with low consumption. In most countries, domestic customers pay energy, environmental and/or value added taxes and turnover tax, whereas industrial customers are exempt from such taxes

International electricity price statistics are not entirely reliable, and they are therefore not included in this publication. ■

Natural gas

Since natural gas was introduced on the Swedish market in 1985, a distribution network has been built along the Swedish west coast from Malmö to Stenungsund. The Swedish natural gas market is therefore a regional market on which natural gas accounts for 20 percent of the energy consumption in areas in which it is an available alternative. But on the national market, natural gas accounts for only 2 percent of the total energy consumption in Sweden.

Sweden has a modestly developed natural gas market compared to the remainder of the EU, where natural gas accounts for around 20 percent of the total energy consumption.

Energy policy and regulations

The objective of the EU is to create a common European natural gas market with real competition. As a result of the new Natural Gas Directive, a number of changes have been implemented on both the Swedish and the European natural gas markets. In Sweden, the new rules are being introduced gradually, and the natural gas market will be fully open to competition by 2007. The changes will affect the producers, consumers and the authorities that will be supervising the market.

A common European market for gas

The first step towards a deregulated market was taken in August 2000, when the new Swedish Natural Gas Act came into force, based on the EU Natural Gas Directive (1998/30/EC), with the aim of achieving competition on the natural gas market.

The Natural Gas Act includes provisions concerning entitled customers being free to choose their gas supplier. In 2000, the limit was set at a consumption of 25 million cubic metres at normal temperature and pressure (Nm^3) annually, and this was then lowered to 15 Nm^3 on 1 August 2003. In May 2004, there were about 10 entitled customers in Sweden, and these account for roughly half the total natural gas consumption in Sweden.

A new Natural Gas Directive (2003/55/EC) was adopted in June 2003, and this requires a number of adjustments to the Swedish regulations to be incorporated into Swedish legislation. In the spring of 2003, the Government therefore appointed a committee (Investigation into the continued development of the electricity and the natural gas markets N:2003:04) in order to review the need for amendments to the Natural Gas Act. In an interim report entitled "Electricity and gas markets – European harmonization", the investigating committee submitted proposals for the legislative changes required by the Directive. Swedish Parliament is expected to take a decision concerning amendments to the Natural Gas Act no later than in the autumn of 2004.

When the Act comes into force, all non-domestic customers will be entitled to choose their supplier. This means that the number of entitled customers will increase to about 3 500, which corresponds to almost 95 percent of the total natural gas consumption.

According to the EU Directive, the market shall be fully open to competition no later than 1 July 2007. This means that other customers, i.e. domestic customers, will be free to choose their natural gas suppliers. Sweden intends to follow this time schedule.

According to the provisions of the Directive, a company may not both trade in and transport natural gas. This separation also applies to those who have natural gas stocks or a plant for liquefied natural gas. Separation of trade and transport is necessary in order to prevent cross-subsidizing between monopolized transport operations and trading in gas that is open to competition. Separation of the operations is therefore necessary in order to achieve competition on equal terms.

The investigating committee also suggests that the Government should appoint the body that will have responsibility for balancing the entire natural gas system. The issue is currently being dealt with by the Swedish Ministry of Industry. Both the system balancing responsibility and the conditions for providing balancing services are regulated.

The proposal for the new Natural Gas Act states that the new Act should be extended to cover biogas, gas from biomass and other gases, if it would be technically possible to admit and use these gases and transport them in the natural gas distribution network.

Economic instruments

The introduction of natural gas in Sweden was a direct consequence of a political decision to find raw materials that would replace oil and coal. Natural gas has therefore served as a replacement raw material, and the pricing has been set on the basis of the alternative cost of other energy raw materials. Changes in taxation and charges have therefore been of major importance to the domestic gas market.

Energy taxation

Energy tax and carbon dioxide tax are levied on natural gas. The carbon dioxide tax that was introduced in 1991 is payable for all fuels, with the exception of biofuels and peat, per kilogram of carbon dioxide emitted. In 2004, the general level of the carbon dioxide tax is 91 öre per kilogram of carbon dioxide[2]. Energy tax is payable regardless of the energy content. The table below shows the tax rate for natural gas applicable as from 1 January 2004.

Natural gas used in vehicles attracts lower tax rates than natural gas put to other uses. The tax rates also vary between different types of end user. Industrial plants may make tax deductions for the entire energy tax and 79 percent of the carbon dioxide tax. As from 1 January 2004, CHP taxation has been amended so that CHP plants pay the same tax rates as industrial plants for fuel used for heat generation in the CHP plant. In the past, deductions were allowed only for half the energy tax, and no deduction was allowed for the carbon dioxide tax.

Out of the total price of natural gas to industrial customers and CHP plants, tax (carbon dioxide tax) accounts for 27 percent, while to domestic customers, tax (energy and carbon dioxide taxes and VAT) accounts for 54 percent.

The amended CHP taxation is expected to lead to an increase of about 1 TWh in the electricity and heat generated in existing natural gas plants. In addition, Göteborg Energi began building a natural gas fired CHP plant (Ryaverket) in May 2004, and this is expected to come into operation at the end of 2006. A further natural gas fired combined cycle plant is planned by Sydkraft for Malmö (Öresundsverket). These two plants will deliver about 4 TWh of electricity and 2 TWh of heat.

Emission Trading Directive

The EU Emission Trading Directive (described in more detail in the section entitled Electricity) will also influence the natural gas market. According to the national distribution plan[3] submitted by the Government to the EU Commission in April 2004, it is proposed that the energy sector should be allocated 80 percent of the historical emissions from the plants. It is proposed that new electricity and heat generation plants should be allocated emission rights based on the benchmark values developed in the distribution plan. The benchmark values specify the number of tonnes of carbon dioxide emission per GWh, and are calculated from historical emissions from existing electricity and heat generation plants. The final decision concerning allocation will be taken by the Environmental Protection Agency.

A parliamentary investigating committee has been appointed to investigate the question of emission rights – "A system and regulations for the flexible mechanisms of the Kyoto Protocol" (FlexMex2 investigation). In an interim report entitled "Trade for a better climate – trade in emission rights 2005–2007, etc.", the investigating committee proposes that the carbon dioxide tax should be abolished for the plants covered by the emission rights system, with the exception of plants in heat generation.

The investigating committee proposes that companies in the heating sector should be given rights to compensation for the cost of that part of the emissions that is covered by purchased emission rights, while limiting the total tax liability to the level of carbon dioxide tax before the compensation.

Natural gas in Sweden

The Swedish natural gas market is concentrated to the west coast of the country, along the distribution network that runs from Trelleborg to Stenungsund, and to Gislaved in Småland. There is technical scope for transporting natural gas in liquid form, which is known as Liquefied Natural Gas (LNG), without using the pipeline network. In Stockholm, Fortum Heat is studying the possibility of using LNG in the town gas network. A trial delivery is expected to be made during 2004.

From the introduction and up to 1992, the natural gas market in Sweden grew rapidly from 1 TWh in 1985 to 8 TWh in 1992, when the growth rate levelled off. In 2003, the total imported natural gas represented an energy of about 9 TWh. In Sweden, natural gas is used mainly as energy raw material for power and district heating generation, and in industry. Natural gas is also used in single-family houses and multi-family houses and, to some extent, also as vehicle fuel.

2 Budget draft bill 2003/2004:1
3 The distribution plan specifies the principles for allocating emission rights in Sweden.

TABLE 13

Tax rates for natural gas from 1 January 2004, SEK per 1 000 m3

	Energy tax	Carbon dioxide tax	Total
Engine-powered vehicle, ship, aircraft	0	1 105	1 105
Industrial plant and CHP plant	0	409	409
Others	237	1 946	2 183

Source: Tax authority, incl. processing by the ÅF Group

Transport of natural gas

Natural gas is transported mainly in pipelines and, unlike other network based energy forms, can be transported over long distances without loss of thermal energy in the gas.

The distribution network begins at the gas field and carries the gas up to the end consumer. The natural gas system is divided into a number of pressure levels in order to optimize the transmission capacity.

The network is monitored from a control station, from which parts of the network can be isolated for maintenance work or in the event of disturbances, using remotely controlled line valve stations.

In 2004, the Swedish natural gas network consisted of about 650 km of transmission pipeline and around 3 000 km of distribution pipes.[4]

Transmission

Gas is transported over long distances in the transmission system. There is no clear-cut definition of which parts that are included in the transmission system. In the new EU Directive, transmission is defined as the transport of gas through main and branch pipes, or the transport of gas up to the metering and regulating station (MR station)[5]. The main pipeline conveys the gas from the infeed point and changes over into a branch line that is the connection pipe to the MR station. The task of the MR station is to meter the quantity of gas transported and to regulate the pressure to the required level.

All natural gas transmission operations in Sweden are carried out by Nova Naturgas and Sydkraft Gas. Nova owns the pipeline from Malmö the Gothenburg, the new 16-bar pipeline between Gothenburg and Stenungsund, and the submarine pipeline between Dragör in Denmark and Klagshamn in Sweden. Sydkraft owns the majority of the branch pipelines in Swedish natural gas system.

Distribution

Distribution denotes the transport of natural gas after the MR station[6]. The distribution system operates at different pressure levels in order to adapt the delivery volumes to suit various customer groups.

Storage services

Variations in consumption naturally occur during the year as a result of temperature variations, seasonal variations in process industries, and variations in the prices of other energy raw materials during the year. Minor variations can be regulated by pressure adjustments in the gas pipeline, known as linepack, but larger changes require access to a gas storage facility.

There are no known natural facilities for natural gas storage in Sweden. Linepack was the only form of storage that was available up to 2003, when Sydkraft Gas opened the Skallen trial plant in the county of Halland. The storage facility is based on Lined Rock Cavern (LRC) technique, which involves a welded gas container being located in a rock cavern, with cement injected around it. In the foreseeable future, Sweden will have to rely on storage facilities in other countries, or deliveries that can even out fluctuations in the market demand.

System balance responsibility

System balance responsibility denotes the general responsibility for short-term balance being maintained between the infeed and draw-off of natural gas in the whole of the natural gas system. Nova Naturgas has so far undertaken this service on an agreement basis. However, the Directive requires that responsibility should be regulated. The question of who will have system balance responsibility in Sweden is currently being considered by the Swedish Ministry of Industry.

The market

The Swedish natural gas market is characterized by a small number of companies and a high degree of vertical integration. Several players own or control both the suppliers and the distributors, and are thus able to influence the entire sales chain. There are seven trading companies on the Swedish natural gas market. Sydkraft accounts for the distribution and sales of around 50 percent of the gas, Göteborg Energi about 18 percent, Öresundskraft around 10 percent and Nova Naturgas about 10 percent. The remaining three jointly have around 10 percent of the market.

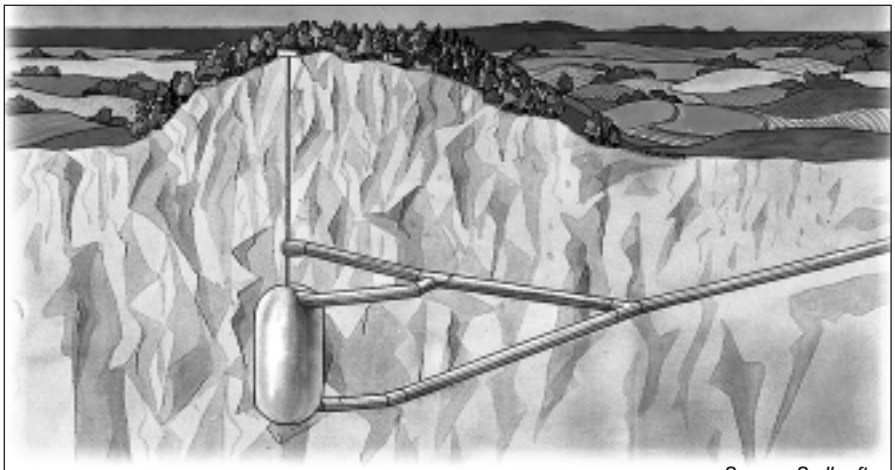
Natural gas is delivered to Sweden via the Danish natural gas network in accordance with an agreement between Nova Naturgas and the

4 Sources: Nova Naturgas and SOU 1999:115, and also information processed by ÅF (Swedish Steam Users' Association)
5 Definition in accordance with SOU 2003:113
6 Definition in accordance with SOU 2003:113

FIGURE 12
The Swedish natural gas network

Source: Nova Naturgas

FIGURE 13
Natural gas storage facility in Skallen in the county of Halland



Source: Sydkraft

FACTS

Linepack

A pipeline system also has a certain storage capacity within it. The pressure and volume in the pipeline can be varied by increasing or decreasing the infeed rate into the pipeline. This can be used as a method of storage, and is known as linepack. The Swedish main pipeline is designed for a pressure of 80 bar, but the pressure normally varies between 50 and 60 bar. In extreme cases, the pressure has risen to 69 bar. The main pipeline network contains between 4 and 6 million Nm^3, depending of the pressure. This gas volume is equal to the consumption in 24 hours on a cold winter day.

Danish company Dong. Up to November 2003, Nova Naturgas was the only natural gas importer in Sweden, but during the same year, Göteborg Energi began importing natural gas from Denmark via Dong.

Ownership structure

All natural gas companies, with the exception of Nova Naturgas, are members of various forms of energy companies, that have other operations on the electricity and/or district heating markets. The companies have different ownership structures – Nova Naturgas and Sydkraft are owned by foreign private or state energy companies, whereas Swedish municipalities own Göteborg Energi, Varbergs Energi, Lunds Energi, Ängelholm Energi and Öresundskraft. The German energy company E.ON has a majority holding in Sydkraft and, through its ownership of Ruhrgas, has a holding in Nova Naturgas.

Swedish natural gas companies

Nova Naturgas owns and operates the main pipeline from Dragör in Denmark through Klagshamn, south of Malmö, to Gothenburg. A new pipeline from Gothenburg to Stenungsund was taken into service in May 2004.

Nova also has trading operations, i.e. sales of natural gas to end users. Nova Naturgas imported and transported 928 million Nm^3 in 2003. In May 2004, Nova announced that it would transfer its sales operations to Dong on 1 July. The Swedish Competition Authority was notified of the transfer in May 2004. Nova is owned by Statoil, Ruhrgas, Dong and Fortum.

Sydkraft Gas owns the branch lines in the regions of Skåne, Småland and Halland. Sydkraft Gas has trading operations in Skåne, Halland up to and including the town of Falkenberg, and to Gnosjö and Gislaved in Småland. Sydkraft Gas has also submitted a concession application for extending the pipeline from Gislaved to Jönköping and is also planning, together with Danish, German and Norwegian energy companies, to build a new transmission pipeline from Germany, to be known as the Baltic Gas Interconnector.

Sydkraft Gas supplies natural gas to local distributors and to around 25 000 private customers. Sydkraft Gas is owned by the Norwegian Statkraft and the German E.ON energy conglomerate.

The remaining five active natural gas companies in Sweden in 2003 were *Göteborg Energi, Öresundskraft, Lund Energi, Varberg Energi* and *Ängelholm Energi*.

Use of gas

Natural gas was initially used in Sweden mainly in industry as replacement for oil and coal. Industry currently accounts for just under 40 percent of the consumption, power and CHP plants for just over 40 percent, and the 'others' sector comprising dwellings, commercial premises and some minor industrial plants for just under 20 percent. Domestic customers account for only 5 percent of the total natural gas consumption in Sweden. A minor part is also used as vehicle fuel and for heating greenhouses.

According to the Swedish Gas Association, natural gas is used by about 55 000 customers in 32 municipalities, of which more than 50 000 are domestic customers and 3 500 are corporate customers. Out of the domestic customers, about 16 000 use gas for cookers, and around 30 000 single-family dwellings and 4 000 multi-family houses use natural gas for space heating[7].

[7] Values estimated by the Swedish Gas Association.

TABLE 14

Imports of and trade in natural gas in Sweden in 2003, Million Nm^3

Imports	Nova Naturgas 891						Dong 33
Trade	Nova Naturgas	Sydkraft gas	Varberg Energi	Lunds Energi	Ängelholms Energi	Öresunds-kraft	Göteborg Energi[1]
	99 11 %	464 50 %	8 1%	69 7%	22 2%	91 10%	171 18%

Note: Since 1 October 2003, Göteborg Energi has imported via Dong.

Source: Information from the natural gas companies.

Pricing

The price of natural gas is generally based on the cost of alternative fuel that would be payable by the customer. The principle is applied between all of the various players in the entire chain from supplier to end customer. The point of departure in the negotiations is the alternative cost facing the customer by using other energy raw materials. In most agreements, the price of natural gas deliveries is indexed against the price of oil, although in some cases also against the price coal and, in recent years, also against a quoted price of electricity.

Alternative pricing largely still applies to the continental part of Europe, including Sweden. Marketplaces have been created mainly in Great Britain and Belgium, whereby several suppliers can offer natural gas in competition. This leads to the alternative pricing losing in importance and being replaced by competition between different gas suppliers.

Prices to end user

In addition to the price of gas, the end customer also pays a network charge for the transport of gas through the Swedish pipeline network. This charge is based principally on the power and energy drawn, to which energy tax and VAT are added.

The natural gas prices to end customers in Sweden presented in this chapter are based on the price statistics from Statistics Sweden. Natural gas prices to domestic customers are shown in Table 16, and the prices to industrial customers in Table 17.

TABLE 15

Ownership structure on the Swedish natural gas market in 2003

Company	Owner/Share	Other activities of the Group in the energy sector
Nova Naturgas	E.ON – 30% Statoil – 30% DONG – 20% Fortum – 20%	None
Sydkraft	E.ON – 55% Statkraft – 45% Others – 1%	Electricity generation, distribution and trade. District heating generation and sales.
Göteborg Energi	Gothenburg municipality	Electricity generation, distribution and trade through the Plus Energi company owned jointly with Vattenfall.
Öresundskraft	Helsingborg municipality	Electricity generation, distribution and trade. District heating generation and sales.
Lund Energi	Lund municipality – 97% Lomma municipality 3 %	Electricity generation, distribution and trade. District heating generation and sales.
Varberg Energi	Varbergs municipality	Electricity generation, distribution and trade. District heating generation and sales.
Ängelholm Energi	Ängelholms municipality	Electricity generation, distribution and trade through subsidiaries. District heating generation and sales.

Source: Swedish Agency for Administrative Development

TABELL 16

Natural gas prices to domestic customers 1 januari 2004, öre per kWh

		TOTAL PRICE OF NATURAL GAS[1]		
	Number of customers	Incl. tax and VAT	Excl. tax and VAT	Incl. tax excl VAT
Domestic gas	12 917	85.75	41.80	68.60
Heating and domestic gas	12 125	70.56	36.58	56.45
Central heating for at least 10 households	561	61.37	28.94	49.09

Note: Preliminary statistics

[1] Average products price incl. transport costs.

Source: SCB

TABELL 17

Natural gas prices to industrial customers 1 januari 2004, öre per kWh

			TOTAL PRICE ON NATURAL GAS[1]	
	Number of customers	Annual consumption	Excl. tax	Incl. energy and environmental taxes excl. VAT
Industry	368	<15 milj m^3	27.05	39.11
Industry	..	>15 milj m^3	..	..
CHP and condensing plants	3		27.90	27.90

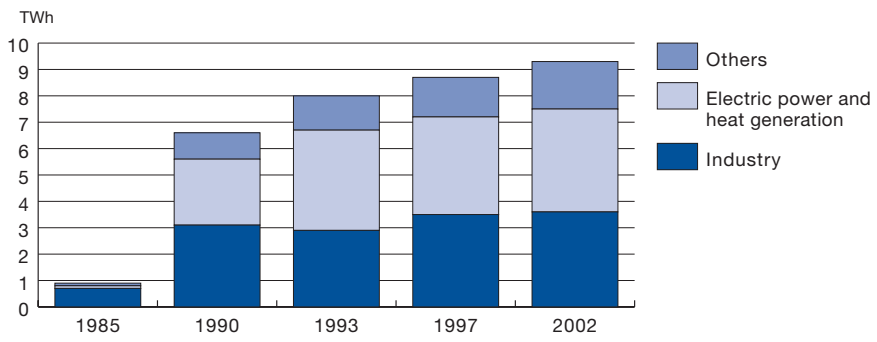
Note: Preliminary statistics

[1] Average products price incl. transport costs.

Source: SCB

FIGURE 14

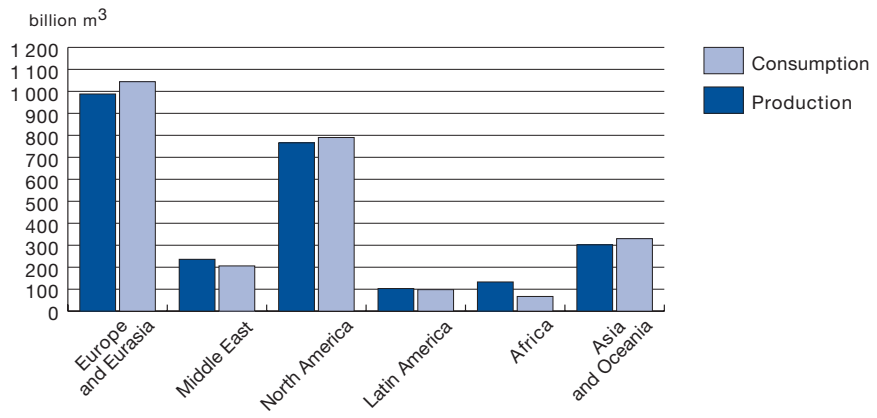
Consumption of natural gas in Sweden distributed by user sectors, TWh



Source: Information received from Energy in Sweden, Statistics Sweden (2002), and Nova Naturgas AB (1985 – 1997) processed by the ÅF Group.

FIGURE 15

Production and consumption per region in billion cubic metres



Note: Eurasia denotes countries formerly in the USSR. *Source: BP Statistical Review 2003*

FACTS

Agreements

Delivery agreements have traditionally been of a very long-term nature, since the production and transport of gas are very capital intensive.

Agreements between gas importers and trading companies usually run for between 20 and 30 years and may include 'take or pay' commitments. In a 'take or pay' agreement, the seller undertakes to deliver a maximum volume and the buyer undertakes to pay for a minimum volume. The buyer must pay for the agreed volume, regardless of whether or not he has consumed that volume.

Agreements between trading companies and major customers usually run for five years and are extended by one year at a time. Such agreements seldom include 'take or pay' undertakings. Long-term agreements are sometimes supplemented with short-term purchasing agreements in which gas is purchased on a 24-hour basis and payment is made for the volume received.

An international perspective

The world consumption of natural gas has been increasing at an average rate of 1.8 percent annually since 1990. The total global consumption of natural gas in 2002 was 26 500 TWh, which represents 24 percent of the total world energy consumption.

In the EU member countries, natural gas accounted for 24 percent of the total energy consumption in 2002. However, the proportion of natural gas consumption varies between countries, ranging from around 1 percent in Portugal and Ireland to almost 40 percent of the total energy consumption in Great Britain.

In Sweden, natural gas accounts for around 2 percent of the total energy consumption. In the 32 municipalities in which natural gas is available, it accounts for about 20 percent of the total energy consumption.

Production of natural gas is highly concentrated to the Russian Federation and the USA, which together accounted for around 44 percent of total production in 2002. In Europe, Norway and the Netherlands are the biggest producers of natural gas.

The largest known natural gas reserves are in Russia (15 percent) and in the Middle East (36 percent). The EU has only 2 percent of the reserves. The total commercially exploitable reserves in the world are estimated to be 156 000 billion cubic metres and are expected to suffice for more than 60 years at the present rate of consumption.

Price developments in certain European countries

The international price statistics of natural gas are not entirely reliable, and they are therefore not reported in this publication. The main reason is that there are few players on the natural gas market, and also that the prices to end customers vary with the type of tariff and agreement the end consumer has concluded.

Moreover, the IEA price statistics are based on average prices to various end customers in each country. The average price to the various end customer categories has been estimated from information on costs per unit of natural gas delivered to domestic customers and information from gas suppliers on revenues per unit delivered to industrial customers.. ■

District heating

District heating is a very common form of space heating in Sweden. Around half of all apartments in multi-family houses in the country are heated by district heating systems. In addition, heat is supplied to around 130 000 single-family houses, as well as to industrial plants and public premises. District heating systems account for around 40 percent of the heating market.

The construction of district heating systems, better flue gas treatment equipment in the district heating plants and changeover from oil to other fuels have resulted in a great impovement to the enviroment. As an example, the sulphur emissions from district heating stations have dropped by 92 percent between 1980 and 1999. In addition, the need for imported oil has been reduced.

Energy policy and regulations

From 1995, district heating has been regulated in accordance with the Electricity Act. This means that the cost-of-service principle for municipal companies no longer is mandatory. The pricing of heat from district heating systems is thus no longer regulated, except for co-operative associations and technical management in municipalities that must be non-profit making.

One goal of the energy policy has been to replace heating with oil and electricity by district heating. The construction of district heating plants has therefore received various forms of State support. Subsidies have been granted for the construction of biofuel-fired CHP plants, for the construction of distribution networks and for the conversion of electrically heated houses to district heating. Moreover, better flue gas treatment techniques in district heating stations have resulted in environmental benefits compared to individual combustion plants installed in every single property.

District heating has played an active role in the conversion of the energy system for creating a better environment and reducing the greenhouse gases by increasing the use of alternative energy sources. The use of biofuels and other energy sources has increased as a result of increased energy taxes on fossil fuels. Moreover, the competitiveness of district heating has benefited from increased taxes on oil.

In Sweden, the competitive situation of district heating is currently being scrutinized, and the issues studied include possible price regulation and third party access (i.e. freedom for third parties to be granted access to district heating pipelines). The first report to the Government proposes that district heating operations shall be reported separately and that the separation from trading in electricity should be made clearer, in order to avoid cross-subsidizing. It is proposed that district heating operations should not be pursued within the same corporate body as electricity market operations, with the exception of combined heat and power generation, provided that the electricity generated is sold on commercial terms, i.e. the prevailing market price.

District heating in Sweden

Construction of district heating systems in Sweden began in the 1950s. The district heating networks were built by municipalities, and municipal real estate companies were often the first and most important customers. As a result of the oil crises, it became profitable to convert district heating plant for combustion with energy sources other than oil. Coal was initially used as the replacement fuel, but increased taxation of coal led to growing use of other energy sources.

One of the benefits of district heating is that it can use energy sources that have no alternative use. This includes various fuels that are difficult to handle, such as refuse and logging residues, although waste heat from industrial plants and from CHP plants can also be used.

The construction of district heating systems was due to the increasing prices of oil and, above all, due to increased oil taxes. District heating became a competitive alternative to oil and electricity for heating multi-family houses. Other alternatives that can now compete with district heating include combustion of biofuel and using heat pumps.

Between 1992 and 2002, the total fuel consumption for district heating increased by more than 10 TWh or by almost 25 percent. The major change since 1992 is that the proportion of biofuel has increased by around 250 percent, whereas the use of coal and electrical energy for electric boilers declined by around 80 percent each.

FACTS

District heating

District heating is the generation and distribution of hot water in a pipeline system for the collective heating of buildings. The heat is generated in boiler stations or in CHP plants. Hot water distribution is carried out through a network of pipes.

A district heating network consists of two pipelines – a supply pipe and a return pipe for returning the cooled water to the district heating plant. The following four criteria are generally said to determine whether a system is a district heating system:

- that there is an agreement between the customer and the supplier,
- that the customer pays for the delivery,
- that more than one property is connected, and
- that the deliveries are distributed onto several customers and that heat is supplied on commercial terms.

TABLE 18

Fuels used for district heating

	2000	2001	2002
Thermal energy delivered, TWh	41.4	46.6	47
Subscribed thermal power, GW	24.2	24.8	24.7
CHP generated, TWh (net)	3.7	4.4	5.2
Installed electric power, GW	2	2.1	2.2
Consumed fuel, etc., TWh	51.1	56.6	58.6
of which oil	3	4.6	4.7
coal	3.7	3.6	3.7
wood fuel	13.9	16.3	16.4
tall pitch oil	1.5	1.8	1.6
refuse	5.5	5.7	6.7
industrial waste heat	3.5	3.7	3.7
elec. energy for elec. boilers	1.8	1,4	1
generation from heat pumps	7.1	7,1	6.6
peat	2.4	2.9	3.8
natural gas	3	3.3	3.8
other fuels, hot water, etc	5.8	6.1	6.6
Length of distribution network, km	12 020	12 780	13 517
Efficiency, percent	85	87	86

Source: Annual statistics from the Swedish District Heating trade organization

The market

Up to the early 1980s, most district heating stations were operated as municipal services. During the past 20 years, most of these have been re-organized into municipal limited liability companies. Most of the district heating companies are still owned by municipalities, although the present development is that large energy groups are taking over municipal companies, and that small non-municipal businesses are establishing district heating systems in small communities. Nineteen district heating companies were sold during 2001–2003, and Sydkraft purchased nine of these companies.

The vast majority of district heating companies are members of groups of network and/or electricity trading companies and are members of the Swedish District Heating trade organization.[8] In May 2004, Swedish District Heating had 162 member companies. Non-member companies that generate around 1 percent of the heat, operated in about 40 places in Sweden, often in the form of municipal technical services.

District heating systems therefore vary widely in terms of both size and customer density. Sweden has about 570 separate district heating systems in around 1 900 urban areas. In 1990, municipal district heating companies delivered just over 98 percent of the total heat, and in 2002, this proportion dropped to 62 percent. In 2002, the four large energy groups (Fortum, Graninge, Sydkraft and Vattenfall) delivered 36 percent of the total heat, and municipal companies, 62 percent.

Use of district heating

The customers of district heating companies are mainly owners of multi-family houses. In 2002, 51 percent of the thermal energy (GWh) delivered by district heating systems went to multi-family houses. In 2002, 75 percent of the floor area of multi-family houses were heated by district heating systems. The corresponding figure for commercial premises was 56 percent and for single-family houses, 7 percent.

Prices of heat from district heating systems

In the past, the price of heat from district heating systems owned by municipal companies was set according to the cost-of-service principle. Price variations between district heating companies were due to the costs incurred by the companies for generation, fuel costs and customer density.

The prices of heat from district heating systems show wide scatter between companies in different locations in Sweden. This is shown by the report entitled "Heat in Sweden in 2003" that was prepared as a follow-up of district heating prices in 2002.

The Swedish Energy Agency report entitled "District heating on the heat markets" ER 19:2000 concluded that the prices charged by municipally owned companies were lower than the national average. Based on an annual consumption of 193 MWh, the prices charged by the municipally owned companies were an average of 22 SEK/MWh lower.[9] The difference was small but significant. The follow-up report for 2001 also shows that ownership has a certain influence on the price level.

According to the latest report entitled "Heat in Sweden in 2004", prices have risen most in companies with the lowest price levels. This also appears to apply in particular to municipal companies that have been sold to large energy groups[10].

Competition between the alternatives

District heating prices vary locally due to fac-

8 Out of the member companies, 76 percent were partially or wholly municipally owned, 9 percent were municipal services, 12 percent were private, and 3 percent were State owned.

9 Prices in 1999 to houses that had an annual consumption of 193 MWh were an average of 457 SEK/MWh and 479 SEK/MWh respectively.

10 District heating companies and ownership – May 2004, the EKAN Group.

tors such as the fuels used, the financial yield requirements of the companies, and the competition.

District heating companies therefore have a market advantage as long as the prices of district heating are lower than those of competing alternatives. The price of competing alternative thus serves as a ceiling for the prices that district heating companies can charge.

Increased prices of energy raw materials can therefore favour district heating companies. Increased oil tax and increased oil prices have given the district heating companies an opportunity to expand and also to raise prices.

The alternatives that can currently compete with district heating are heat generated from biofuels/pellets and heat pumps.

In the report entitled "Heat in Sweden in 2004", the Swedish Energy Agency has compared the costs of different heating alternatives. These statistics are based on information obtained from trade organizations and particulars of network charges obtained by the Swedish Energy Agency. The report shows that the least expensive average heating alternative in Sweden is the heat pump, followed by pellets and district heating[11].

However, for technical reasons, limited opportunities are available for installing heat pumps in areas with many large multi-family houses. The heat source that can conceivably be used (rock, soil or water) may be too limited to provide a sustainable amount of heat. Heat pumps are therefore relatively uncommon in multi-family houses. The alternative of combustion with pellets may also have technical limitations as regards the boiler, storage facilities and chimney stack, and also as regards the local emissions of environmentally harmful substances.

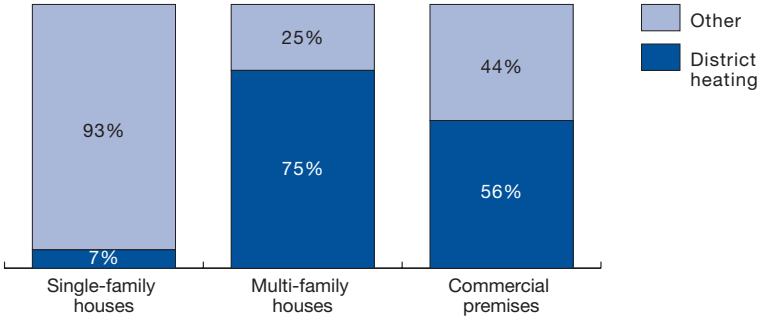
The costs of district heating differ between different places in the country. Cost comparisons show that it is profitable in most cases to change over to firing with biofuel pellets. It was profitable to retain district heating compared to changing over to pellets in only 33 places or 17 percent of the total. This can be explained by reluctance to change, and also technical and environmental restrictions, that counteract changeovers from district heating to pellets.

Variation in district heating prices between companies

Low prices may be due to the company using a large proportion of waste heat as the source of energy and/or the company having a high customer density. The distribution costs can then be spread onto a larger number of customers. Companies that charge high prices are mainly characterized by being relatively small, having boilers that are fired with fuels for which taxation has increased, and by having low customer density. The price difference between the least expensive and most expensive companies differs by a factor of two. This means that the price of heat from the most expensive company is twice as high as that from the least expensive company.

FIGURE 16

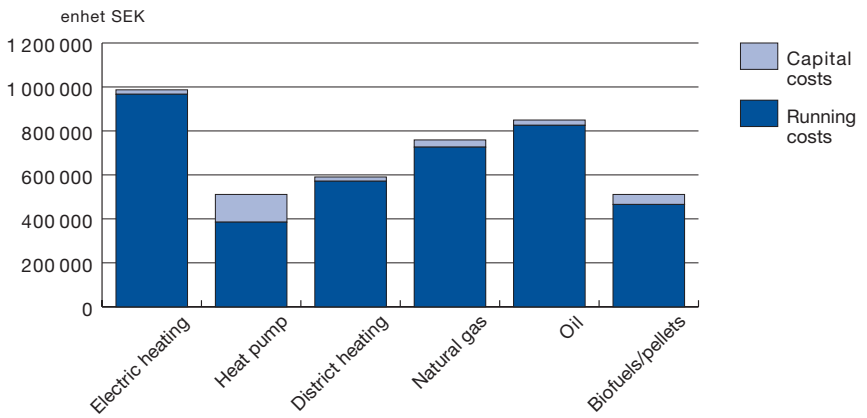
District heating deliveries to various user categories, 2002



Source: Statistics Sweden. District Heating Association 2002

FIGURE 17

Annual running costs of heating and annual capital cost at 1 000 MWh per year in 2003



Source: Swedish Energy Agency

Price developments

From 1996 onwards, district heating prices have basically followed the consumer price index. During the period between 1996 and 2003, the average price has increased by almost 11 percent.

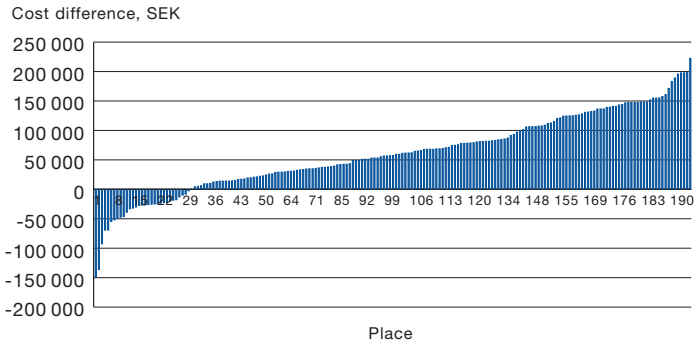
In a questionnaire circulated by the Swedish Energy Agency in the spring of 2004, 30 companies were selected at random from the previous year's study. To ensure that the study is representative, the selection was weighted so that companies of different sizes were included in the study.

The study shows that the 30 companies increased their prices by between 3 and 6 percent, depending on the amount of heat pur-

[11] These cost calculations are affected by items such as interest rates and depreciation times. The purpose of the calculation is to provide a generalized picture of the relative costs of the alternatives in Swedish municipalities.

FIGURE 18

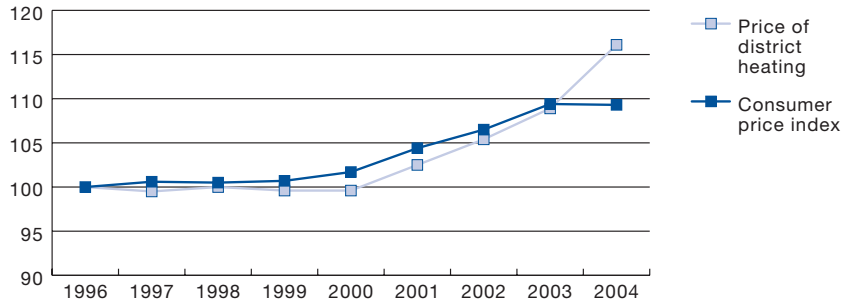
Cost difference of changing over from district heating to biofuel pellets in 2003



Source: Calculations by the Swedish Energy Agency

FIGURE 19

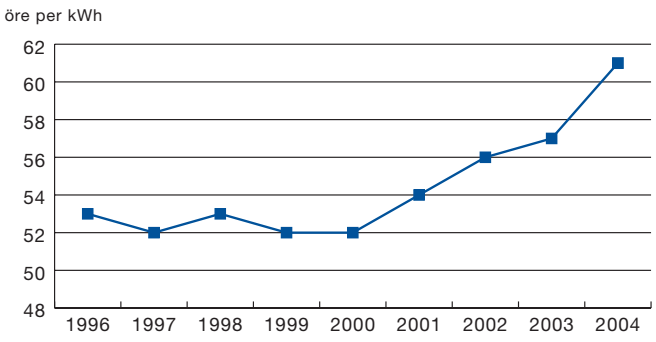
Price development for an annual energy delivery of 193 MWh compared to the consumer price index



Source: Swedish District Heating Association and Statistics Sweden

FIGURE 20

Price development between 1996 and 2004 for an annual energy delivery of 193 MWh, öre per kWh



Source: Swedish Energy Agency

chased by the customer. The study also showed that the prices charged by the companies studied have risen by about 15 percent during the period between 2001 and 2004 to all heat customers. According to the study, the prices of district heating increased substantially during 2004 compared to the consumer price index, which underwent a certain amount of deflation.

District heating prices in the Nordic countries

Prices of district heating differ between the Nordic countries. District heating has historically competed with oil. At the outset, oil represented both fuel and a substitute for district heating.

A comparison of the price levels for district heating in the Nordic countries shows that Denmark has the highest price level and Finland the lowest. Prices in Sweden are between the two countries. In 2002, the price of delivery to a single-family house in Denmark was 88.3 öre per kWh (unweighted mean price expressed in SEK, including VAT), whereas the corresponding price in Finland was 52.3 öre per kWh, and in Sweden, 62.2 öre per kWh.

Regulation of district heating prices in the Nordic countries

The rules for district heating in the Nordic countries, which affect prices and competition, are briefly outlined below. The differences between the Nordic countries are wide. The regulations in Denmark involve price regulation in combination with mandatory connection, whereas neither price regulation nor mandatory connection apply in Sweden. There is little difference in rules between Sweden and Finland.

Denmark

Danish regulation of district heating has a planned economy orientation. This is due to the decision to eliminate the country's high oil dependence for heating. The construction of district heating systems was and is regarded as a social infrastructure in which the municipality could achieve benefits of scale and density by planning the areas that would be supplied with district heating. The mandatory connection rule was introduced in order to achieve environmental benefits and a higher efficiency by employing combined heat and power generation. The cost-of-service principle was introduced in order to prevent unreasonable pricing. The prices are allowed to include financing of the necessary costs. The principle is that any surplus from the operations must not be used for financing other activities, and that municipal taxes must not be used for subsidizing the operations.

Finland

There is no special legislation for regulating the district heating prices or revenues. General legislation for commerce and industry in the form of competition and consumer laws thus applies to district heating. The competition authority supervises the competition in commerce and industry in accordance with the provisions of the competition law. Since district heating has a very high market share wherever it is available, it was considered to have a dominant position on the local heating market.

Most district heating companies are municipally owned, and municipal limited liability company is the common corporate form. In most cases, the municipality owns both the network and the generation plant. There are no obstacles to a district heating company extending its operations beyond the municipal boundaries. The siting principle that applies to municipal companies in Sweden does not apply in Finland.

Norway

Price regulation that specifies that the prices of district heating must not exceed the cost of electric heating is applicable in Norway. This applies to plants rated in excess of 10 MW, for which a concession is needed. Plants rated below 10 MW may also apply for a concession if the owner wishes to ensure mandatory connection of the relevant properties. The district heating company then has obligation to deliver. The Energy Act (Clause 5-5) includes regulations for prices, whereby these may consist of a connection charge, a fixed annual charge and an energy charge. District heating suppliers must give notice of price changes. The recipient of the notification is the Norwegian Water Resources and Energy Directorate (NVE). ■

Security of supply

A number of major power cuts occurred in recent years in Sweden, Italy and the USA. Regardless of the reason for the power cuts, the issue of security of supply has arisen. Society is in growing need of energy, and the consequences may be serious if the energy supply is interrupted.

Security of supply means that the availability of energy must be sufficient, that the supply is dependable, and that the consequences to society of brief or long interruptions in energy supply are minimized. This also involves increasing the awareness among electricity consumers and electricity generators of the need for robust systems and planning for alternative supply routes.

The factors that affect security of supply vary depending on the time perspective.

In the very short term (a couple of hours)
- The balance in the networks must be maintained, i.e. the instantaneous supply and consumption of energy must equal at all times.
- Margins and disturbance reserves are necessary in order to allow for technical problems.

In the short term (around one year)
- The generation capacity or supply must be sufficiently high to meet any consumption peaks or reduced generation capacity, e.g. in dry years.

In the long term (several years)
- Increased supply or generation capacity will be needed in order to meet the growing demand.
- New plants on the energy market are usually big, and it takes a long time to build a new plant. Incentives for new investments are a central issue for future security of supply.

An additional dimension in the concept of security of supply is the ability to meet the energy demand in the event of energy crises. In order to secure the availability of oil products for energy supply in the country during serious supply crises, vendors and consumers are required by law to keep contingency stocks of oil products.

Security of supply and Europe

The world's biggest market for gas and electricity is being created in the EU. The ambition is to achieve both higher efficiency and improved security of supply as the former national markets are linked together. This is done by putting to use the fact that the generation systems of the various countries are based on different fuels and different generation techniques.

A focal security of supply issue for the EU is to reduce dependence on imported energy. A common internal market for electricity and gas will simplify trade between member countries, thus increasing domestic trade.

In Sweden, Svenska Kraftnät is responsible for maintaining the instantaneous balance between electricity supply and demand. Svenska Kraftnät is also responsible for supervising the reliability of the national electricity system and for power reserves being available. The Swedish Energy Agency is liable for supervising the network companies that, in turn, are responsible for maintenance of the network and for the quality of supply. The Swedish Energy Agency is also responsible for the overall coordination of preparedness provisions for the various energy sources and for planning how energy consumption can be reduced or rationed in times of crisis or war. The Swedish Energy Agency also monitors the various international energy markets and carries out security policy analyses for energy supply.

According to the EU Electricity and Gas Market Directives, the member states are responsible for monitoring matters related to security of supply. In particular, this monitoring must cover
- the balance between supply and demand on the domestic market,
- expected future demand,
- additional capacity that was planned or is being planned or is in the course of being installed,
- the network quality and maintenance level,
- measures for meeting demand peaks,
- measures for handling delivery shortfalls from one or several suppliers.

Every other year, the authorities must publish a report that describes the results of the monitoring of these issues, and the adopted or planned measures. The report must be submitted to the European Commission.

According to the interim report of the Electricity and Gas Market Investigation (SOU

2003:113), it is proposed that an authority should be responsible for following up and analyzing the supply situation, and for reporting the results to the Government. The investigation has proposed that the Swedish Energy Agency should be entrusted with this task, in consultation with Svenska Kraftnät. According to the Electricity and Gas Market Investigation, the Government should ultimately be responsible for monitoring the security of supply and reporting to the European Commission.

On 10 December 2003, the European Commission submitted the so-called security of supply package. The package consists of the Commission's memorandum on the energy infrastructure and security of supply, with four new proposals:

- Memorandum on energy infrastructure and security of supply (KOM (2003) 739, 740, 741, 742)
- Draft directive for energy services (KOM (2003) 740, final)
- Draft directive concerning security of supply and infrastructure investments (KOM (2003) 740, final)
- Draft gas market ordinance (KOM (2003) 741, final)
- Decision for guidelines on the trans-European network (KOM (2003) 742, final)

The drafts are being negotiated within the EU. In view of the proposals, the Commission intends to supplement the directives for the electricity and gas markets that were adopted in July 2003, in order to create an open internal market.

Investments

After deregulation, investments in the Nordic countries will be made in new generation capacity on the energy markets will take place on the competitive market. The players on the market are responsible for ensuring that adequate capacity is available for supplying consumers with energy. In the long term, no State authority is responsible for ensuring that the generation capacity is adequate. This makes demands on the market performing satisfactorily and having an appropriate structure.

The market price is one of the incentives for new investments. On an open market, generators are interested in investing when the prices are sufficiently high to cover their costs, with a satisfactory profit, when the incentives for an investment are greater than the obstacles.

Incentives can be classified into market-related and political. The market-related incentives consist of the market price, and also the price of electricity certificates and emission rights. Political incentives consist of openness on the market, environmental policy issues and the structure of the taxation system.

Price is one of the most important driving forces on a market that is exposed to competition. On the energy markets, the investments are generally high and the lead times are long. Assessments of price developments in the long term are necessary for estimating future profits. Since it is difficult to make assessments of future prices, investors take a relatively high risk. It may therefore be difficult to interest investors in new investment projects.

Generation and consumption vary over the year as a result of external factors, including variation in the generation capacity of hydro power from year to year due to variations in precipitation, while the consumption varies with temperature changes.

From the security of supply aspect, the variations make it necessary to have margins in the generation capacity. Electricity generators therefore have generation plants that are taken into operation only on a few occasions during the year. These plants are taken into operation if the price covers the variable generation costs.

If the amount demanded increases, the amount generated will also increase, which leads to a new equilibrium position and a new price. On the energy markets, an increased amount demanded leads to more expensive generation sources being put to use. As a result, the short-term marginal costs will increase. When the short-term marginal cost of the system is on a level with the long-term marginal cost, new generation capacity will be profitable.

During 2002 and 2003, the price of electricity rose which, together with an expected increase in consumption, has created greater interest on the market for investing in increased capacity. Electricity generators plan for new plants and for upgrading and restarting certain older plants.

Göteborg Energi is planning to build a natural gas-fired CHP station, and two of the Swedish nuclear power plants have applied for permission to increase the output of their plants. In addition, Vattenfall has applied for permission to restart its old oil-fired condensing power station in Stenungsund. The plant would be fired with heavy oil of environmental class 3. Combustion of this fuel requires permission from the Environmental Court and investments in flue gas treatment equipment. The electricity certificate system, which is designed to stimulate the construction of power generation plant using renewable energy sources, has also increased the interest in these generation sources.

Electricity, gas and district heating are distributed by networks to the consumers. These pipes and conductors must be maintained and must be sized to suit the demand.

On the electricity market, power lines are provided at local, regional and national levels.

The network provider is responsible for the networks in his area at local and regional levels. A network concession is granted by the Swedish Energy Agency. The costs of investments within the concession area must be met by the network provider and are included in the network charges levied by the company. The company may levy a connection charge for connection to new generation plants and new customers.

At national level, Svenska Kraftnät is responsible for the national grid. Investments are financed by grid charges and connection charges. Svenska Kraftnät is a State-owned public utility, which means that it has financial returns liability to the Government. During the spring of 2004, Svenska Kraftnät announced that it is planning to strengthen the national grid by investing in two new projects. One of these is a new transmission line between Malmö and Hallsberg, and the other is the replacement of the 275 kV line between Järpströmmen in the county of Jämtland and Nea in Norway with a 400 kV line.

On the natural gas market and the district heating market, investments in transmission pipelines principally involve connecting new customers and expanding the market. Investments must be made on commercial grounds.

In the spring of 2004, Nova Naturgas opened a new pipeline from Gothenburg to Stenungsund, and Sydkraft Gas submitted a concession application for a further extension from Gislaved to Jönköping. In addition, Sydkraft Gas, together with Danish, German and Norwegian energy companies, are planning to build a new pipeline from Germany, to be known as the Baltic Gas Interconnector.

Electricity

Security of supply on the electricity market involves meeting the instantaneous demand, power demand and energy demand over a longer period of time.

The consumption of electricity in Sweden is met by both domestic generation and imports. In recent years, imports have increased and reached a record level of 12.8 TWh in 2003. Since 1996, the capacity of the links with foreign countries has increased by a total of more than 2700 MW, which has created better conditions for trading in electricity in the Nordic countries.

Power consumption in the Nordic countries has increased in recent years. At the same time, the installed generation capacity has decreased. On a market exposed to competition, the supply meets the demand, and an equilibrium price and equilibrium quantity are established. This leads to a resource-adapted system, although the margins in the system simultaneously decline. The reduced margins may be particularly serious in dry year situations and during temporary consumption peaks.

Since 1996, the installed power generation capacity has decreased, since the cost of keeping the plants in a state of readiness could not be economically justified. Between 1996 and 1999, the installed power declined by about 3300 MW (see Table 19). Most of this capacity consisted of conventional thermal power plants, principally oil-fired condensing power stations. When Barsebäck 1 was decommissioned, the capacity dropped by a further 600 MW.

However, the installed power has increased between 1999 and 2003. This is mainly the result of the power reserves purchases made by Svenska Kraftnät. Only a few major new plants have been added. The new plants built during this period are wind turbines and biofuel-fired CHP stations.

The instantaneous consumption varies between day and night, between weekdays and holidays, and between summer and winter. The variations depend on the consumption pattern and the ambient temperature. The power consumption record in Sweden is 27 000 MW.

Based on winter temperature data with a recurrence time of 10 years, the conceivable power demand in extremely cold weather is estimated to be 28 000 MW. Table 19 shows that generation capacity is available for meeting this demand, although this capacity is not always fully available.

Hydro power is limited by the total effect of water rights court judgements, hydrological limitations, and also local and regional network limitations. The availability of thermal power is known from experience to vary between 90 and 98 percent. In addition, the choice of fuel affects the peak power and controllability.

Strict safety requirements are made on nuclear power, which may mean that the duration of an overhaul shutdown is substantially extended or that a defect occurring in one reactor leads to all reactors of the same type having to be shut down for inspection. In addition to the limited availability in generation capacity, constraints in the Swedish transmission system make it impossible for full power to be transmitted from the north to the south of the country. In total, this means that power shortfalls may occur in southern Sweden in extremely cold weather.

Natural gas and district heating

The natural gas market in Sweden is relatively small. The gas network covers only the southwestern parts of the country. Only one pipeline feeds Sweden today, and the capacity of this pipeline is not fully utilized. If the natural gas consumption in Sweden were to increase, this could create future problems in security of supply. Sydkraft Gas has applied for permission to build a pipeline between Germany and

TABLE 19

Installed power generation capacity on 31 December in 1996–2002, MW

	1996	1997	1998	1999	2000	2001[1]	2002[1]	2003[1]
Hydro power	16 203	16 246	16 204	16 192	16 229	16 239	16 097	16 143
Wind power	105	122	174	215	241	293	339	399
Nuclear power	10 055	10 056	10 052	9 452	9 439	9 436	9 424	9 441
Condensing power	2 842	2 777	846	452	332	1 023	1 356	2 108
CHP, district heating networks	2 464	2 354	2 246	2 248	2 264	2 340	2 492	2 572
CHP, industrial	776	776	841	841	932	929	956	979
Gas turbines, etc1 713	1 713	1 631	1 485	1 341	1 461	1 559	1 719	
Total	**34 158**	**34 044**	**31 994**	**30 885**	**30 894**	**31 721**	**32 223**	**33 361**

[1] Including the power reserve purchased by Svenska Kraftnät.

Source: Annual statistics from Nordel

Sweden, and this matter is currently in the hands of the Government for a decision.

Natural gas can also be transported in liquid form as Liquefied Natural Gas (LNG), which would reduce the dependence on pipelines. LNG is usually transported by sea to a plant ashore, in which the gas is received, stored and gasified before being distributed into a local gas network. In Stockholm, Fortum Heat, which is jointly owned with Stockholm City, intends to build an LNG plant.

Both in the natural gas networks and in the district heating networks, the supply and consumption must be kept in balance. However, the time aspect is not as critical for natural gas and district heating water as it is for electricity. The purpose of the investments on the gas and district heating markets is to extend the networks and upgrade the production plants rather than to ensure security of supply. The purpose of investments on a natural gas market is generally to expand the market. In certain district heating plants, reinvestments may be needed to keep the plants operational.

The Swedish Energy Agency

The Swedish Energy Agency is currently running a study intended to chart the investment climate on the competitive energy market. The purpose is to describe and analyze the conditions for developing the security of supply on the Swedish markets for network based energy.

In 2001, the Energy Agency was instructed by the Government to develop the electricity supply safety and preparedness project (HEL project – Overview of electricity supply). New forms of private-public cooperation are needed in order to increase the awareness in society of the vulnerability of electricity supply. Pilot projects are being run in several places with the aim of establishing voluntary cooperation between private and public players. ■

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