Power Sector Reform in the Baltic States

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FOREWORD

POWER SECTOR REFORM IN THE BALTIC STATES

The Swedish Energy Agency is active in different ways to support and promote an environmentally friendly development of the energy sector in the Baltic Sea Region. The Agency is of the opinion that it is of greatest importance to use the market forces in the work to introduce a more rational use of both production resources and the electricity network installations that in a longer perspective contribute to a more efficient and environmentally adapted electricity system in the Baltic Sea Region. The Agency has at some earlier occasions reviewed the electricity market development in the Baltic States and the Baltic Sea Region (i.a. the report "future conditions for integration of the Baltic Electricity supply", Report No ER 25:1999).

In the present report "Power Sector Reform in the Baltic States" it is fairly evident that in recent years certain important progress has been made in the work on integration of the electricity markets of Estonia, Latvia and Lithuania. However, it also points out that important measures remains to be implemented. The report puts focus on areas that may need further studies or widened studies that include more countries in the Baltic Sea Region. One of the aims of the report is to form a basis also when it comes to evaluate the needs to replace electricity production that will be phased out when the two nuclear reactors in the Ignalina Nuclear Power Plant will be closed down. What possibilities are there to use alternative energy sources that will not increase the emissions of green house gases and what possibilities will there be to implement such projects as climate projects in line with the mechanism of Joint Implementation under the Kyoto Protocol? The report also touches upon such aspects.

The development of the electricity market in Estonia, Latvia and Lithuania has been in the focus ever since these countries reached independence from the former Soviet Union. In later years thus certain important steps to establish a common and joint electricity markets has been achieved. The development is very rapid - from three separate markets dominated by the three national power monopolies to a more or less open market allowing for trade with electricity over the borders. To start with it will be possible for greater industrial customers to participate in the Joint Baltic electricity Market but the aim is a step-by-step opening of the market to comprise a larger number of customer groups. This will in its turn pave the way for a rapid EU adjustment of the Baltic electricity market and a more practical connection to the neighbouring markets, for example the Nordic Electricity Market.

The Nordic Electricity Market is one good example of a successful way for regional market integration, which is used as a model and source of positive experiences in other regions, both within the EU and in the candidate countries. The Baltic authorities are interested to make further use of the Nordic experiences and to introduce an electricity market, which in its construction is very similar to the Nordic model. This will make it even more interesting for the Nordic authorities and actors to follow the development in the Baltic States and to finds ways and means for more practical co-operation and partnership.

It shall also be noted that the support from the Nordic Countries, including through the Nordic Council of Ministers for Energy, to the reform and adjustment to the EU policies and requirement of the energy sector in the Baltic States has increased in recent years. In this context the co-operation established within BASREC - the Baltic Sea Region Energy Co-operation - where electricity market issues constitutes one of four main areas shall be observed.

Eskilstuna, August 2002

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Table of Contents:

Summary

Brief overview

Estonia, Latvia and Lithuania are in a process of restructuring and liberalising their electricity sectors. The countries also want to create a common Baltic electricity market open to competition. In ECON's view, there are no significant legislative or structural obstacles against the establishment of the common Baltic electricity market. However, in the initial phase, there is likely to be a limited number of market players on the common market – especially power producers. In order to reduce the producers' possibilities to exert market power, in ECON's opinion, it will be necessary to extend the trade with the neighbouring countries – in the first place with Northwest Russia and the Nordic Market.

Background

The three Baltic States (Estonia, Latvia, and Lithuania) won their freedom from the Soviet Union in 1991. Since then they have been in a process of restructuring and liberalising their electricity industries. The Baltic States also have decided to establish a joint electricity market, which will be open to competition. Exactly when the common Baltic electricity market will materialise is still open to discussion. For the moment, it seems that such a market will come about at the earliest in 2003.

On behalf of the Swedish Energy Agency, ECON in 1999 studied the future conditions for integration of the Baltic electricity supply system. The Agency now has asked ECON to up-date the report from 1999. The present study mainly deals with three questions:

- What is the status of the power sectors in the Baltic States?
- What is the outlook for power sector reform and the creation of the common Baltic electricity market?
- What future electricity prices can be expected in the common Baltic electricity market?

The study's main findings

Status of the power sectors in the Baltic States

The Baltic power system is highly integrated in terms of physical connections and system stability. Thus, the Baltic countries are connected with each other with strong inter-connectors. Furthermore, the physical power balance is regulated by one common central (DC Baltija in Riga), which is jointly owned by the main utilities of the three countries.

The Baltic power system was originally built to be part of the Soviet Union’s northwest Interconnected Power System (IPS). The Baltic power system is still both connected to and operates parallel with those neighbouring power systems that also were part of the Soviet Union, i.e. the Unified Power System (UPS) of Russia and the Power System of Belarus.

After the break-up of the Soviet Union the economies of Estonia, Latvia and Lithuania at first developed slowly, with negative GDP-growth and high inflation. But from 1995 and onwards the economies have gained momentum.

The trend for power consumption has basically shown the same pattern as the economies in general. Thus, the demand for electricity dropped considerably right after the break-up of the Soviet Union, but has since increased. However, total yearly power consumption for the three Baltic countries is still a lot lower than during the time of the former Soviet Union. Thus, in 1990 Estonia, Latvia and Lithuania together consumed more than 35 TWh, compared to a little less than 25 TWh in 2001. Split between the countries the consumption figures for 2001 were: Estonia 7.8 TWh, Latvia 6.2 TWh, and Lithuania 10.7 TWh.

Lithuania is the biggest power producer of the three countries, with a generation of 14.7 TWh in 2001. Power generation in Lithuania is highly dependent on the country's sole nuclear power plant (Ignalina), which produces more than 70 percent of Lithuania’s power. Estonia, with a generation of 8.4 TWh in 2001, is the second biggest power producer of the Baltic countries. Estonia is mainly reliant on electricity generated from oil shale. Latvia generated 4.3 TWh in 2001, mainly from hydropower facilities.

As is obvious from a comparison of the figures in the last two paragraphs, Latvia is the only net importing country of the three Baltic States, importing up to 30 percent of its electricity demand. On the other hand, Lithuania in particular exports quite a large amount (20 - 30 percent) of its annual production.

After the break-up of the Soviet Union much of the power infrastructure in the Baltic States was old and in need of rehabilitation. Efforts to renovate the grid and the power plants have therefore been made, but a lot still remains to be done. An illustration of this is that transmission losses in the Baltic grids are as high as around 15 percent.

Even though the transmission and distribution lines of the Baltic countries are in need of renovation, it should be noted that they were originally built as an integrated part of the northwest Soviet Union IPS, and were then capable of dealing with twice the level of generation and a 50 percent greater level of demand than today. Hence, there is an inherent capability for interchanging significantly greater levels of power than is presently the case.

The Baltic States plan to improve inter-connections to the Nordic and central European grids. Priority inter-connections include new links from Estonia to Finland (Estlink), and from Lithuania to Poland (the PowerBridge). At present, though, it is hard to tell when (or even if) these inter-connections eventually will materialise.

Apart from modernisation, the Baltic power supply system will also for other reasons have to go through considerable changes in the coming years, e.g. to meet EU's and other international environmental standards. The most obvious example is that the EU, for safety reasons, has made closure of the Ignalina nuclear power plant a pre-condition for Lithuanian EU-membership. Ignalina has two reactors, of which the first will be closed down in 2004, and the second probably in 2009.

The cost of shutting down Ignalina has been estimated to be around USD 2.5 - 3.0 billion. To facilitate the closure and to develop alternative sources of power the international community has granted Lithuania monetary support of approximately USD 3.5 billion.

Traditionally the power sector in each of the Baltic States has been dominated by one state-owned, vertically integrated utility, involved in power generation, transmission, and distribution, i.e. Eesti Energia in Estonia, Latvenergo in Latvia and Lietuvos Energija in Lithuania. Lithuania has differed a bit from this pattern, though, since the main power generation facility (Ignalina) has been housed in a separate state-owned enterprise.

Since the mid-nineties all three Baltic States have been in the process of restructuring their electricity industries. This process mostly deals with the breaking up of existing vertically integrated utilities into separate companies. So far, the process of unbundling the vertically integrated utility has been most far-reaching in Lithuania, where Lietuvos Energija has been split into several different companies. In Estonia and Latvia the different activities have been separated, but still mostly remain as business units or subsidiaries to the main utility.

By and large the electricity industries in the Baltic States remain under state ownership, and the main utilities still have very dominant positions in their respective countries. However, all three countries have privatised small parts of their power sectors, the most substantial example being the floatation on the stock exchange of approximately 10 percent of Lietuvos Energija in 1999 (these shares are now owned by E.ON of Germany). In recent years a couple of rather big mergers and acquisitions have been under discussion, but have in the end failed to materialise. Thus, in January 2002 the Estonian government cancelled a deal in which it was to sell 49 percent of the Narva Power Plants to the American company NRG Energy for USD 70.5 million. Furthermore, in the summer of 2000 the Latvian parliament decided to put a halt to the discussions of merging Eesti Energia and Latvenergo into a new energy company called the Baltic Power Group.

All three countries have to some extent opened their electricity markets to competition. Estonia and Latvia have so far defined eligible customers as those with an annual consumption exceeding 40 GWh, which means that there at present are 10 eligible customers in Estonia and 8 in Latvia. The Lithuanian market opening has so far been more far-reaching. Thus, for the year 2001, eligible customers in Lithuania were defined as those with an annual consumption exceeding 20 GWh, falling down to 9 GWh per year from 2002. According to present plans, full market opening will occur in Latvia in 2006, and in Lithuania in 2010. Estonia has not yet decided on a date when full market opening will be established, but an opening of at least 35 percent is foreseen for the year 2008.

Outlook for power sector reform and the creation of the common Baltic electricity market

After the break-up of the Soviet Union, the Baltic countries have moved rapidly towards European integration. All three countries have applied for membership of the European Union. Estonia started negotiations for EU accession in 1998, Latvia and Lithuania in 2000. All three countries seem to have a fair chance of being among the candidates that will join the EU in the first enlargement wave in 2004-2005. Latvia, as the first country, successfully concluded the negotiations and closed the Energy Chapter before the end of 2001.

The process towards EU accession sets vital prerequisites for the energy and electricity market policies of the Baltic States, as the countries' legislations must be transformed in conformity with the EU directives and trends. One example is that the EU accession requires that the Baltic States open their electricity markets to competition. Another example is that the EU out of environmental concerns requires the Baltic countries to renovate many of their generation facilities.

In line with the EU requirements, the Baltic countries now have designed their respective principle energy sector legislation so as to provide for electricity market liberalisation, integration with the neighbouring region, and integration with the internal market of EU. This is especially true of the legislations of Latvia and Lithuania. Thus, in these countries the legislative framework not only allows for the sought-after market opening, but also puts requirements on restructuring of the power industry, unbundling of the transmission system operations from the generation and securing regulated access to the grids. The legislation of Estonia is not yet as well developed as the other two countries', but will be so as soon as the new Electricity Market Act, which will be decided by July 2002, comes in to effect.

As was mentioned earlier, all three Baltic States have since the mid-nineties been restructuring their electricity industries, with the aim of breaking up the vertically integrated utilities into separate companies. An important aspect of this process is unbundling of the function of Transmission System Operator (TSO) from the countries' main utilities. In our view, Latvia and Lithuania have created what in practice seem to be more or less independent TSOs, and the same will apply to Estonia once the new Electricity Market Act comes in to effect. It should be noted, however, that the TSO in all three countries still remain in ownership of the main utility, i.e. Eesti Energia in Estonia, Latvenergo in Latvia and Lietuvos Energija in Lithuania.

All three countries have established independent regulatory institutions – organised as a state agency, reporting to the Ministry of Economy, and funded through the state budget, i.e. the Energy Market Inspectorate in Estonia, the Public Service Regulation Commission in Latvia, and the National Control Commission for Prices and Energy in Lithuania.

All Baltic Governments maintain price controls on electricity, carried out by the agencies mentioned in the last paragraph. The price control has traditionally meant a cross-subsidy in benefit of especially households, whose electricity prices frequently have been set below the costs of supply. However, with increasing competition in the Baltic electricity market there also follows a need to set prices that fully reflect the actual costs of energy supply. In the future, the prices (at least wholesale prices) will not be regulated in the same manner but will be subject to competitive price setting. The tariff-structures in the Baltic countries are therefore about to change. As a consequence, especially the retail prices for households can be expected to rise.

In 1998, the Governments of Estonia, Latvia and Lithuania made a political commitment to develop a common Baltic electricity market. The start of the common Baltic electricity market was initially scheduled for 2001. But this turned out to be unrealistic, and at present it seems that the common Baltic electricity market will come about at the earliest in 2003.

The Ministers responsible for energy signed a resolution in the autumn of 2001 stipulating the basic principles of the common Baltic electricity market. Accordingly, the common Baltic electricity market shall be opened for the three Baltic States on the principle of regulated third party access (TPA) to transmission and distribution networks. The market shall be organised between eligible customers, producers and suppliers on the basis of voluntary bilateral contracts and auction base. The legislation shall ensure that within the Common market area the three Baltic States do not apply cross-border tariffs, but do apply a common cross-border tariff and reciprocity towards neighbouring countries.

With the legislative changes that have been made in the Baltic States in recent years, and the changes that can be foreseen in the nearest future, in ECONs opinion there are no significant legislative limitations for initiating the common Baltic electricity market. Nor are there, in our view, any significant structural limitations for initiating the common Baltic electricity market. Thus, the Baltic countries are connected with each other with sufficiently strong inter-connectors to be regarded as one integrated system where occurrence of (persistent) bottle-necks is unlikely.

At present, however, there are some practical limiting factors that should be taken into account when evaluating the prerequisites of the common Baltic electricity market, mainly:

- *Small number of suppliers*. In the short term, the common Baltic electricity market will probably involve only the three Baltic countries (and maybe Russia). Thus, since the main utilities still are very dominant in their respective countries, there is reason to believe that there will only be three or four large competing generators on the common Baltic electricity market in the initial phase – maybe supplemented by another three or four medium sized independent generators. The risk of market power must therefore be taken into account.
- *Small number of customers*. With the criteria that have so far been set for acquiring the status of eligible customer, it is likely that there will only be a limited number of customers on the market in the initial phase. In fact, even if the limit for annual consumption was lowered to match the requirements

of the present EU directive, i.e. a market opening including at least 33 percent of total consumption by February 2003, the number of eligible customers would still not be more than approximately 2 000 in the Baltic countries put together. Also, in our view, it is unrealistic to aim at a 33 percent opening of the market by 2003. A more realistic threshold would probably be opening for eligible customers above 10 GWh per year, which corresponds to approximately 15 percent of the market.

- *Little awareness among potential market players*. At present, the awareness of the potential market players doesn't seem to be sufficient to motivate them to put pressure on the market opening. Since the degree of competition in a market is highly dependent on the activity and awareness of consumers, we therefore believe further action must be taken in order to increase the awareness of the customers and their active participation in the market.

In view of the above-mentioned practical limiting factors, we believe that further enlargement of the Baltic market will be necessary to achieve a more significant competition. In our view, it is relevant to study the Baltic development parallel to the neighbouring areas, i.e. first Northwest Russia, the Kaliningrad area and Belarus.

Price development in a competitive environment until 2010

We have analysed the market balance and wholesale prices in a hypothetical, integrated competitive Baltic market until 2010. Although it seems clear that there will not be a fully open competitive market in the next few years time, it is relevant to study price development in a would-be market environment: such an analysis provides us with a reference case against which the actual market can be measured. It also enables us to assess the feasibility of new investments and upgrading of existing assets, as well as the rationale for the planned inter-connectors. We have analysed the market balance in 2002, 2005 and 2010. The main findings are:

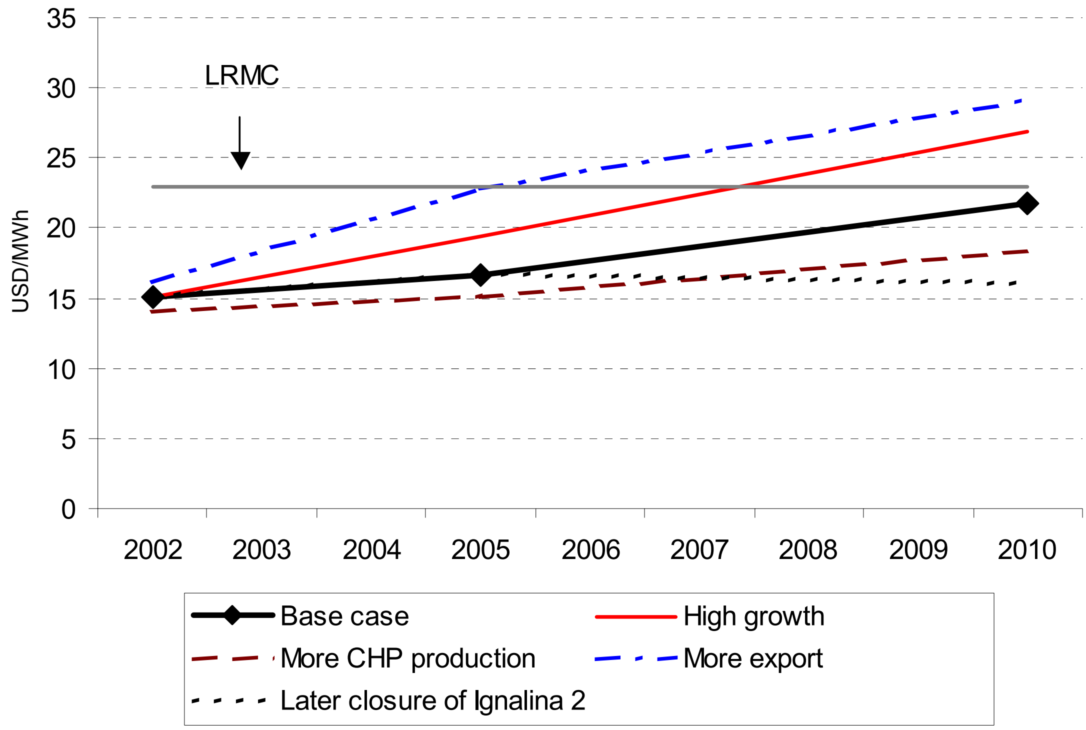
- *Surplus capacity today.* The results suggest that there is considerable excess capacity at present, which will prevail for some years to come. Today, the large nuclear and oil shale power plants, together with hydropower and some production in CHPs that is connected to heat supply, are sufficient to cover the demand and some exports. Oil shale is the most expensive plant in production and prices are determined by marginal costs of oil shale plants.

  The actual prices of today are regulated prices that allow the generators to cover their fixed costs in addition to marginal production costs. The present wholesale price level is about the double of what a competitive market would yield.

- *Tighter market balance, but still surplus capacity in 2010?* Increasing demand and decommissioning of plants result in a tighter market balance towards the end of this decade. Prices increase, but will still not reach the long run marginal cost (LRMC) of new capacity by 2010 in our base case scenario.

The price development in the base case, together with that of alternative scenarios, is shown in Figure A below. The price for 2002 in the figure is a calculated power price (energy component) in a hypothetical, integrated, competitive Baltic market.

Figure A *Wholesale prices in different scenarios for the Baltic power market, compared to LRMC for new capacity*



Note: Prices in 2002, 2005 and 2010 are model results, the other years are interpolated.

The single most important event is the decommissioning of Ignalina nuclear plant in Lithuania. In the reference case, we have assumed that the first block of Ignalina is decommissioned in 2004 and the second in 2009. If the decommissioning of the second block is postponed, the surplus capacity prevails and prices will remain under the level of LRMC for many years.

On the other hand, higher consumption growth would effectively erode the surplus capacity of today. Alternatively, if the old fossil fuelled capacity (especially oil shale plants in Estonia) will be decommissioned earlier or are imposed production caps, the market will be tighter. Trade with neighbouring countries is an important source of uncertainty: either higher exports to or more imports from other regions can tilt the balance in one or another direction.

In the study, we have also analysed the possible impact of two different, hypothetical levels of CO_2 taxes on the competitive Baltic power market: 4 USD/tonne CO_2 and 10 USD/tonne CO_2 respectively. CO_2 taxes (or, alternatively, a system with tradable emissions permits) increase marginal costs of power production and prices. Whether or not the merit order of the plants will change and emissions will be reduced, depends on the level of the CO_2 tax.[1] The lower tax level (4 USD/tonne CO_2) does not change the merit order of plants. Although the tax increases the marginal costs of oil shale plants more than the costs of the oil/gas fuelled plants, the marginal costs of the oil shale plants are still lower. In this case,

[1] We assume that both domestic demand and exports/imports are the same as in the base case. This is not necessarily a realistic assumption.

emissions are not reduced compared to base case. The higher tax level (10 USD/tonne CO_2) changes the merit order of the plants. In this case, the resulting average price is higher than the full costs of new (gas-fired) capacity. If investments occur, emissions will be reduced, too.

The study offers a first assessment of market balance and price development in the Baltic countries. There is of course considerable uncertainty about many of the assumptions that we have made. Trade with neighbouring countries is the single most important source of uncertainty in the analysis. There are high-capacity transmission links to neighbouring countries, but these remain under-utilised and it is uncertain how trade will develop in the future. On the supply side, there is an imminent risk of market power, if the market is introduced without measures to reduce concentration on the generation side. Also, the technical and environmental characteristics of the system are uncertain. Big changes have taken place on the demand side during the last ten years – we have without doubt witnessed a break in trend. This makes predicting future development even more complicated and uncertain than usually. Once again trade with the neighbouring countries and its effect on the Baltic market balance needs a closer look.

1 Introduction

After the break-up of the Soviet Union, the three Baltic States (Estonia, Latvia, and Lithuania) have been in a process of restructuring and liberalising their electricity sectors. In the coming years the Electricity markets of the three Baltic States are facing further changes. Partly due to the requirements of the countries future status as EU-members, they have decided to establish a joint electricity market, which will be open to competition. Thus, a common Baltic electricity market is expected to come about in the near future. Furthermore, the common Baltic electricity market will in the future be integrated with electricity markets in the Nordic countries and Western and Central Europe.

The Swedish Energy Agency has, as one of its main priorities, the development of closer co-operation on energy, environment and climate issues in the Baltic Sea region. In 1999 the Agency contracted ECON to analyse the conditions for closer linkages between the Baltic countries and the Nordic electricity market. The findings and conclusions were presented in the report Future conditions for integration of the Baltic Electricity Supply System (ECON memorandum 71/99). The Agency has wished to up-date the report from 1999, and has contracted ECON to do so.

The principle objectives of the present study have been to:

- Document the status of the electricity industries in each of the three Baltic States.
- Analyse the future conditions for creating the common Baltic electricity market.
- Make a quantitative projection of the future development.

Our approach to the study, as a first step, comprised a description of the Baltic electricity supply systems, e.g. in terms of consumption, generation capacity, energy resources, and price developments. This was mainly undertaken using material from the internet and previous studies, including ECON's former report. In this part of the study we also sought to give a brief overview of the neighbouring electricity markets of Russia and Belarus.

As a second step, we analysed the liberalisation process in the region, and examined the outlook for power sector reform.

Based on steps one and two, the third step of the study was to analyse the future development. The main focus of this part of the study was to try and project the future electricity prices of the common Baltic electricity market. With a time frame spanning the development up to the year 2010, we formulated a realistic base line case, and tested its assumptions in some scenarios, e.g. with regards to varying growth-rates of the economies, different speeds of physical integration with neighbouring electricity markets, etc.

In the report, we present price-levels, etc., in US-dollars (USD). The exchange rates are those of January 2002.

The report closely follows our overall approach to the study:

- Chapter Two presents an overview of the electricity sector in the Baltic States, and briefly describes the electricity markets of Russia and Belarus.
- Chapter Three deals with the outlook for power sector reform and the creation of the common Baltic electricity market.
- Chapter Four presents our projection of future electricity prices in the common Baltic electricity market.

2 Overview of the Baltic Electricity Market

2.1 General background

Estonia, Latvia and Lithuania are situated on the eastern front of the Baltic Sea, neighbouring Finland, Russia, Belarus and Poland (see map below).

Figure 2.1 Map of the Baltic countries

As is shown in table 2.1 below the Baltic countries are all small both in size and population.

Table 2.1 Size, population and capital of the Baltic countries

	Size (km²)	Population (millions)	Capital
Estonia	45 000	1.5	Tallinn
Latvia	64 000	2.4	Riga
Lithuania	65 000	3.7	Vilnius

The economies of Estonia, Latvia and Lithuania developed in close association with the northwest region of the former Soviet Union.

After the Baltic countries had won their freedom from the Soviet Union in 1991, they were quick to adopt market economies and to implement democratic reforms. Relations with Russia were strained in the first years after independence, but seem to have improved in recent years, partly due to mutual business interests.

Political relations between the Baltic countries have traditionally been close, and economic co-operation has become a vital feature of their recent transition. The Baltic countries have moved rapidly towards European integration, and all three have applied for membership of the European Union. Estonia started negotiations for EU accession in 1998, Latvia and Lithuania in 2000. All three countries seem to have a fair chance of being among the candidates that will join the EU in the first enlargement wave in 2004-2005.

In the year 2000 the Baltic countries showed the following GDP per capita: Estonia 3 564 USD, Latvia 2 582 USD, and Lithuania 2 880 USD[2]. After the break-up of the Soviet Union the economies of Estonia, Latvia and Lithuania at first developed slowly, with negative GDP-growth and high inflation. But, as is shown in tables 2.2 and 2.3 below, from 1995 and onwards the economies have gained momentum, even though there was a temporary setback in 1999 in the aftermath of the Russian financial crisis.

Table 2.2 GDP growth in the Baltic countries (% change)

	1993	1994	1995	1996	1997	1998	1999	2000	2001 (est.)	2002 (est.)	2003 (est.)
Estonia	-9.0	-2.0	4.3	3.9	10.6	4.7	-1.1	6.9	4.5	3.9	5.7
Latvia	-14.9	0.6	-0.8	3.3	8.6	3.9	1.1	6.6	7.3	4.6	5.5
Lithuania	-16.2	-9.8	3.3	4.7	7.3	5.1	-4.2	3.9	4.7	3.9	5.5

Sources: EBRD (1993-1999), Nordea (2000-2003)

Table 2.3 Development of consumer prices (annual average % change)

	1993	1994	1995	1996	1997	1998	1999	2000	2001 (est.)	2002 (est.)	2003 (est.)
Estonia	89.8	47.7	29.0	23.1	11.2	8.2	3.3	4.0	5.8	4.2	3.9
Latvia	109.2	35.9	25.0	17.6	8.4	4.7	2.4	2.6	2.5	2.6	3.6
Lithuania	410.4	72.1	39.6	24.6	8.9	5.1	0.8	1.0	1.3	1.4	2.0

Sources: EBRD (1993-1999), Nordea (2000-2003)

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2 Source: SIVA Internasjonal, Landsinformasjon og annen statistikk for Øst- og sentral Europa.

2.2 The Electricity Markets in the Baltic countries

The Baltic power system is highly integrated in terms of physical connections and system stability. One example is that the physical power balance is regulated by one common dispatch centre (DC Baltija in Riga), which is jointly owned by the main utilities of the three countries.

The Baltic power system was originally built to be part of the Soviet Union´s northwest Interconnected Power System (IPS), and is still closely integrated with the power system of northwest Russia. The grid of the IPS encompassed the Baltic countries, Belarus and the Russian areas of Kaliningrad, Pskov, St Petersburg and the Kola Peninsula.

After the break-up of the Soviet Union the three Baltic States have been in the process of restructuring and liberalising their electricity industries. The countries also hold a common goal of establishing a joint electricity market, which is integrated with electricity markets in the Nordic countries and Western and Central Europe.

In this chapter we describe the current status of the electricity sectors in the Baltic States.

2.2.1 Electricity consumption

Yearly power consumption for the three Baltic countries together amounts to a little less than 25 TWh (see table 2.4 below). It should be noted that the figures in the table include transmission losses, which are as high as around 15 percent.

Table 2.4 Power consumption in the Baltic Countries, gross (TWh per year)

	1997	1998	1999	2000	2001
Estonia	8.2	8.1	7.6	7.6	7.8
Latvia	6.3	6.3	6.1	5.9	6.2
Lithuania	11.3	11.5	10.8	10.1	10.7
Total	25.8	25.9	24.5	23.6	24.7

Source: DC Baltija

Today’s power consumption is a lot lower than when the Baltic countries were still part of the former Soviet Union. In 1990, for instance, Estonia, Latvia and Lithuania together consumed more than 35 TWh.

The main reason for the drop in consumption is the negative GDP-growth right after the break-up of the Soviet Union. In part, however, the decline in consumption can also be explained by the introduction of more cost-based pricing, and that there used to be some heavy, electricity-intensive industry in operation in the Baltic States before the break-up of the Soviet Union, that has since ceased to exist.

Different sectors' shares of annual power consumption are shown in table 2.5 below. If not otherwise stated figures are from 2001.

Table 2.5 Electricity demand by different sectors (% of total consumption)

	Estonia	Latvia	Lithuania
Industry	29.8 %	27.2 %	29.5 %
Agriculture	3.0 %	1.8 %	2.1 %
Households	19.3 %	18.5 %	16.4 %
Transport	1.2 %	2.0 %	0.6 %
Auxiliary	12.2 %	4.9 %	13.8 %
Transmission losses	16.4 %	15.7 %	13.2 %
Others	21.8 %	29.9 %	24.3 %

Sources: Estonia (figures for 2000): Statistical Office of Estonia, Database (www.stat.ee); Latvia and Lithuania: DC Baltija.

All Baltic Governments maintain price controls on electricity, which traditionally has meant a cross-subsidy in benefit of especially households, whose electricity prices frequently have been set below the costs of supply. A comparison of average electricity tariffs for industrial, commercial and domestic consumers in the year 2001 is presented in table 2.6 below.

Table 2.6 Electricity prices in the Baltic States in 2001

	Industrial	Commercial	Domestic
Estonia	0.041 USD/kWh	0.041 USD/kWh	0.053 USD/kWh
Latvia	0.048 USD/kWh	0.064 USD/kWh	0.064 USD/kWh
Lithuania	0.039 USD/kWh	0.051 USD/kWh	0.053 USD/kWh

Source: Power in East Europe, May 27, 2002

The tariff-structure is, however, about to change. With increasing competition in the Baltic electricity market there also follows a need to set prices that fully reflect the actual costs of energy supply. In Estonia, for instance, the Energy Market Inspectorate has approved a change in the tariff-structure for the all-dominant utility Eesti Energia[3]. As of spring of 2002, there will be no separate price lists for residential customers and business customers. The reform is designed to make the customers aware of the actual cost points in electricity consumption, and eliminate cross subsidies to residential customers. The weighted average price of electric power will, therefore, grow by 21 percent, and for residential customers the average price rise is expected to be 33 percent. Eesti Energia will launch a special social programme, in order to alleviate the increase in prices for weak consumer groups.

According to Eesti Energia, the end tariff under the new Estonian prices means that the electricity producer will get 44.9 percent, distribution (medium and low

[3] Source: Eesti Energia Press release, September 28, 2001

voltage) will get 36 percent, transmission (high voltage) 6.6 percent and sale 2.5 percent[4].

2.2.2 Electricity generation

Total installed generating capacity in the three Baltic countries amounted to approximately 11 500 MW by January 1, 2002[5]. Figures for total annual power generation in each country is presented in table 2.7 below.

Table 2.7 Power generation in the Baltic Countries (TWh per year)

	1997	1998	1999	2000	2001
Estonia	9.2	8.5	8.2	8.5	8.4
Latvia	4.5	5.8	4.1	4.1	4.3
Lithuania	14.8	17.6	13.5	11.4	14.7
Total	28.5	31.9	25.8	24.0	27.4

Source: DC Baltija

If you compare the figures for consumption (table 2.4) and generation (table 2.7) you find that Latvia is the only net importing country of the three Baltic States, importing up to 30 percent of its electricity demand. On the other hand, Lithuania in particular exports quite a large amount (20 - 30 percent) of its annual production.

Of the total installed capacity of 11 500 MW in the Baltic countries Lithuania accounts for over 50 percent. Power generation in Lithuania is highly dependent on the country's sole nuclear power plant (Ignalina), which produces more than 70 percent of Lithuania's power. Apart from Ignalina, Lithuania also has several oil/gas and combined heat and power plants. Estonia, which accounts for slightly more than 25 percent of total installed capacity in the Baltic States, is mainly reliant on electricity generated from oil-shale. Latvia (less than 20 percent of capacity) relies heavily on hydropower facilities.

The largest power plants of the Baltics are presented in table 2.8 below. The table, which covers around 95 percent of total installed capacity, has been arranged country-by-country. The abbreviations of the different sort of plants and fuel are explained at the bottom of the table.

4 ibid.

5 Source: DC Baltija

Table 2.8 Largest power plants of the Baltic power system

Plant	Country	Fuel	Installed capacity 2002-01-01 (MW)	Available capacity 2001-12-13 (MW)
Estonian CPP	Estonia	Oil shale	1 610	1 280
Baltic CPP	Estonia	Oil shale	1 290	845
Iru CHPP	Estonia	Gas, HFO	190	190
Riga CHPP1	Latvia	Gas, Peat	129	102
Riga CHPP2	Latvia	Gas, HFO	390	390
Plavinas HPP	Latvia	Hydro	870	870
Riga HPP	Latvia	Hydro	402	402
Kegums HPP	Latvia	Hydro	261	239
Ignalina NPP (2 reactors)	Lithuania	Nuclear	2 600 (2* 1 300)	2 600
Lithuanian CPP	Lithuania	Gas, HFO	1 800	1 800
Vilnius CHPP	Lithuania	Gas, HFO	360	348
Mazeikiai CHPP	Lithuania	Gas, HFO	194	106
Kaunas CHPP	Lithuania	Gas, HFO	170	170
Kruonis PSPP	Lithuania	Hydro	800	800
Kaunas HPP	Lithuania	Hydro	101	100

Source: DC Baltija. NPP = nuclear power plant, HPP = hydropower plant, CPP = condensing power plant, CHPP = combined heat and power plant, PSPP = pumped storage plant, HFO = heavy fuel oil.

After the break-up of the Soviet Union much of the power infrastructure in the Baltic States was old and in need of rehabilitation. Efforts to renovate the power plants have therefore been made. One example is that Latvia, with help from a substantial loan from the EBRD, has modernized its three hydropower plants (Kegums-Plavinas-Riga, which constitute the Daugava cascade located on the Daugava River). The Kegums hydropower station, for instance, officially re-opened in August 2001 after USD 21 million worth of renovation to extend its service life another 40 years.

Apart from renovation, the Baltic power supply system will also for other reasons have to go through considerable changes in the coming years, e.g. to meet the EU's and other international environmental standards. The most obvious example is that the EU, for safety reasons, has made closure of the Ignalina nuclear power plant a pre-condition for Lithuanian EU-membership. In 1999, the Lithuanian Government announced that one of the two units at Ignalina will be shut down by 2005. In the EU-membership negotiations Lithuania has recently agreed to close the second unit in 2009[6]. The cost of shutting down Ignalina is estimated to be around USD 2.5 - 3.0 billion[7]. To facilitate the closure and to develop alternative sources of power the international community has granted Lithuania monetary support of approximately USD 3.5 billion[8]. In the next few years it is expected

6 Source: Dagens Nyheter, June 12, 2002

7 Source: Dagens Industri, March 7, 2002

8 ibid.

that around USD 300 million will be needed to modernize Lithuania's non-nuclear power plants, especially the Lithuanian CPP.

The drive to meet EU requirements is also expected to have far-reaching effects on the Estonian oil-shale power plants. Estonian officials are worried that if the local power market is opened to imported electricity immediately upon the country's entry into the EU it could result in a steep drop in the generation of oil shale-fuelled power, thus creating a social and economic crisis in north eastern Estonia, where the oil shale-industry and the electricity sector are important parts of the economy. Estonia therefore wants the EU to accept that the majority of the country's electricity will come from oil shale-fuelled power plants until at least 2015.

2.2.3 Grid-structure and power flow

The three Baltic States have an internal co-operation agreement, and their common power system is also connected to, and operates parallel with, the Unified Power System of Russia and the Power System of Belarus.

The basic network forming the Baltic power system is high voltage power lines of 330 kV. Within the different countries the power distribution networks consist, on the highest level, primarily of 110 kV lines, except in Estonia where there is also a 220 kV network. As was the case with many power plants, after the break-up of the Soviet Union transmission and distribution networks were frequently in poor condition and in need of new investment. Table 2.9 below shows the length of the transmission and distribution lines within the Baltic power system.

Table 2.9 Length of transmission and distribution lines (km)

	330 kV	220 kV	110 kV	6-35 kV	0.4 kV
Estonia	1 233	545	3 206	19 000*	33 000*
Latvia	1 248	-	3 951	31 800*	65 300*
Lithuania	1 656	-	5 007	51 816**	67 343**
Total	4 137	545	12 164	102 616	165 643

Sources: 110-330 kV: DC Baltija; 0.4-35 kV: ECON memorandum 71/99 (*) and Lietuvos Energija (**)

Capacities of the cross-border 330 kV inter-connectors are presented in table 2.10 below.

Table 2.10 Total cross-border transmission capacity (MW)

Estonia-Latvia*	To Estonia: 1 200	From Estonia: 1 200
Estonia-Russia	To Estonia: 3 300	From Estonia: 3 300
Latvia-Lithuania*	To Latvia: 2 100	From Latvia: 2 900
Latvia-Russia*	To Latvia: 300	From Latvia: 300
Lithuania-Belarus	To Lithuania: 2 500	From Lithuania: 2 500
Lithuania-Kaliningrad	To Lithuania: 1 200	From Lithuania:1 200

Sources: Latvian Energy Sector Restructuring, EU's Phare Programme Inception Report, September 2001 (*), and NUTEK, Elmarknaderna runt Östersjön 1997.

Annual power flow between the Baltic countries and between the Baltic countries and the neighbouring power systems are shown in table 2.11 below.

Table 2.11 *Power flow to (+) and from (-) the Baltic countries (TWh per year)*

	1997	1998	1999	2000	2001
Estonia:					
- to/from Russia	+1.7/-3.0	+0.8/-2.1	+0.9/-2.8	+0.5/-2.1	+0/-1.7
- to/from Latvia	+2.3/-0	+1.7/-0	+2.5/-0	+2.5/-0	+2.3/-0
Total for Estonia	+4.0/-3.0	+2.5/-2.1	+3.4/-2.8	+3.0/-2.1	+2.3/-1.7
Latvia:					
- to/from Russia	+0/-0.7	+0/-0.7	+0/-0.7	+0/-0.7	+0/-0.4
- to/from Estonia	+0/-2.3	+0/-1.7	+0/-2.5	+0/-2.5	+0/-2.3
- to/from Lithuania	+1.2/-0	+1.9/-0	+1.2/-0	+1.3/-0	+0.8/-0
Total for Latvia	+1.2/-3.0	+1.9/-2.4	+1.2/-3.2	+1.3/-3.2	+0.8/-2.7
Lithuania:					
- to/from Latvia	+0/-1.2	+0/-1.9	+0/-1.2	+0/-1.3	+0/-0.8
- to/from Belarus	+2.1/-0	+5.4/-0	+1.2/-0	+0/-0.1	+1.8/-0
- to/from Kaliningrad	+2.6/-0	+2.6/-0	+2.7/-0	+2.8/-0	+3.0/-0
Total for Lithuania	+4.7/-1.2	+8.0/-1.9	+3.9/-1.2	+2.8/-1.4	+4.8/-0.8

Source: DC Baltija

The Baltic States plan to improve inter-connections to the Nordic and central European grids. Priority inter-connections include new links from Estonia to Finland, and from Lithuania to Poland. The underwater power cable from Estonia to Finland (Estlink) will have a capacity of 315 MW, and the possibility to transfer electricity in both directions. The investment cost will be approximately USD 100 million, and the cable will be ready in 2004 at the earliest[9]. A decision about the Estlink project is due to fall in October 2002. Estlink is part of a broader plan to integrate the Baltic States with Nordic Power pool members in Finland, Norway and Denmark. Meanwhile, Lithuania hopes to boost electricity export to Europe through a power line connection to Poland (the PowerBridge). The cost of this project is estimated to be approximately USD 300 million[10].

2.2.4 The legislative and policy context

The legal and policy framework regarding the electricity sector is in a process of rapid liberalisation and adoption to the EU requirements. Below we describe this process for each of the Baltic countries.

Estonia

The energy policy in Estonia in principle follows the EU accession guidelines and is outlined in The Long-term National Development Plan for the Fuel and Energy

9 Source: EuroPower, March 8, 2002

10 Source: Baltrel, Gas and Electricity in the Baltic Sea Region (October 2001).

Sector, which sets out the principal priorities in energy sector development. The Plan, which was approved in 1998, provides an outlook for the energy sector development to the year 2005 and states the principal development trends to about 2018.

The Plan states a number of main policy objectives. One objective is to provide the political and economic independence to the state by making the fuel and energy supply a strategic branch of the economy; to establish security reserves in conformity with the requirements of the European Union. Further higher efficiency in oil shale based energy production follows with the concurrent and significant reduction of harmful environmental impact by the renovation of combustion technology. This means to provide rational use of oil shale resources in the existing underground mines and open pits with the total capacity of 0.6 Btons without production losses and which is sufficient for keeping the power plants and oil processing plants in operation to the end of their depreciation time after their renovation based on the existing infrastructure. It also prefers the principle of distributed electricity production and combined heat and power production by planning new power plants with the concurrent optimal use of the available heating capacities. The Plan also promotes wider use of renewable energy sources by applying tax allowances both in investments and energy production based on those investments.

In terms of market integration the Plan aims to provide for European integration of the Estonian energy sector in conformity with the EU directives and trends. The Plan also aims to improve the security of energy supply by international agreements[11].

In practice, the Estonian government is implementing a policy that promotes and strongly supports the oil shale industry, as it ensures significant employment, especially in Northeast Estonia. Availability of abundant oil shale resources plays an important part in the government's energy policy. This seems also to be the future basic generation followed by the CHP.

Electricity sector legislation is included in the Energy Act, approved in 1997 and adopted in 1998. The Energy Act deals with some of the requirements of the EU Directives, but fails to meet all of the obligations. Several amendments have been made to the Energy Act, of which the latest were included in May 2001.

The Energy Act provides the regulatory framework for the energy sector, including rights, obligations and liabilities of network operators and of energy traders dominating the market, principles of licensing of energy utilities, state-supervision etc. Some key aspects of the Energy Act relevant to the power sector are:

- Accounting separation for generation, transmission, distribution, and supply of electricity;
- Ban on cross-subsidy between different activities;
- Requirement of transparent pricing and accounting;

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[11] For the maintenance of energy facilities on the border with the Russian Federation, and fuel and energy supply agreements with neighbouring countries for emergency and security reserves.

- A system of unified tariffs for transmission services;
- The state must own at least 51 percent of the share capital of any power station of strategic importance.

Although the Act does require accounting separation between different activities, there is no specific designation of a separate transmission system operator.

The Estonian electricity market has to some extent been opened to competition. Thus, a Governmental regulation from July 1999 defined eligible consumers as those whose consumption exceeds 40 GWh per year. The initial definition of the eligible consumer covered also distributors of electricity with total annual sales over 40 GWh. This definition was changed by a Governmental regulation from July 2001, which specified that eligible consumers are only consumers with own consumption over 40 GWh.

In the year 2002 there has been intensive preparations for a new legislation for the entire energy sector. According to the plans, the new Electricity Market Act will be decided at the latest by the summer of 2002 and become effective from 2003. Together with legislation for district heating, gas and fuel market, which is also under preparation, the Electricity Market Act will replace the existing Energy Act. The new Electricity Market Act will introduce:

- A legal separation of the National Grid.
- Legal unbundling for distribution companies of over 100 GWh per year.
- Eligible customers: An eligible customer is the customer who consumes itself on one site annually over 40 GWh.
- By December 31, 2008 the electricity market must be opened 35 percent. The opening will be arranged through decrees from the Minister of Economic Affairs.
- Grid companies (except Transmission Grid Company) shall buy their electricity from Estonia.
- Electricity import is based on import licence, subject to reciprocity and similar power pricing principles.
- Grid Company must buy electricity from connected producer of renewable electricity, additional costs are covered by the Transmission Grid Company.

An Estonian sector regulator, the Energy Market Inspectorate, was established in January 1998. The institution was formed based on the statutes in the Energy Act from January 1998 and the special Statute of Estonian Market Inspectorate approved by the Minister of Economy in January 1998. The subjects for regulation are the entire electricity and gas markets, heat market for participants with production higher than 50 GWh per year and the fuel market. The regulator's mandate includes issuing of market licenses, price control on energy prices and tariffs, supervision of market dominating participants and control of supply quality for transmission and distribution of energy.

Latvia

The Latvian Cabinet of Ministers approved the current policy for the electricity sector in September 2001. The policy aims at movement towards the common

Baltic electricity market according to the commitments made by the Baltic Council of Ministers. Reorganisation of the all-dominant utility Latvenergo is considered within this process as a key element in reforming and liberalising the market. Objectives of the policy anticipate comprehensive sector reforms and envisage completion in both wholesale and retail of electricity.

Although the policy aims at 80 – 90 percent self-sufficiency in electricity production by the year 2008 this statement is not based on any feasibility assessments. In fact even within the past years it has been possible to cover 90 percent of annual Latvian consumption by domestic sources (depending on hydro output). Furthermore, the electricity market opening considerably reduces the possibilities to provide direct support to domestic generators.

By introducing a moderate and reasonable price policy in compliance with the amendments introduced to the Energy Law and combining it with the support of international programmes aimed at introduction of environmentally friendly energy technologies, the Cabinet of Ministers will annually specify limits of new renewable generation capacities, which can enjoy governmental promotion.

Market liberalisation is defined as the government's priority and the policy anticipates full electricity market opening by the year 2006.

Purchase of power from generators using renewable energy resources (water, wind, bio mass-wood waste, peat), will be ensured by imposing a public service obligation on the transmission and distribution system operators. As a result, the generation of electricity and heat energy at power plants operating on renewable energy resources would be promoted in a predictable and planned manner and, upon reaching a certain level of development, will enable Latvia to join the "green certificate" market supported by the European Union.

The Energy Law passed by the Parliament (the Saeima) in September 1998 and being in force since October 6, 1998, incorporates the main provisions of the EU energy directives. It regulates rights and obligations of enterprises operating as natural monopolies with the intention to protect consumer interests, promote business development within the energy sector and ensure implementation of the Government policies.

According to the Energy Law, the main task of the energy sector in Latvia is to:

- Provide secure, environmental-friendly and long-term energy supply to the national economy and the country's residents. This should be done in the requested amount and quality for economically based and acceptable prices.
- Ensure efficiency and competitiveness in energy undertakings and in the national economy.
- Separation of accounts for production, transmission and distribution transactions has been provided for in vertically integrated companies in order to guarantee transparency of their operations and accessibility of the records.

The system operator concept regulates access to transmission and distribution networks at reasonable costs, taking into account existing capacities of transmission and distribution networks, and expands options for consumer choice of energy supplier.

A power transmission system Grid Code was approved on May 30, 2000. The Grid Code sets procedures for liberalisation of power supply market and states the role of power transmission and/or distribution system operator as well as for other market players.

The Grid Code was approved by the responsible regulatory body, which at the time was the Energy Supply Regulation Council. However, based on the fact that all public utility sectors are more or less in a process of liberalisation, the Latvian Government recently decided to reorganise its regulatory body. Thus, a new "super regulator", the Public Service Regulation Commission, was established in October 2001. The mandate of the Commission is to regulate all state regulated sectors such as energy (except heat supply), telecommunications, post and railway. In the field of electricity the regulator sets methodology for tariff calculation, approves tariffs for utilities, issues licenses for utilities' operations and supervises compliance with requirements for quality and environmental protection.

Lithuania

Lithuania's policy within the energy sector is stated in the National Energy Strategy, the first version of which was approved in 1994. The document, which covers the next 20 years, outlines the provisions of the government for energy sector development. According to the Energy Law of 28 March 1995, the National Energy Strategy is to be reviewed every 5 years. The current version is in effect since September 1999.

Ignalina Nuclear Power Plant plays the key role in Lithuania's energy sector, and consequently the country's energy sector policy is largely built upon the possible scenarios for Ignalina's operation. It has been acknowledged that all the necessary measures will be taken in order to meet international nuclear safety requirements according to the Nuclear Safety Account Grant Agreement. The government has expressed its commitment to implement all recommendations of the safety Analysis Report, its Independent Review and the international Ignalina Safety Panel.

The Government of Lithuania is committed to continue operating and safety upgrading of Ignalina NPP according to Western European approaches and guidelines. This implies a need for both technical assistance and financial support from G7 countries, EU, bilateral donors and international financing institutions, for the performance of safety analyses and investment programs for safety upgrading. As was mentioned in section 2.2.2 the first unit of Ignalina NPP will be closed down before the year 2005, and the second unit probably in 2009.

Since the large power generation capacity that is available at present is under utilised, Lithuania's national energy policy specifically addresses issues connected with the power trade, and especially the export of electricity.

Acknowledging that the country is committed to deeper integration into the European Union's energy market and the energy systems of Baltic and Nordic states, a priority is given to development of traditional electricity exports via available transmission lines to the North and the East as well as to establishing a new interconnecting power link to Western Europe through Poland.

Co-operation between the Baltic and North European states in creating a common electricity market is considered as one of the key possibilities to reduce present dependence on the Russian power system. This is especially important considering the Ignalina NPP operations.

A clear priority, after indigenous and renewable fuels, has been given to natural gas. Further, the Strategy supports conversion of natural gas heat-only boiler plants to combined heat and power operation to improve overall efficiency and performance of district heating systems, as well as contributing to increased electricity production.

The government plans to continue its reforms in the sector according to the following guidelines:

- restructuring of the energy sector should increase its efficiency and reliability, reducing energy production costs;
- immediate unbundling of accounts in the power sector followed by gradual formation of independent generation, transmission and distribution operators;
- further promotion of privatisation, stimulating local and foreign investment;
- gradual privatisation where elements considered of strategic importance remain under the State control;
- the high voltage electricity transmission grid with the main system regulation controlling devices, including Kruonis Pumped Storage Plant and Kaunas Hydro Power Plant, will remain under State control;
- price transparency;
- abolishment of subsidies associated with regulated price and establishing a pricing system reflecting economic costs;
- fair competition for all market players;
- concession system for energy generation and distribution.

In 2000, the Seimas (the Lithuanian Parliament) formed a legal base for the future liberalisation of natural gas and electricity markets when it passed the Laws on the Restructuring of Lithuanian Power and Gas Companies. These laws provide the methods for restructuring these monopolies. The methods include separation of the companies' non-core activities, and within the electricity sector they are separated into individual companies for generation, transmission and distribution.

The Seimas also adopted modern Laws on Electricity and Natural Gas, which in principle conform to the provisions of EU directives. These laws came into power on January 1, 2002. Key requirements of the Electricity Law include:

- Producers, suppliers and eligible customers will participate in the electricity market under voluntary contracts or regular auctions, using regulated Third-Party Access (TPA) to the transmission system.
- The Lithuanian electricity market has to some extent been opened to competition, since the Electricity Law define eligible consumers. From 2001 eligible consumers are defined as those with consumption greater than 20 GWh per year (falling to 9 GWh per year from 2002, and all consumers

from 2010). However, eligible consumers may import electricity only having obtained permission from the Ministry of Economy.

- The Ministry of Economy shall grant permission for import of electricity only if other countries provide for equal opportunity for import from Lithuania, and "taking into account the set quotas for the electricity imports".
- New generation undertakings can enter the market, subject to an authorisation procedure.
- Accounting separation for generation, transmission, distribution and supply activities shall take place within the internal accounts of integrated undertakings, with a view to avoid discrimination, cross-subsidies and distortion of competition.
- Provision for dealing with stranded costs, to be defined by the government.
- The Ministry of Economy shall approve a Grid Code, in which minimum technical design and operational requirements are defined on an objective and non-discriminatory basis.

The Lithuanian National Control Commission for Prices and Energy sets energy pricing principles, approves price calculation methodologies and co-ordinates with suppliers the prices of electricity, natural gas, district heating, and hot water. Through the Laws on Electricity and Natural Gas the Commission has been given a wider role, similar to those of corresponding regulatory institutions in Western Europe.

2.2.5 Structure of the power industry

The electricity industry in the Baltic States, by and large, remains under state ownership. In each country there is one dominant, state-owned company that is in charge of all high-voltage transmission and almost all distribution: Eesti Energia in Estonia, Latvenergo in Latvia and Lietuvos Energija in Lithuania. In Estonia and Latvia the main utility also is responsible for most of the power generation, whereas in Lithuania the main nuclear facility is housed in a separate state-owned enterprise, Ignalina Nuclear Power Plant. All three countries have restructured the main state utilities into publicly owned enterprises formed as joint stock companies.

As has been described in section 2.2.4, since the mid-nineties all three Baltic States have been in the process of restructuring their electricity industries. This process mostly deals with the breaking up of existing vertically integrated utilities into separate companies. So far though, these companies mostly remain as business units or subsidiaries to the main utility. For instance, in all three countries the Transmission System Operator (TSO) is still owned by the main utility. All three countries have also taken small steps towards privatisation.

Below we briefly describe the market structure for each country.

Estonia

In Estonia, the main utility is Eesti Energia, which is a 100 percent state-owned vertically integrated public limited company, engaged in power production, transmission, distribution and sales as well as other power-related services. In 1999 Eesti Energia was restructured to create separate business units/subsidiaries for generation, transmission, and distribution.

Through its business unit National Grid, Eesti Energia is responsible for the 110-330 kV substations and transmission network, and for the power balance and an efficient and smooth operation of the Estonian Power System. Eesti Energia controls the major generation facilities in Estonia. Thus, Narva Power Plants Ltd (which was established in 1999 and mainly consists of Estonia's two largest power plants, the oil shale-fired plants the Estonian CPP and the Baltic CPP) is a fully-owned subsidiary, while the country's third largest power plant (the Iru CHPP) is a separate business unit to Eesti Energia.

By the summer of 2000 it seemed that a big part of Narva Power Plants Ltd would be sold to foreign interests. Thus, after almost four years of negotiations, in August 2000 the Estonian government fixed the conditions for the sale of a 49 percent stake in Narva Power Plants Ltd to the American company NRG Energy for USD 70.5 million. Eesti Energia was to retain the remaining 51 percent. NRG Energy also made commitments to make substantial investments in the power stations over the coming years. However, in January 2002 the Estonian government cancelled the deal, since NRG Energy had failed to come up with the necessary financial guarantees[12].

However, small parts of the Estonian electricity industry have been privatised. The first step was taken in 1996 with the establishment of the joint-stock company Kohtla-Järve Soojus, comprising two smaller oil shale-fired power plants. Kohtla-Järve Soojus still remains a subsidiary to Eesti Energia though, since the country's main utility still owns 59 percent of the shares. Some other small energy assets have been fully privatised. For instance, since 1999 the power generator and distributor Viru Energia is co-owned by the Estonian bank Eesti Ühispank (which owns 30 percent) and the Finnish company Fortum (70 percent). Fortum also has controlling stakes in two other smaller electricity distributors.

There has also been talk about merging Eesti Energia and Latvenergo, into a new energy company called the Baltic Power Group. However, in the summer of 2000 public opposition to foreign ownership forced the Latvian parliament to decide not to privatise Latvenergo.

Latvia

In Latvia the state owned joint stock company Latvenergo has a very dominant role in the electricity industry. Latvenergo is engaged in the production of electricity and heat, the transmission and distribution of electricity and the sale of electricity to customers. Latvenergo controls Latvia's major generation facilities, i.e. the three hydropower plants that constitute the Daugava cascade and the Riga CHPP.

Since the mid-nineties Latvenergo has been restructured. Thus, from January 1, 1998, accounting at Latvenergo was divided along the lines of the company's

[12] Source: powernews.org, January 9, 2002

main operations: generation, transmission, distribution and other economic activity. In 2000, the power transmission function was separated from power generation and power distribution, creating a TSO. Since December 2001, the TSO has been housed in a separate legal body, the High Voltage Network Company, but it is still owned by Latvenergo. The TSO's duties include the provision of electricity transmission service, maintenance of the 330 kV and 110 kV lines and substations, and responsibility for the operational reliability of the electricity network.

The Latvian government has on more than one occasion suggested that Latvenergo should be privatised. According to the EBRD[13], the company was at first to be privatised by the middle of 1998, but a lack of political consensus over its restructuring and the privatisation method to be used contributed to long delays. In the spring of 1999, the government proposed unbundling the sector under a holding company structure that would remain majority state controlled. In February 2000, the government approved a plan for the restructuring of Latvenergo by the end of the year and the privatisation of some of its parts in the first quarter of 2001. According to the plan, the hydropower stations and high-voltage network would remain in state hands, while stakes of up to 49 percent in the thermal power stations would be sold. Although the low-voltage distribution network was not to be sold, the plan did allow for private companies to take over maintenance of the network and purchase and sale of energy.

However, 23 percent of eligible Latvians signed a petition for a referendum against privatisation and in August 2000, in accordance with the results of the referendum, the Latvian parliament adopted amendments to the energy law blocking the sale of any parts of Latvenergo, retaining it as a vertically integrated company. As we mentioned in the section about Estonia, this also put at stop to the idea of merging Eesti Energia and Latvenergo.

Lithuania

Restructuring of the Lithuanian power sector is proceeding along similar lines as in the other two Baltic States. Thus, the main, mostly state-owned, utility Lietuvos Energija has been divided into separate companies for generation, transmission and distribution.

However, the structure of Lithuania's power sector differs in some ways from that of Estonia or Latvia. For one thing, only in Lithuania has there been any significant private sector involvement. Thus, in 1999 approximately 10 percent of Lietuvos Energija was floated on the stock exchange, and was bought by the Swedish company Vattenfall. In November 2000, however, Vattenfall transferred its Lithuanian interests to E.ON of Germany, as part of the deal in which Vattenfall bought E.ON's shares in Hamburgische Electricitäts-Werke (HEW).

Furthermore, Lietuvos Energija, which was established in 1995 after reorganization of the Lithuanian State Power System, has not had a dominant role in power generation, since Lithuania's major power generation facility (Ignalina Nuclear Power Plant) is housed in a separate state-owned enterprise.

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13 EBRD, Latvia Investment Profile 2001 (April, 2001)

Another thing that differs, is that the separation of Lietuvos Energija has been more far-reaching than is the case with the main utilities of the other two Baltic States. Thus, in 1997 a rather large part of Lietuvos Energija's generation capacity (the two CHP plants of Vilnius and Kaunas) was transferred to the local municipalities. Furthermore, Lietuvos Energija has recently been thoroughly restructured. By the end of 2001, the distribution services were transferred to two separate distribution companies (the Western Distribution Company and the Eastern Distribution Company). At the same time, Lietuvos Energija's major generation facilities (the Lithuanian Power Plant and the Mazeikiai Combined Heat and Power Plant) were transferred to two separate power generation companies. According to the EBRD[14], the Lithuanian government plan to privatise these spin-offs from Lietuvos Energija, but so far the new companies have the same owners as Lietuvos Energija had before the restructuring.

After the restructuring, Lietuvos Energija retain ownership of the transmission network as well as the Kaunas Hydropower Plant and the Kruonis Hydro Pump Storage Plant, and is responsible for regulating the energy system and for coordinating electricity exports, imports and transit.

2.3 Electricity Markets in the neighbouring countries

Since the common power system of the Baltic States is connected to, and operates parallel with, the Unified Power System of Russia and the Power System of Belarus, we in this section briefly describe the electricity markets of Russia (2.3.1 and 2.3.2) and Belarus (2.3.3).

2.3.1 Russia

Russia, of course, is a gigantic country, with a size of more than 17 million km^2 and a population of approximately 146 million. Moscow is the capital of the country, but for the Baltic States, connections to Russia's northwest region and its dominant city St. Petersburg probably are more important.

After the financial collapse of August 1998, the Russian economy has gained momentum. In 1998 GDP-growth was negative (-4.9 percent), but since then GDP has grown approximately 5 percent per year on average. According to the EBRD, soaring world oil prices and the low rouble exchange rate have been the driving forces behind economic recovery[15].

Russia has 7 regional power systems, one of which is the northwest power system neighbouring the Baltic States. Six of the regional power systems operate as an integrated power system, with the Russian Far East being separate and independent.

[14] EBRD, Lithuania Investment Profile 2001 (April, 2001)

[15] EBRD, Russian Federation Investment Profile 2001 (April, 2001).

Total generating capacity in Russia amounts to approximately 200 000 MW. Of the total capacity around 130 000 MW is fossil-fuelled thermal generation (of this about 50 percent is combined heat and power), around 45 000 MW is hydropower, and around 21 000 MW is nuclear generation. About 70 percent of the country's generating capacity is located in European Russia, i.e. west of the Ural mountains. In the year 2000 Russia's power supply system generated approximately 875 TWh. Natural gas provides about 45 percent of supplies, hydropower 19 percent, coal 16 percent, nuclear generation 15 percent, and heavy fuel oil 6.5 percent[16].

Consumption is lower than generation. Thus, in the year 2000 electricity demand amounted to approximately 820 TWh, or around 725 TWh excluding generation losses. As was the case in the Baltic States, both generation and consumption decreased considerably during the nineties (20-25 percent). The decrease, however, was not as far reaching as the general decline in economic activity.

Russia's power generating facilities are ageing, and in need of rehabilitation. About two-thirds of them were commissioned more than 20 years ago, including one-third from more than 30 years ago, and it was estimated in 1999 that about 50 percent of the power sector's fixed assets had passed their intended productive lifetime. The increased obsolescence of power stations' equipment exceeds the rates at which they can be updated and new facilities can be installed. This means that instead of a surplus output by 2005, Russia will instead have a shortfall of about 49 000 MW[17]. To resolve this problem, significant investments are necessary. The overall investment requirements in the sector have been assessed at about USD 50 billion from 2001 to 2005, and will be even higher in subsequent years[18].

Russia's Electricity Sector is dominated by the joint-stock company RAO UES (Unified Energy Systems). RAO UES owns and operates about 84 percent of the transmission grid, the Central Dispatching Unit, as well as 20 percent of large thermal and 25 percent of hydropower stations. The company also oversees the country's 72 regional electricity companies, known as energos. RAO UES has a majority vote in 44 energos, a near majority in 26 energos, and is increasing its influence in the remaining two energos. Via its energo holdings, RAO UES controls about 90 percent of capacity and 70 percent of the country's generation. RAO UES also controls foreign trade in electricity.

RAO UES has been partially privatized. According to the company's homepage the Russian state owns the majority (52.5 percent), while the rest of the ownership is split between domestic (13.2 percent) and foreign investors (34.3 percent)[19].

Russia's nuclear generation capacity is controlled by the Ministry of Atomic Industry. According to Standard and Poor's the ministry directly owns the

16 Source: Standard and Poor's, Is the Russian Electricity Industry Running Out of Power? (October 2001).

17 According to an estimation made by experts from RAO UES.

18 Source: Standard and Poor's, Is the Russian Electricity Industry Running Out of Power? (October 2001).

19 www.rao-ees.ru

Leningradskaya Nuclear Power Plant and Rosenergoatom, a holding company that controls the remaining nine nuclear power plants[20].

In May 2001 the Russian government approved of a plan for electricity sector restructuring, which is to be carried out in three stages until 2010. The first stage mainly focuses on preparatory works. The second stage includes development of the legal and regulatory framework for competition. According to Standard and Poor’s, it is planned that RAO UES-controlled power stations will be consolidated into five to seven generation subsidiaries, while regional energos will be consolidated into 50 to 60 newly created RAO UES subsidiaries[21]. Furthermore, a federal high-voltage transmission company will be formed, as well as a system and a market operator.

The Federal Network Company (FSK) is considered the most important step towards an electricity sector reform. All large transmission networks in Russia will belong to this company. The size of the company capital is not yet decided but so far the RAO UES Board has declared the amount of RUB 140 billion to correspond to the capital value of network utilities included in the FSK.[22] The FSK shall include all network utilities of 330 kV and above, but also those networks that connect power generation plants and those that secure the parallel network operation of power systems in the federation.

In April 2002 the Board of RAO UES decided that restructuring will continue with unbundling of regional and distribution networks from supply of electricity. This process will be finalized in the late autumn of 2002.[23]

The next step, integration and merging of regional electricity companies, will be finalized in the summer of 2003. At this stage, the new power sector structure in Russia will, in principle, be settled and consist of one Federal Network Company, seven regional network companies, around 70 local network companies and 70 supply companies.

By the end of this stage (2004), competition will be introduced in the wholesale and retail market. Transmission and distribution tariffs will remain regulated. It is planned that the supply companies emerging from today's energos will maintain a legal supply obligation. Details of the third stage of the reform plan (2006-2010) are more vague, but the key elements will be to complete market liberalization and privatization of generation assets.

According to Standard and Poor’s, structural changes will be made within RAO UES, but these are initially not intended to change the company’s ownership structure[24]. RAO UES will initially have total control over all newly formed or

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20 Source: Standard and Poor’s, Is the Russian Electricity Industry Running Out of Power? (October 2001).

21 ibid.

22 Source: Izvestia, January 26, 2002

23 Source: Izvestia, April 6, 2002

24 Source: Standard and Poor’s, Is the Russian Electricity Industry Running Out of Power? (October 2001)

reorganized companies, but the restructuring could pave the way for further privatization of the electricity industry.

2.3.2 Northwest Russia and the Kaliningrad area

As was mentioned in section 2.3.1, substantial investments are due in the Russian power sector. How much of this future capacity will be located in European Russia and how will it effect the relations to the Baltic market? We believe it is relevant to study the Northwest Russian development in a more integrated manner with the Baltic market.

The electricity supply of Northwest Russia is basically covered by a couple of subsidiaries and branches of RAO UES. A board of governance for the Northwest Russian subsidiaries (Sevzapenergo) is situated in Moscow and its role is to promote the policy of the RAO in this region.

The Unified Power System has a branch of Northwest interconnection networks, which is responsible for network operations including securing the export to Finland and the Baltic States. Also, the Central Dispatch Unit has a branch for operation of Northwest Russia, and handles the dispatching of the 330 kV Baltic transmission network. This dispatch includes the eight regional electricity companies – Archenergo, Karelenergo, Kolenergo, Komienergo, Lenenergo, Novgorodenergo, Pskovenergo and Jantarenergo.

The number of gas and CHP generation plants belong mainly to Pskov, Komi, St. Petersburg areas and Lenenergo. The two nuclear plants in this region are Leningradskaya NPP and Rosenergoatom/Kolsk NPP.

Electricity generation by different technologies in Northwest Russia in 2000 is shown in table 2.12 below.

Table 2.12 Electricity generation by different technologies in 2000 (% of total generation)

Technology	Total Generation (78.9 TWh)	Generation capacity (19 785 MW)
Gas PP	17.4%	15.0%
CHP	29.5%	34.3%
Condense CHP	13.4%	21.4%
Nuclear PP	39.7%	29.3%

Source: Energy System for Northwest Russia

As is shown in the table, the dominant generation source in Russia's northwest region is nuclear power, which in the year 2000 stood for 39.7 percent of total generation, followed by CHP with 29.3 percent.

Electricity consumption by different sectors in Northwest Russia in 2000 is shown in table 2.13 below.

Table 2.13 *Electricity consumption by different sectors in 2000 (% of total consumption)*

	Total consumption (67.5 TWh)
Industry	53.9%
Agriculture	3.0%
Households	28.2%
Transport	4.6%
Others	10.3%

Source: Energy System for Northwest Russia

Since total generation (78.9 TWh in 2000) exceeds total consumption (67.5 TWh in 2000), the region offers export possibilities. Thus, in 2000 the power exchange for the region looked as follows: 6.2 TWh import (from the Central Russian region) and 17.6 TWh export. The export is transferred mainly through Kolenergo, Lenenergo and Pskovenergo (to Kaliningrad via Lithuania and to Belarus).

There are a number of power plants independent from RAO UES in the region owned by large industrial companies, e.g. the metal industry, pulp and paper industry and heavy industrial manufacturing.

Russia's coming power sector reform will in the Northwest region have the following major consequences:

- Enlargement of the regional electricity network companies compared to the existing networks within the energos, such as new network companies separated from Lenenergo and Pskovenergo and Novgorodenergo (3.2 million consumers), Kolenergo and Karelenergo respectively (1.75 million consumers). The network serving St. Petersburg (population 4.6 million) will be separated from Lenenergo.
- In this region only two generation companies will be created.
  - North company, on the basis of Kolenergo (generation capacity 1 600 MW)
  - Magistral company, on the basis of Lenenergo, Pskov, Pechora (generation capacity of 4 870 MW).

The nuclear generation is, as was mentioned earlier, directly owned by the State and not controlled by RAO UES.

The RAO UES policy is to promote new ownership in the CHP plants basically by transferring the ownership from RAO UES to the municipal authorities but also by selling generation capacity to private investors.[27]

[27] For instance, the Board of RAO UES approved (on February 22, 2002) the sale of Solikauskoj CHP Permenergo (valued to be worth USD 11,95 million by Ernst & Young).

This transformation is not surprising, since in western European countries CHP plants and networks are mainly owned by municipalities. Many of these have recently been transferred to limited companies and sold to private investors. There is no doubt that the CHP plants generate at considerably lower cost than the condensing plants, which promotes competitiveness for the new owners on the open market. On the other hand, the efficiency of the existing CHP plants is radically different for different plants and units, e.g. the oldest CHP supplying a part of St. Petersburg has high generation cost. How to find a suitable mix and how to evaluate and allocate shares to the new power companies is one of the issues that needs to be solved.

In conclusion, the RAO UES policy is to perform a high speed restructuring of the power sector in Russia's Northwest region and to enter into dialogue with neighbouring countries on more open terms.

One main consideration for RAO UES is the supply of the Kaliningrad area. Long-standing plans to turn Kaliningrad, Russia's exclave Baltic-coast region, into a strategic energy bridge to an enlarging European Union via a new gas-fired power station are finally being put into effect. The first trance of money for construction of CHP plant, a 450 MW plant in Kaliningrad, is due for release by the government this year. According to the region's governor, the Russian prime minister last year gave final backing to the plan which is estimated to cost USD 550 million in December last year. The project, first conceived in 1992, is due for completion in 2005.

Financing for the project is being shared by the federal budget (15 percent), the Kaliningrad regional budget and RAO UES. Gazprom is also involved in the project since it will require modernisation of natural gas supply routes to the region.

Kaliningrad officials also reveal plans for a second block for the plant, with a further capacity of 450 MW, with a provisional timetable leading up to 2010.[28] If constructed this second plant could meet opposition from the European Union, which says that the extra 450 MW are surplus to local needs and fears that it is therefore aimed at export – possibly at dumping levels. One alternative is increasing Russian (via Lithuania and Belarus) or Lithuanian import to this block. There is no doubt that the area of Northwest Russia and Kaliningrad has high relevance for the integrated Baltic development.

2.3.3 Belarus

Belarus has a population of approximately 10 million. The size of the country is 207 600 km², and Minsk is the capital.

Unlike its Baltic neighbours, Belarus has been reluctant to implement political and economic reforms since the collapse of the Soviet Union. Instead president Lukashenko, who came to power in 1994, has made the country return to a form of market socialism. This policy means, for instance, that administrative controls over prices and currency exchange rates have been re-imposed, and that the state's right to intervene in the management of private enterprise has been expanded.

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[28] Source: Power in East Europe, May 27, 2002

Instead of turning to the West, Belarus has tightened its links to Russia. Thus, by the end of 1999 the two countries signed a new Union Treaty, which sets out the principles for a future formation of a single economic zone. This is planned to come about through, for instance, a subsequent merger of the currency systems, harmonized national legislation and uniform policies on tax, customs, borders and defence as well as a common securities market. Russia already is an important business partner for Belarus, accounting for almost half of the country's exports.

The economy of Belarus has been growing rather steadily in recent years. In the year 2000, GDP rose by 6 percent, compared to 3.4 percent in 1999[29]. However, inflation-rates are, and have been, high. Thus, average annual inflation in 2000 stood at 168.8 percent, down from 293.7 percent in 1999, and was forecast by the government to decrease to 63 percent in 2001.

Electricity consumption in Belarus amounted to approximately 27.6 TWh in 1999. The national Power System of Belarus consists of 6 Energy Regions: Brest, Vitebsk, Gomel, Grodno, Minsk and Mogilev[30]. The country has a power-generating capacity of 7 400 MW, and in 1999 produced approximately 25 TWh. Electricity is mainly produced in natural gas-fired power plants (around 70 percent of power generated) and oil-fired plants (approximately 30 percent). There are also some hydropower plants, which account for only 0.1 percent of power generated.

After the break-up of the Soviet Union, both power generation and consumption dropped considerably during the nineties; generation by 38 percent and consumption by 27 percent[31]. The power infrastructure has been badly maintained, resulting in power generation slipping faster than consumption, and leaving Belarus a net importer of electricity.

Belarus has looked mainly to Russia and Lithuania to supplement its electricity needs. However, since Belarus often has been slow to pay for imported power, Lithuania periodically have been suspending electricity supplies in order to force debt payment. As of September 2001, Belarus's debt for imported electricity stood at USD 69 million, including 19.4 million owed to Russia and 49.6 million owed to Lithuania[32].

The dominant utility of the electricity sector in Belarus is the state-owned enterprise Belenergo, which is responsible for the national planning, construction, operation and control of the Power System of Belarus.

At the beginning of 1999, the country announced plans to restructure its energy sector through privatization up until 2010. However, no concrete action seems to have been taken in this direction. The government of Belarus has estimated that as much as USD 5 billion would be needed to upgrade the industry[33].

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[29] Source: EBRD, Belarus Investment Profile (April 2001).

[30] Source: Baltrel Annual report 1999

[31] Source: EBRD, Belarus Investment Profile (April 2001).

[32] Source: US Government Energy Information Administration.

[33] Source: EBRD, Belarus Investment Profile (April 2001).

3 Principle market design for the common Baltic electricity market

The common Baltic electricity market is presently in the initial stage of its development. In this chapter we describe the guiding principles behind the reform, the planned schedule for the common Baltic electricity market, its main actors, etc.

3.1 Basic principles

3.1.1 Political and institutional agreements

The Governments of Estonia, Latvia and Lithuania have made a political commitment to develop a common Baltic electricity market according to the Baltic Energy Strategy adopted by the Baltic Council of Ministers in 1998, as well as closer integration with Nordic and European electricity markets. A rather ambitious, and as it has turned out unrealistic, time frame for the establishment of the common Baltic electricity market by 2001 was approved by the Baltic Council of Ministers in spring 1999. At present, it seems that the market will come about at the earliest in 2003.

The development of the common Baltic electricity market has continuously been supported by high-level political commitments and agreements. The latest was the Baltic Prime Ministers Resolution signed in July 2001[34]. The Prime Ministers supported the establishment of the common Baltic electricity market and obliged the Committee on Energy to continue the coordination of the process. The Prime Ministers emphasised the necessity to proceed with the reforms in the countries' electricity sector promoting the functioning and facilitating further integration of the market into Nordic and Western European electricity markets. The Prime Ministers also noted the necessity for creation of independent Transmission System Operators (TSOs), which is a key factor for free competition in the Baltic electricity market.

[34] Resolution of the Heads of Governments, of the Republic of Latvia, the Republic of Estonia and the Republic of Lithuania, signed in Sigulda, Latvia, July 9, 2001

An important resolution on the "next" political level, the Ministers of Economy in the three Baltic States, was signed during Autumn 2001[35]. The Ministers enunciated the basic principles such as organising the electricity market among eligible customers, producers and suppliers based on voluntary bilateral contracts and auction using regulated Third Party Access (TPA) to the transmission and distribution grids.

The year 2002 started with specific efforts on the "third" level of energy sector institutions such as regulators and TSOs. Thus, the Baltic regulators will sign a memorandum agreed on common regulatory principles for the common Baltic electricity market. This memorandum paves the way for introductory regulation of such a market and stipulates the functions of the TSOs and the regulators in the context of an integrated market.

3.1.2 Legislative and regulatory context

As has been described in section 2.2.4, the principle energy sector legislations (Energy or Electricity Acts) in each country are designed to provide for electricity market liberalisation and integration with the neighbouring region and in a longer term with the internal market of the EU. In terms of creating the common Baltic electricity market, however, the preconditions at present vary somewhat between the Baltic countries:

- The acts of Latvia and Lithuania provide the necessary legislative framework for the sought-after market opening. Both the Latvian Energy Law from October 1998, with its amendments from 2000 and 2001, and the Lithuanian Electricity Law, valid from January 2002, allows some degree of market opening. This implies a freedom of choice for large customers and gives qualified/eligible customers the right to choose their electricity supplier and make bilateral agreements with such supplier using the open access to the grids. The laws of Latvia and Lithuania also put requirements on restructuring of the power industry, unbundling of the transmission systems operations from the generation and securing regulated access to the grids.
- In Estonia the legislation is not yet fully developed. However, the current Estonian Energy Law will soon be replaced by separate sub-sector laws, dealing with the electricity market, gas, fuels and heating. The new Electricity Market Act, which will be decided by July 2002, will provide similar conditions as in the two other States.

After the decision on the new Estonian legislation there will be no significant barriers for cross border trade between power generators, suppliers and eligible customers. In other words, the first steps towards market integration within the area of the Baltic States can be taken.

The principle acts in all three countries provide rules for acquisition and usage of electricity, generation, transformation, transmission, distribution and supply of electricity to the users. The acts also stipulate the obligation of transmission in the electricity sector and principles of organization of the electricity transmission and

[35] Resolution regarding the basic principles of the common Baltic electricity market, November 2001

supply. Thus, they basically fulfil the current requirements of the EU electricity directive of unbundling by accounts between the transmission operations and other activities. In practice, however, the Baltic market structure has progressed even further. In Latvia and Lithuania legal unbundling of the transmission system operations has been introduced, and such a process is also on the way in Estonia.

The acts stipulate provisions for participation in electricity trade and describe the parties entitled for such trade. Also, basic criteria for acquisition of status for such participation are stipulated. The status of qualified customer makes it possible to, not discriminating any other users, enter into electricity supply/purchase contracts with an electricity transmission or a distribution system operator and directly with a power producer within or outside the network license validity area. All three countries' legislations define procedures for acquiring such status – usually license based. In addition to the acts a number of Cabinet or Governmental decisions have been issued in order to define the annual consumption limit for the acquisition of qualified customer status, which for the time being is not less than 40 GWh per year[36].

All three Baltic States have chosen a more or less "selective" market opening. Thus, as is also recognised in the common Baltic strategy and national policies, the market will stepwise involve a growing number of participants. The clause of reciprocity should guide the coming steps of market opening, but the time schedule for taking such steps is not yet clear.

At the inception of the market opening there are still a number of restrictions imposed, such as import licences, lack of deregulation on power generation price and not very clear boundaries regarding the responsibility of the national TSOs and that of DC Baltija. It is also evident that the practical unbundling of the TSO and putting in place of an independent TSO requires further adoption of the legislation.

As provided in the three principle acts there is a need for regulation of the electricity market. In the acts the regulatory function is in principle described as a state institution, aiming to supervise the operations of monopolies and to approve tariffs for their services and also for energy to the energy consumers. All three Baltic regulators are relatively new institutions and have experienced similar challenges as in any other European country during the process of electricity market liberalisation.

In all three countries the regulator is organised as a state agency, reporting to the Ministry of Economy, and funded through the state budget. The principle acts also provide for some basic functions, which are similar for the three regulators, such as settlement of disputes regarding the right to use networks, imposition of penalties for violations of laws, and approval of the status of qualified customer.

General regulatory objectives[37] for the international trade in the common Baltic electricity market can be summarized as follows:

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[36] It should be noted that Lithuania has lowered its limit for attaining eligible customer status to an annual consumption of 20 GWh. However, not for cross-border trade.

[37] Draft memorandum between the three Baltic Regulators, June 2002.

- Ensure third party access by avoiding discriminatory treatment of cross-border transactions.
- Pricing with complete recovery of transmission (ancillary services) and distribution network costs, including extension and development. This will result in cost based tariffs, in order to give efficient economic signals.
- Regional market development seeking to avoid artificially low or high network prices to certain customers or certain groups of customers and tendency to limit electricity imports regardless of economics.
- Ensure the separation of the other activities from TSO's main functions in accounts.
- Encourage the justified investments avoiding non-justified barriers to trade.
- Abolish the appearances of the cross-subsidy, discrimination, abuse and other obstacles for the competition.
- Effort to increase quality of service and security of power supply.

Regarding pricing and payments, the proposed regulation states that the actors only should pay for the transmission services to the national transmission system operator. Furthermore, TSOs will compensate each other for additional network losses from transit flows according to a set methodology established by an agreement among the TSOs. The proposed regulation also states that producers, as suppliers, should not pay for the transmission services. Furthermore, transmission tariffs can differ between the countries, but should be based on the following common principles:

- Transmission tariff shall cover components such as: profit, costs of TSOs' structural and technical networks, losses, own needs and ancillary services;
- National transmission tariff shall cover domestic transmission costs;
- Calculating the transmission tariff, there should be evaluated the amount of the electricity (capacity) of the customers, which have their own generation sources or receive the electricity from the direct line;
- Calculating the transmission tariff, there should be evaluated the amount of the electricity (capacity) of the distribution networks, which receive the electricity directly from the producers except those, that use the renewable or waste energy sources.

3.1.3 Initial rules for market opening

The common Baltic electricity market is foreseen as a voluntary bilateral contract market with a balancing pool, the 'competitive' market, trading in parallel with the 'captive' market supplying the smaller customers. Eligible/qualified consumers will be allowed to trade freely with existing generators or new Independent Power Producers (IPPs) in each country. The market will be opened step by step and the mechanisms for balancing energy and allocating the costs to market participants will evolve from simple to more complex methods.

Common efforts of the Ministries responsible for Energy sector, Regulators and Transmission System Operators are concentrated on approximation market access rules in individual countries and harmonization of the transmission tariffs.

It is agreed that the common Baltic electricity market means a single market area consisting of the combined territory of Estonia, Latvia and Lithuania[38]. The Transmission Network of each State provides market access for generators, customers and traders based in a particular country, but access fees from one country to another would be unacceptable.

"Transit" shall mean the electricity transmission from one system to another through a third country's electricity network.

Third party access (TPA) to the networks is ensured by avoiding discriminatory treatment of cross-border transactions and by fair allocation of limited network capacity (when this is the case). This implies harmonisation in principles for tariff setting within the national transmission networks. Regarding market access, the Ministers of Economy in the three Baltic States have agreed that no cross-border tariff for network use should be allowed inside the market area[39]. Also a common cross-border tariff and reciprocity principle from the market area towards neighbouring countries shall be ensured. A "post stamp tariff" for transmission system users is recommended.

Participation in the common Baltic electricity market shall include all legal persons holding a license for generation, supply, transmission and/or distribution of electricity in Estonia, Latvia and Lithuania[40]. This means that participation in the common market will only require a license granted for the participants' operations within the country borders and issued by the respective national regulator. Furthermore, the market participants shall include all qualified/eligible customers in the three states. The license of an independent supplier issued in one of the Baltic States may have validity in the other countries within the market area.

Transmission tariffs can be different in different countries, but shall be based on the same principles, such as covering the transmission network costs, including extension and development. The transmission tariff shall cover domestic transmission costs. But TSOs shall also compensate each other for additional networks losses caused by transit flows in their countries.

The ancillary services shall be provided by the national TSOs, taking advantage of the co-operation and the joint operation of the Baltic Interconnected Power System. The national TSOs shall act as the country representatives in the Baltic balance energy market[41]. This means that the system balance will be put on market terms – trading of balance power shall be the responsibility of the national TSOs, but shall later involve "corresponding market participants".

Increased trade with external parties (Russia or countries to the west) have, for both technical and commercial reasons, only limited possibilities in the short term. Initially the new trading therefore will be primarily between generators and

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38 Draft memorandum between the three Baltic Regulators, June 2002

39 Resolution regarding the basic principles of the common Baltic electricity market, November 2001

40 Draft memorandum between the three Baltic Regulators, June 2002

41 ibid.

eligible consumers in the three Baltic countries. The envisaged market approach is similar to that adopted in the Nordic countries, but constitutes a simplified version in the first instance. Already agreed is the possibility of stronger linking between the Baltic and the Nordic markets. At some later stage stronger financial as well as physical links between the Baltic and Nordic markets will become a reality, which will lead to enlarged market integration in the Baltic Sea Region.

A specific decision about the time schedule for the market opening has not yet been made. The Ministers of Economy in the three Baltic States have agreed that the market shall be opened in steps, gradually involving a larger number of customers[42]. A first step is envisaged for year 2003. The steps and thresholds for market opening shall be co-ordinated between the countries.

3.2 Market participants

The participants at the competitive market will be the generators, one or more categories of suppliers, and the eligible customers. These actors are in turn described in sections 3.2.1 to 3.2.3. Of importance to the competitive market are of course also the providers of the market infrastructure, i.e. the network operators. These will be described in section 3.3.

3.2.1 Power producers

Initially, there are likely to be three or four large competing generators on the common Baltic electricity market, supplemented by another three or four medium sized generators (primarily the Latvian and Lithuanian CHP plants). The market will therefore be characterised by a small number of competitors, and market power is likely to be a problem. On the other hand, although current generating assets are old, they are potentially much in excess of likely demand, and this makes use of the competitive pressure on prices and costs. This situation will change in the future with plant closures suggested or already decided to address issues such as environmental concerns.

In Estonia the oil shale fuelled plants clearly dominate electricity generation. The two large power plants, Estonian CPP and Baltic CPP, are more than 30 years old. Oil shale has provided Estonia with a relative self-sufficiency, especially after the decline in electricity consumption since 1990. The environmental issues put pressure on replacing this old generation capacity with new sources. This has caused a significant decrease in the oil shale generation: from 98 percent of power generated in Estonia in 1996, to 91 percent in 2000. According to the Estonian Long-term National Development Plan for the Fuel and Energy Sector there is in principle stipulated that the power plants shall be kept until their depreciation time after the renovation. The Plan at the same time foresees a decrease in the oil shale generation and points out the alternatives of Russian gas and local peat and wood. Russian natural gas is now the second largest energy source for power generation in Estonia.

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42 Resolution regarding the basic principles of the common Baltic electricity market, November 2001

In 2000 Eesti Energia started renovation of Estonian and Baltic Power Plants. The aim is to increase the efficiency of the oil shale fire process, and to reduce the pollutions by using new technology of circulating fluidised bed fired boilers in one 200 MW unit per plant. The renovation will be finalised in 2004, and will prolong the use of oil shale for electricity generation.

Although the installed capacity in Latvia is more than sufficient, the country is a net importer of electricity. This is due to the fact that Latvia's electricity generation is based on hydropower. The three largest plants are situated along the Daugava River. The Daugava cascade's operation is extremely dependent on the water conditions of the river. This means that Latvia's dependency on electricity import can fluctuate from 10 percent to more than 50 percent for different years[43]. The average import volume is about 1/3 of the countries' gross domestic consumption and comes from Estonia, Lithuania and Russia.

Latvia's thermal power plants are small and their high generation cost makes them unable to compensate for the fluctuation of the hydro generation. In conclusion, there is only one significant Latvian generator on the market. Thus, as a part of the common Baltic electricity system, Latvia is an interesting partner in short term trade and weekly regulation. This is a significant addition to the two other countries, which cannot provide such flexible and low cost regulating capacity. On the other hand the fluctuations in Latvia's hydropower generation make it unsuitable for long-term contracts of power and energy.

Lithuania is the strongest generation player in the Baltic system, and has, apart from the dominating nuclear generator Ignalina, also a couple of mid-sized CHP Plants and hydropower plants, which can be significant players on the market. Ignalina generates on average 75 percent of the gross domestic consumption. The second largest generation facility, Lithuanian CPP, is basically used as a reserve for Ignalina, although it is the largest thermal plant in the Baltic system. On average, the Lithuanian CPP generates only 5-7 percent of Lithuania's consumption[44]. Vilnius CHP plant is the biggest combined heat and power generator in the Baltic system, and generates about 10 percent of Lithuania's consumption. After these plants follow the two medium sized CHP plants in Kaunas and Mazeikiai, as well the two hydro power plants Kaunas HPP and Kruonis Hydro Pump Storage (with a generation of some 5 percent for the two latest). It should be noted, though, that the Krounis HPSPP primarily is used to regulate the nuclear generation, which affects the generation curve of the plant.

In conclusion, each country separately is too small on its own, with the ownership of generation capacity too concentrated. The oligopoly situation described is a potential problem in any market opening initiative. However, developing a common Baltic electricity market will significantly enlarge the market and reduce oligopoly power, relative to the situation under separate national markets, especially considering the level of excess generating capacity that will be made available.

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[43] Source: DC Baltija

[44] Source: DC Baltija

One way of improving the supply/demand balance (and potentially increasing the number of competing generators) would be to break down the barriers to entry by neighbours in the west, by establishing transmission links to suitable countries. As was mentioned in chapter 2 there are plans for building inter-connectors to Finland and Poland. However, even if this option is superficially attractive, AC links to Finland and Poland are not currently feasible and DC links would be expensive. In the short term, therefore, we assume that the market will involve only the three Baltic countries (and possibly Russia).

The concentration of market power among a small number of generating companies is one important reason why a mandatory power pool is not envisaged for the nearest future. Given the limited opportunity for entry of new generators into the market, consideration must be given to how generation capacity will become available for the competitive market. This would be dependent on the three countries adopting and implementing strongly pro-competitive policies towards unbundling and ownership separation.

Medium to long term (i.e. post 2005) the concentration of generation could change as some existing capacity is retired and load growth occurs. A significantly more competitive market structure is possible if the existing generation is unbundled and ownership separation is implemented essentially on a plant-by-plant basis.

3.2.2 Suppliers - independent or others

On the current Baltic market there is no completely clear definition of an electricity supplier. It is obvious that the large generators, who also hold a supply/market license, can sign contracts with eligible customers in their own country or in the market area. The purchasing agents that have been mentioned as suppliers to the captive market[45] will also be able to supply eligible customers. The three Baltic Regulators propose a definition of independent supplier as a legal person or an undertaking without the rights of a legal person, providing supply services to the eligible customers under the agreements.

Independent suppliers, who take bids from one or more generators and can sell to a number of eligible customers, are not really represented on the market yet. In principle, though, the two private distribution networks in Estonia could act as independent suppliers – this is already possible within the current legislation. The largest private network in Estonia (Narva Electricity Distribution Network AS) is co-owned by the American company Synergy Global Power (67 percent) and the Estonian Private industry (33 percent). The company was granted an import license, valid until June 2002, and has since 2000 partly traded their electricity from Lithuania. The total trading volume of the company is around 300 GWh per year, or approximately 5 percent of Estonia’s consumption. Of this volume 70 percent is purchased from Lithuania. The other private network company in Estonia is smaller. This company has not yet used its import license, but could potentially act as an independent supplier within the market area.

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45 Integrated Energy Markets for the Baltic States, the EC Synergy Programme Report (February 2001)

There are also a number of independent power producers on the market (industrial CHP, small hydro and wind power utilities), who, although small in terms of market opening, can contribute to the diversified electricity supply.

Third country suppliers are currently only involved in import/export transactions, as well as electricity transfer to, for instance, the Kaliningrad area. As a sub-set of the Northwest Russian area the Baltic system potentially faces substantial destabilisation flows if Russia is allowed unrestricted access. Currently, Russia has access to the transmission system for wheeling power to Belarus and Kaliningrad. Russia could potentially access the Baltic market for supply to eligible customers – either directly or via a trader resident in the Baltic area. Russia could also be allowed access to supply reserve and balancing services. This would also attract charges representing overall transmission and balancing costs.

In conclusion an important prerequisite for the future market opening will be the establishment of new independent suppliers. These will be able to operate by being more skilful than the consumers at constructing balanced portfolios of purchases and sales, and by offering professional risk management.

3.2.3 Consumers

All three Baltic countries intend to open the market stepwise, starting with a small number of the largest consumers. Who then are these largest customers on the integrated Baltic market?

Electricity consumption shows a common pattern in the three countries, with the industrial sector having the biggest consumption. The most electricity-intensive industries are the oil refining industry, the metal industry, the mining, and the chemical manufacturing industry. However, in the year 2000 only a few companies consumed more than 100 GWh, e.g. A/S Liepajas Matalurgas in Latvia, Mazeikiu Nafta AB and Achema AB in Lithuania.

Eligible customers have the right to purchase their electricity directly from an electricity producer within or outside the area of the transmission system license.

The three countries are applying similar criteria for eligibility. Within the national principle acts, or based on these, the Governments have set the eligibility criteria to 40 GWh of annual electricity consumption. According to these criteria, there are presently 10 customers in Estonia and 8 in Latvia. Lithuania seems so far to provide for a faster market opening than the other two countries. Thus, for the year 2001 eligible customers were defined in Lithuania as those with an annual consumption exceeding 20 GWh, falling down to 9 GWh per year from 2002.

The consumption of the eligible customers as a group represents different shares of the respective national market, and the differing criteria for eligibility indicate that the issue of reciprocity between the countries partaking in the common Baltic electricity market must be dealt with. Means of securing such reciprocity could be, for instance, the existing requirement of a special licence for import and export. The rules for granting such licenses differ in the three countries. Latvia's legislation does not require an import license while licenses are granted in Estonia by the Regulator and in Lithuania by the Government. For the nearest future, though, a common agreement is needed for the reciprocity on the common Baltic electricity market and its coming steps for gradual opening.

A limit of 40 GWh per year will fulfil the initial need for reciprocity, but will mean that consumers with access to the open market only will represent approximately 10-12 percent of total consumption. This means that the Baltic countries will have problems fulfilling the current EU Electricity Directive, i.e. a market opening including at least 33 percent of total consumption by February 2003. For the Baltic market this will require quite rapid introduction to the market for customers much smaller that the current eligibility criteria. An estimation of numbers of eligible customers with different degrees of market opening is shown in table 3.1 below.

Table 3.1 Size of eligible customers

	Estonia	Latvia	Lithuania
Threshold size for 2001, GWh	40 GWh	40 GWh	20 GWh
Estimated numbers over 10 GWh, around 15% market opening	41[46]	34	40
Estimated number of customers for 25% market opening	175	100	350
Estimated number of customers for 33% market opening	700	500	1000
Full market opening	Year 2012[47]	Year 2006	Year 2010

Source: EC Synergy Programme Report, Cabinet Decisions, Policy documents

As is shown in table 3.1, customers with an annual consumption exceeding 10 GWh represent around 15-20 percent of total consumption, while opening the market to 25 or, even more so, 33 percent of total consumption would result in a large increase in the number of eligible customers. A 25 percent market opening would mean that customers with an annual consumption in the range of approximately 1-3 GWh would be given access to the market. With 33 percent market opening the threshold size would drop substantially below 1 GWh per year and involve over 2 000 customers in the Baltic countries put together.

In conclusion, a very important threshold is to follow the speed for 33 percent opening of the market. In our view, though, it is obvious that the Baltic system is not prepared for such a rapid market opening by 2003. A more realistic threshold would probably be opening for eligible customers above 10 GWh per year, which corresponds to approximately 15 percent of the market.

[46] This includes private distribution companies. Excluding them, the number is 31.

[47] According to the agreement with EU on a transitional period.

3.3 Market infrastructure

3.3.1 Roles and responsibilities of the national TSOs

An electricity network primarily provides transport from generators to consumers. However, in a competition environment the network operation has a wider significance. Thus, it also includes metering and settlement of energy deliveries, securing the system balance between consumption and supply, and providing market information to the market participants and institutions. This way the electricity network becomes the most necessary infrastructure for the function of a competitive market.

Thus, in a competitive market open access to the transmission networks for all market participants is needed. To guarantee this, there is in the Baltic countries need for a new structure of the power industry, which secures the transmission system operation to be independent from electricity generation and sale. This has also been explicitly manifested in the political agreements paving the way for the common Baltic electricity market. In the resolution signed in Sigulda, for instance, "the Prime Ministers noted the necessity for creation of independent institution of transmission system operators, which is a key factor for free competition in the Baltic electricity market"[48].

Since when the above-mentioned political agreement was made, positive structural changes have occurred. The principle energy legislation in Latvia and Lithuania does not explicitly require a legal unbundling of the transmission operator. But in practice these two countries have already enforced such unbundling. In Lithuania a corporate decision for major transformation of Lietuvos Energija was made, and since January 2002 the company is structured into one transmission company (parent company), two distribution companies, and two generation companies. The Government of Latvia decided to establish the TSO as a separate legal entity inside Latvenergo. The new legal company, the High Voltage Network Company, was registered in December 2001. On the other hand, the proposed new legislation in Estonia, the Electricity Market Act, requires legal separation for the TSO from the other activities in Eesti Energia. The generation utilities are in principle already unbundled from other activities but there are also plans for organising a TSO as an independent subsidiary of Eesti Energia as soon as possible. In conclusion, the infrastructure in the all three States will be legally prepared for the market opening before the end of 2002.

One of the main issues in the process of unbundling is the question about the ownership of grid assets. In Lithuania, for instance, the network is fully owned by the parent company, Lietuvos Energija, which is also the basic TSO but also owns other company assets including generation and distribution as separate subsidiaries. In Latvia, the recently unbundled legal body, the High Voltage Network Company, does not own the network assets, which, according to the Law on Energy cannot be transferred from Latvenergo. This means that the fully owned subsidiary of Latvenergo, cannot own but only lease the network assets from the power company Latvenergo. Currently the Estonian power company

[48] Resolution of the Heads of Governments, of the Republic of Latvia, the Republic of Estonia and the Republic of Lithuania, signed in Sigulda, Latvia, July 9, 2001

Eesti Energia seems to be the strongest vertically integrated. On the other hand the company structure shows that the power generation is legally unbundled in separate generation plants with mixed ownership. The exception is Iru PP, which is also used for operation and balancing the transmission system, which together with the network utilities belongs to the mother company.

The responsibilities of TSOs as network utility operators, management of generation despatch, as well as a non-discriminatory provider of the system to all transmission system users, are defined in the countries' principle acts. There is also an obligation for TSOs to define further management procedures regulating the co-ordinated operation of the entire supply system, i.e. co-ordination between generators, distribution utilities and users, which is approved by the regulator (secondary legislation). The backbone of each country's secondary legislation are the Grid Codes, approved by the Regulators. The Grid Codes put requirements on the TSO as a provider of network services and system operator. Accordingly, the TSO is obliged to calculate and publish transmission network service tariffs as well as to secure the system regulation, security and planning. What does not seem very clear is the responsibility for metering of energy consumption as well as the responsibilities of the parties involved in the settlement process.

One main issue in the requirements towards the TSOs, is the definition of the system responsibility which includes system balancing, reserve management, management of bottlenecks etc. These definitions are not very clear in the Grid Codes. Another issue is the responsibility for metering and settlement. This function is not sufficiently defined, which in light of its importance for the sales of electricity can be a real obstacle for market opening. Finally the Grid Code requirements on metering and settlement systems are not fulfilled. The existing systems for metering and data acquisition, mostly manual, are not in compliance with the functions of competitive market and may be currently the main short-coming of the market infrastructure.

Contracts for transmission services and separate grid service tariffs are required by the Grid Codes. However, it is not very clear if such contracts must be concluded by the TSO only with the qualified customers, generators or even between the TSOs and the underlying distribution networks, especially if they are all subsidiaries of the same company. The latest is on its way to be solved and will result in such contracts as soon as the final establishment of generation and distribution subsidiaries is put in place.

Finally, in terms of cross border electricity trade there is a physical infrastructure between the Baltic States, Russia and Belarus. The current cross border trade is based on bilateral contracts between the three Baltic power companies and their partners in Russia and Belarus. In this trade the electricity price is not separated from the price for transmission service and the transmission cost is not considered at all. Accordingly, the tariffs for cross border transmission towards the market area do not exist. This issue will be solved accordingly to the principle common Baltic electricity market agreement to establish a common tariff for entering the Baltic market area.

3.3.2 The integrated Baltic infrastructure

The operation of the Baltic Interconnected Power System (IPS) is based on a multilateral agreement between the three Governments signed in 1992. On company level, there are multilateral agreements between the three main state-owned Baltic power companies and DC Baltija, and, on the other side, a bilateral agreement between DC Baltija and the Central Dispatch Unit of Russia. Since the Baltic IPS is connected in a common electricity loop together with Russia and Belarus there is also a multilateral agreement between the three Baltic power companies, RAO UES and Belenergo about parallel operation of these power systems. These agreements outline the basic principles for transmission system operation, generation control, power exchange, balance and reserve management.

DC Baltija carries out operational dispatch management of the Baltic IPS. In principle, DC Baltija is responsible for despatching the entire 330 kV network connecting the Baltic States with the neighbouring systems of Russia and Belarus. DC Baltija plans and schedules the power balance based on the despatch orders made by the companies on monthly, weekly and daily basis. Furthermore, DC Baltija is responsible for settlement of power transactions and transit of power.

The three national Baltic TSOs are responsible for operation of the entire 110 kV (or 220 V when any occurs) network and the national 330 kV lines after co-ordination with DC Baltija. Their operation is performed according to the schedule planned by DC Baltija.

Before independence, the power utilities in the three Baltic countries were operated as an integrated part of the Northwest Soviet Union UPS, and in 1990 were capable of dealing with twice the level of generation and a 50 percent greater level of demand, compared to today. Hence, there is an inherent capability for interchanging significantly greater levels of power than is presently the case.

Overall, the Latvian and Lithuanian systems are one very strongly interconnected, cross-linked ring, with a tee off to Kaliningrad and strong interconnection to Belarus. To the north this ring connects through three separate and strong links (one of which goes through Russia) to a smaller Estonian ring. Physically it functions as one transmission system interlinked strongly to northwest Russia rather than three isolated transmission systems with interconnection.

While the three systems are not absolutely integrated they are sufficiently strongly connected that, given present patterns of demand and present generation capability, there appears to be no permanent transmission restriction to the creation of a single internal electricity market.

The Synergy Programme Report examined the robustness of this conclusion with respect to a load growth scenario based on the growth rates in the Lithuanian Least Cost Plan, namely 4 percent economic growth to 2010 and 3 percent growth from 2010 to 2020. The report concluded that the single market could continue without undue transmission reinforcement, assuming that the retirement of large plant (e.g. in Lithuania and Estonia) would most likely be replaced by a well distributed new generation.

One issue of increasing importance for the TSOs is the balance management. For opening a competitive market and giving qualified customers a free choice of supplier, new requirements on the power system balancing have to be fulfilled. As was mentioned above, the three national Baltic power systems operate in parallel with the Baltic IPS, which requires common balance management. The balance management is basically ordered by DC Baltija but partly operated by the national TSOs. The national TSOs have to follow the hourly schedule prepared by DC Baltija. The aim of this hourly planning is to bring production and energy trade as close to the level of consumption as possible, and to minimise the unbalance. DC Baltija manages physical unbalance during the operation hour. This is done via remote generation control on the Daugava HPP cascade, which has high reservoir capacity. On a daily basis there is also need for co-ordination of transactions between DC Baltija and the Russian UPS, which is also within DC Baltija's responsibility.

To summarize, the existing interconnected power system, which includes centralised despatching operations through DC Baltija, well-developed interconnections and a diversified and complementary structure of power generation, provides a firm foundation for the further integration of the Baltic power markets.

3.4 Outlook for initial competition

The first elements of competition in the electricity generation sections in the Baltic States are already in place. As we have already described, there are neither obvious legal nor structural barriers for introducing the common Baltic electricity market. Also, it seems clear that a functioning competitive market hardly can be realised on national level in the Baltic countries, but has to rely on opening the borders for trade between the countries.

The international trade of electricity and ancillary services is currently carried out only by bilateral contracts between the national power companies. Transactions are usually performed using two levels of contracts – long-term structural contracts (for a year and more) which determine general conditions of trade, whereas monthly implementation contracts determine the volumes and additional conditions of trade. There have also been single stand-alone transactions.

The power companies participating in current and future power trades within the Baltic market can roughly be divided into general exporters and general importers. The exporters are Eesti Energia, Lietuvos Energija and RAO UES of Russia, while Latvenergo and Belenergo of Belarus are importers. The roles are not constant, however, as in different periods of time the normal importers occasionally export and vice versa. There is even simultaneous export and import by the same player with different trade partners. Prices for energy and services are negotiated bilaterally. This presents a good ground for further developing of the market for power trade.

This kind of regional trading has a number of very strong economical drivers such as fuel costs, complementary generation patterns and load/generation balances, but also the physical operational structure of the Baltic IPS. Thus, there is reason to believe that continuous trading between the power generators will exist even in a more competitive market environment.

The existing diversified structure of generation in the three countries together provides a good opportunity to utilise existing synergy potential by optimising system operation and co-ordinating regulatory frameworks. This requires better integration in terms of harmonising electricity trading rules, regulations, environmental and technical standards, etc. However, the basic differentiation between various types of generating plants offers a potential for specialisation in the provision of power from plant specialising in base load, mid-merit or peaking. The variety of generation types also offers greater opportunities for specialisation in the provision of balancing and other transmission services in a combined market. A competitive market in these services across the Baltic States should lead to least cost provision.

Improvements in security of supply are obviously available in an integrated market, although this must be tempered by the fact that there is surplus generation anyway. The benefits under this heading of a combined market would be the availability of security of supply at lower cost.

In terms of customer supply, the existence of established supply businesses in the different countries gives reasonable ground for several competing companies to offer customers delivery in a combined market. In addition, combining the markets offers scale economies for new supply businesses seeking to compete. These new businesses are also able to source generation from across the national boundaries, and can therefore minimise potential restrictions in availability of power that could otherwise only be sourced from vertically integrated incumbents.

There are currently five main players on the Baltic Electricity Market: Eesti Energia, Latvenergo, Lietuvos Energija, RAO UES and Belenergo. The trade between these power actors is fully supported by the legislation and by the integrated structure of the power and transmission system. In terms of formal agreements the five power companies signed a multilateral agreement in February 2001 on Parallel Operation of Power Systems. This agreement formally replaces the previous bilateral agreements between respective countries.

Since the year 2000 participation in the wholesale market has been possible for a larger number of producers and independent suppliers. During this year the role of DC Baltija as a load dispatcher in merit order was replaced by bilateral agreements between the Baltic parties. These agreements are based on commercial pricing of the power, and are subject to confidentiality between the contracting parties. The role of DC Baltija is as a load dispatcher to operate the system so that the contracted volumes by the parties will be transmitted. One example is the electricity trade between the private Narva Electricity Distribution Network Company in Estonia and the Ignalina NPP in Lithuania, which is supported by an import licence granted to the company. This shows that even the current legislation provides sufficient framework for initial cross border trade.

The degree of competition in the retail or supply sections is highly dependent on the activity and awareness of consumers. So far though, the eligible customers have been more active in driving the necessary changes for market opening, than in taking active part in the market itself. A lot remains to be done to increase the awareness of the customers and their active participation in the market, even though several activities have been carried out – one recent example being the

Manual of Qualified Customers, drafted by the Ministry of Economy in Latvia in co-operation with the World Bank.

The strict regulation of electricity generation prices in the Baltic States, pursuant to the provisions of the national energy legislations, still imposes unnecessary restrictions on the energy producers and discriminates them at the opening stage of the energy market, as the qualified customers can obtain more attractive offers only from the producers outside the national borders. These restrictions will most likely have to be lifted from the national energy legislations, instead allowing the producers to offer competitive prices to qualified customers in the entire area of the Baltic Electricity Market.

Despite the fact that a number of studies have been carried out[49], and that several recommendations for a "preferred market model" for the common Baltic electricity market have been given, the Baltic actors still haven't reached a consensus on what model to choose. So far though, this has not meant a significant barrier, since the dialogue between the Baltic market institutions is close, and the legislations mainly seem to develop in a harmonised fashion. Also, which market model that eventually should be chosen, will obviously become clearer the more market participants put their own views and requirements into the question. Experiences so far also show that market models can be adjusted according to the market requirements.

In conclusion, we believe that there are no significant limitations for initiating the open market, neither on legislative nor structural level. One example of the latter is that the Baltic countries are connected with each other with strong interconnectors, and that the region can be regarded as one integrated system where occurrence of (persistent) bottlenecks is unlikely. At present, however, there are some practical limiting factors that should be taken into account when evaluating the prerequisites of the common Baltic electricity market, such as the small number of market players, i.e. producers as well as suppliers and eligible customers. Furthermore, it must be noted that the present awareness of the potential market players do not seem to be sufficient to motivate them to put pressure on the market opening.

[49] The two latest were: Integrated Energy Markets for the Baltic States, the EC Synergy Programme Report (February 2001) and Principles of Organisation and Functions of the CBEM, by the three Baltic Energy Institutes (February 2000).

4 Future price development

The reforms in the Baltic countries' electricity industries may change pricing of electricity and the way the power plants are operated. Until now, integrated companies, who dominated the electricity sectors, had monopoly in their areas and could determine the price. In the recent years, the industry has been restructured and the companies have become more corporate-oriented. Regulators who must approve the prices have been put in place. But further deregulation will mean further changes in price setting.

The aim of this chapter is to indicate how prices in the Baltic market may develop in the years to come. Although it seems clear from the previous chapter that there will not be a fully open competitive market in the next few years time, we believe it is relevant to study price development in a would-be market environment. Such an analysis provides us with a reference case that we measure the actual market up to. Also, international power trade will most likely depend on prices that resemble market prices rather than regulated prices. How the currently planned interconnectors to Finland and Poland will influence the Nordic market will depend on development in the Baltic market.

For the analysis, we have used a simple model to assess the development of supply and demand side in the Baltic countries. Although it is not an optimisation model, it allows us to assess the possible price development and need for new capacity in the Baltic region. As well as assessing the feasibility of new investments, the analysis can answer the following questions: Does it pay to upgrade existing assets to prolong their lifetime? Or is the excess capacity enduring, so it would be better to decommission some of the capacity?

We start off with explaining price formation under different systems, before a short overview over the present prices in the Baltic countries. Then we describe the model we have used to estimate prices in a hypothetical competitive market. At last, we discuss the possible outcomes for price development until the year 2010. As many factors are uncertain, we have made a sensitivity analysis for some cases.

4.1 Which prices?

Market reforms in many countries entail a separation of generation and networks. Generation is potentially a competitive activity and a market should cater for the best solution. Transmission and distribution of electricity is a natural monopoly and grid tariffs must be regulated.

There are many ways of reforming the market. It is possible to have a fully competitive wholesale market with only a limited opening of the retail market. In that case, producers and large suppliers (distributors) have access to the wholesale market, while small consumers are captive. Prices to the captive customers must be regulated in some way.

In the short term, it seems that the Baltic countries aim for this type of reform: a competitive wholesale market, but a largely captive retail market. In this case, the wholesale power prices are the most interesting for us.

In the following, we will focus on the wholesale energy price and, when we not explicitly say otherwise, will mean the energy component when talking about power price.

4.2 Price formation in different systems

Price formation is fundamentally different in a regulated system than in a competitive market. Both rationale for investments and the impact of them is different in these two environments.

4.2.1 Prices in a regulated system

In a regulated market, prices are usually regulated to be "cost-plus", i.e. to reflect average costs in the industry (including a regulated return on capital). The regulated companies must get approval for any price increases from the regulator. Often incentives for cost reductions are included in the regulation. The regulated entity plans investment and seeks approval for these investments to be included in the cost-base for price setting. Consequently, prices *increase* as a result of an investment. It is consumers who take the risk, i.e. they pay for investment through regulated prices.

Presently, there are no market prices in the Baltic countries. Prices are either negotiated through bilateral contracts (for customers who are eligible to change supplier) or subject to approval by the regulator (for captive consumers).

Currently a sophisticated methodology is applied to calculate the regulated prices. Future development depends on regulatory methodology, degree of market opening, investments and other factors. It is difficult to predict price development in such an uncertain environment. Furthermore, we do not have enough data to calculate the regulated prices properly since much of the data is considered confidential information and difficult to obtain. We can assume that the regulated prices will increase substantially over the next years since both generation units and networks desperately need upgrading and investments. According to Power in East Europe[50], Latvian electricity prices were envisaged to increase from 3.04 to 4.9 s/kWh (LVL) if Latvenergo's 10-year investment program was carried out. That means an increase of 62 percent!

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50 Central and Eastern Europe and FSU electricity prospects for 2001, special edition, January 2001

Also the degree of cross-subsidisation influences prices to different consumer groups. In Estonia cross-subsidisation was brought to an end 2002, implying a price increase of 10.15 sent/kWh (EEK) to households.

4.2.2 Prices in a market

In a market, prices are determined through the interaction of supply and demand in a market environment. Market prices are based on marginal costs of production: price equals marginal costs (fuel cost and other variable costs) of the most expensive unit that generates.

In the long run, prices are determined by full costs of new capacity (so-called long run marginal cost – LRMC). In the market environment, investors respond to price signals: if prices are adequate to cover the costs of new capacity (included capital costs), investors will find it possible to sell power at the required price.[51] No investments are made as long as prices are too low to cover the costs of new capacity. An investment increases capacity and leads to *lower* prices. If there is over-investment, prices will be too low to cover the costs of new capacity. In a market, investors take the risk.

For several reasons, however, prices can be based on other factors than marginal costs of the system.

Capacity prices

When capacity is scarce, the price may be higher than the variable cost of the marginal generator. If production in all plants is not sufficient to cover demand, prices increase beyond marginal costs. As a result, demand is suppressed until it equals supply. This price increase in excess of marginal costs signals that new capacity is needed and induces investments. In reality, all installed capacity is not necessarily available in each moment. Therefore, prices start rising before the absolute capacity limit is reached. This helps to induce investments in new capacity before we really reach the capacity limit, because of expectation of higher prices in the future.

Market power

When producers can exert market power, they might be able to increase prices beyond the competitive price level. Each producer weighs the return he can get by asking a higher price against the possible loss of sales resulting from the higher price. The more inelastic the demand is (i.e. demand does not respond to price changes), the less the loss of sales and the larger the gain of higher price. On the other hand, the more idle capacity there is in the system, the greater is the possibility to lose sales to another generator.

4.3 Integrated Baltic market

Although it seems clear from the previous chapter that there will not be a fully open competitive market in the next few years time, price development in a

[51] Assuming rational investors.

would-be market environment is highly relevant. A competitive market would deliver the demanded electricity at least cost for the society, thus serving as a useful reference case. Prices in a competitive market would also give an indication about whether existing capacity is sufficient to cover demand or there is any need for new capacity (and which type of capacity). Also, (potential) trade will most likely depend on prices that resemble market price, rather than regulated prices: trade will depend on marginal costs (plus a mark-up depending on potential market power) of the trading parties even in a regulated environment, as the regulated company can cover the other costs through regulated prices.

4.3.1 The model

We have used a simple model to estimate price development in a hypothetical competitive Baltic market. The model takes into account existing generation capacity in all three countries. This information allows us to construct a merit order curve[52] for the area. Comparing the merit order curve with projected load[53] (demand) in the area allows us to determine prices in different load periods: it is the marginal cost of the most expensive plant that generates that determines price in a competitive market.

The model depicts a "typical" winter week. The week is divided into five load periods (morning and afternoon peak, daytime, evening/weekend, night). Stochastic elements, such as sudden load increases, unforeseen outages of plants etc., are not included, nor is the balancing market.

Capacity prices in a market with scarce capacity are taken care of by a multiplicator: as demand approaches the capacity limit, the marginal cost of the last generator is multiplied with a multiplicator. The multiplicator is larger than 1 and increases as capacity gets scarcer.

Supply

Power plants in all three countries are included in the model. Each plant is represented by generation capacity, fuel, thermal efficiency, availability, variable operation and maintenance (O&M) costs and taxes. This information allows us to construct a merit order curve for the region (see Figure 4.1).

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[52] A curve where all generation units are arranged according to their marginal production costs.

[53] We have assumed inelastic demand. The model finds, according to the merit order, which capacity is needed to cover that demand.

Figure 4.1 Merit order curve in the Baltic market in 2002

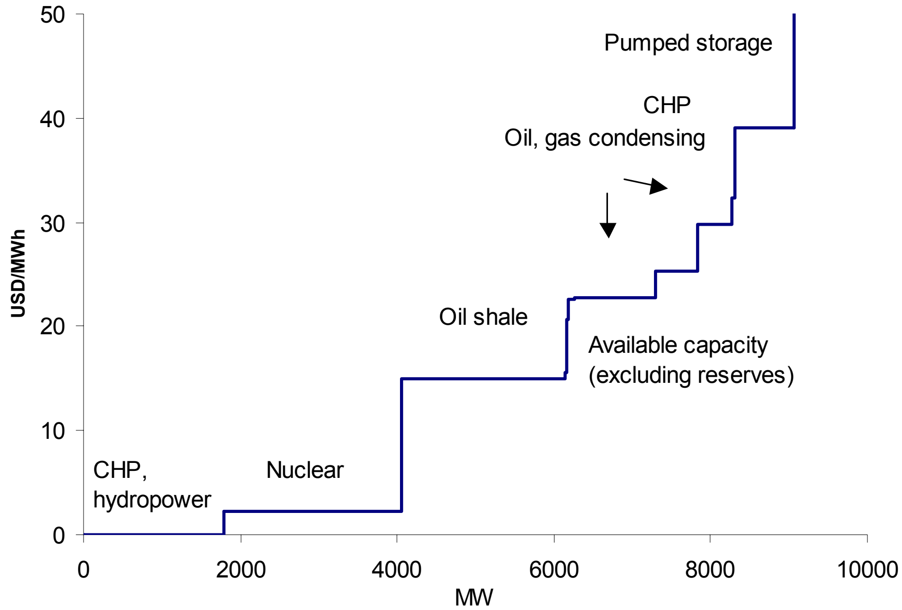


Figure 4.1 shows the merit order curve in 2002. Hydropower and heat-determined power generation in CHPs are the cheapest. The marginal costs of nuclear are very low. Costs of oil shale fuelled plants are low, too, compared to oil and gas condensing plants. Electricity production without cogeneration of heat is even more expensive. The pumped storage plants are the most expensive ones, once we take into account the costs of power purchases.[54]

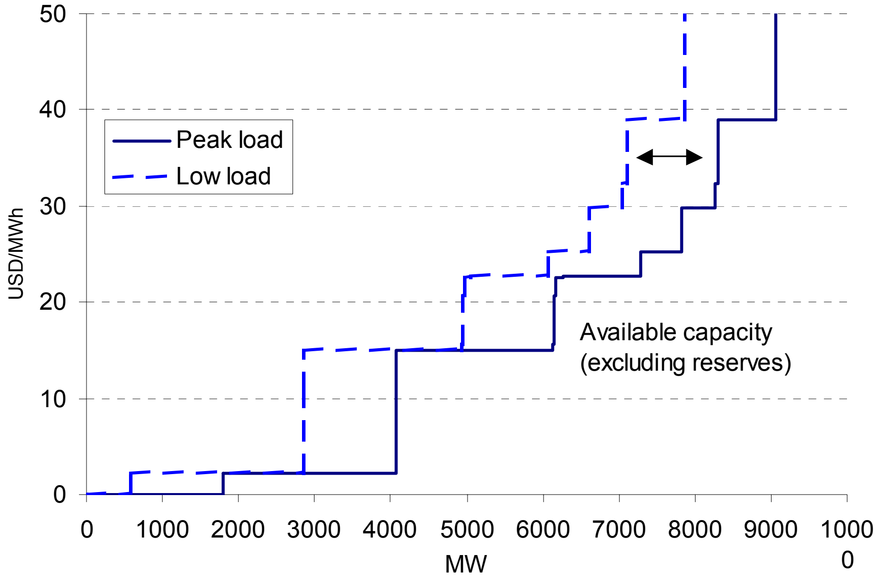
In addition to the mentioned parameters, some other restrictions apply to some technologies. Pumped storage capacity cannot be used for production and pumping water to the reservoir at the same time. Hydropower is in addition to capacity (MW) restricted by water inflow and reservoir capacity. The nominal installed capacity is not always available. In fact, the total capacity in the Daugava cascade is available only during some weeks in spring. The regulating cycle is one week, as the reservoir capacity is limited. Both hydropower and pumped storage are used to balance the system in the Baltic countries, and this reduces variation in other technologies, especially nuclear plants.

The model is a simplified and stylised version of reality. We have not taken into account existing bilateral contracts, as rational market participants would seek to cover their contracted sales from the cheapest source – either from own production or buy at market. We have assumed that hydropower produces only during peak and high load hours (16 hours at daytime), since the water constraint does not allow base load production of hydropower. This is also how the hydropower plants in Latvia and Lithuania are used. Pumped storage produces during peak load (day) and consumes power during low load (night), but only when price differences between the load periods are large enough. (In reality, they may

[54] Pumped storage plants produce power in one period (when prices are high), but consume power in another period (when prices are low) to pump the water up to the reservoir again. The production costs of pumped storage thus depend on power prices during the period of power purchases. Also, as losses occur when pumping, some price difference is required if the pumped storage plants are to operate with surplus.

produce for lower price differences because of system stability reasons, but in that case, they must be compensated through other channels e.g. from the TSO.) This variation in hydropower causes the merit order curve to shift over time – the merit order curve is dynamic. This is shown in Figure 4.2

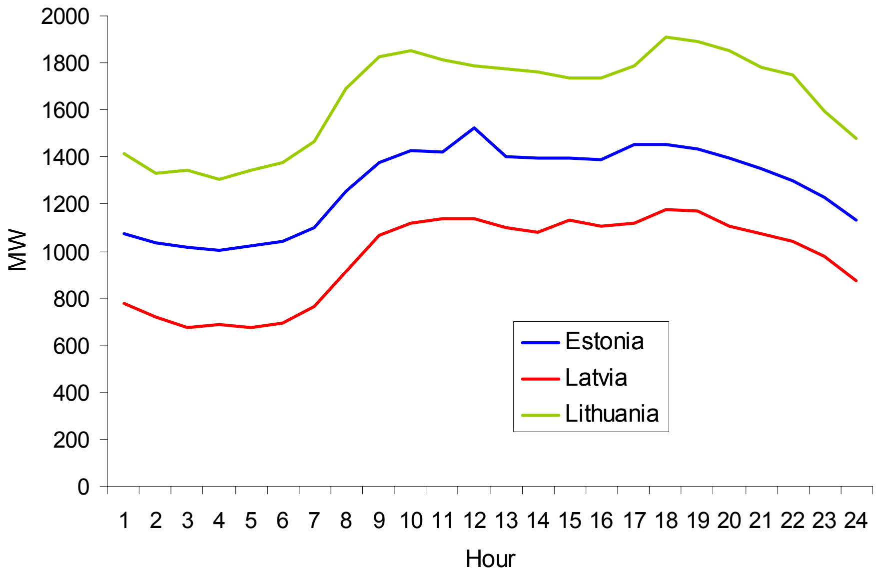
Figure 4.2 Dynamic supply curve



Demand

There is an underlying variation in load, both during the day and over seasons: load is usually higher during daytime than during night, and higher in winter than in summer. Load variation on a winter day is shown in Figure 4.3.

Figure 4.3 Load variation during a day. MW



Source: DC Baltija

International transmission lines and trade

In a national market, prices are determined by the interaction of supply and demand. In a market with connections to other systems, trade flows, too, influence price formation.

For historical reasons, the Baltic countries are connected with each other with strong interconnectors. The region can practically be regarded as one integrated system and occurrence of (persistent) bottlenecks is unlikely.

There are also powerful transmission lines out of the system, to Russia (Kaliningrad, St. Petersburg and Pskov regions) and Belarus (table 2.10). However, trade flows in the last years have been much lower than the existing capacity would allow. One reason for such a low utilisation of the lines has been the desire to become independent of the Russian electricity system; another reason has been non-payment for power (for Lithuanian exports to Belarus). Yet, a smooth running of the Baltic system requires some sales to neighbouring countries (e.g. running of Ignalina depends partly on power sales to Belarus). Unfortunately, we do not have enough information about individual contracts or other trade conditions, as these are now regarded confidential information.

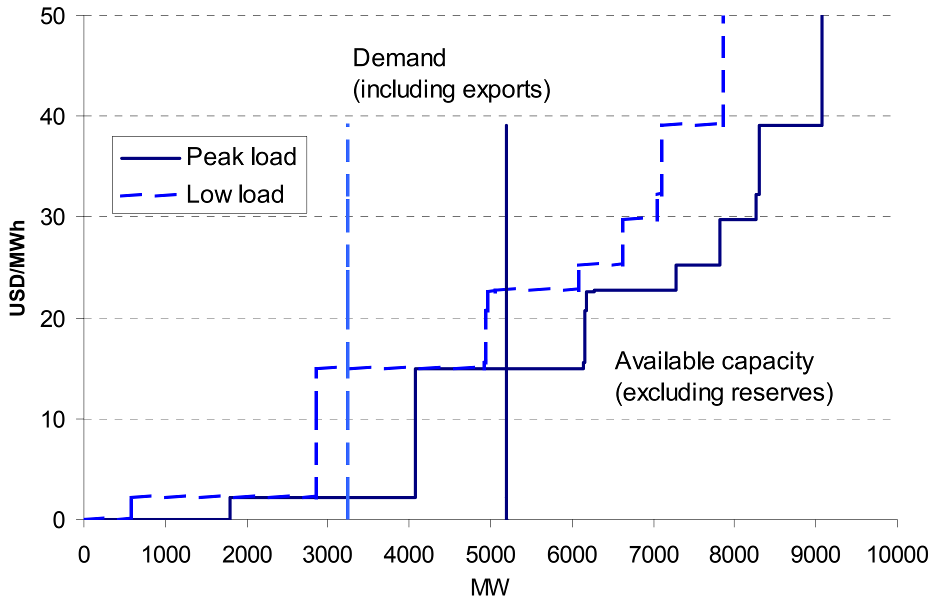
We have assumed base load exports to the Kaliningrad region (350 MW, 3 TWh/year) and Belarus (250 MW, 2.2 TWh/year) in the analysis. This trade does not depend on prices, but represents an extra demand towards the Baltic producers. We return to the impact of different assumptions about trade in a sensitivity analysis.

Market clearing and price formation

In a market environment, price is determined by the interaction of supply and demand: with increasing demand, prices increase and units with higher marginal costs start to produce. At the same time, the higher prices suppress demand. Demand decreases and supply increases until a balance is reached.

Figure 4.4 shows market clearing and price formation in different load periods, low load (night) and peak load (afternoon). The variation between day and night load shown in Figure 4.3 makes also the demand curve dynamic. During low load, demand is low and only the cheapest plants produce: CHPs in cogeneration mode, nuclear and oil shale. Oil shale capacity is not fully utilised. During peak load hours, demand is much higher. The higher load is covered by increased production in hydropower and oil shale plants. Oil shale is still the most expensive plant in production, and prices are still determined by variable costs of oil shale plants.

Figure 4.4 Market clearing in different load periods



Note: Demand curves are shown as vertical lines, since demand is inelastic in the very short term (from one hour to another). In the longer term, downwards-sloping demand curve is assumed.

Demand curves are adjusted for exports.

Prices in 2002

Based on the assumptions presented above, we find that there is considerable excess capacity in the Baltic region at present. As shown in Figure 4.4, capacity in hydropower, CHP, nuclear and oil shale plants is sufficient to cover demand and to determine the price during the whole day. Prices are also shown in Table 4.1.

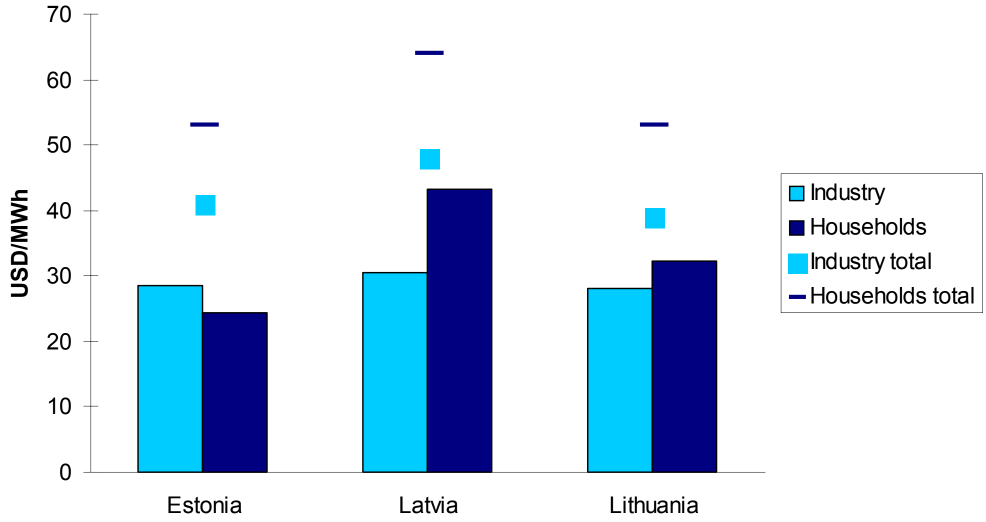
Table 4.1 Calculated Power prices (energy component) in a hypothetical, integrated, competitive Baltic market in 2002. USD/MWh

	2002
Night	15.0
Weekend day	15.0
Morning peak	15.0
Day	15.0
Afternoon peak	15.0
Average	*15.0*

Figure 4.5 depicts total electricity price in industry (large consumers) and households in 2001, together with a calculated power price. The figure suggests that the costs of power production are around 25 USD/MWh in Estonia, and somewhat higher in Latvia (30-40 USD/MWh) and Lithuania (30 USD/MWh). The differences might be due to different production costs or different regulation. Lower prices to households in Estonia are due to cross-subsidisation that was still in place in 2001 (abandoned from 2002). The figures suggest, however, that production costs in Estonia (where power is produced in oil shale plants) are lower than in the other countries. This fits well with reality in generation: oil shale

plants have low fuel costs and are cheap in operation. Although the variable costs of nuclear in Lithuania are low, too, the high fixed costs are most probably included in the cost base and explain the high costs in Lithuania.

Figure 4.5 *Power price (energy component) and total electricity price (excl. VAT) in industry and households in the Baltic countries. 2001*



Note: Power prices have been calculated using grid tariff structure at different grid levels, assuming that industry is connected to distribution grid at 6-35 kV level, while households are connected to 0.4 kV level. The figure should only be used as an indication, as the total prices refer to 2001 and grid tariffs to 2002.

Source: Power in East Europe (May 27, 2002) for total prices in 2001. The National Control Commission for Prices and Energy in Lithuania (personal contact) for grid tariffs in 2002.

Comparison of Table 4.1 and Figure 4.5 suggests that current prices are much higher than a competitive market would yield. However, the regulated prices also include fixed costs of production. In its comments to approval of Eesti Energia's prices for 2002, the Estonian regulator mentions that fuel costs of the Narva power plants have been around 12 USD/MWh.[55] This fits well with our assumptions and results.

Our calculation of competitive prices suggests that prices are well below the level of full cost of new capacity (which is around 23 USD/MWh). That raises also the question whether the upgrading plans of different plants are feasible or not. The next section looks at possible price development and thereby tries to give an answer to that question.

[55] Source: Kokkuvõte: Kommentaarid Eesti Energi AS majandustegevusele ning otsused seoses 2002/2003 majandusaastal kehtivate elektrienergia tariifidega (*Summary: Comments to Eesti Energia's economic activities and decisions regarding electricity tariffs in 2002/2003 financial year),* Estonian Energy Market Inspectorate (www.eti.gov.ee)

4.4 Prices in the future competitive market – reference case

4.4.1 Assumptions about future development

The previous section showed us the situation in the Baltic market at present. Over the course of time, both demand and supply curves shift: demand curve as a result of demand growth, supply curve as a result of decommissioning of old plants, investments in new plants and relative changes in fuel prices. Evaluating these changes enables us to project future price development. In this section, we assess the possible development in supply, demand and trade until 2010 to suggest some price trends.

We have selected two "key" years to analyse: 2005 and 2010. 2005 was chosen because this is the year after the closure of the first block of Ignalina and can thus provide information about the impact of closing the nuclear plant. 2010 is the end of this decade. Also, the second block of Ignalina will probably be closed by 2010. Lack of accuracy about existing data and future development does not justify modelling more years.

In this section we present what we believe is the most realistic development, i.e. our reference case. In section 4.5 we will test how some other assumptions will influence the results.

Supply side – new capacity?

We have taken into account information about decommissioning, commissioning and upgrading of plants, mainly from annual reports of the generation companies.

Much of the capacity in the region is relatively old, from the 1950-ies and 1960-ies. Some apparently old plants are still online. Some upgrading of the plants has certainly taken place, but we lack full information about that. Therefore, we have not taken any plants based on age.

The only major decommissioning is that of Ignalina nuclear power plant. The Lithuanian authorities have agreed to decommission the first block in 2004. The second block is currently subject to discussion with EU and it seems to be decommissioned in 2009. Altogether, this means a decline of 2 600 MW in generation capacity. Klaipeda CHP (11 MW) from 1939 will also be closed permanently in 2002.

However, there are many upgrading plans of the existing plants:

- The Estonian authorities have decided to continue with oil shale based electricity production until 2015, in order to utilise the oil shale resources at existing mines, and because of high costs of alternatives.[56] During 2001-2004, two 200 MW blocks at the oil shale power plants (one at Baltic and

[56] Source: Eesti põlevkivienergeetika restruktureerimise tegevuskava 2001-2006 (*Programme for restructuring Estonian oil shale energy industry 2001-2006)*, Estonian Ministry of Economic Affairs, 2001

one at Estonian plant) will be refurbished. The old boilers will be replaced by a new circulating fluidised-bed boiler technology. This will extend the lifetime of the plants, as well as increase efficiency and curb environmental problems.

- Upgrading of hydropower plants in the Daugava cascade has been going on for some years.
- Total renovation of Riga TEC-1 plant will be carried out in 2001-2004; renovation of Riga TEC-2 will probably start in 2007.
- Modernisation of Lithuanian Power Plant at Elektrenai and Vilnius 3 is planned as a part of the preparation for closure of Ignalina. This will increase efficiency at the plants.
- Kaunas CHP will be modernised in 2001-2004, and generating capacity increased by 100 MW when Ignalina is closed.

In addition, many investments influence the environmental performance and efficiency of the plants. These do not, however, influence the available capacity and merit order curve. Table 4.2 sums up the assumptions that affect the merit order curve (i.e. reduced capacity during upgrading, when it comes online again, increased efficiency after renovation, etc).

Table 4.2 Assumptions about generation capacity in the model. Change from the previous year. MW

Plant	2002	2005	2010	Comment
Klaipeda CHP	-11			Closed in 2002
Baltic PP*	-200	200		Refurbishing of a 200 MW block (fluidised-bed boiler technology); efficiency increases to 36%.
			595	Emission cap* removed after investments in environmental measures
Estonian PP	-200	200		Refurbishing of a 200 MW block (fluidised-bed boiler technology); efficiency increases to 36%.
Riga TEC-1	-129	129		Total refurbishing, efficiency increases to 35%
Kaunas CHP	-170	170	100	Modernisation, efficiency increases to 35%
				Increased capacity when Ignalina decommissioned
Lithuanian PP				Efficiency increases to 42%
Ignalina 1		-1300		Decommissioned
Ignalina 2			-1300	Decommissioned

* There is now an emission cap on Baltic PP: the SO_2 emissions should not exceed 50 percent of the 1980-level today, and 20 percent of the 1980-level from 2005.[57] The total capacity that can be used now is therefore 845 MW, not 1290 MW as installed.[58]

[57] Source: Eesti energiamajanduse erinevad arenguvariandid (*Different development scenarios for Estonian energy sector)*, Estonian Energy Research Institute (www.eeri.ee), 2000

Demand growth

Demand response to price and income changes is crucial for the market balance. Generally, demand increases when income increases, and decreases when price increases. Other factors, such as demand side management (DSM) and energy conservation measures, may also influence demand in addition to the price/income effect.

The Baltic economies are in transition. Consumption growth declined dramatically in the Baltic countries in 1992 and 1993, following the breakaway from the Soviet Union. In the recent years, consumption has varied considerably: for instance net electricity consumption in Estonia showed no growth in 1998 after a growth period since 1994, declined 5 percent in 1999, but increased again 3 percent in 2000. There are many explanations for this development: overall economic decline in the beginning of 1990-ies, restructuring of the economies, with a substantial decline in agriculture[59] (electricity consumption in this sector declined more than 5 times!), increase in the use of electric appliances in households following increase in living standards, increased efficiency in consumption, among others. This indicates that the recent trends (if any are found!) cannot be extrapolated into the future, but future demand must be analysed thoroughly. How will increasing income influence demand? What is the potential of efficiency increase? What are the goals of energy conservation programmes? How will more widespread use of electrical heating influence demand? All these are important questions to be analysed.

Unfortunately, there are very few studies on historic demand in the Baltic countries and even fewer on future demand. We have not found any studies on elasticity (i.e. demand responsiveness on price and income changes).[60] Also, the factors mentioned above suggest a trend shift may have happened – that the former relationship between income (price) and demand is no longer valid. A thorough study of future demand is beyond the scope of this project.

In lack of any studies about relationship between price, income and demand, we have made assumptions about *consumption* growth, rather than demand growth. We have assumed a consumption growth of 1.5 percent p.a., a rather moderate figure. Impact of higher consumption growth will be discussed in a sensitivity analysis.

Trade with neighbouring countries

Future trade and utilisation of transmission lines have a major impact on the results of the analysis. At present, there is excess capacity in the Northwestern part of Russia, but also in Russia demand is growing and capacity is old.

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[58] Source: DC Baltija

[59] Part of this decline has statistical reasons: earlier, collective farms were the customers of electricity companies and grid losses in their areas were regarded as part of their consumption. After the disintegration of collective farms, customers are much smaller: private farms and households. Losses are no longer regarded as part of their consumption.

[60] A study about a future Lithuanian power market (Economic analysis in the electricity sector in Lithuania (Final report), by Elkraft System, COWI, Lietuvos Energija and Lithuanian Energy Institute, April 2002) presents some figures for price elasticities, but in the analysis, demand is assumed to be inelastic.

According to some studies, a balance will be reached shortly after 2005 if no new investments are made. Some investments are certainly planned: the Russian prime minister recently gave backing to a plan to build a new CCGT (combined cycle gas turbine) in Kaliningrad, with the first 450 MW unit to be completed by 2005 and the second by 2010.[61] A full assessment of market balance in Russia is beyond the scope of this study, but critical for development in the Baltic market.

Conditions of trade are also uncertain. There is some concern that if left to the market, Russian companies would dump power in the Baltic market. This might be the case. Another possibility is that Russian companies will exercise market power, thus pressing prices higher. This is probably not the case as long as there is excess capacity in the Baltic region (as long as oil shale plants in Estonia and Ignalina are on line), but may be the case in longer run when generation capacity in the Baltics becomes scarcer.

We have assumed in the base case scenario that trade with the neighbouring countries remains the same during the whole period: there is a base load export to the Kaliningrad region (350 MW, 3 TWh/year) and Belarus (250 MW, 2.2 TWh/year). Impacts of more exports are discussed in a sensitivity analysis.

New interconnectors

There are plans to invest in new interconnectors to neighbouring countries: the PowerBridge between Lithuania and Poland has been discussed since mid-1990-ies, and the Estlink cable between Estonia and Finland since 1998. Both are still on the drawing board, although a decision about the Estlink project is due to fall in October 2002. In this case the cable could be online in January 2004. The question is still whether the potential income is sufficient to cover the investment costs of the cables – about USD 100 million for Estlink and USD 300 million for PowerBridge?

We have not included these two interconnectors in the base line price projection. We evaluate the conditions and rationale behind these investments in section 4.5.

4.4.2 Prices in the future

Based on the assumptions above, we find price development as presented in Table 4.3. The changes in demand and supply curves are depicted in Figure 4.6. The figures suggest that even with a moderate demand growth, prices increase substantially (almost 20 percent) from 2002 to 2005, but are still lower than LRMC in 2005. The main reason for the price increase is decommissioning of Ignalina 1. The magnitude of the price increase can be explained by the oil-shale plants having much lower marginal costs than the next plant (of any substantial size) in the merit order curve. Prices at night are still set by the oil shale plants, but during increasingly more hours oil- and gas-fired condensing plants are needed. They set the price both during daytime, morning peak and even on weekends.

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[61] Power in East Europe, May 27, 2002.

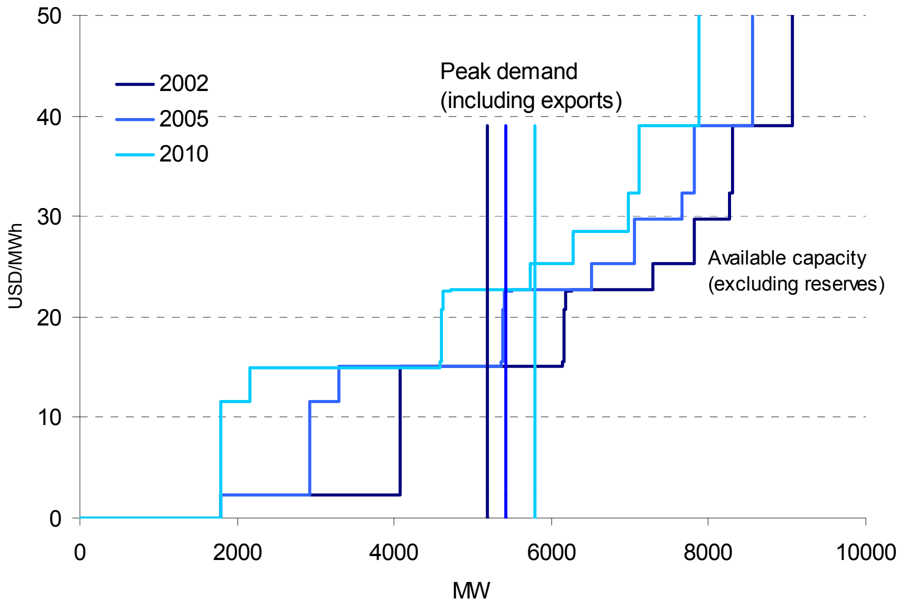
In 2010, after the second block of Ignalina (1300 MW) has been decommissioned, prices increase further and are in the range of LRMC. Oil shale plants produce base load, but it is not sufficient to cover demand even during low load periods.

The rather surprising result that prices at night are higher than during daytime in 2005 and 2010 is a result of the rigid way we have modelled hydropower (production in daytime only), combined with the way hours are grouped into load periods. In reality, production is more flexible. Hydropower production will level out prices between night and day: some hydropower production is shifted from day (low price period) to night (high price period), thus increasing prices during day and reducing them during night. This occurs until prices are equal or until all hydropower capacity is operating. Nevertheless, peak prices will *not* be affected by this shift, since we already have assumed that all capacity is available during peak hours. Also the average price will probably not be affected, since the price fall during night has to be compensated by a price increase during daytime.

Table 4.3 Power prices (energy component) in a competitive Baltic market. USD/MWh

	2002	2005	2010
Night	15.0	16.1	21.4
Weekend day	15.0	16.9	21.5
Morning peak	15.0	15.0	21.2
Day	15.0	15.0	20.8
Afternoon peak	15.0	19.1	25.2
Average	*15.0*	*16.7*	*21.8*

Figure 4.6 Merit order curve and peak demand in the Baltic region in 2002, 2005 and 2010



4.5 Prices in the future competitive market – alternative scenarios

4.5.1 Higher growth rate

In our reference case in section 4.4, we assumed quite a moderate consumption growth in the base case. A higher growth rate, 3 percent p.a., would increase prices considerably both in 2005 and 2010 (Table 4.4).

In 2005, the average price increases only by 2.8 USD/MWh, but morning and afternoon peak prices increase by more and reach 22.8 USD/MWh. The increase in night and weekend prices is much lower.

In 2010, the average price increases by 5.2 USD/MWh. Peak prices increase more than 10 USD/MWh to 31-35 USD/MWh. Also, prices on average are higher than LRMC, so in this case, prices are high enough to support new capacity and investments should occur. However, no more new capacity than 200-300 MW is needed to bring prices down to LRMC again. This implies that scarcity during peak load is not dramatic. This also implies that the results are sensitive to changes in the load profiles: if peak load demand is reduced relative to base load demand, the peak load prices may fall substantially (without increasing low load prices to the same extent).

Table 4.4 High growth scenario: price change compared to base case. USD/MWh

	2002	2005	2010
Night	0.0	1.6	3.4
Weekend day	0.1	0.4	3.4
Morning peak	0.0	7.7	10.1
Day	0.0	4.2	6.4
Afternoon peak	0.0	3.7	10.3
Average	*0.0*	*2.8*	*5.2*

4.5.2 Later closure of Ignalina 2

Decommissioning of Ignalina has major impact on the market balance in the Baltic power market, as the one 1300 MW block constitutes 13 percent of total capacity in the region (in 2010) and is among the cheapest units. Even though the Lithuanian government recently agreed to close the plant in 2009, it is interesting to see the impact of the opposite. For one, this would give an impression of the lower bound of prices - also relevant in case of over-investments in other capacity.

Later closure of Ignalina 2 would only influence prices in 2010. This has major impact on prices: prices would be 5.8 USD/MWh lower on average, 15.9 USD/MWh. Oil shale is the most expensive production capacity most of the time. There is little price variation between day and night, only during afternoon peak hours they rise 5 USD/MWh over the low load prices.

Keeping Ignalina 2 thus postpones the need for new capacity. This result does not hinge critically on the assumed (relatively) low consumption growth, but is also true for considerably higher consumption growth. It's only when consumption growth exceeds 5 percent p.a. that new capacity is needed also in the presence of Ignalina 2.

4.5.3 Tax on CO_2 emissions

According to the Kyoto Protocol, the industrial countries have binding commitments to reduce emissions of six greenhouse gases by at least 5 percent from 1990-levels during the period 2008-2012. All three Baltic States have agreed to reduce their respective emissions by 8 percent in the protocol. However, it is expected that they will have no problems fulfilling their commitments, as the emissions have declined substantially since the break-up of the Soviet Union.[62] Instead, they may have substantial amounts of so-called "hot air" to sell in the international emissions trading market. However, as applicant countries to the EU, the Baltic countries may become obliged to reduce emissions, for instance as a part of an emission permits trading system in the EU. Alternatively, they may be obliged to implement EU-taxes on emissions.

It is still uncertain exactly how the policies will be formulated. In principle, it is possible to obtain the same emission levels with a tax and with a tradable emission permits market. In the case of taxation, the tax will be an extra cost increasing variable production costs. In the case of the permits market, the price of the permits is a shadow price on variable production costs. For the same level of emissions, the tax should equal the permit price.

We will analyse the impact of two different levels of CO_2 taxes on the competitive Baltic power market: 4 USD/tonne CO_2 and 10 USD/tonne CO_2 respectively. Given the US position on the Protocol and likely restrictions in the supply of allowances from Russia and Ukraine, most analysts expect that market prices under the Kyoto framework are likely to be around 10 USD/tonne CO_2e during the first commitment period. However, uncertainties are clearly substantial, as indicated by results from a range of model studies that provide estimates in the range of 3 – 86 USD/tonne CO_2e.[63]

A study carried out by the Stockholm Environment Institute Tallinn Centre[64] analyses scenarios with a CO_2 tax of 4 USD/tonne CO_2 (in their high tax scenario, the tax increases to 20 USD/tonne CO_2 in 2015). We assume that the tax applies to the period 2008-2012 (the first Kyoto period). Hence, we analyse the impact on the Baltic market only in 2010.

Taxes on CO_2 emissions affect plants differently: production costs (measured in USD/kWh) increase most in plants with high emissions (low energy efficiency) and least in plants with low emissions (high energy efficiency). In addition, the

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[62] Lithuania may be an exception if Ignalina is closed in the period.

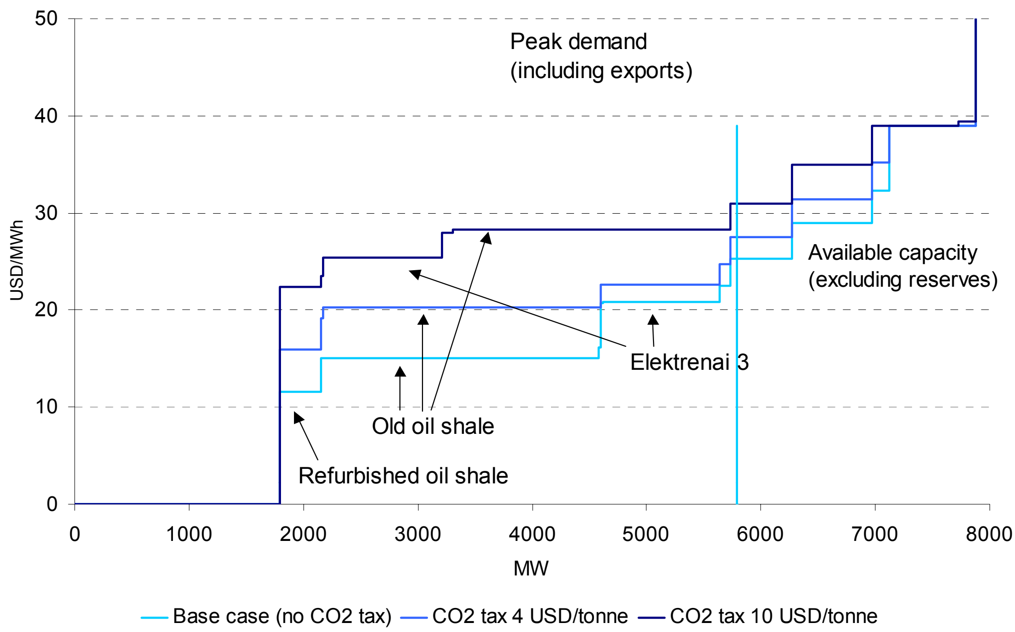
[63] Varilek and Marenzi, 2001: Greenhouse Gas Price Scenarios for 2000-2012: Impact of Different Policy Regimes. Diskussionsbeitrag Nr. 96, Universität St. Gallen, Institut für Wirtschaft und Ökologie

[64] Possible Energy Sector Trends in Estonia. Context of Climate Change. Edited by T. Kallaste, O. Liik, and A. Ots. Stockholm Environment Institute Tallinn Centre and Tallinn Technical University, Tallinn 1999

carbon content differs among fuels. The Estonian oil shale plants, among the cheapest in the Baltic states, have low marginal production costs due to low fuel costs. The efficiency of the plants is, however, relatively low, 27-29 percent. Newer oil and gas-fuelled plants (for instance Elektrenai in Lithuania) are more efficient (30-45 percent), but their marginal costs are higher because of higher fuel costs. Adding a tax on the marginal production costs may change the merit order. This depends largely on the tax level. The tax level of 4 USD/tonne CO_2 increases the cost for old oil shale plants by 0.53 USD/MWh and the cost of the refurbished oil shale plants by 0.43 USD/MWh. The costs of oil and gas-fuelled plants increase only by 0.18-0.29 USD/MWh, depending on efficiency.

Figure 4.7 shows the merit order curves with the alternative levels of the CO_2 tax, together with the base case (no CO_2 tax). The lower tax level (4 USD/tonne CO_2) does not change the merit order of plants. Although the tax increases the marginal costs of oil shale plants more than the costs of the oil/gas fuelled plants, the marginal costs of the oil shale plants are still lower. With the higher tax level (10 USD/tonne CO_2), the most efficient of the gas/oil-fuelled plants (Elektrenai 3) become cheaper than the old (not refurbished) oil shale plants. Hence, they switch places in the merit order curve.

Figure 4.7 Merit order in 2010 with different levels of CO_2-tax



As long as both domestic demand and exports/imports are the same as in the base case, it is the same plants that cover demand: oil shale and newer oil and gas fired plants produce base load, and some older oil and gas fired plants and hydropower contribute in peak load. In that case, the emissions are the same as in the base case.

Table 4.5 summarizes the price changes with the different levels of CO_2-taxes, and Table 4.6 shows prices and full costs of new capacity with different tax levels. Prices increase exactly by the amount of the tax in the plants that determine the price in different load periods. A tax on CO_2 emissions of 4 USD/tonne CO_2 increases the power prices by 2 USD/MWh on average in 2010. Afternoon peak prices increase more than average, while prices in other load periods increase less. With the higher tax level (10 USD/tonne CO_2) prices increase by 7 USD/MWh on average, to 28.8 USD/MWh.

In the high tax case, the resulting average price is higher than the full costs of new (gas-fired) capacity. This means that investing in new capacity becomes attractive – the new, efficient gas-fired plants have lower marginal production costs than the older plants, and can replace them. According to the results, it can be profitable to invest in as much as 2600 MW. The resulting merit order curve is shown in Figure 4.8. In this case, also emissions will be reduced.

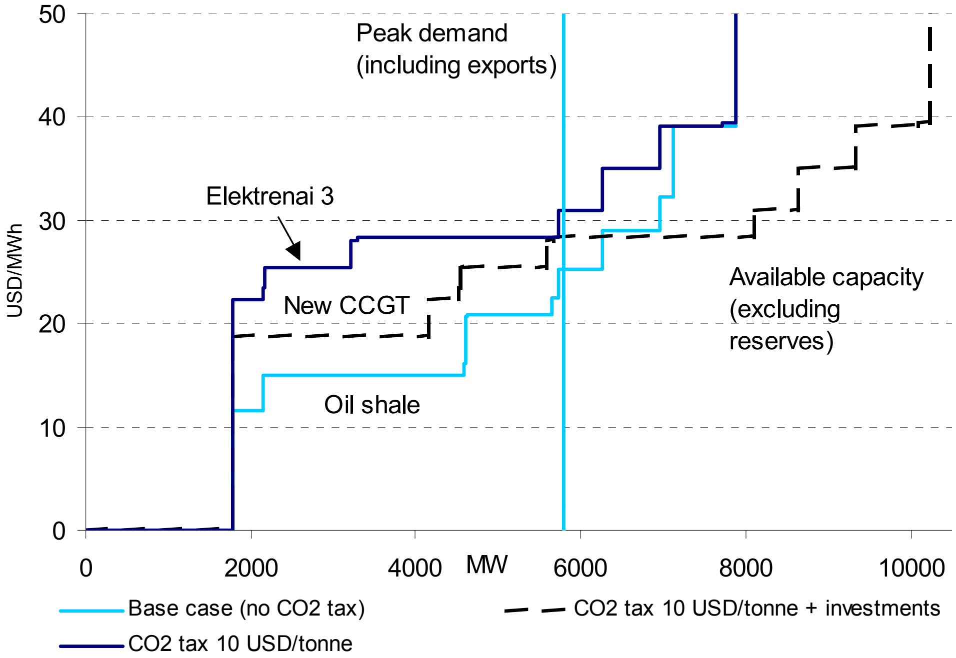
Table 4.5 Taxes on CO_2 emissions scenarios: price increase in 2010 compared to base case. USD/MWh

	4 USD/tonne CO_2	10 USD/tonne CO_2	10 USD/tonne CO_2 – with investments
Night	1.9	7.3	4.6
Weekend day	1.9	7.0	4.7
Morning peak	1.9	7.1	6.2
Day	1.8	7.5	5.0
Afternoon peak	2.3	5.7	3.1
Average	*2.0*	*7.0*	*4.8*

Table 4.6 Average price and LRMC with different CO_2 tax levels. USD/MWh

	Base case	4 USD/tonne CO_2	10 USD/tonne CO_2	10 USD/tonne CO_2 – with investments
Average	21.7	23.7	28.8	26.6
LRMC	22.9	24.3	26.3	26.3

Figure 4.8 *Merit order in 2010 in base case and with a CO_2-tax of 10 USD/tonne CO_2*



We have assumed the same demand level as in the base case. In reality, however, demand may respond to higher prices. We return to that issue below. Also, we have assumed that trade flows to neighbouring countries do not change. When trade depends on prices, taxes may also influence trade patterns. If the trade partners are not subject to the emission tax, their plants become relatively cheaper and may crowd out the Baltic plants. If the trade partners are subject to the same tax, also costs of their plants increase. But it depends on the fuel and efficiency of the plants whether they become cheaper than the Baltic plants or not.

4.5.4 More production in CHPs

In the reference case in section 4.4, we assumed that there is a minimum generation level in the CHPs that is connected to heat deliveries. If this exogenous generation would be higher, more low-cost power would come to the market, pressing prices down. We have reviewed the impact of more low-cost production in a scenario where all CHPs produce at full capacity. It is not a realistic assumption, but will provide us with a "floor price": with more production in CHPs, the prices will be somewhere between the reference prices and the prices in this scenario, all other things equal.

Table 4.7 shows the results. In 2002, prices would be slightly lower. As electricity production in CHPs is higher than in the reference case, there are some hours when CHPs, hydropower and nuclear plants are sufficient to cover all demand – no generation in oil shale plants is required. In 2005, oil shale, CHPs, hydropower and nuclear plants are sufficient. The impact is largest in 2010, when prices are almost 3.5 USD/MWh higher than in the reference case. Prices are lower in all load periods, but the difference is largest during night hours and weekends: while prices were almost the same throughout the day in the reference case, night and weekend prices fall to a lower level when CHPs produce more. Also afternoon peak prices are considerably lower.

Table 4.7 More exogenous production in CHPs: price change compared to base case. USD/MWh

	2002	2005	2010
Night	-1.3	-1.1	-4.4
Weekend day	0.0	-1.8	-4.9
Morning peak	0.0	0.0	-0.5
Day	-1.8	0.0	-2.5
Afternoon peak	0.0	-4.0	-4.4
Average	*-1.0*	*-1.7*	*-3.4*

4.5.5 Trade with Kaliningrad and Belarus

In the base case, we have assumed relatively moderate exports to Kaliningrad and Belarus. Exports to these regions may be considerably higher, either because of more rapid demand growth there or because of better trade environment (Belarus becomes a more reliable trade partner) that enables more efficient utilisation of the whole system (i.e. more exports from the Baltic region instead of new capacity in Belarus and Kaliningrad).

More export to Kaliningrad and Belarus means higher demand towards the Baltic producers. Assuming that 1400 MW are exported (compared to 600 MW in the base case) does not increase prices substantially in 2002, but gives considerably higher prices in 2005 and 2010 (Table 4.8). In 2005, prices are more than 6 USD/MWh higher when exports are higher, and approach full cost of new capacity. In 2010 prices are 7.3 USD/MWh higher than the reference case and considerably higher than LRMC.

Table 4.8 Higher exports to Russia and Belarus: price change compared to base case. USD/MWh

	2002	2005	2010
Night	0.9	6.8	4.9
Weekend day	6.0	5.9	5.3
Morning peak	0.0	7.8	12.9
Day	0.0	7.8	9.3
Afternoon peak	0.0	3.7	12.4
Average	*1.1*	*6.1*	*7.3*

4.5.6 New interconnectors

Plans about interconnectors towards west have been around for a couple of years. Apart from the political reasons (to become less dependent on the Russian electricity system), also economic reasons (potential income from power exports) have been brought up. So far, none of the plans have been realised. So how do the economic arguments fit into the picture – are the potential income flows sufficient to cover the investment costs of the cables?

Both Finland and Poland have access to electricity from other sources and to larger electricity markets than the Baltic. Therefore, one cannot expect bilateral trade agreements that do not take into account power prices from alternative sources.

Estlink

Our estimated prices for 2002 are about 3.3 USD/MWh lower in the Baltic market than in Finland in a normal hydrological year. Average Nord Pool price in Finland was 20.5 USD/MWh in 2001, 5.5 USD/MWh higher than the modelled Estonian price.

Finland is part of the Nordic power market. Although bottlenecks occur from time to time, prices in Finland do not differ much from those in Sweden and Norway. Prices in the Nordic market are expected to increase as a result of tighter market balance as demand grows and surplus capacity is eroded. It is expected that prices reach the level of LRMC between 2005 and 2008. By then, prices are sufficient to trigger development of new gas-fired power plants in Norway.[65] After that, prices are assumed to stabilise at the level of LRMC (assuming rational investors and politicians). The Baltic market is expected to reach the balance later, only after closure of the second block of Ignalina (here assumed in 2009). Before that, prices in the Baltic market are 5 USD/MWh lower on average than in Finland. After Ignalina 2 is closed, the difference shrinks to only 2 USD/MWh.

However, it is not the *average* price difference that determines trade, but the price difference in *each hour*. A small average price difference can conceal large differences in different load periods. The large share of production generated by hydropower in the Nordic market contributes to relatively little price variation over the day compared to predominantly thermal systems. However, the combination of excess capacity and relatively much hydropower (relative to demand) leads to a similar result in the Baltic market. On the other hand, the estimated prices assume full certainty and do not take into account stochastic elements. In reality, price differences may be much larger. Also, by 2010 we may get situations with scarce capacity in peak load, resulting in capacity prices. In that case, peak load prices may be *higher* in Estonia than in Finland.

If there are persistent bottlenecks between the Nordic countries, imports from Estonia can be an alternative to building new capacity in Finland. The plans to build the fifth nuclear reactor in Finland got parliament approval just recently. Environmental policies in the future make the costs of potential exports from Estonia uncertain.

The volatility in the Nordic hydropower system is another factor that may contribute to the viability of the cable: imports from the Baltic region can ensure power supply in dry years.

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65 Since transportation costs of gas are lowest to potential CCGT sites in Norway, LRMC is lower in Norway than in other Nordic countries, and probably lower than in the Baltic countries. Power transmission lines are in most cases sufficient to transport power from Norway to Sweden and Finland.

PowerBridge

The rationale of PowerBridge was to export cheap excess electricity from Lithuania to the Western European markets. Closure of both blocks of Ignalina means a shortfall of about 20 TWh per year eroding much of the excess capacity. At present, there is excess capacity also in the Polish market, as well as in Germany.

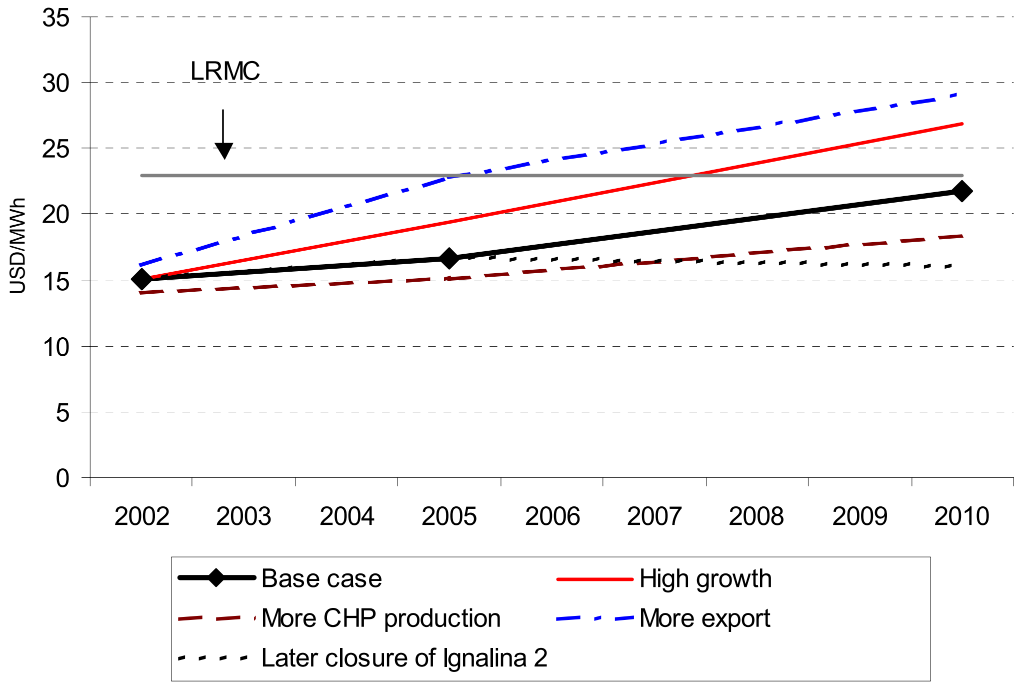
At present, there is no well-functioning market in Poland: prices at the Polish power exchange varied between 99 and 101 Zl/MWh in 2001! The new interconnector can only start operation towards the end of the decade. An assessment of market balance in an isolated Polish market suggests that new capacity is needed from around 2008. There are, however, large price differences between peak and off-peak hours, which may add to the profitability of the cable. Yet, as this assessment does not take into account the market situation in other neighbouring countries, and as there are many uncertain factors in our analysis of the Baltic market, it is difficult to conclude about the viability of the PowerBridge interconnector.

4.6 Comparison of prices in different scenarios

Figure 4.9 sums up the results of the different scenarios (the CO_2 scenario, however, is presented in figure 4.10). Prices in the reference case increase from 2002 to 2010, but do not reach the level of LRMC. If consumption growth or exports are higher, prices will be substantially higher in 2010. Prices will reach LRMC some time between 2005 and 2010. This implies that new capacity is needed.

On the other hand, if Ignalina 2 is not closed in 2009 or overinvestment occurs otherwise, prices will be substantially lower. Also more production from exogenous sources (such as heat-determined production in CHPs) contributes to lower prices.

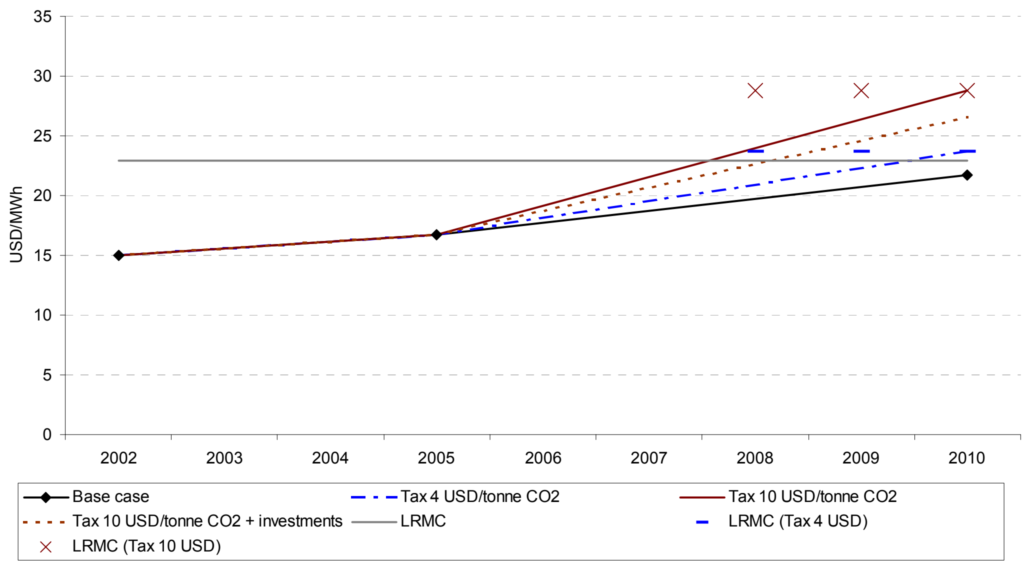
Figure 4.9 Prices in different scenarios for the Baltic power market



Note: Prices in 2002, 2005 and 2010 are model results, the other years are interpolated.

CO_2 taxes (alternatively tradable emissions permits system) increase marginal production costs and prices (figure 4.10). When taxes are 10 USD/tonne CO_2, prices increase beyond the costs of new capacity. In this case, new oil or gas-fired plants can replace the old plants.

Figure 4.10 Prices and LRMC with different levels of CO_2 tax



Note: Prices in 2002, 2005 and 2010 are model results, the other years are interpolated.

4.7 Sources of uncertainty

This study offers a first assessment of market balance and price development in the Baltic countries. In many cases, we have lacked data and assumptions have been made. More accurate data, along with a more detailed study of electricity demand in the Baltic countries, is needed to develop a better model and create more reliable results. A study of electricity industries in Russia (at least Kaliningrad region) and Belarus is also important, as exchange with these regions are crucial to the Baltic market. Here, we point out some sources of uncertainty that affect the price projections.

4.7.1 Trade

Trade with neighbouring countries is the single most important uncertain factor in the analysis. There are high-capacity transmission links to neighbouring countries, but these remain under-utilised and it is uncertain how trade will develop in the future. Development in electricity industries in the neighbouring regions is crucial for their future demand from or supply to the Baltic market. We recommend therefore that a study of these regions be combined with a future study of the Baltic markets.

4.7.2 Uncertainties on the supply side

Market power

It seems clear that the national markets would be highly concentrated and a competitive market outcome is unlikely: there are only few companies in each country. Even if the three countries will pursue an integrated regional power market, the risk of market power remains if no measures to reduce concentration in generation are taken. It is outside the scope of this study to evaluate the magnitude of the risk that the generators will exert market power.

Modelling price outcome in a market with market power is difficult. In the long run, prices may lie between the competitive market outcome and the level of LRMC: by lifting prices above that level, producers attract new investors to the market, thus increasing competition (if there are no restrictions to investments). Where exactly in this range prices will lie, depends on the relative size of the generators, but also on the type and cost of their capacity. On the other hand, if potential investors are aware of the surplus capacity and realise that the high prices are stem from abuse of market power, they refrain from investing. In this case, prices may exceed LRMC also in the longer term.

Fuel prices

There is uncertainty about fuel prices in the Baltic countries. Oil shale is domestic fuel in Estonia and Baltic producers have access to Russian oil and gas. Lower transportation costs, among other things, may contribute to lower prices than in the Western European market. Future development of fuel prices is uncertain, too.

We have calibrated our model so that production costs fit with information from other sources and assumed constant fuel prices over the period. Even if the fuel costs are inaccurate, results will not be substantially changed. The price *range* is still more or less correct. Even if some of the (more expensive) technologies may shift sequence in the merit order curve, the overall picture that emerges is still very much the same: hydropower is the cheapest, and the relatively cheap nuclear and oil shale power plants constitute a large share of capacity. If the plants are switched from oil shale to another fuel in the future, the marginal generation costs will rise and shifts may occur in the merit order curve.

Availability of plants

Much of the capacity in the Baltic system is relatively old and outages probably occur more often than in a modern system. It is possible that we overestimate availability of the plants, thus exaggerating the impression of excess capacity. On the other hand, many of the plants are being modernised, and, among other things, this would contribute to fewer outages and better availability in the future. Thus, in case we overestimate the availability now, we probably do not towards the end of the prediction period.

Environmental requirements and taxes

The old plants may not comply with today's environmental requirements. For instance, the emission limit imposed on the Baltic power plant in Estonia allows only 845 MW of capacity to be used, instead of the 1290 MW installed. This limit is taken into account in the projections, but there may be other similar limits that we are not aware of. Again, this may cause overestimation of excess capacity in the beginning of the period, but probably not in the end, as many of the planned investments improve precisely the environmental performance of the plants.

In spite of investments, some emissions remain, especially CO_2 emissions. The design of the future environmental policy is still uncertain. The analysis of two different levels of CO_2 tax showed that the impact on the Baltic power market depends on the tax level.

Minimum production in CHPs

CHPs constitute a little less than 20 percent of total thermal capacity. We have assumed a certain minimum level of production in CHPs that is connected to heat deliveries (i.e. marginal costs of power production are zero). If these deliveries are higher than we have assumed, more power with zero marginal costs will come to the system and prices will be lower. The lower bound for price is shown in the sensitivity analysis with CHPs producing with full capacity.

Hydropower and pumped storage

The installed capacity of hydropower is more than 1600 MW (14 percent of total); another 800 MW is pumped storage. However, hydropower production is limited by water inflow, not necessarily by installed capacity. We do not know the exact profile of hydropower production over seasons or over day. Instead, we assumed that only 75 percent of total hydropower capacity is available in the modelled winter week, and, apart from one unit at Kaunas plant, hydropower produces only during daytime. If we have overestimated the feasible hydropower production, peak and high load prices have been kept too low. On the other hand, we may have overestimated the costs of pumped storage plants. This means that our peak prices are too high.

Uncertainties on the demand side

Large changes have taken place on the demand side during the last ten years – we have without doubt witnessed a break in trend. This makes predicting future development even more complicated than usually. On one hand, income growth is expected to lead to higher electricity demand. On the other hand, some of the structural changes may have taken place already, thus reducing the future demand growth. There is also considerable potential for more efficient use of electricity and to reduce losses in transmission and distribution, both of which would reduce consumption growth.

It is also uncertain how load (MW) will develop compared to consumption (TWh): will peak load demand increase relative to off-peak or not? Extensive use of new technology could lead us in both directions: more widespread use of PCs, together with growth in service sector relative to industry may increase peak load demand. More two-way-communication and other load-shifting technologies will reduce peak load demand relative to off-peak. More widespread use of electrical heating will also contribute to less variation over day, but increase total demand.

Elasticity

It is typical for regulated markets to predict development in future consumption (usually continuing a historical trend), not taking into account possible price and income effects. This seems to be the case also for the Baltic countries. We have not been able to find any studies about the elasticity of electricity demand, despite being in contact with several research institutes. On the other hand, the value of such an analysis would be limited, if based on relatively old data (i.e. before the trend break).

4.8 Conclusions

We have evaluated price development in a hypothetical integrated, competitive Baltic market. The analysis shows that at present, there is considerable excess capacity in the market. Today's demand (including a small export) can be covered by hydropower, nuclear and oil shale fuelled power plants. A competitive market would yield a low price level, determined by the variable costs of oil shale plants.

Capacity gets tighter towards the end of this decade, but prices will still not reach the full cost of new capacity by 2010 in our base case scenario (with moderate consumption growth). The single most important event is decommissioning of Ignalina nuclear plant in Lithuania. If the decommissioning is postponed, prices will remain under the level of LRMC for many years. On the other hand, higher consumption growth would effectively erode the surplus capacity of today. Alternatively, if the old fossil fuelled capacity (especially oil shale plants in Estonia) will be decommissioned earlier or are imposed production caps, the market will be tighter. Trade with neighbouring countries is an important source of uncertainty: either higher exports to or more imports from other regions can tilt the balance in one or another direction.

CO_2 taxes (alternatively tradable emission permits system) increase marginal production costs and prices. Whether or not the merit order of the plants will change and emissions will be reduced, depends on the tax level, on demand response to the price increase and on a possible change in trade flows. At present, however, it is not yet clear how the details of the climate change policies will be designed.

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