NATIONAL ENERGY STRATEGY

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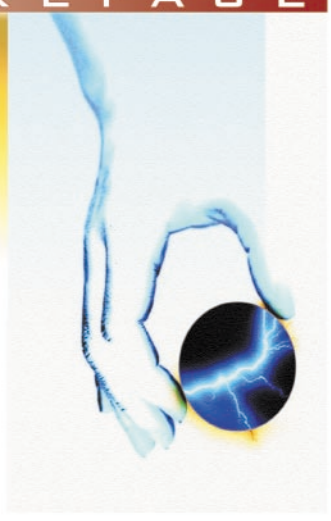
PREFACE



The Law on Energy provides for an obligation to revise Lithuania's National Energy Strategy every five years. The first Strategy was approved by the Government of Lithuania in 1994. Five years later, on 5 October 1999, the Seimas (Parliament) approved the second National Energy Strategy, which was due for a further revision in 2004. However, the resolution of Lithuania to join the European Union and the related pre-accession processes required an approval of a revised Strategy two years earlier than anticipated. This was mainly to establish the exact dates for the final closure of both Ignalina Nuclear Power Plant reactors to meet European Union requirements. Decommissioning of such an important facility has a great influence on the energy sector of Lithuania, thus making it necessary to revise the entire Strategy for the period until 2020.

The period for the preparation of the Strategy and its consideration in public and by different institutions was fairly short. The public, and even political parties and the mass media still have insufficient understanding of some fundamental provisions of the Strategy. With a view to going some way to address this gap, this publication has been developed, following the procedure adopted in 1999 when a similar publication was released after the approval of the Strategy. It contains the text of the National Energy Strategy as well many comments and illustrations, special definition and term explanations and comparisons of many Lithuanian indicators with the data of other countries. These are expected to help the readers to understand better the policy statements of the National Energy Strategy underlying the governmental decisions.

The Ministry of Economy developed the National Energy Strategy on the basis of studies, forecasts and optimising calculations produced by the Lithuanian Energy Institute as well as on structured statistical information analysed by them. This data and information was discussed in detail at various institutions, conferences, seminars and working groups. Undoubtedly, opinions do vary on some essential issues, particularly as regards the future of nuclear and hydro energy. However, it is to be hoped that the emotions and professional "patriotism" will not lead to an unjustified preference for one or another mode of electricity generation. Decision-making will hopefully, in the end, be based on economic reasoning, realistic demand forecasts and the latest achievements in development of energy generation technology. The final decisions should be made by those choosing to invest in one technology or another, after comprehensive economic evaluations of the profitability of alternate investments.

The National Energy Strategy was developed in line with the fundamental provisions established in the Law on Energy, stating that the long-term planning of the energy sector must be defined with regard to all sectors and general objectives (energy demand forecasts, electricity, heat supply, environmental protection etc.). However, to evaluate the interaction between the sectors, an attempt was made to achieve an integrated and

uniform approach to all energy sectors. Based on modern strategic planning methods, the Strategy highlights the strengths of the energy potential, the favorable opportunities to gain advantages and the threats that may produce painful effects and must therefore be minimized. The analysis which was done, contributed to the formulation of strategic goals and planning for State actions and measures to achieve those goals.

The scenarios for the potential energy sector development were designed, taking account of the general provisions of the energy policy and projections of the economic development in Lithuania, together with the lifetime of the main energy units, the country's international commitments, environmental requirements, available technologies and energy development trends throughout the world and particularly in the neighboring countries.

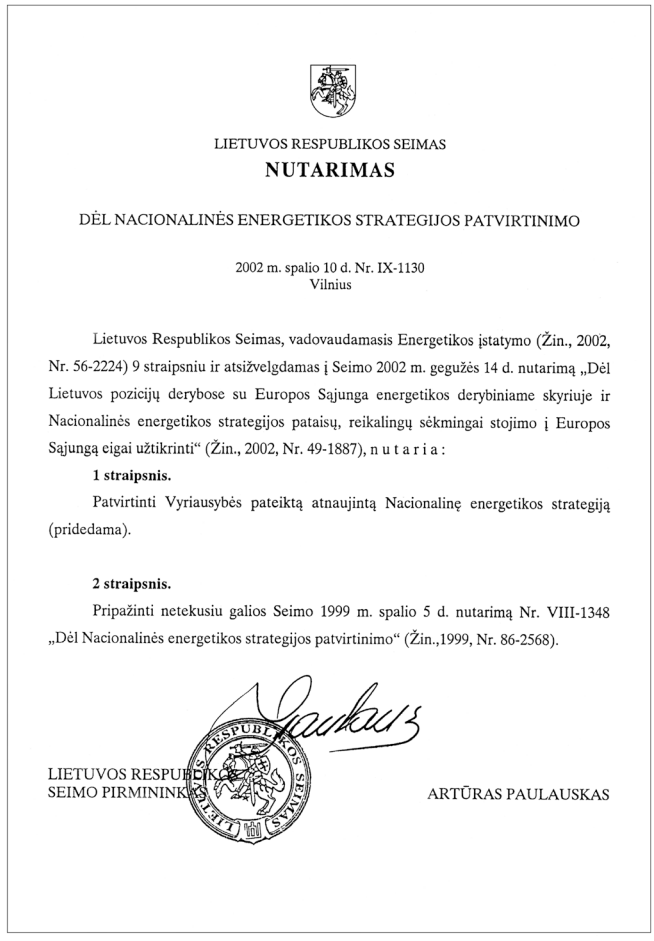
The revised Strategy adheres to the previous approach to economic development scenarios and energy demand forecasts. It retained a great deal of the provisions presented in the 1999 Strategy. However, many of these provisions have been redefined with figures, dates and tasks. Some provisions were omitted in 2002 Strategy owing to their successful implementation, e.g. the power sector was reorganized into independent activities of power generation, transmission and distribution and privatization of the energy sector is proceeding.

The development of the 2002 Strategy was based on thorough evaluations of the latest European Union directives and recommendations laid down in the EU Green Paper and European Union Energy Charter Treaty.

The development of the new Strategy took place at the time of Lithuania's negotiations for its accession to the European Union. Energy issues were dealt with in a separate chapter; the negotiations opened on 11 June 2001 and were successfully closed in exactly a year, on 11 June 2002. The process of the negotiations had an impact on a number of highly important strategic provisions, including the final closure of Ignalina NPP Unit 2 by the end of 2009 and building up of 90-day stocks of petroleum products by 2009. The Strategy also provides that all environmental directives of the European Union will be implemented in the energy sector of Lithuania in a timely manner. The negotiation achievements contributed to the invitation of Lithuania to join the European Union at the European Summit in Copenhagen on 12-13 December 2002.

We believe that the revised National Energy Strategy provides for a proper future development of the Lithuanian energy sector until 2020. We hope that it will be successfully implemented with the combined efforts of Lithuanian governmental institutions, energy companies and future investors and thus promote economic and social progress in the Republic of Lithuania.

Professor Jurgis Vilemas
Director, Lithuanian Energy Institute



LIETUVOS RESPUBLIKOS SEIMAS

NUTARIMAS

DĖL NACIONALINĖS ENERGETIKOS STRATEGIJOS PATVIRTINIMO

2002 m. spalio 10 d. Nr. IX-1130
Vilnius

Lietuvos Respublikos Seimas, vadovaudamasis Energetikos įstatymo (Žin., 2002, Nr. 56-2224) 9 straipsniu ir atsižvelgdamas į Seimo 2002 m. gegužės 14 d. nutarimą „Dėl Lietuvos pozicijų derybose su Europos Sąjunga energetikos derybiniame skyriuje ir Nacionalinės energetikos strategijos pataisų, reikalingų sėkmingai stojimo į Europos Sąjungą eigai užtikrinti“ (Žin., 2002, Nr. 49-1887), n u t a r i a :

1 straipsnis.

Patvirtinti Vyriausybės pateiktą atnaujintą Nacionalinę energetikos strategiją (pridedama).

2 straipsnis.

Pripažinti netekusiu galios Seimo 1999 m. spalio 5 d. nutarimą Nr. VIII-1348 „Dėl Nacionalinės energetikos strategijos patvirtinimo“ (Žin.,1999, Nr. 86-2568).

LIETUVOS RESPUBLIKOS
SEIMO PIRMININKAS ARTŪRAS PAULAUSKAS

Official translation

Seimas of the Republic of Lithuania

Resolution

On the Approval of the National Energy Strategy

10 October 2002 No IX-1130
Vilnius

The Seimas of the Republic of Lithuania, invoking Article 9 of the Law on Energy (*Valstybės Žinios* (Official Gazette), 2002, No 56-2224) and having regard to the Resolution of the Seimas of 14 May 2002 on Lithuania's Position in Negotiations with the European Union in the Negotiation Chapter on Energy and Amendments to the National Energy Strategy Necessary to Ensure a Successful Course of EU Accession, has resolved:

Article 1.

To approve the updated National Energy Strategy submitted by the Government (attached thereto).

Article 2.

To repeal Resolution of the Seimas No VIII-1348 of 5 October 1999 on the Approval of the National Energy Strategy (Official Gazette, 1999, No 86-2568).

Chairman of the Seimas
of the Republic of Lithuania Artūras Paulauskas

APPROVED
by Resolution No IX-1130
of 10 October 2002

1 GENERAL PROVISIONS

1. The energy sector of Lithuania, according to its importance, the number of employees (about 14% of industrial employees), the total value of capital assets of energy enterprises (about 25% of the total assets of the enterprises in the country) and the amount of expenses for the acquisition of energy resources, which are imported into Lithuania, is one of the most significant sectors in the country. The energy sector comprises interrelated energy systems (electricity, district heat supply, oil, natural gas, coal, as well as indigenous fuel and renewable energy resources), which consist of the entirety of enterprises and equipment intended for the extraction, generation, transformation, transmission, distribution and consumption of different energy resources. The inherited extensive energy sector, which is oriented towards substantial, yet inefficient consumption of electricity and oil products, as well as towards considerable exports, does not conform to the current requirements in its essential characteristics (efficiency, management principles, structure, etc.). Therefore, the recent national policy is primarily focused on substantial restructuring of the energy sector, the reorganisation and privatisation of the energy sector, as well as the implementation of the European Union (EU) directives.

The National Energy Strategy, which was approved by Resolution of the Seimas No VIII-1348 of 5 October 1999, formulated the key provisions of the Government on the restructuring and development of the energy sector for the period until 2020. Although the Law on Energy provides that the National Energy Strategy must be revised and updated ***every five years***, the Government, taking into account Lithuania's striving to complete negotiations for EU membership in 2002 and to become an EU member in 2004, prepared this updated National Energy Strategy (hereinafter referred to as the Strategy). The Strategy contains particular decisions on conditions and terms of the final decommissioning of the Ignalina NPP, considers new environmental requirements, as well as revises the energy development trends established in 1999. When updating the Strategy, account has been taken of significant changes in the economy and energy sector, use has been made of the acquired experience and information required for the planning and forecasting of the development of individual energy sectors, and account has been taken of the plans for the energy sector development in Lithuania and neighbouring countries, and of global trends in the area of environmental protection and market liberalisation.

The Law on Energy of the Republic of Lithuania establishes the following requirements for the contents, procedure for the adoption and implementation of the National Energy Strategy:

- the Strategy shall determine energy development trends for a twenty-year period;
- the Strategy shall be approved by the Seimas (Parliament) of the Republic of Lithuania upon the recommendation of the Government of the Republic of Lithuania;
- the Strategy shall cover all energy sectors and it shall be subject to revision at least every 5 years. The Strategy shall be prepared, revised and implemented using State budgetary and other funds.

The strategic provisions of the ***European Union*** defined in the ***Green Paper*** 2000 are as follows:

- completing the EU internal energy market and reforming the energy tax system;
- restricting the growth of energy demand, saving energy and promoting new energy-efficient technologies;
- reforming the transport system and promoting clean urban transport;
- mandatory introduction of energy saving thresholds in buildings and incorporating renewable energy sources in new buildings;
- promoting renewables, research into future types of nuclear reactors and methods of radioactive waste management;
- accumulating fuel stocks, expanding the use of natural gas and maintaining a minimum coal production platform;
- continuing the dialogue and strategic partnership with Russia.

The National Security Strategy envisages that the country could be threatened by the following problems in sectors of the economy, which are important for national security:

- the excessive dependence of the Republic of Lithuania on strategic raw materials and energy supply from a single country; or a high proportion of foreign capital from an economy with an insecure and unstable free market;
- the takeover of assets for political purposes with a view to pursuing activities damaging economic security in the sectors of economy and facilities that are strategically important;
- poor performance of economic and energy sectors that are strategically important and malfunctioning of particular strategically important facilities, improper use of such facilities or failure to use them, to the prejudice of State interests.

2. The Strategy has been prepared:

1) applying the experience acquired from the preparation of the second National Energy Strategy approved in 1999;

2) taking into account the development of the country's economy and energy sectors during the period since the restoration of independence, their current status and the key provisions of the Long-term Strategy for Lithuania's Economic Development until 2015 approved by Resolution of the Government No 853 of 12 June 2002;

3) taking into account global energy development trends, as well as trends and basic provisions in energy sector development in the ***European Union*** countries;

4) on the basis of the experience of Western, Central and Eastern European countries;

5) on the basis of the analysis carried out in different studies commissioned by the Ministry of Economy and prepared by national energy specialists in co-operation with foreign experts;

6) on the basis of the provisions laid down in the executive summary of the revised and updated National Energy Efficiency Programme approved by Resolution of the Government No 1121 of 19 September 2001;

7) by applying modern methods of economic planning (forecasting and optimisation);

8) taking into account the European Union *Acquis communautaire* and the course of negotiations with the EU;

9) taking into account the Law on the Basics of ***National Security***.

The energy policy in Lithuania is significantly influenced not only by internal factors of the country, but also by external factors. The most distinctive trend of the energy sector development in the European Union and many other developed countries is universal and free competition, an open energy market in each country and between countries, as well as stricter environmental requirements.

The current energy sector has its strengths and weaknesses. With more efficient use of available opportunities and existing capacities, the energy sector can make significant contribution to more rapid economic growth of the country and its integration into the economic structures of the European Union, avoiding unforeseen threats and troubles.

3. Strengths:

1) Energy capacities are sufficiently developed: power plants, an oil refinery, an oil import and export terminal, a transshipment terminal for petroleum products, natural gas and district heating systems;

2) The primary energy balance is well-structured and dominated by natural gas, petroleum products and nuclear energy;

3) A possibility to use different fuels in the majority of energy enterprises helps to ensure the reliability of energy supply and to maintain comparatively low electricity and heat prices, as well as low environmental pollution.

4. Weaknesses:

1) Due to major economic decline in Lithuania and neighbouring countries, the available energy potential is not used to the full;

2) The Lithuanian electricity and gas networks have no direct connections to the energy systems of Western Europe, thus, they are dependant on a single supplier of natural gas and have no opportunities to integrate into the power systems of Western and Central European countries;

3) The use of energy is still inefficient in many areas of the national economy. District heating systems of residential houses and other buildings constructed before 1990 are not designed appropriately for the rational use of energy, and their modernisation requires considerable investments;

4) A large amount of radioactive waste and spent nuclear fuel has accumulated; the funds necessary for its safe disposal have not been accumulated; reserves of petroleum products conforming to European Union requirements have not been built up and natural gas storage facilities have not been set up;

5) A number of electricity networks and substations, as well as of pipelines are physically and morally worn; a significant number of towns and settlements have not yet connected to the natural gas supply system.

5. Opportunities:

1) Integration into the liberal energy internal market of the EU and the restructuring of the energy sector will accelerate the creation of the competitive energy market in Lithuania and increase the efficiency of energy enterprises;

2) A better use of energy-saving potentials will reduce the rates of growth of energy demands and energy-generating capacities, thereby facilitating the solution of environmental issues and reducing investment demands;

3) The existing gas pipelines allow a substantial increase in the consumption of natural gas. A transit gas pipeline from Russia to Western Europe, if constructed across the territory of the country, would highly increase the strategic reliability of supply;

4) The installation of an interconnection with the Polish power system will allow integration into the Western European electricity market reducing the vulnerability of the economy to the disruption of, or significant decrease in, the supply of energy resources from one country for various reasons, more efficient utilisation of the Kruonis HPSP, as well as a possibility to receive income from electricity transit;

5) The share of renewable and indigenous energy resources (wood, peat, various combustible wastes, wind and hydro energy, etc.) in the primary energy balance will further increase; their potential has so far not been sufficiently used;

6) The existing district heating systems make it possible to expand substantially the combined heat and power generation thereby enabling more efficient consumption of primary energy;

7) Financial support by the European Commission and other donor countries for the decommissioning of the Ignalina NPP will be extended for several decades. This will help consumers to avoid any additional tax burden related to decommissioning, in particular to the management of radioactive waste and spent nuclear fuel, at the end of the lifetime of the Ignalina NPP.

6. Threats:

1) About 90% of primary energy is imported from a ***single supplier***, therefore, energy supply to Lithuania is vulnerable. However, this vulnerability will significantly decrease through future membership in the European Union, planned ratification of the European Energy Charter, political and economic developments in neighbouring countries, as well as alternative supply sources of electricity and petroleum products envisaged in this Strategy. The development of the use of indigenous and renewable energy resources foreseen in this Strategy will gradually reduce dependence on primary energy suppliers;

In 2000, *imported energy resources* such as coal, natural gas, oil, petroleum products and nuclear energy accounted for 86.7% in the primary energy balance of Lithuania ***(Fig.1.1)***. However, according to the principles of international statistics, the share of the energy resources produced in Lithuania amounted to 43.3% of the country's primary energy balance of year 2000. Due to the high security of nuclear energy supply, the electricity generated by nuclear power plants is considered a local energy source, irrespective of the country from which the nuclear fuel was imported.

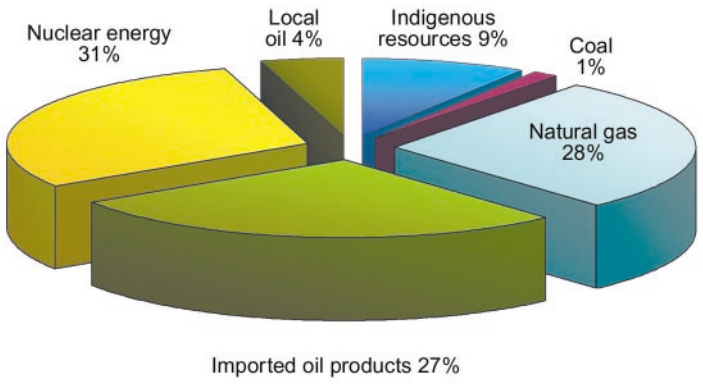
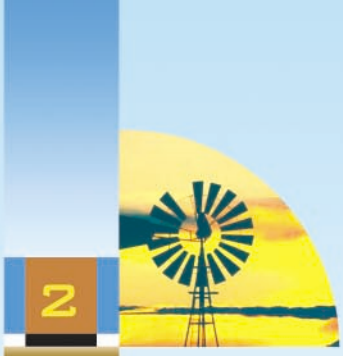


Fig. 1.1. Structure of Lithuanian primary energy balance in 2000

2) The early closure of the Ignalina NPP without the required financing from the European Union and international financial institutions would become an unbearable burden on the economy of the country;

3) As a result of the slow modernisation of district heating systems, a number of consumers are disconnecting from these systems, and this may cause economic and social problems;

4) As a result of reliance on imports of primary energy resources, the economy of Lithuania is highly dependent on the general situation in global energy resource markets. Any delay in accumulating experience and slow transition to the latest technologies in electricity and heat generation, as well as higher prices of imported fossil fuel will lead to an inevitable rise in energy prices for consumers.



OBJECTIVES OF THE ENERGY STRATEGY

7. When setting up the main objectives of the National Energy Strategy, account was taken of the essential requirements and provisions of the Europe (Association) Agreement, the Energy Charter Treaty, other international treaties and European Union directives in the area of energy, as well as of the principles and guidelines of energy policy formation in the European Union and individual Member States.

The future energy sector of Lithuania will constitute an integral part of the advanced economy in a modern society that will ensure reliable and secure energy supply to all economic sectors at economically justified prices, taking into account actual costs and operational efficiency. It will be environment-friendly, create favourable conditions for further progress of the country, be integrated into the Western and Eastern energy systems and competitive in an open international energy market. It will consist of well-balanced energy sectors enabling further development of the society and economic growth.

8. Taking into account the key factors that shape the energy policy, the following ***strategic objectives*** of the Lithuanian energy sector have been set:

1) to ensure a reliable and secure energy supply at least cost and with minimum environmental pollution, as well as constantly enhancing the operational efficiency of the energy sector;

2) to liberalise electricity and natural gas sectors by opening the market in accordance with the requirements of EU directives;

3) to privatise energy enterprises subject to privatisation in the natural gas transmission and distribution and power sector, as well as to continue privatisation of oil refining and transportation enterprises;

4) within the terms agreed with the European Union, to develop and start performing a set of measures facilitating the implementation of the European Union environmental directives in the energy sector, as well as to ensure compliance with nuclear safety requirements;

5) to ensure that 90-day stocks of crude oil and petroleum products are built up by 2010 according to the agreed schedule;

6) to prepare for the decommissioning of the reactors of the Ignalina NPP, the disposal of radioactive waste and the long-term storage of spent nuclear fuel;

7) to integrate the Lithuanian energy systems into the energy systems of the European Union within the next 10 years;

The defined ***strategic objectives*** add to and elaborate on the goals for regulation of energy activities, established in the Law on Energy of the Republic of Lithuania:

- security of energy supply;
- efficient use of energy sources and energy;
- mitigation of the adverse impact of energy activities on the environment;
- promotion of justified competition;
- promotion of the use of indigenous and renewable energy sources.

8) to further develop regional co-operation and collaboration with a view to creating a common Baltic electricity market within the next five years;

9) to pursue an active policy of integration into the Western and Central European electricity markets and ensure that conditions conforming to the Energy Charter, EU legislation and practices are applied to the transit of energy resources through Lithuania;

10) to increase the efficiency of district heating systems;

11) to achieve that the share of the electricity generated in the combined ***heat and power operation mode*** would account for at least 35% in the electricity generation balance at the end of the period**.**

The use of primary energy sources is far more efficient in cogeneration power plants (CHP) with combined power and heat generation ***(Fig. 2.1)***.

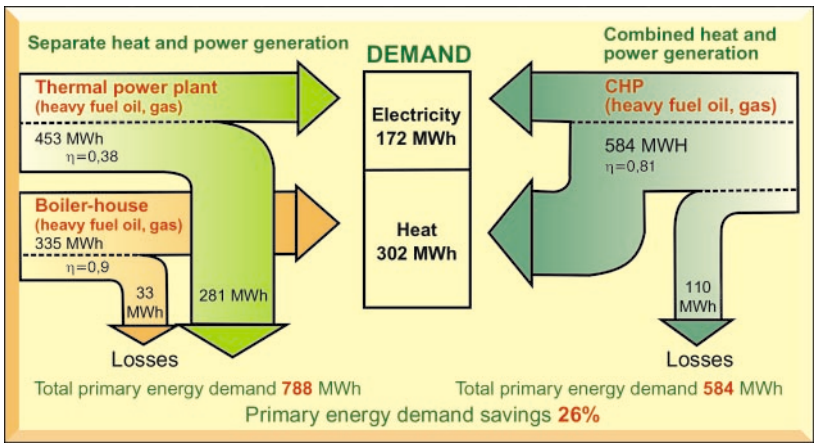


Fig. 2.1. Energy flows for combined and separate heat and power generation

12) to strive for a share of renewable energy resources of up to 12% in the total primary energy balance by 2010;

13) to improve energy sector management, i.e. strengthen institutions in the sector, improve the skills and knowledge of specialists of those institutions.

3 ECONOMIC DEVELOPMENT FORECAST

9. In this Strategy, like in the National Energy Strategy approved in 1999, the same scenarios have been chosen: 1) fast economic growth scenario, 2) basic scenario, 3) slow economic growth scenario (***Fig. 3.1***).

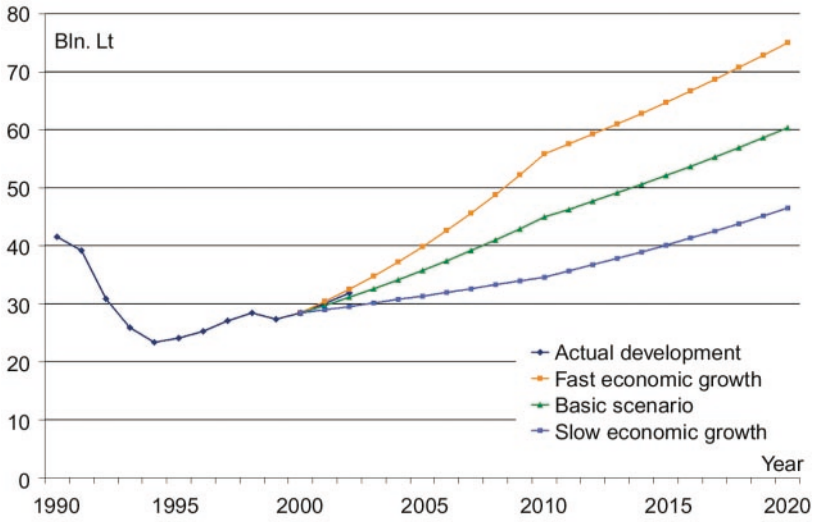


Fig. 3.1. Country's GDP growth scenarios

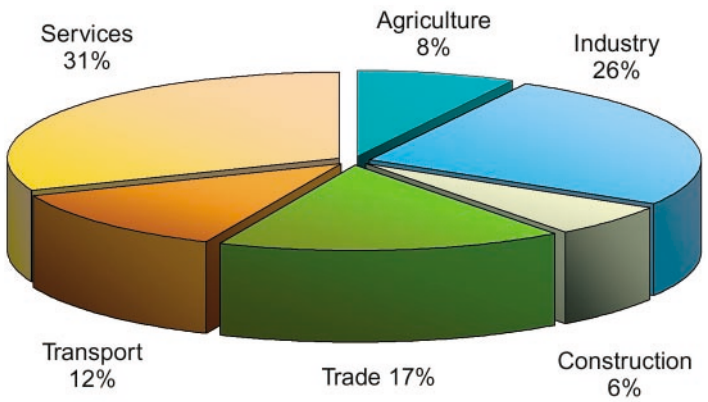


Fig. 3.2. Country's GDP structure in 2000

Gross domestic product (GDP) is the value of domestic goods and services produced for final consumption in market prices in the period under review (within a year, as a rule). GDP is one of the key statistical figures characterizing the development of the national economy, widely used for drawing international comparisons and making economic analyses. Normally, GDP is expressed either at current prices or constant prices. Presently, GDP calculation using constant prices is based on the prices of 1995. The dynamics of GDP per year in terms of constant prices serves as a base for measuring the country's economic growth and for forecasting future growth. The Lithuanian Department of Statistics provides, on a yearly basis, the assessment of the contributions made by different branches of economy ***(Fig.3.2)*** and different regions to the country's GDP.

The fast economic growth scenario foresees very high rates of economic growth in Lithuania during the period until 2020, i.e. on average 5% per year (7% until 2010 and 3% after 2010) assuming that: 1) the expansion of the Lithuanian industry would

be very fast; 2) the common policy of economic development would be very favourable to large investments intended for the modernisation of the economy and the acquisition of new technologies; 3) technical and economic assistance by the EU would be generous and efficiently used.

The low average annual growth rates of GDP in Lithuania (2% until 2010 and 3% in 2011-2020) forecasted in the slow economic growth scenario could be a result of very slow pace of economic restructuring, insufficient domestic and foreign investments, unexpected economic and political crises, slow privatisation of ***infrastructure*** enterprises, etc.

The basic scenario is based on the economic development trends, which have been provided in the forecasts of macroeconomic indicators for the years 2002-2005 prepared by the Ministry of Finance, extending them to the year 2010 and assuming that a GDP growth rate would be 4.7% until 2010 and 3% after 2010 (on the average 3.85% during the period from 2000 to 2020). The common assumption of the three scenarios is that after the year 2010, upon the expiry of the first phase of economic restoration, GDP growth rates would be 3% per year.

Infrastructure means the entirety of the production and non-production branches of economy serving the overall reproduction process and enabling this process. The infrastructure of a country comprises roads, communications, transport, construction, energy generation, transmission and distribution companies, health care, education, etc. The infrastructure can be divided into the production infrastructure directly serving the material production branches and non-production or social infrastructure.

4

ENERGY DEMAND FORECAST

MAED (Model for Analysis of Energy Demand) is a simulation model used for forecasting final energy demand. In 2000, the International Institute for Applied Systems Analysis (Austria) in cooperation with International Atomic Energy Agency produced a new version of this model. Based on the detailed analysis of the statistical data on energy consumption, this model is used to quantify the relations between the energy demand and its determinants.

10. The new version (2000) of the Model for Analysis of Energy Demand (***MAED***) widely applied in Western countries in forecasting energy demand was used. This version offered better opportunities to analyse energy consumption in economic sectors depending on mutual relationship between the factors determining consumption and tendencies of their changes.

In drawing up the energy demand forecast, detailed information on the GDP growth, its structural changes, development of social indicators, technological indicators of energy consumption by economic sectors (industry, construction, agriculture, transport, household, trade and services sector), changes in energy consumption and other indicators was used.

11. Final energy demand has been predicted by estimating energy saving potential in particular economic sectors in accordance with the executive summary of the National Energy Efficiency Programme revised and updated in 2001. The total increase in energy efficiency has been predicted by taking into account a reduction in ***energy intensity***, i.e. a decrease in the final energy consumed per GDP unit. Final energy means the share of primary natural resources (coal, natural gas, oil, etc.) and secondary energy resources (electricity, petroleum products, district heat, etc.), which is consumed for a particular type of industrial production, for a desired quantity of services provided by the services sector and a desired level of living conditions. Final energy is directly consumed by ***final consumers*** (industrial and agricultural enterprises, enterprises in the transport and services sector, individual consumers, etc.) in their equipment.

Energy efficiency is most frequently judged by the indicator of ***energy*** (primary or final) ***intensity***, i.e. the ratio between the total energy consumption and national GDP. Various statistical publications and special studies mostly use the indicator of the ***primary energy intensity***. In order to compare the energy intensity in different countries, GDP is recalculated using the constant prices of 1995 and national currencies are estimated in USD according to the official exchange rates. Based on this indicator, the energy intensity in many Central and East European countries is 3-5 times (in Lithuania - 6 times, in Bulgaria, Russia and Ukraine - more than 10 times) higher than the average for countries of the European Union ***(Fig. 4.1)***.

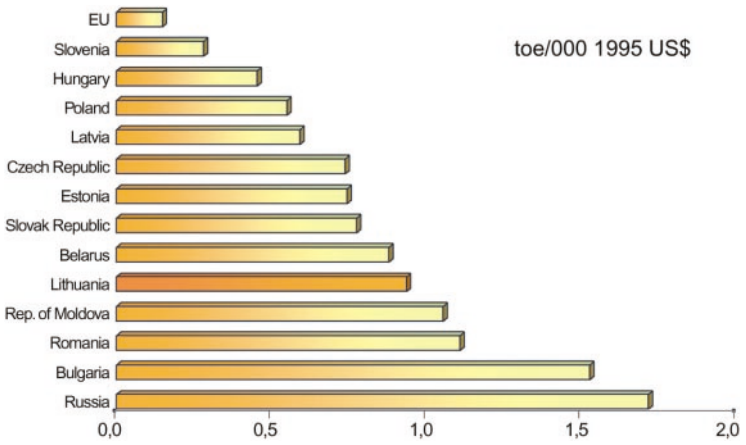


Fig. 4.1. Primary energy intensity in the Central and East European countries in 2000, GDP based on the rate of exchange

Such a great difference in energy intensities calculated using this method is mainly determined by different principles of the methodology used for GDP estimation (particularly the differences in the prices of goods and services) in the developed countries and countries of the former Eastern Block. To take into account these factors and to reduce the effect of price distortions, GDP is determined using estimates of Purchasing Power Parity (PPP) in every country. This indicator can much better reflect the real living standard of different countries, for when GDP estimation is based on PPP, the internal purchasing power of every country is taken into account. In this case, in the majority of the countries with previously centrally planned economy, the ***primary energy intensity*** in 2000 was 1.5-3 times higher than the average for countries of the European Union ***(Fig. 4.2)***.

Energy efficiency in different countries is best characterized by the final energy consumption per GDP unit, with the level of economy reflected using PPP indicators. As illustrated in ***figure 4.3***, using the ***final energy intensity*** indicator, the value added created in 1999 (using constant prices of 1995 in USD) in the Lithuanian economy needed 1.5 times more energy than the average for countries of the European Union.

The main phases of energy transformation and energy flows (starting with imports of primary energy resources or their production in Lithuania and ending with *final consumption*) characterizing the present status of the country's energy sector are represented in ***figure 4.4.***

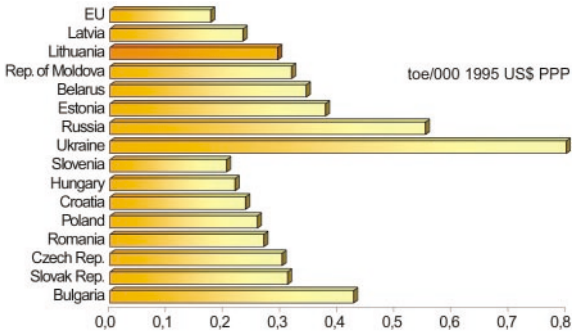


Fig. 4.2. Primary energy intensity in the Central and East European countries in 2000, GDP based on the Purchasing Power Parity

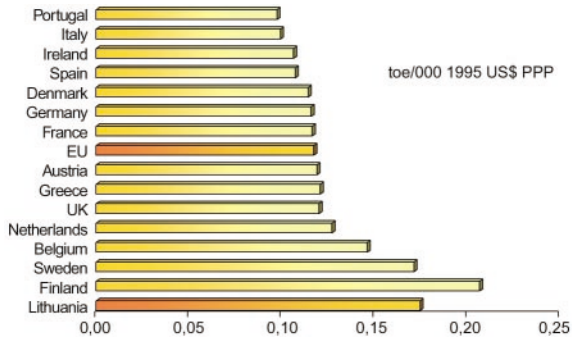


Fig. 4.3. Final energy intensity in the European Union countries and Lithuania in 1999, GDP based on the Purchasing Power Parity

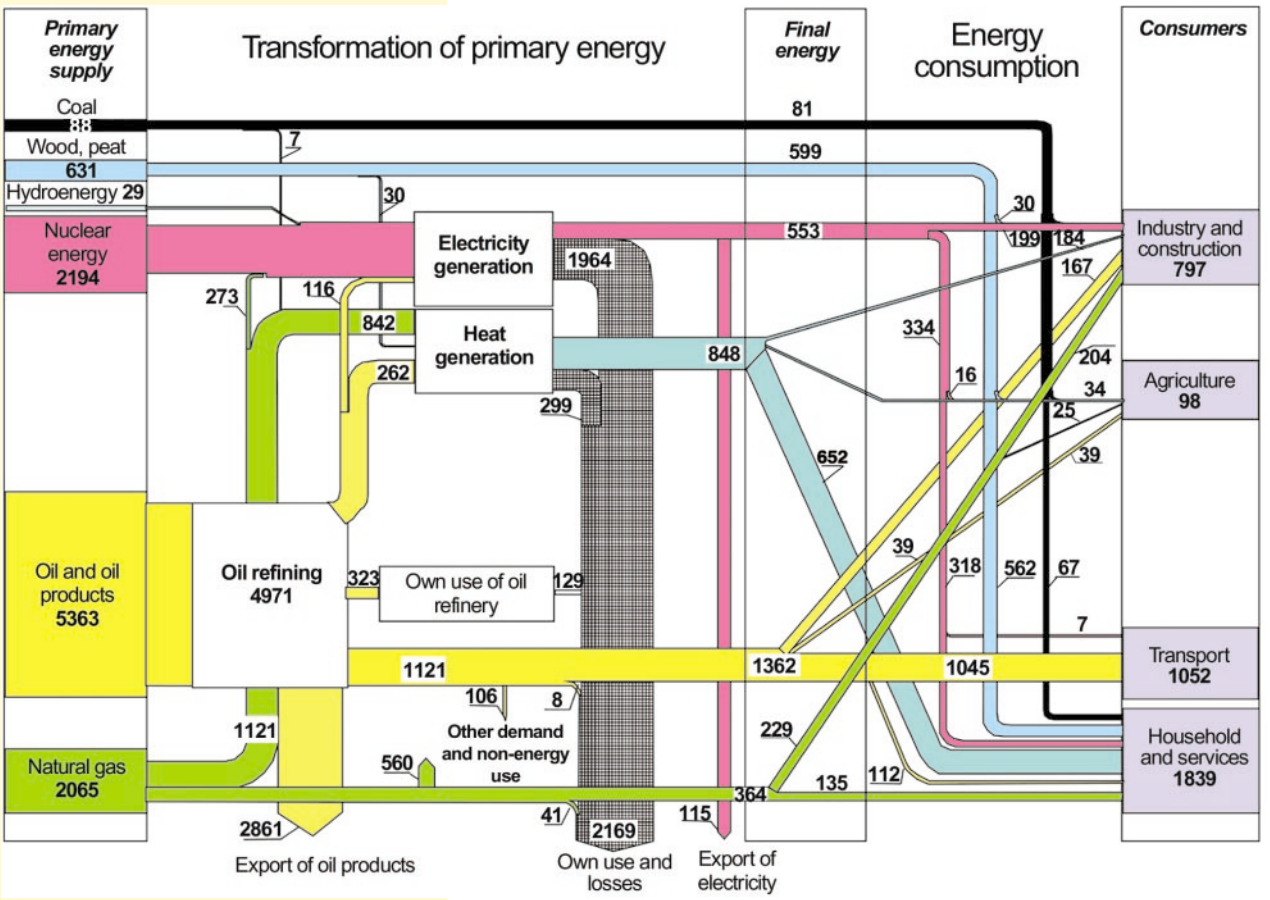


Fig. 4.4. Diagram of main fuel and energy flows in 2000, ktoe

At present, the *final energy* balance is dominated by the household and transport sectors ***(Fig. 4.5)*** consuming over 60% of the energy supplied for the country's economy. Meanwhile, the share of industry and agriculture in the final energy balance decreased to half as much as a decade ago and in 2000 amounted to only 22.8%.

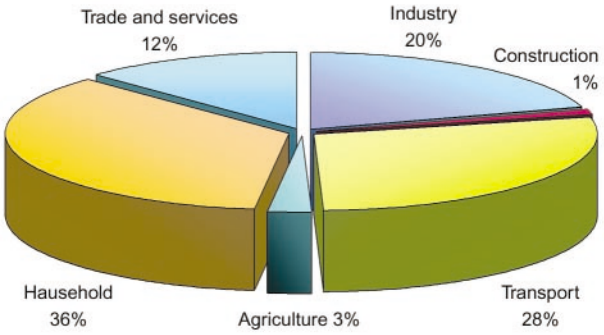


Fig. 4.5. Structure of final energy balance of Lithuania in 2000

A thorough analysis shows that in all cases the final energy demand in 2020 would not exceed the demand in 1990. At the end of the forecasting period, the consumption of fuel and energy in the basic scenario would be 6.2 million tons of oil equivalent, or 71% of the amount in 1990 (***Tab. 4.1***). In this case, the energy intensity index in 2020 would constitute only 49%, as against 1990, while energy efficiency according to this indicator would be close to the current average level in the European Union.

The country's total energy consumption is most frequently estimated in terms of ***million tons of oil equivalent (Mtoe)***, petajoules (1 PJ = 1015 J) or terawatt-hours (1 TWh = 1012 Wh).

1 Mtoe = 41.861 PJ = 11.628 TWh,
1 PJ = 0.278 TWh = 0.0239 Mtoe,
1 TWh = 3.6 PJ = 0.086 Mtoe.

In 2000, the primary energy consumption in Lithuania was equal to 7.33 Mtoe (i.e. 306.78 PJ or 85.22 TWh), electricity exports amounted to 1.34 TWh (i.e. 0.11 Mtoe or 4.81 PJ), and the final energy consumption by the branches of economy was estimated at 3.77 Mtoe (i.e. 157.77 PJ or 43.82 TWh).

Tab. 4.1. Final energy demand of Lithuania

Year	Slow growth scenario	Basic scenario	Fast growth scenario
Energy demand, million toe			
1990	8.7	8.7	8.7
1995	4,7	4,7	4,7
2000	3,8	3,8	3,8
2005	4,1	4,7	4,9
2010	4,5	5,3	5,9
2015	4,9	5,7	6,5
2020	5,2	6,2	7,1
Index (1990 = 100)			
1990	100	100	100
1995	53,5	53,5	53,5
2000	43,4	43,4	43,4
2005	47,2	53,4	56,5
2010	51,8	60,2	67,7
2015	55,7	65,4	74,6
2020	59,7	71,0	81,8

12. The decrease in the electricity consumption in 1990-2000 was the least as compared to the consumption of other energy forms. However, at present Lithuania is lagging behind developed European countries in terms of the comparative indicator of electricity consumption in economic sectors per capita (1860 kWh per capita), i.e. the average indicator in the European Union in 1999 was 3.1 times higher. Thus, according to forecasts, the modernisation of the national economy could lead to the fast growth of electricity demand, and its share in the structure of final energy would increase according to all scenarios and in all economic sectors. During the period until 2010, electricity demand in economic sectors in the basic scenario could increase annually by 4.3% on average. According to this scenario, electricity consumption in 2020 could exceed the 1990 level nearly 1.1 times.

The electricity consumption *per capita* in Lithuania (based on the electricity consumption to meet all the country's needs) is several times lower than in the majority of the developed countries. This indicator in many countries of the former Eastern Block is also 1.5-2 times higher than in Lithuania ***(Fig. 4.6)***. Therefore the energy demand forecasts were based on the assumption that the modernization of the Lithuanian economy would require the rapid growth of the electricity demand. According to the forecasts, the net electricity generation for country's needs (gross production minus own use by power plants) would reach and exceed the level of 1990 by year 2020, for both the basic and fast economic growth scenarios ***(Fig. 4.7)***. Only in case of the slow economic growth scenario, would the electricity demand not reach this level. However, this scenario is hardly probable.

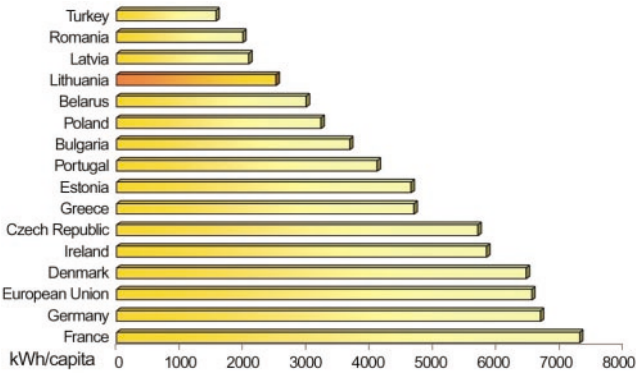


Fig. 4.6. Electricity consumption (total consumption excluding losses) per capita in 2000

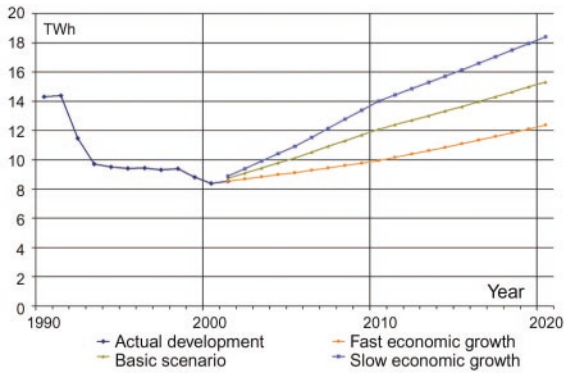


Fig. 4.7. Forecast of electricity demand (net production)

Figure 4.8 shows that the forecast of electricity consumption per capita, in case of the fast economic growth scenario, would reach the level exceeding the present indicator of Spain and would be approximate to the average of the European Union countries and the present level of Ireland, UK, Germany, Denmark and other countries. On the basis of the comparison of the forecasts contained in the strategy with the actual statistical data on the growth of the electricity consumption per capita in Ireland in 1980-2000, where the electricity consumption growth rate at that time was the highest among all the countries of the European Union, it may be concluded that the forecasted growth rate of electricity consumption in Lithuania is optimistic ***(Fig. 4.9)***.

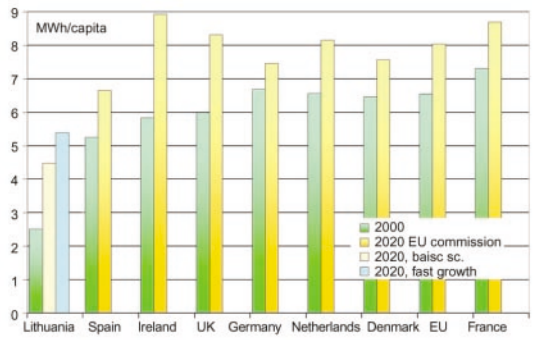


Fig. 4.8. Forecast of electricity consumption per capita

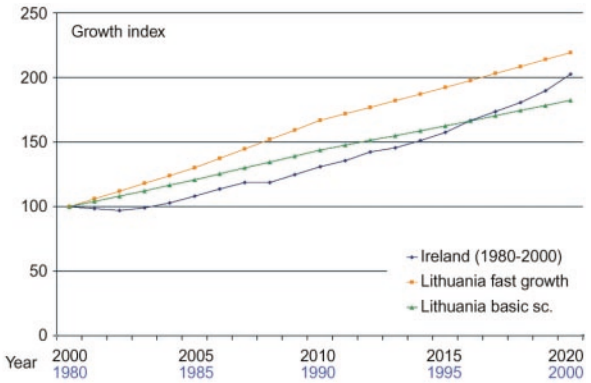


Fig. 4.9. Actual growth index of electricity consumption per capita in Ireland in 1980-2000 and forecasts for Lithuania in 2000-2020

District heat consumption decreased nearly three times in 1990-2000. In all cases, the district heat demand in 2020 will not reach the 1990 level. At the end of the forecasting period, the district heat consumption in sectors of the Lithuanian economy in the basic scenario would be 1.3 times higher than in 2000.

13. With the closure of the Ignalina NPP by the end of 2009, ***primary energy*** demand in the basic scenario would increase only by approximately 30% during the period until 2020. However, total demand for fossil fuel would increase almost 1.9 times within 20 years, i.e. from 5 million tons of oil equivalent in 2000 to 9.4 million tons of oil equivalent in 2020. The increase in natural gas consumption would be particularly rapid – from 2.1 million tons of oil equivalent in 2000 to 5 million tons of oil equivalent in 2020. During the forecasting period the share of natural gas in the primary energy balance would increase from 28.5% to 53%. The forecasts predict that at the end of the period the share of indigenous (excluding indigenous crude oil) and renewable resources in the total primary energy balance would increase by up to 14%, while the share of petroleum products would constitute about 32%.

Primary energy means the energy contained in natural resources such as chemical energy dormant in fossil fuel; potential water energy; solar energy; energy released in nuclear reactions; wind energy etc. The best part of the primary energy sources is transformed into electricity and heat energy or converted into the fuels used by consumers, eg. gasoline, diesel fuel, heavy fuel oil, liquefied gas, peat, etc. The energy resources obtained through transformation and conversion of the primary energy are referred to as secondary energy.

The long-term primary energy balance of Lithuania will be dominated, either by natural gas ***(Fig. 4.10)***, if, following the decommissioning of both Ignalina NPP units, new combined cycle gas turbine power plant (CCGT) becomes the main source of electricity, or by oil products (including orimulsion), if the modernized Lithuanian Power Plant becomes the main electricity supplier ***(Fig. 4.11)***.

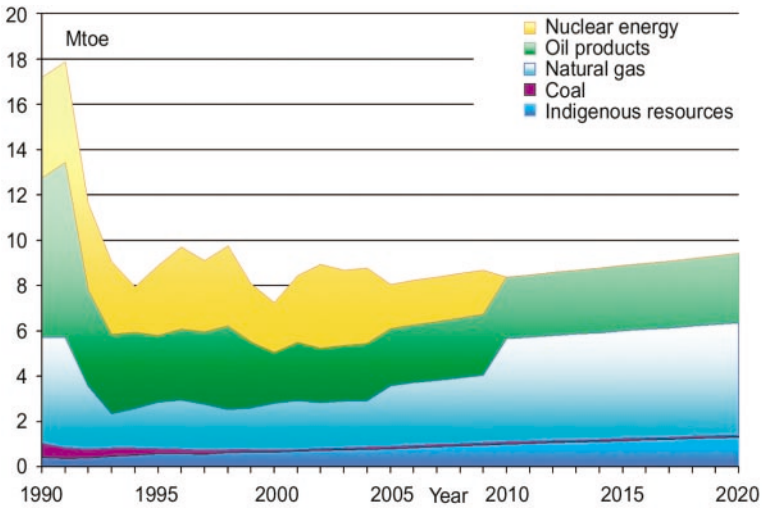


Fig. 4.10. Forecast of primary energy demand (in case of construction of a new CCGT plant)

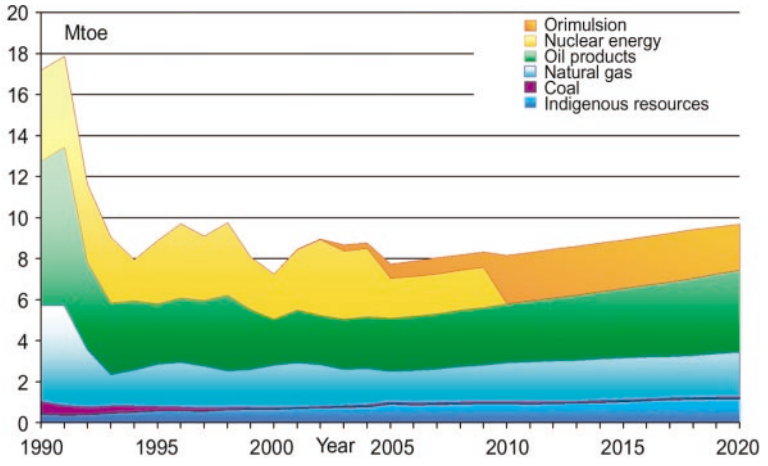


Fig. 4.11. Forecast of primary energy demand (in case of modernisation of Lithuanian Power Plant)

5 STRATEGY FOR THE POWER SECTOR DEVELOPMENT

14. The total installed electricit - generating ***capacity*** (***Tab. 5.1***) (nuclear and non-nuclear) exceeds the present domestic needs of Lithuania by three times, and the main source of electricity in the country is the Ignalina NPP, which generates ***cheaper*** electricity than thermal power plants using fossil fuel (***Fig. 5.1***). Over the period of the last five years it has generated from ***76% to 86%*** of the total electricity production (***Fig. 5.2***). The development of the entire power system of Lithuania in the next decade will be considerably influenced by the choice of the operation period of the Ignalina NPP, which should be substantially dependent on its safety and economic indicators.

The Ignalina NPP was inherited from the former Soviet Union with the low level of safety culture, but much has been done in the last decade to improve safety at the Ignalina NPP. Many countries which have considerable experience in the nuclear energy area have provided and continue providing effective support in improving the safety of the Ignalina NPP to ensure its better compliance with international nuclear safety objectives. Information and conclusions about the safety level of the Ignalina NPP are based on numerous in-depth and voluminous international analyses. The probabilistic safety assessment indicators show that the present safety level of the Ignalina NPP could be compared to that of nuclear power plants of Western countries; however, the Ignalina NPP does not have a containment installed in the Western power plants, which would contain accidentally released radioactive materials. Thus, some experts from Western countries and different organisations draw the conclusion that the risk of operating nuclear power plants with RBMK

Tab. 5.1. Installed capacity of power plants in Lithuania, MW

	Power plant	Installed capacity, MW
1.	Lithuanian Power Plant	1800
2.	Vilnius CHP	384
3.	Kaunas CHP	178
4.	Mažeikiai CHP	194
5.	Klaipėda CHP	11
Total thermal power plants (1-5)		**2567**
6.	Kaunas HPP	101
7.	Small HPP	15
8.	Kruonis PSPP	800
Total HPP (6-8)		**916**
9.	Ignalina NPP	3000
10.	Other power plants	61
Total (1-10)		**6544**

The electricity generation cost presented in ***figure 5.1*** reflects the real situation of 2001 and the possible price in case of power plant operation in their normal regime (Lithuanian Power Plant - 7 000 hours, Vilnius, Kaunas and Mažeikiai power plants - 4 500 hours, Ignalina NPP - 7 000 hours, also taking into account the costs of the final disposal of spent nuclear fuel). The cost of electricity in power plants depends on two components: fixed and variable costs. Some power plant operation costs, so called "fixed costs", arise irrespective of whether the power plant is in operation or idle. Such costs include wages to workers, building maintenance costs, etc. Other costs such as fuel, auxiliary material, water costs etc. are directly related to the amount of electricity generated and are referred to as "variable costs". In the case of power plants operating on fossil fuels, their major cost is represented by fuel costs, whereas with nuclear plants, fixed costs are higher. Fuel costs depend also on the power plant operation regime and the number of the stops and start-ups of the plant. If the power plant units subject to intensive regulation and the plant is frequently stopped and brought into operation again, then more fuel is required for generation of one kilowatt-hour and consequently this leads to the increased fuel costs. The bigger the electricity production volumes of a plant, the higher the "variable costs", however they are the same per electricity unit produced (1 kWh). The "fixed costs", on the contrary, remain unvaried, no matter how much electricity is generated. Thus, when the fixed costs are spread over a high production volume of electricity, they are small, but if the plant operates only for a short time, the fixed costs are a more significant proportion of the total cost.

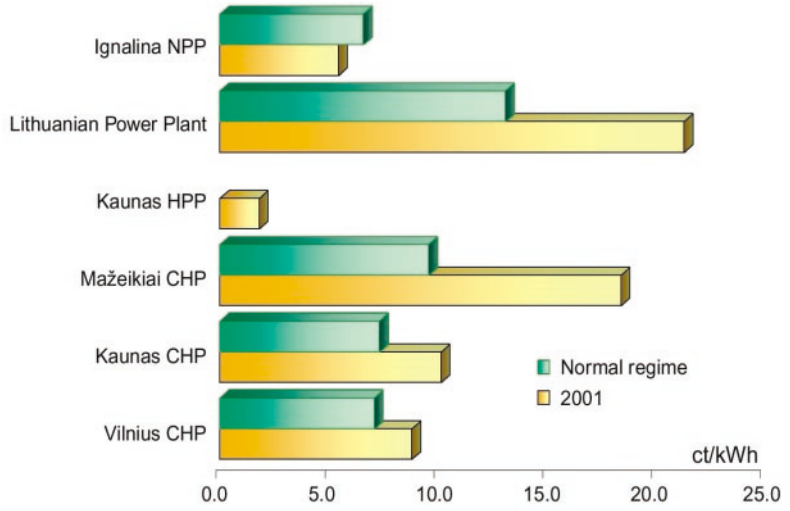


Fig. 5.1. Electricity generation cost in 2001 and possible cost in case of normal regime

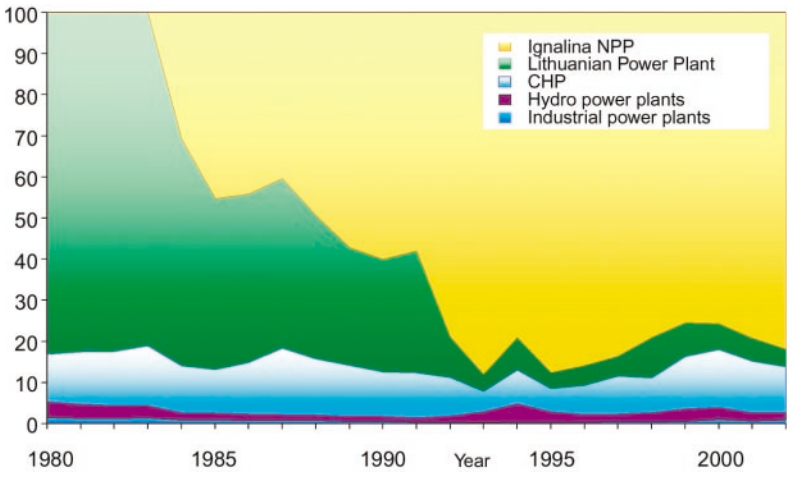


Fig. 5.2. Structure of electricity generation

reactors cannot be reduced to such an extent that they could be safe enough for long-term operation . The opinion of the international community is important to Lithuania, which is preparing for accession to the European Union and NATO.

15. The National Energy Strategy approved by the Seimas in 1999 provided that in accordance with the ***Nuclear Safety Account Grant Agreement*** Unit 1 of the Ignalina NPP will be closed before 2005, taking into account the conditions of long-term and considerable ***financial assistance*** from the European Union, ***G-7*** countries and other countries, as well as international financial institutions (***Fig. 5.2***). On the basis of the same assumptions and taking into consideration the recognition by Member States of the European Union that the decommissioning of the Ignalina NPP will have to continue beyond the current financial perspectives and that this effort represents for Lithuania an exceptional financial burden not commensurate with the size and economic strength of the country, and the declaration that the Member States are, in solidarity with Lithuania, ready to continue to provide adequate additional Community assistance to

The Nuclear Safety Account Grant Agreement is an agreement signed by the European Bank for Reconstruction and Development, Government of the Republic of Lithuania and Ignalina NPP (in 1994). In the Agreement, the Bank allocated the support of ECU 33 million to Lithuania for nuclear safety improvements at Ignalina NPP and Lithuania undertook not to replace the reactor fuel channels at the end of their lifetime, but to shut down the reactors. The channel lifetime ranges from 15 to 18 years.

G-7 is a group of the seven most developed countries, namely USA, Canada, Japan, Great Britain, France, Germany and Italy.

The Safety Analysis Report (SAR) is a scientific Study undertaken in 1996 to evaluate the nuclear safety situation at Ignalina NPP. It may be stated that the reactors operated at Ignalina NPP are unique among other RBMK-type reactors in the scope and comprehensiveness of the analyses carried out in this SAR using modern Western methodologies. SAR was financed with funds from the EBRD Nuclear Safety Account. Having analyzing this report, specialists from various countries provided an independent SAR review. On the basis of the two reports, the Ignalina NPP Safety Panel, consisting of international nuclear energy experts, made recommendations to the Government of the Republic of Lithuania. The Government of the Republic of Lithuania made an official declaration that all recommendations contained in both reports and provided by the Panel would be implemented in full and included into the second Safety Improvement Program (SIP-2). The implementation of this program has required about 600 million litas. According to State Nuclear Safety Inspection (VATESI), the probability of a nuclear accident at Ignalina NPP is no greater than in other reactors of the same age in Western countries. However, the Ignalina NPP reactor and primary circuit lack a containment, thus adding to the risk of the discharge of radioactive materials into the environment in case of a major accident.

the decommissioning efforts also after Lithuania's accession to the European Union, Unit 2 of the Ignalina NPP will be closed in 2009, subject to financing sources, the required scope of financing supported by agreements with EU institutions and other donors. Lithuania commits itself to the closure of reactors, on the understanding that a programme organising additional financial assistance of the EU to the early closure of Unit 1 of the Ignalina NPP before 2005 and Unit 2 in 2009 will be adequately addressed at a later stage of accession negotiations. By implementing this programme, Lithuania will resolve the consequences of the closure of the Ignalina NPP. In the event of a failure to ensure the required financing from the EU and other donors, the operation of Units 1 and 2 of the Ignalina NPP will be extended taking into account their safe operation period.

In accordance with the Nuclear Safety Account Grant Agreement, the Government of the Republic of Lithuania will take all the necessary measures to ensure that the Ignalina NPP satisfies international nuclear safety requirements. The Government commits itself that Lithuania will completely fulfil all the nuclear safety recommendations presented to the EU Council in the report of

Tab. 5.2. Financing of Ignalina NPP pre-decommissioning activities and coping with the effects of INPP decommissioning and shutdown

Support categories and projects		**Demand** (million EUR, 2004-2006)				**Sources of financing** (million EUR, 2004-2006)						
Support line	Project	2004	2005	2006	2004-2006	%	National Fund [1]	%	Companies	%	EU support and source	
Pre-decommissioning	Predecommissioning projects B1-B6 (IINPPDSF[2])	43,8	16	25,8	~2009 before 250	7-12	11,8 (approved) 17.5 (to be approved)		-	88-93	**210**	IINPPDSP
											up to **30**	2003 PHARE contribution
Decommissioning	Dismantling of Unit 1	7,78	88,49	25,34	**121,61**	10	12,16		-	90	**109,45**	Ignalina Program (IP)
	Support to INPP personnel	3,69	8,58	7,13	**19,40**	10	1,94		-	90	**17,46**	
Capacity replacement	Support to Lithuanian Power Plant	6,77	11,17	6,77	**24,71**	10	2,47	20	4,94	70	**17,30**	
Environmental investments	Support to Lithuanian Power Plant	50,85	65,05	35,8	**151,7**	10	15,17	10	15,17	80	**121,36**	
Security of supply	Construction of gas storage in Vaškai	18	30	30	78					(20-60)[3]		As a separate case, Ignalina Program
	Construction of power bridge and gas line	20,7	46	47	113,7							or/and support for EU transeuropean grid development (~20%)
Economic regeneration of the region	Under the Single Programming Document									(85)[4]		Structural funds
Other projects directly related to the decision to close down INPP	Energy efficiency, generation, transmission, distribution and power plant upgrading									(up to 50)		IINPPDSF, IP, EU funds, bilateral assistance
TOTAL (only IP and IINPPDSF)		69,09	173,29	75,04	**317,42**		31,74		20,11		**265,57**[5]	IP (**for distribution** - 19,43)
		43,8	16	25,8	up to **250** (2009)		29,3				up to **240**	IINPPDSF

[1] Lithuanian Ignalina NPP Decommissioning Fund

[2] International Ignalina NPP Decommissioning Support Fund managed by EBRD

[3] compatibility of the assistance with the internal market will be considered as a separate case

[4] subject to further negotiations in the process of coordination of the Single Programming Document

[5] EU support to Lithuania for 2004-2006 through Ignalina Program as established in a separate protocol to the Accession Treaty in the form of appropriation obligations amounts to EUR 285 million (about 1 billion litas).

the Working Party on Atomic Questions and Nuclear Safety, as well as the recommendations of the ***Safety Analysis Report***, its Independent Review and the international Ignalina Safety Panel.

16. On the basis of the available information and the technical-economic analysis carried out, it can be stated that upon the closure of both the units of the Ignalina NPP the following measures will be necessary in order to ensure the least costs of the development and operation of power and district heating systems, as well as higher reliability of electricity supply:

1) modernisation of the Lithuanian Power Plant, the major electricity source, and of the Vilnius and Kaunas CHP plants: installation of new burners, modern control and management equipment, flue gas cleaning equipment;

2) renovation of the Kaunas Hydro Power Plant by 2007;

3) should new capacities be required and be economically justified, the construction of CHP plants in Klaipėda, Šiauliai and Panevėžys, a combined cycle gas turbine condensing power plant and additional CHP plants in other cities;

4) reconstruction of the existing boiler-houses: installation of gas turbines and generators or small CHP plants using indigenous fuel, provided that their installation would be economically feasible taking into account the local conditions and that they could compete with renewed large power plants.

The strategy for the development of the Lithuanian power sector is based on the continuity and development of the safe nuclear energy. With a view to remaining a nuclear energy state in the future and generating electricity in nuclear power plants complying with modern safety requirements, Lithuania will legally, financially and politically support investments in the construction of a new unit or reactor with the use of the existing infrastructure at the Ignalina NPP.

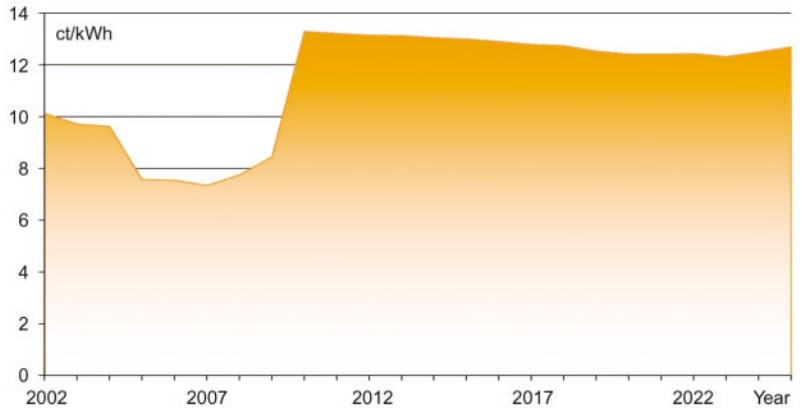


Fig. 5.3. Forecast of average electricity generation cost in the Lithuanian power system

As a result of the closure of Unit 2 at the Ignalina NPP, the average electricity generation cost (***Fig. 5.3***) will increase by approximately 3 Lithuanian cent/kWh. In calculating the average electricity generation cost, all the components of the operational costs of power plants (expenses for fuel, repairs, wages, etc.), investments in the construction of new units or modernisation of the existing ones, as well as the costs of the management and disposal of new radioactive waste and spent nuclear fuel have been taken into account. In addition, with a view to enhancing the reliability of fuel supply, providing opportunities to use at least two types of fuel in large thermal power plants and satisfying the environmental requirements, it is necessary to construct flue gas cleaning installations. While transferring the solution of the problem related to the reliability of fuel and energy supply in the Lithua-

nian energy sector to one or several power stations, and with a view to avoiding distortion of the opportunities of the power plants in the competitive market, it is necessary to foresee ways of targeted financing for the installation of environmental protection measures or a pollutant quota trade system.

The negative effects of the premature closure of Unit 2 of the Ignalina NPP will be more abrupt and will have greater impact on the national economy, compared to a later closure.

17. The closure of Units 1 and 2 of the Ignalina NPP will have direct socio-economic, environmental, energy-related and other consequences, including impact on the security of supply. The solution of problems resulting from these consequences will require a lot of time.

In addressing the issue of the closure of the Ignalina NPP, the consequences of this closure, including the maintenance of the reactors of the Ignalina NPP after their shutdown, also problems concerning the dismantling of the reactors, radioactive waste management, compensation for socio-economic consequences in the region, modernisation of electricity capacities and construction of alternative electricity generating sources, as well as environmental problems related to the decommissioning of the Ignalina NPP should be considered.

The decommissioning of Units 1 and 2 of the Ignalina NPP will entail technical decommissioning costs. The structure of a near-surface repository for low- and intermediate-level short-lived radioactive waste will be finally chosen only after decisions on waste management and disposal strategies are taken. Costs for spent nuclear fuel disposal will be adjusted in accordance with the chosen waste management strategy.

The evaluation of all groups of consequences resulting from the closure of Units 1 and 2 of the Ignalina NPP will be regularly updated on the basis of the most recent information, while in updating such evaluation, the actual costs incurred, should also be taken into account. In this context, a number of dynamic parameters should be taken into consideration, i.e. parameters related to economic growth, changes and trends in the internal energy market, the reliability of energy supply (including dependence on oil and gas prices in global markets), effects of efficient energy consumption, response to social consequences, the role of the private sector, as well as the complexity and extended duration of the decommissioning process. In addition, it is necessary to take into account the fact that the closure of Units 1 and 2 of the Ignalina NPP is the first case when RBMK-1500 nuclear reactors of such capacity are being decommissioned. Thus, the current evaluation should be regularly updated to ensure safety requirements in the long closure process.

The closure of the Ignalina NPP will also have positive consequences, i.e. the amount of radioactive waste in Lithuania will stop increasing, thereby reducing the costs of the storage of radioactive waste and spent nuclear fuel, a better environment for competition will be created.

Capacity balance means the balance condition between the output power and consumed power in an electric power system at any moment. In general terms, the capacity balance can be defined as (generation) + (imports) = (consumption) +(exports); the generation comprises the operating capacity of all power plants in Lithuania and the consumption comprises all Lithuanian consumer loads, losses in electric networks and own use of power plants, including the generating units of Kruonis HPSP operated in the pumping mode. The power capacity balance condition is physically necessary or otherwise voltage and frequency levels cannot be maintained stable in the power system.

Reserve capacity means the standby capacity of a power plant or its unit, which can be released as the need arises because of outages of any power plant or its unit.

Maneuvering power means the power of a power plant or its unit, which may be promptly released and swiftly alternated in a wide range.

Daily regulation means the co-ordination of the power balances in an electric power system at different moments in the twenty-four-hour cycle. It is achieved through the adjustment of the output powers of power plants, so that the surplus power of Ignalina NPP and thermal power plants would load Kruonis HPSP in low load (off-peak) hours and, conversely, a deficit in power can be supplied by Kruonis HPSP in high load (peak) hours. The weekly control and daily control differ solely in the cycle duration.

The Baltic Ring means the concept of interconnecting the power grids of the Baltic Sea States (Norway, Sweden, Denmark, Germany, Poland, Baltic States, Finland, Russia and Belarus) into a ring around the Baltic Sea. In 1996-1998, eighteen electricity companies, including AB Lietuvos Energija, were involved in the Baltic Ring project, which investigated the feasibility of establishing the electricity market of the Baltic Sea States and the related necessary physical connections: to begin with the Lithuanian and Polish power grid interconnection. Upon completion of the project study, the participants established the BALTREL organization (Baltic Ring Electricity Cooperation Committee), which is proceeding with the initiated investigations.

Interconnection with Poland means the planned 380 kV (400 kV) power transmission line to interconnect the power systems of Lithuania and Poland.

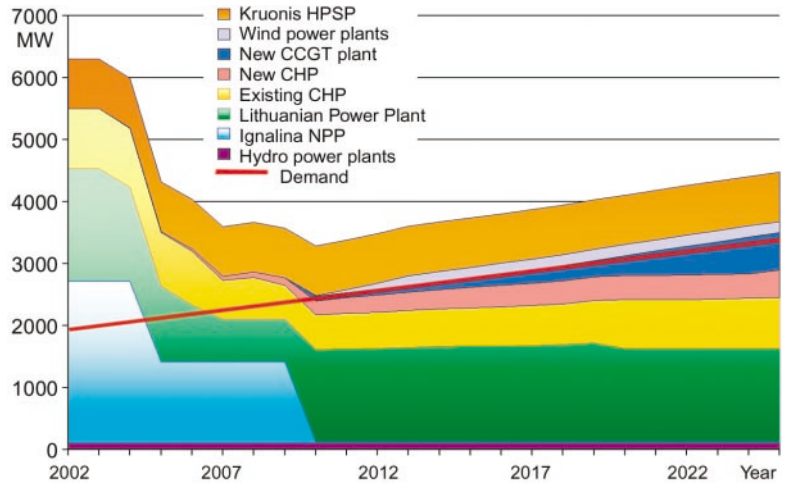


Fig. 5.4. Forecast of structure of generation capacities in the Lithuanian power system (basic demand scenario)

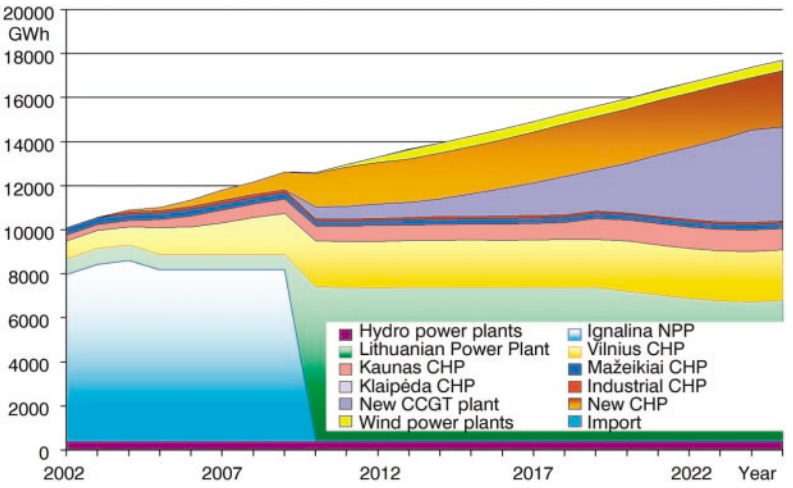


Fig. 5.5. Forecast of electricity generation in Lithuania (basic demand scenario)

Measures for the mitigation of social consequences and their financing will be established by appropriate legal acts.

18. After the closure of the Ignalina NPP, the existing ***capacities*** will be sufficient to meet the national demand for a period beyond the year 2010 in all cases of the domestic demand growth in Lithuania, if the Lithuanian Power Plant is maintained and modernised (***Fig. 5.4***). The modernisation of the existing combined heat and power plants and the construction of the new ones (of about 400 MW capacity) will facilitate the solution of the problem relating to the growing demand.

With at least one unit of the Ignalina NPP in operation and with limited export, the Lithuanian Power Plant would serve as a source for meeting demands for ***reserve and manoeuvre capacity***, as well as being able to substitute for the Ignalina NPP during its scheduled repairs. After the closure of both the units of the Ignalina NPP, the Lithuanian Power Plant will become the ***major source of electricity*** (***Fig. 5.5***). All the four 300 MW units should be prepared for operation before the closure of Unit 2 of the Ignalina NPP. It is also expedient to use the Kruonis HPSP not only in a regime of ***daily regulation*** but

also in a regime of weekly regulation; its role, however, in the Lithuanian power sector and in the larger region will depend on the course of the implementation of other international projects (the ***Baltic Ring***, the electricity transmission ***line to Poland***, etc.) and on the increase in electricity demand in neighbouring countries. Having modernised the existing thermal power plants, the cheapest electricity generating sources would be combined heat and power plants in the combined heat and power operation mode, and their share of electricity generated (also taking into account the contribution of new CHP plants) in the total electricity balance could increase up to 35-45% in 2015-2020. A greater contribution of CHP plants would correspond to a scenario of high fuel prices as CHP plants enable to increase the total fuel consumption efficiency. With regard to changes in fossil fuel prices, the construction of new hydro power plants on the Neris cascade and the mid Nemunas may be justifiable.

Fig. 5.6. Power transmission grid in the Baltic States

Power transmission network means the highest voltage level(s) of the power grid linking the whole electricity system and thus further referred to as the national electricity network. Power plants supply the electricity generated for the entire country into this network, which is also used for transmission of transit flows to other systems. In Lithuania and the Baltic States region, the voltages in the transmission network are 330 and 110 kV, while in Western and Northern Europe, the voltage levels are 380 and 220 kV.

Power distribution networks mean the high voltage (110 and 35 kV), medium voltage (10 kV) and low voltage (0.4 kV) power networks of local significance. They are used to distribute the electricity received from the transmission network or small local generators to consumers.

Taking into account global nuclear energy development trends, the latest technologies of reactors and their technical-economic characteristics, a comprehensive study on the continuity of the use of nuclear energy in Lithuania will be prepared in 2003-2004, covering the justification of nuclear safety and acceptability of nuclear energy, including the construction of new nuclear power plants (reactors).

19. Electricity ***transmission*** and ***distribution networks*** in principle are able to meet the current needs of the power system; however, three quarters of the transmission and distribution equipment are more than 20 years old, and one quarter of this equipment is more than 30 years old. Thus, investments will be required not only to maintain the current level of electricity networks, but also to improve their status with a view to complying with the increasing requirements for the reliability and stability of energy supply, as well as to create a common Baltic electricity market.

It is a major shortage that there is no direct connection to the power systems of Central and Western Europe. It is necessary to construct a powerful inter-connection with the Polish power system as soon as possible. In the near future, this line would allow integration into the Western European electricity market and thus enhance the reliability of energy supply.

Lithuanian integration into the European Union and closer co-operation with the other Baltic and Scandinavian countries require changes in the structure of the national electricity grid. The three Baltic States should make joint efforts to prepare a strategy for the development of the transmission system (***Fig. 5.6***) and action plans for its implementation, as well as to plan a sequence of actions and financing sources.

20. Taking into consideration the economic significance of the efficient use of all the available capacities, the forecast of electricity export and of the reliability of electricity supply is as follows:

1) with at least one unit of the Ignalina NPP in operation, it is possible to maintain traditional electricity export via available transmission lines to the North and the East;

2) until 2010, energy export from the Lithuanian Power Plant could be profitable only during peak and half-peak hours;

3) the construction of an electricity transmission line to Poland is necessary for integration into the European electricity market.

Taking into account the strategic significance of an interconnection between the Lithuanian and Polish power systems, the state will give political and legal support for investments satisfying the criteria defined in the Law of the Republic of Lithuania on the Basics of National Security. It is necessary to ensure that the planned inter-connection with the Polish electricity transmission system, like the national transmission networks, would belong, directly or indirectly, to Lithuania and that the latter would

have considerable influence when taking decisions that are important for ensuring national security and security of energy supply.

21. In order to ensure the reliability of electricity supply and integration into the EU internal market, the following measures are necessary:

1) to maintain the existing potential of non-nuclear power plants by gradually adapting them to the requirements of a market economy and by introducing measures for instantaneous capacity balance regulation;

2) to reconstruct and restore physically and morally worn electricity transmission and distribution networks in order to accommodate the growing loads, ensure the reliability of electricity supply and meet quality requirements;

3) to ensure the safety and reliability of the Ignalina NPP;

4) to co-operate with the neighbouring countries to provide reserve capacity;

5) to construct an inter-connection with Poland for integration into the power system of Western European countries, thereby increasing the strategic reliability of electricity supply;

6) to strengthen co-operation and collaboration with other Baltic States, i.e. to create a common electricity market and utilise optimally the total potential of the power systems of the Baltic States;

7) to prepare, in conjunction with Latvia and Estonia, a new strategy for the development of the Baltic transmission system better adapted to integration into the networks of Western European and Scandinavian countries and allowing better utilisation of available generating capacities;

8) to implement the programme for the privatisation of generating enterprises and distribution networks, as well as the requirements of the EU directives. To this end, the electricity sector was reorganised in 2002 by separating the Lithuanian and Mažeikiai Power Plants, as well as the East and West Electricity Distribution Networks. The implementation of programmes for privatisation in the sector is foreseen in 2003.

In implementing programmes for privatisation in the electricity sector, account should be taken of the provisions of the National Security Strategy, which prohibit investors of one foreign state from dominating in this strategically important economic sector and which require to prevent the penetration of illegal capital or capital of undetermined origin into enterprises of the Lithuanian economy.

22. Taking into account the analyses carried out in the Baltic Ring feasibility study, the most acceptable way for Lithuania of connecting the national power system to the Western system is via a direct current back-to-back station. This would allow having a direct connection with the common Western European system without disconnecting from Eastern neighbours and losing opportunities to purchase services on a regular basis from the East.

6 STRATEGY FOR THE HEAT SUPPLY SECTOR DEVELOPMENT

23. About 75% of residential houses in Lithuania's towns is supplied with heat from district heating systems. The method of district heat supply, prevailing in Lithuania, is fairly advanced; however, due to various economic, technical and social reasons it is not sufficiently effective and needs rehabilitation. This option of heat supply must be brought in line with the decentralised heat sources in order to benefit most from the advantages offered by both methods.

According to the international principles for compiling the energy balance, district heat means the total heat produced by public combined heat and power plants and boiler-houses and the heat, which is sold by industrial or other autonomous combined heat and power plants and boiler-houses to households, service sector and other consumers. Based on the data of the Lithuanian Department of Statistics, the volume of the centrally produced heat decreased more than two times ***(Fig. 6.1)*** and its consumption by industry - by 11 times, by agriculture - nearly 7 times and by service and energy sectors - more than 3 times. Over the period of 1994-2001, the heat consumption for heating of residential buildings slumped 1.7 times. At present, household and service sectors dominate in the structure of district heat consumption ***(Fig. 6.2)***.

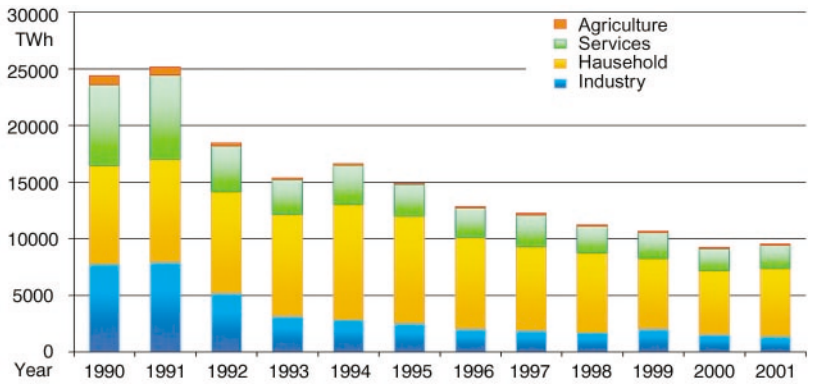


Fig. 6.1. Dynamics of district heat consumption in branches of economy

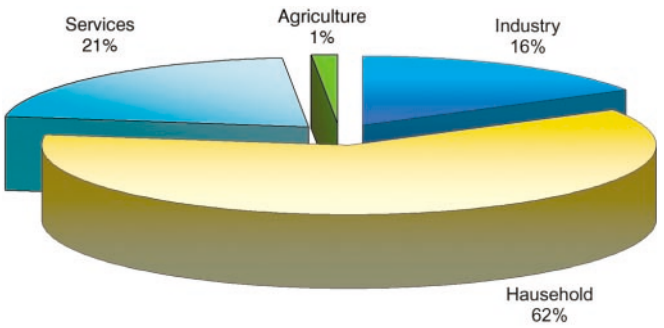


Fig. 6.2. Structure of district heat consumers in 2000

24. To this end, the key strategic provisions shall be as follows:

1) to prepare heat supply development plans for municipalities, in line with the national priorities of the energy sector;

2) to manage the heat sector in accordance with the heat sector development plans approved by the municipalities, providing for key decisions in the rehabilitation and development of the heat sector in the long term. The main target of the heat sec-

tor development plan is meeting the consumers' demand for heat at least cost and pollution, by zoning according to the main method of heat supply, introducing an economically justified procedure for choosing the main method of heat supply and regulating the conditions of connection and disconnection;

3) to set up gradually at district heating utilities, after the closure of Unit 1 and especially of Unit 2 of the Ignalina NPP, combined heat and power (CHP) plants, subject to their economic feasibility study, offering electricity at a price that would be competitive on the open electricity market;

4) to encourage heat production from local and renewable energy sources;

5) to use the domestic waste collected by municipalities for the generation of heat and electricity where it is economically and ecologically feasible. To exploit the potential of waste heat and combustible substances. This would enable the reduction of fuel imports and contribute to the solution of the waste storage problem. A possibility to use waste for co-generation must be assessed on a case-by-case basis;

6) to provide conditions for competition among heat producers and to establish a procedure for purchasing heat from the independent producers for the heat supply systems;

7) to modernise consistently the heat supply systems by providing a possibility for the consumers to regulate the amount of heat to be consumed and the consumption schedule of their own choice;

8) to establish the procedure for the purchase of electricity generated by CHP plants to encourage the consumption of heat generated by CHP plants for heating in towns;

9) to encourage participation of private capital in the projects of rehabilitation of the heat sector through energy service companies and in any other way meeting the public interest;

10) to provide conditions for heat consumers to take part in the management and rehabilitation of the heat sector. To control natural monopolies and to balance the interests of suppliers and consumers.

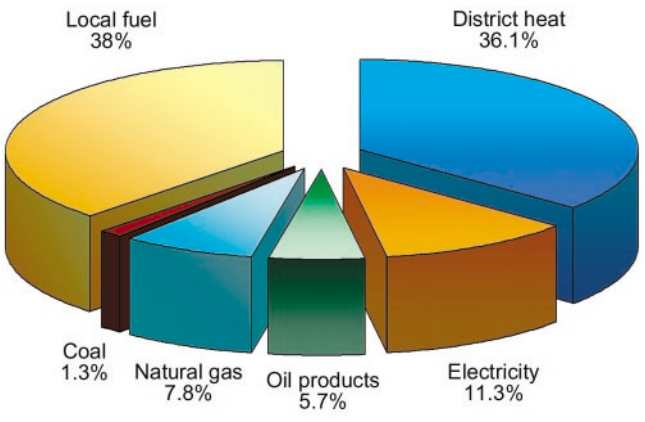


Fig. 6.3. Structure of final energy consumption in household in 2000

25. Consumers residing at some distance from gas pipelines and heat supply systems, where their connection to these systems is not economically feasible, for the purposes of decentralised heating, taking account of the local conditions, should use:

1) wood and other biofuels;

2) liquefied gas;

3) heating oil;

4) environment energy by using heat pumps;

5) other sources meeting the public interest and ecological requirements.

The State shall encourage competition between fuel suppliers and heat producers.

7

STRATEGY FOR THE NATURAL GAS SECTOR DEVELOPMENT

26. The share of natural gas in the national balance of primary energy resources constitutes at present close to 28%. Natural gas is imported from a ***single source*** – the Russian Federation. In 2000, 2.58 billion m^3 of gas was imported for domestic needs, and 0.47 billion m^3 of gas was supplied in transit to the Kaliningrad Region. The import capacity of the gas pipelines in Lithuania (6 billion m^3 per year) is in excess of the current consumption needs. The Lithuanian gas supply network is linked with the Latvian gas pipeline grid and the Kaliningrad Region. However, it is not connected with the gas pipeline grid of Western Europe, which prevents there being an alternative natural gas supply.

Natural gas is supplied from Russia to Lithuania through a single 1 200 mm diameter gas pipeline from the Minsk compressor station on the main Jamal - Western Europe gas pipeline ***(Fig. 7.1)***. This gas pipeline is also used for natural gas transit to Kaliningrad region across the territory of Lithuania through the main pipeline Vilnius - Kaunas - Šakiai. The Lithuanian gas system is also connected to the gas system of Latvia. However, this connection is closed for the time being due to the absence of a metering station at the border (to be built in the coming years).

Fig. 7.1. Future natural gas transmission network in Lithuania

Technologically and ecologically, natural gas is the most effective fossil fuel with its vast world reserves. Taking into consideration the large resources of Russia's gas fields, the routes of and trends in their export to the West, the existing technical supply facilities and the ever more stringent environmental requirements, natural gas in Lithuania is the most promising kind of fossil fuel during the whole period under review.

Following the restoration of the independence of Lithuania, natural gas consumption fell sharply. In 1993, the gas consumption was 3.3 times lower compared with 1991. The present tendency shows the increase in demand for this fuel - the share of natural gas in the country's primary energy balance increased from 21.8% in 1994 to 25.4% in 2001. In absolute terms, the natural gas consumption for energy purposes hardly changed over the last seven years ***(Fig. 7.2)***. The use of gas for fertilizer production showed steady growth over this period and the gas consumption for this purpose was 1.9 times higher in 2001 compared with 1994.

Lithuania has a well-developed gas supply network; the length of its main pipelines amounts to 1630 km. However, the construction of the gas main network with 55-bar working pressure started as far back as in 1961. Therefore some pipelines are outdated and the pressure of the gas supplied to consumers is limited to 42-49 bars in some pipeline sections. In the future, the Lithuanian gas network will be renovated and expanded. The study specifying the long-term plan for the development of the Lithuanian natural gas networks foresees the provision of gas supply to Mažeikiai and Ignalina regions in the coming years. It is proposed to interconnect Kaunas and Klaipėda main pipelines by a ring line in 2015-2020. To meet the increased demand for natural gas and to ensure the security of supply, building of another line Vievis - Kaunas - Šakiai is planned.

With a view to improving the security of gas supply, the possibilities are being investigated for the interconnection of the Lithuanian and Polish gas networks. A feasibility study for the interconnection of the Lithuanian gas system with the gas networks of neighboring countries was carried out by Lithuanian Energy Institute. This showed that the reverse gas supply to Lithuania from Poland, the already mentioned Jamal gas pipeline, would be economically unreasonable without substantial financial support from the European Union. The gas supply from other sources, i.e. building an 800 km gas line across the entire Northern Poland to Niechorze and connecting it to the planned Denmark - Poland gas pipe interconnection, would be technically complicated and economically unsound. With a view to the supply diversification, Lithuania should support, in every possible way, the building across its territory (on seafloor of the Baltic Sea) of a transeuropean gas line, which would provide a connection between the Russian Shtokmanov production enterprises and West European networks.

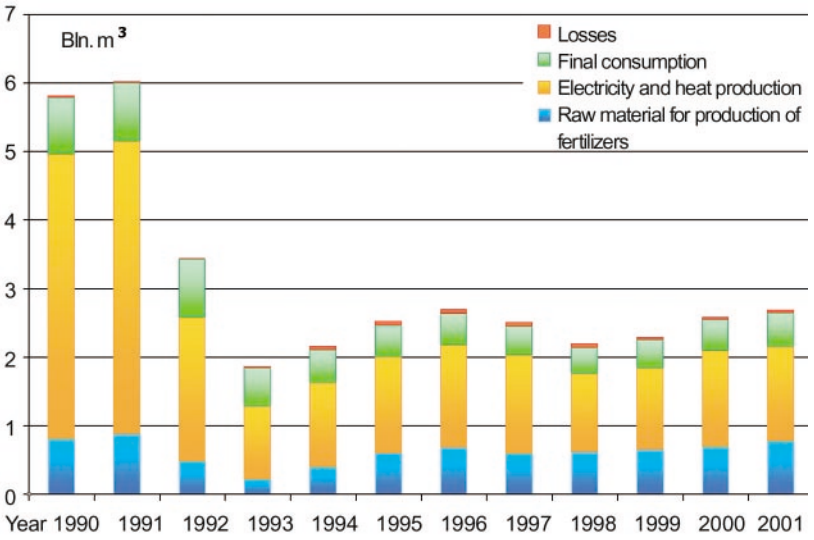


Fig. 7.2. Dynamics of natural gas consumption

27. Technical facilities for the supply of natural gas from Russia do not in any way restrict the use of natural gas in Lithuania at present, nor will they restrict its supply in future. However, some gas pipelines are outworn and even at present the pressure of gas ***transmitted through them is being limited***. This calls for their upgrading and enhanced capacities in future, especially in the direction of Kaliningrad. The construction of a new pipeline for natural gas to Kaliningrad should be considered and a feasibility study needs to be prepared. The increase in the consumption of natural gas in future may be restricted owing to the inadequate reliability of gas supply.

Adequate reliability of gas supply may be insured by supplying gas from several sources, by developing transit, building up gas reserves at storage facilities, and regulating the balance of primary energy consumption. A gas storage facility should be constructed or leased in order to enhance reliability in gas supply. Gas supply and transmission enterprises are responsible for building up gas reserves. The enterprises, which use gas as a raw material for the manufacturing of mineral fertilisers, oil refining etc., should solve by themselves, together with the gas supply enterprises, the issues related to the accumulation of gas reserves.

Gas reserves have to be ensured with priority for the producers of electricity and heat who use only natural gas for generation of energy.

28. In order to enhance strategic reliability in the supply of natural gas it is necessary:

1) to expand and upgrade the gas transmission networks and ensure that conditions applied for transit of energy resources in Lithuania are in line with the European Energy Charter, legal acts of the European Union and their practical implementation;

2) to install the missing gas metering stations on the cross-border gas pipelines;

The main measure ensuring the security of gas supply is the use of underground gas storage. With this purpose, the possibility of leasing capacity from the Latvian Inchukalns gas storage has been analyzed in the first stage. However, the installed capacity of the Inchukalns storage is insufficient to meet the needs of Latvia, North-Western region of Russia and Lithuania. Therefore other possibilities are investigated for building underground gas storage in Lithuania's no longer exploited saturated oil strata (Genčai, Kretinga) or sandstones - water bearing horizons (Malūkai, Syderiai, Southern Salantai, Vaškai).

The regulation of the gas market in Lithuania is developing in compliance with the EU legislation and directives underlying the Law on Natural Gas approved by the Seimas (Parliament) in October of 2000. The Law provides general principles for the organization of the natural gas sector and for the activities of natural gas companies as well as their relations with consumers in the supply, distribution, transmission and storage of natural gas. A great deal of the provisions of the Law are elaborated in secondary legislation. The implementation of this Law and the secondary legislation will have an impact on many activities of the Lithuanian gas company with respect to reorganization and liberalization of gas market.

The use of the liquefied gas, particularly to meet transport needs, has steadily increased in Lithuania after year 1996 ***(Fig. 7.3)***. In 2001, the consumption of liquefied gas in households amounted to 36.3%, in transport - 59.3% and for other needs - 4.4%.

3) to continue the investigation and prepare a study for the construction of the storage facility, to be followed, subject to a feasibility study, by the ***construction of an underground gas storage*** in Lithuania;

4) to consider, together with the other Baltic States, the possibility of connecting with the gas pipelines of Poland and Finland.

29. The development of the national natural gas system shall be market oriented and based on mutual arrangements between the consumers and suppliers. The State shall provide support for the strategic projects, necessary for ensuring the reliability of gas supply and environmental standards. The forms and measures of assistance will be determined by the Government.

The natural gas market will be developed and ***regulated*** in accordance with the provisions of EU directives and other legal acts, implementing regulations, having regard to the realistic possibilities for implementing these provisions and commitments to the EU.

30. In 2000, ***190,000 tons*** of liquefied gas ***were consumed*** in Lithuania, 57% of that amount – by transport. In future, demand for liquefied gas in households will increase insignificantly. If the tariff system is not changed, consumption of liquefied gas for transport will grow faster.

The consumers whose demand for fuel is not high are recommended to use liquefied gas as a type of ecological fuel. To ensure a stable supply of liquefied gas, advanced technologies are to be applied.

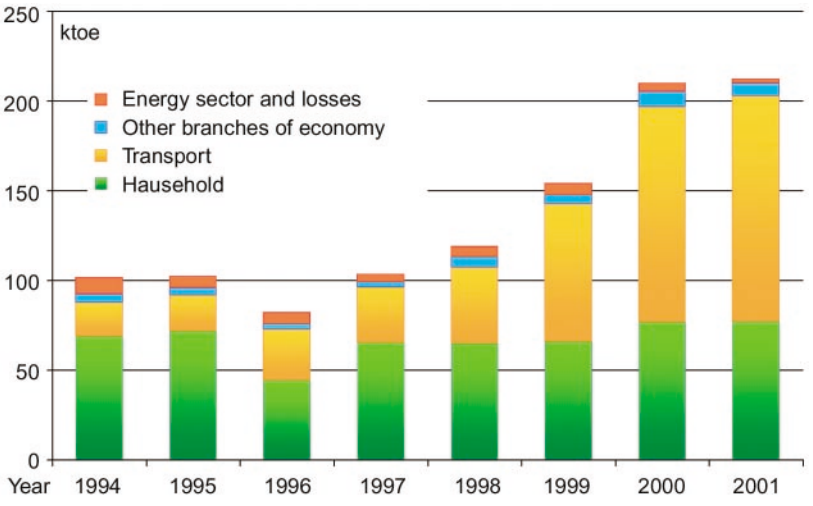


Fig. 7.3. Dynamics of liquefied gas consumption

8 STRATEGY FOR THE CRUDE OIL AND PETROLEUM PRODUCT SECTOR DEVELOPMENT

31. The share of petroleum products in the balance of the country's primary energy resources is quite significant: in 2000, the consumption of oil products by all sectors of economy amounted to 2.2 million tons. This constituted about 31% of the total amount of the consumed primary energy resources. Lithuania possesses the only oil refinery in the Baltic states region with the annual crude oil refining capacity amounting to 7-8 million tons, also the oil terminal for oil import-export via the Baltic Sea with the capacities equal, accordingly, to 6 and 8 million tons, and the petroleum products transhipment terminal in Klaipėda, reconstructed in 2001, one of the region's most modern, the capacity of which reaches 7 million tons. At the present time Lithua-

Two oil pipelines and one diesel fuel pipeline were built across the territory of Lithuania ***(Fig. 8.1)***. Through a pipeline with annual capacity of 16.2 million tons, oil is supplied from Russian oil production enterprises to Venspils port in Latvia. This port is also used for the export to the West of oil and diesel fuel produced by Novopolock oil refinery. Another pipeline with the annual capacity of 16.2 million tons is used to supply oil, via Biržai pumping station, from Russia (Polock) to Mažeikiai oil refinery and Butinge oil terminal. It is planned that half of the oil supplied to Lithuania will be refined by Mažeikiai oil refinery and the other half will be exported.

Fig. 8.1. Oil supply pipelines in Lithuania

The design capacity of Mažeikiai oil refinery amounts to 12 million tons of oil per year. In 1992-1996, the company refined only 3.5-5.0 million tons of oil ***(Fig. 8.2)***. At present, the oil refinery capacities are exploited more efficiently, for the amount of the oil refined approximated to 7.0 million tons in 2001.

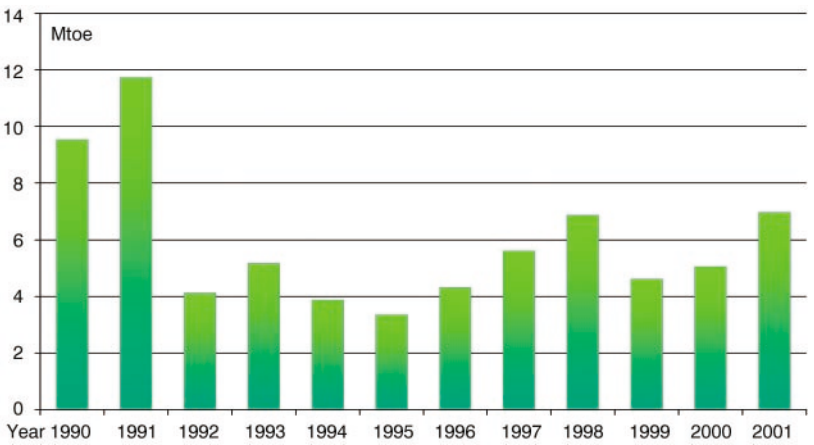


Fig. 8.2. Volumes of crude oil refined at Mažeikiai Oil Refinery

nia possesses all technical possibilities for importing crude oil and petroleum products and has achieved diversification in supply countries. In this way Lithuania has substantially expanded its petroleum products supply capacities and is technically protected against possible disruptions in the supply from any country.

32. Implementing the provisions of the Law on the Basics of National Security and seeking to have an alternative source of supply with petroleum products, state control over the management of AB "Klaipėdos Nafta" should be guaranteed.

33. In order to ensure reliable supply of the economy with oil and petroleum products, mandatory ***90-day stocks of crude oil and petroleum products*** will be built up. The stocks will be accumulated gradually until the end of 2009, i.e. for an eight-year period. 50% of the stocks of petroleum products will be built up with state funds. In order to ensure reliable and safe storage of petroleum products, warehouses, storage facilities and terminals should conform with the EU legislation and environmental requirements.

In 1998, the EU adopted a Directive imposing an obligation on the Member States to keep 90-day stocks of crude oil and petroleum products. In Lithuania, the accumulation, formation and storage of state stocks is subject to the Law on State Stocks of Petroleum Products and Crude Oil, adopted in 2002. A State of Emergency in energy would be declared in case of the disruption in the normal supply of energy resources to energy companies and consumers, which could result in the failure of energy companies to plan and to manage, in a timely manner, their economic activity. The oil stocks can also be used by the Government in the event of another type of State of Emergency or state of war declared in the manner prescribed by the law.

The state will establish measures for the regulation of the petroleum product market and restriction of petroleum product consumption in emergency situations in the energy sector in accordance with the provisions of the Law on the State Stocks of Petroleum Products and Crude Oil. The Lithuanian Petroleum Products Agency was established on 31 December 2001 for the accumulation of stocks of petroleum products with state budget funds.

34. ***Indigenous oil resources*** are not very plentiful, however, oil production from them can be continued for several decades, maintaining the annual oil extraction level of 0.3-0.5 million tons. For this reason the sector of crude oil and petroleum

The forecast for local oil resources is estimated at 278 million tons. However, the exploitable resources amount only to 87 million tons, including 64 million tons on land and 23 million tons in the Baltic Sea shelf. The pilot production of oil started in Lithuania in 1990 and has been continuously expanded *(Fig. 8.3)* since that time. In 2001, the country produced 471 thousand tons of top-quality oil, the bulk of which was exported to Poland.

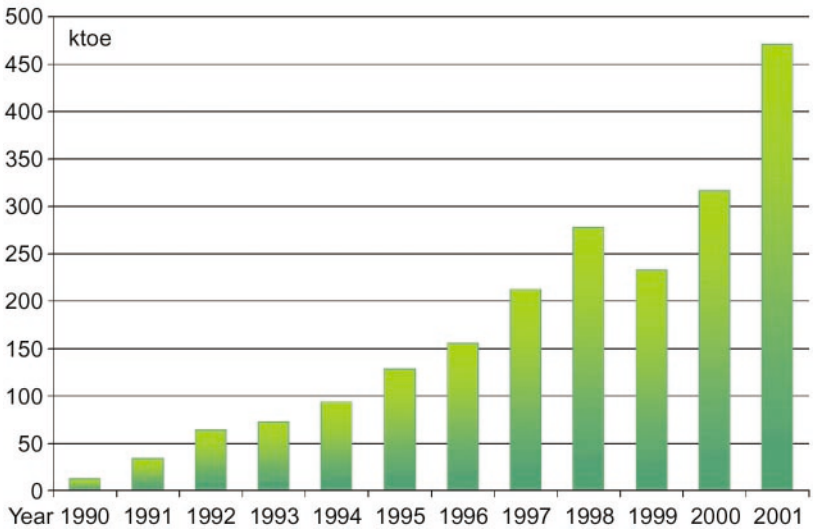


Fig. 8.3. Oil production in Lithuania

products will remain, in the near future and in later years, dependent on the import of crude oil and partly on the import of petroleum products. In the balance of primary energy resources

the share of petroleum products used for the production of other types of energy will shrink and at the end of the period under consideration will amount to 20-25%. Nevertheless, petroleum products will remain a reserve fuel for thermal power plants and large district heating systems and, upon installation of flue gas cleaning equipment, these products will compete with natural gas.

35. Investors of any one country may not dominate the retail trade sector in petroleum products of Lithuania. It must be ensured that the Competition Council of the Republic of Lithuania, in accordance with the Competition Law and other legal acts of the Republic of Lithuania, has at its disposal adequate leverage to ensure fair competition.

36. According to the forecasts, the most noticeable increase in the consumption of light petroleum products is envisaged in the transport sector where their consumption will amount to approximately 2.0 million tons per year in 2020. The currently available transportation, processing, storage and distribution facilities are sufficient to meet the demand in petroleum products.

37. In the process of Lithuania's integration into the EU, more strict petroleum product quality requirements will be gradually imposed seeking to meet environmental goals and reduce pollution. After the accession to the EU, the quality of petroleum products consumed in the country will have to meet the minimum requirements of European standards.

During the entire period under consideration, minimum excise duty rates, provided for in the EU directives, will be applied to petroleum products. Following accession to the EU, Lithuania will harmonise its import-export duty rates with those applied in the EU member states.

9

STRATEGY FOR THE DEVELOPMENT OF THE SECTOR OF INDIGENOUS, RENEWABLE AND WASTE ENERGY RESOURCES

Local fuel resources include peat, firewood, lumber and wood processing waste (bark, branches, sawdust, sawdust briquettes, etc.), agricultural production waste (straw, reeds, boon, etc.), hydro, wind, geothermal and solar energy. Biogas and biofuels produced from ethanol and rape oil have started recently to gain a definite position in the balance of local energy resources. Municipal and industrial waste can also be used as local fuel in the country. The wider concept of local resources covers all renewable including waste energy sources, i.e. the energy derived in any technological process and available as a waste product.

To assist companies, which are going to produce the installations for processing and use of local energy resources, the following is planned:

- to develop technologies and organizational schemes for collecting wood waste and its preparation for use as fuel, to evaluate their use and to organize their implementation;
- to produce generating sets based on local and renewable energy resources as well as installations for processing such resources, also providing support to companies and organizations;
- to perform operational tests on using biofuels in transport and to prepare recommendations for users on the efficient use of such fuels;
- to develop and implement legislation and technical regulations promoting the production and use of renewable and waste energy resources and biofuels as well as the production and introduction of the relevant equipment for their use.

38. In 2000, the share of ***indigenous, renewable and waste energy resources*** (hereinafter - indigenous energy resources), (indigenous crude oil excluded), amounted to about 9% in the overall primary energy balance. A target should be that approximately 2 million tons of oil equivalent of the above energy resources are used per year (from this amount - about 430 000 tons of oil equivalent of waste energy resources).

39. In order to ensure optimum use of indigenous energy resources and at the same time reduce fuel imports as well as create new jobs and improve environmental standards:

1) programmes for the consumption of indigenous energy resources will be drawn up and regularly updated;

2) extensive use of indigenous energy resources will be encouraged by organisational, economic and financial measures, ***support will be given to enterprises*** and production of equipment intended for the processing and use of the above-mentioned resources will be increased and the installation of this equipment will be organised;

3) projects for the use of wind, water and solar energy as well as for the consumption of other renewable and waste energy resources will be implemented, the experience gained in the construction and operation of the relevant facilities will be accumulated and summarised. The state will back the implementation of these projects and provide conditions for the EU structural and other support funds to be used for achieving the above goals;

4) conditions will be provided for developing the production of biofuels (denatured dehydrated ethyl alcohol, oils of biological origin, ethyl and ethyl ester). The existing legal acts and regulations promoting production and use of the above biofuels will be amended and revised on a regular basis;

5) efforts will be directed to increasing share of renewables in the primary energy balance by 2010 to 12% (***Tab. 9.1***) and ensuring that the share is close to meeting the requirements of EU directives.

Tab. 9.1. Consumption and forecast of indigenous and renewable energy resources, ktoe

Type of resources	2000	2010
Wood and wood waste	619,8	795
Peat	11,2	31
Straws	2,5	12
Biogas	1,7	12
Wind energy	-	13
Solar energy	0,001	0,2
Geothermal energy	-	23
Biofuels	-	64
Municipal waste	-	17
Hydroenergy	29,2	40
Total, % in primary energy balance	**659,9 *9,0***	**1007 *12,0***

10

IMPROVING ENERGY EFFICIENCY

40. It has been estimated when revising and updating the National Energy Efficiency Programme that 20-50% of the currently consumed energy resources may be saved in particular economic units of the Rep. of Lithuania. The major share of the final energy (approximately 45%) is consumed by households as well as trade and service sectors (1.84 million tons of oil equivalent were consumed in 2000). These sectors provide a lot of possibilities for energy saving. The total amount of energy resources that may be saved in industry is 0.2 Mtoe (in 2000, 0.75 Mtoe were consumed in the sector) and in the transport system - about 0.15 Mtoe (the amount consumed in 2000 is 1.05 Mtoe.

41. A revised National Energy Efficiency Programme will be implemented according to the following principal directions:

1) drafting of legal acts, regulatory enactments and technical documents intended for implementing the NEEP;

2) renovation of buildings and modernisation of their energy facilities;

3) intensification of the use of indigenous, renewable and waste energy resources;

4) increasing energy efficiency in production processes;

5) further development of information, educational and consulting activities.

With a view to regulating the saving of energy resources, legal grounds for meeting the requirements of the EU directives in the field of energy efficiency will be established.

42. The renovation of residential houses and public buildings as well as the modernisation of their energy facilities will be further financed by the residents, using soft credits administered by the public agency ***Housing and Urban Development Foundation*** as well as drawing on other possible sources of financing. Funds of the Housing and Urban Development of Foundation are comprised of allocations from the state budget and loans granted by the World Bank and foreign countries.

Energy saving measures as well as implementation of projects for the use of indigenous, renewable and waste energy resources will be supported by Special Programme for the Implementation of Energy Saving Measures.

The State will seek to promote the modernisation of energy facilities in existing buildings and the improvement of their insulation, the increase of energy efficiency in industry, transport and other sectors of economy as well as the increase of use of the EU structural and other support funds for the implementation of energy efficiency projects and measures.

The Housing and Urban Development Foundation was established with the purpose of:

- maintaining the system of financing housing and urban development projects operating under market conditions;
- promoting energy conservation and private initiative in implementing energy conservation and housing renovation projects;
- supporting the institutional structure for the development and implementation of investment projects in housing and urban development.

In 1996-2001, the Foundation carried out an Energy Efficiency Housing Pilot Project. Over 300 investment projects were prepared for the renovation of the buildings of educational establishments and residential houses. The energy savings in such residential houses amount to 24% on average.

Since January 2003, this activity has been undertaken by a public institution: the Central Project Management Agency (combining the Central Financing and Contracting Unit and the Housing and Urban Development Foundation). The Agency will administer investment projects through the programs financed with loans from international institutions (banks).

11

ENVIRONMENTAL PROTECTION

43. In the energy sector Lithuania will comply with the international environmental conventions acceded to by Lithuania, with the National Environmental Strategy approved by Resolution of the Seimas of the Republic of Lithuania No I-1550 of 25 September 1996 (Official Gazette, 1996, No. 103-2347), the Strategy for Approximation in the Environment Sector and the National Strategy for the Implementation of the United Nations Framework Convention on Climate Change accepted by Resolution of the Government of the Republic of Lithuania No 1236 of 25 October 1996 (Official Gazette, 1996, No 105-2409) and the requirements of the EU environmental directives.

Over the last decade, total emissions of the main pollutants (particulate matter, SO_2, NO_x, CO and non-methane volatile organic compounds) from all stationary and mobile sources of pollution in Lithuania have decreased more than 2.5 times, from 1.1 to 0.43 million tons. The emissions from stationary sources of pollution in Lithuania decreased more than 4 times. At first this was due to the decline in industrial production which caused the lower energy demand, and later, due to the more efficient and rational use of energy and the introduction of measures for reducing pollution. The emissions from mobile sources of pollution decreased 2 times, although the number of passenger cars increased 2.4 times over the same period.

The dynamics of SO_2, NO_x, and CO emissions is represented in ***figure 11.1*** and CO_2 emission sources are shown in ***figure 11.2.***

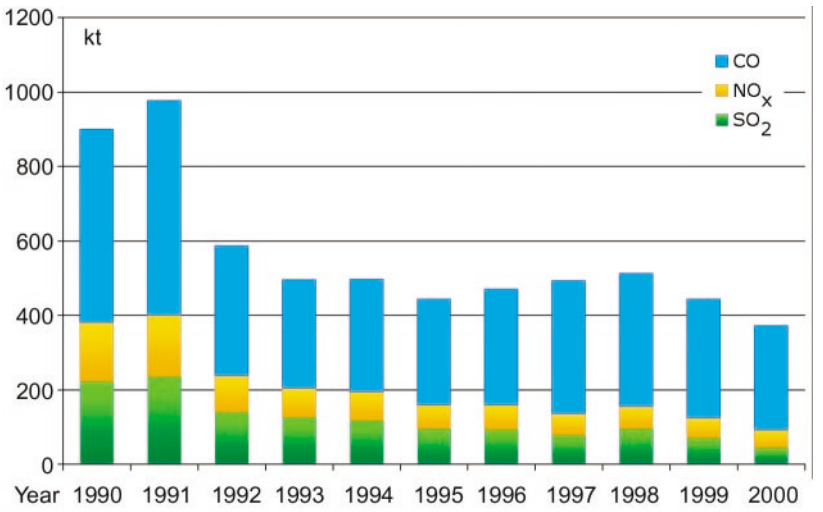


Fig. 11.1. Dynamics of SO_2, NO_x and CO emissionss

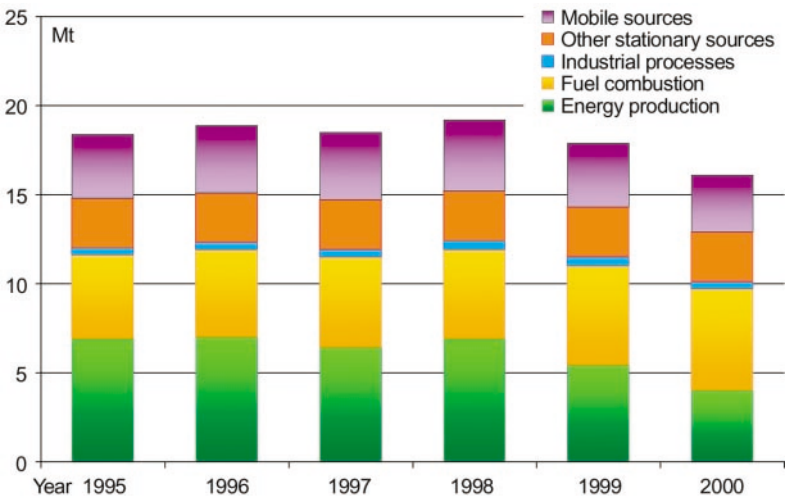


Fig. 11.2. Dynamics and sources of CO_2 emissions

44. The main environmental directions for the energy sector in the nearest future are as follows:

1) in order to comply with environmental requirements, all combustion plants will have to reconsider by 2008 the structure of the fuel used and to prepare for fulfilling new requirements;

2) in order to ensure energy supply reliability, the largest Lithuanian power plants will have to install flue gas cleaning equipment;

3) priority in fuel consumption will be given to indigenous and renewable energy resources, having regard to the environmental and economic aspects of the use of these resources;

4) the Government shall prepare the required legal acts and measures ensuring stable long-term supply of indigenous and renewable resources to energy generating enterprises and other consumers;

5) improvement of ***radioactive waste management*** and reconstruction of radioactive waste storage facilities in conformity with international requirements;

6) ensuring pollutant emission monitoring in major thermal power plants and boiler houses;

7) implementation of oil products desulphurisation technologies in the Mažeikiai Oil Refinery;

8) wider application of economic measures promoting pollution reduction and implementation of environmentally friendly technologies;

9) further development and improvement of the environmental taxation system by ***introducing pollution trading*** systems, ***green certificates systems*** and other measures;

10) priority environmental investment in the energy sector should be made in the atmosphere sector first of all in order to fulfil the EU requirements and other international obligations in the field of atmospheric pollution, taking into consideration the consequences of the Ignalina NPP decommissioning.

In 1997, Lithuania signed the *Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management*. The commitments of the Republic of Lithuania under this Convention and the latest requirements of EU legislation in the sphere of radioactive waste management were incorporated into *the Law on Radioactive Waste Management* adopted in 1999. In this Law, the *State Enterprise Radioactive Waste Management Agency* was founded in 2001 and is responsible for the storage and disposal of the radioactive waste transferred to it. In 2002, the Government of the Republic of Lithuania approved the *Strategy for Radioactive Waste Management*. Its main objectives include the development of radioactive waste management infrastructure based on modern technologies, and actions for the implementation of the key radioactive waste management principles of the International Atomic Energy Agency and to meet the requirements of the EU legal documents in the field of radioactive waste management.

Emission trading will be subject to regulation by the Government, which should establish the emission limits and "pollution permits" to be valued at market prices. Development of a pollution permit market would depend on the existence of differences in emission reduction costs. A company capable of reducing emissions in its production with lower costs will benefit from capturing pollutants exceeding the standard limit, if another company who is willing to purchase the additional emission right pays a higher price than the original costs of capturing the pollutants. In 2001, the European Commission published a proposal for a Directive establishing a framework for greenhouse gas emissions trading in the EU and setting specific national pollution reduction targets. The mandatory emission trade scheme will become operative in 2005.

Green certificate systems are used for promoting the use of renewable energy sources. Under such schemes, the renewable electricity is sold at market prices. With a view to accumulating the financial resources for production of such electricity, all customers are obliged to buy a certain number of green certificates from power plants using the renewable energy resources according to a quota or fixed percentage of the total electricity consumption. As the users are willing to acquire such certificates only at the lowest possible price, the renewable electricity generators compete with each other in selling green certificates.

12

MARKET LIBERALISATION AND IMPROVEMENT OF ENERGY SECTOR MANAGEMENT

Market liberalization means market opening, which enables the customers freely to choose an energy supplier and the supplier - to introduce various innovations to attract consumers.

The cooperation of the Baltic States in a view to establishing the common Baltic electricity market started in 1996 with the Baltic Ring project. The project involved eighteen power supply companies from eleven countries of the Baltic Sea Region.

On 29 October 1998, Ministers of Economy of the three Baltic States signed an agreement on the common energy strategy and policy. On 6 April 1999, the Baltic Council approved the Baltic Energy Strategy. These agreements provide for the commitments to pursue the long-term objective of the energy policy, namely to develop the common Baltic electricity market.

45. Liberalisation of energy market relations will be continued and competition between energy companies will be encouraged seeking to accomplish the main objectives of the National Energy Strategy. When implementing the requirements of *Acquis communautaire*, legal acts in the energy sector will be further drafted and improved with a view to providing favourable conditions for the integration of the energy sector into the EU energy markets.

46. When further revising legal acts and developing market relations, the following is intended:

1) *liberalisation of power and gas sectors*, opening the market in accordance with the requirements of EU directives;

2) development of co-operation with the Baltic States by creating a common ***electricity market*** and later, having connected the Lithuanian and Polish power systems, integration into the electricity market of the Western Europe;

3) integration, together with Latvia and Estonia, of the Baltic states market into the electricity market of the Scandinavian states;

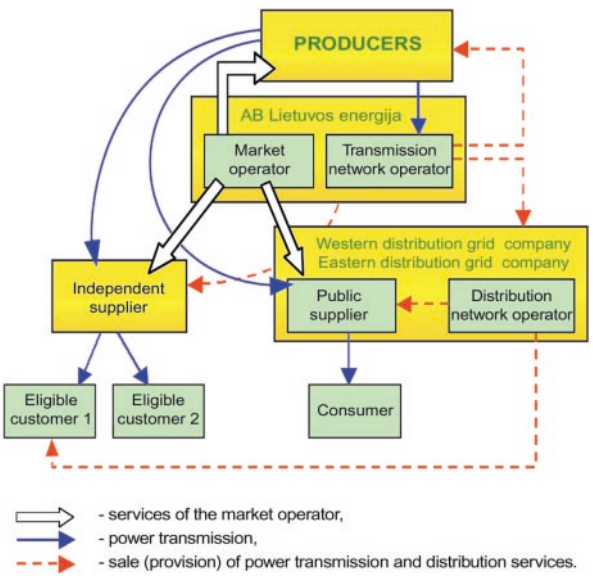


Fig. 12.1. Model of the Lithuanian power market

4) promotion of local and foreign investment in modernisation and reorganisation of energy enterprises, and privatisation of those energy sector enterprises listed for privatisation;

5) retention of state control in the electricity transmission company;

The price cap principle is treated as an incentive regulation. Setting of the upper limit of the price is related to historical costs. Further activities of the company are based on profit making with the successful cost reduction. However, the higher efficiency does not ensure the long-term profit, because the upper limit is gradually diminished. This makes companies work constantly to improve their efficiency.

Energy *regulation* may be economic and technical. Economic regulation means the activity of governmental institutions providing and maintaining the conditions of competition and, where impossible, setting the pricing principles on an artificial basis in order to restrict the monopoly power. In case of technical regulation, certain technical standards of energy activity are established and monitored.

6) improving pricing in the energy sector by implementing effective competition and competitive prices, and in monopolistic area by implementing ***the price cap principle*** with a view to transferring to the adoption of the principle prohibiting abuse of a dominant position, removing cross-subsidisation and gradually introducing multi-component energy prices to be charged to all consumers;

7) improving the procedure for promoting energy production from renewable and waste energy resources and purchasing this energy, implementing competition between the producers, examining the possibility of introducing "Green Certificate" schemes or other systems.

47. Seeking to implement the established strategic objectives of the energy sector, it is necessary to amend legal acts regulating energy management draft new ones, to strengthen institutions of *energy* management, control and *regulation* and to define measures for their implementation, that are based on a comprehensive analysis of scenarios of balanced development of the country's economy and of the energy systems, by optimising calculations using accumulated and systematised statistic information.

48. When improving the energy sector management, the following is required:

1) reduction of influence on the activity of companies by the Government and municipalities, leaving for state institutions the right to make decisions on the strategic issues of energy planning, development and regulation;

2) formation of the structure of energy enterprises, conforming to the requirements of EU directives;

3) development of management incentives, based on economic methods and pricing;

4) establishment of a competitive environment for energy enterprises or creation of an adequate regulatory framework for monopolies.

TRAINING OF SPECIALISTS AND RESEARCH

49. The changes of management principles and forms of ownership in the energy sector, the introduction of the universal energy accounting, emergence of new technologies, and the introduction of entirely new systems of information, control and regulation require specialists with different professional qualifications. Their present training lags behind the rapidly changing needs of the energy sector. If the necessary specialists are not prepared in due time it will be difficult to reorganise the Lithuanian energy sector and the reforms will be delayed.

50. Therefore, it is very important to prepare a programme for the training of energy specialists, based on the experience of Lithuania and foreign countries in preparation of such specialists with similar qualifications. This programme should provide for:

1) updating the training programmes and educational facilities in the technological universities in line with the demand;

2) measures for promoting education and training of the appropriate academic staff;

3) optimisation of the number of students in order to meet the future demand;

4) measures for re-qualification of older specialists;

5) sources of financing the essential upgrading of educational facilities.

National research, design and consultative service institutions will also be necessary in order to modernise the energy sector, increase the consumption of indigenous resources, and provide services to energy consumers and suppliers. In this field the state will promote the establishment of privately funded organisations.

51. The priority areas in research requiring specific support and obligations of the Government are as follows:

1) energy saving and energy efficiency, environmental aspects of energy;

2) energy economics, planning of energy development, optimisation of design and management of complex systems, optimisation and control of technological processes, management and operation of energy systems in the conditions of a competitive market, improvement of management institutions by developing a common, integrated, liberal market of the European Union;

3) nuclear energy safety, reliability and durability of energy equipment, ageing of construction materials;

4) management, storage and disposal of spent nuclear fuel and other radioactive materials;

5) technologies for the use of renewable, indigenous and waste energy resources;

6) small CHP plants, including fuel cells;

7) informatics in the field of energy.

FINAL PROVISIONS

52. The presented revised National Energy Strategy defines the main targets set by the State and directions for their implementation in modernising the country's energy sector, adjusting it to the growing State demand and the most recent international requirements relating to efficiency, reliability, environmental and management improvement. Already at the initial stage of implementation of this Strategy, Lithuanian energy sector will be made fully compatible with the EU requirements and will be in the position to integrate into the common European energy structure. For the implementation of the provisions laid down in the Strategy, the Government of the Republic of Lithuania will approve a five-year Strategy implementation plan and programmes of action, setting specific deadlines for their implementation, together with the sequence of actions, amount and sources of financing as well as the designated implementing institutions.