

Lithuanian Energy: On the Way to Integration into the European Union

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Lithuania is one of the candidate countries preparing to become a member of the European Union and has recently received an invitation to join NATO. The country is in transition from a centrally planned to a free market economy, and is experiencing fundamental transformations and facing many problems. Lithuania has inherited an energy sector with comparatively good technical infrastructure but inappropriate for a small independent state of its size. The Lithuanian economy through 1990 was energy intensive. In order to meet requirements of a modern economy significant changes have occurred during the transformation period, including changes in institutional structure, legal framework, modernization of technologies, etc.

Lithuania inherited from its Soviet past, a very powerful energy sector, including the Ignalina Nuclear Power Plant (NPP) with installed capacity of 3000 MW. This power plant is the most important energy unit in Lithuania, having a high stability of electricity production on a basis of comparatively cheap nuclear fuel. However, the steep decline in the Lithuanian economy over the last decade (to 60% of its 1990 level) resulted in the plant's inefficient use and over capacity. During the last decade, operation of Ignalina NPP was at the center of continuous discussions regarding its safety, reliability and efficiency.

During the last decade Lithuania became an attractive country for many reasons: 1) the possibility to make efficient investments in many activities – industry, transport and communications, services, etc.; 2) very favorable geographical position between East and West; 3) lower energy prices because of close proximity to Russian oil and natural gas sources; 4) well developed energy and transport infrastructure (power, natural gas and oil supply systems); 5) comparatively low cost and qualified labor force; 6) favorable opportunity for investors in future markets of energy, goods and services, etc.

Changes in the Lithuanian Economy

After the collapse of the former Eastern Block, almost all countries with centrally planned economies experienced a large reduction in economic activity. Based on the indicators prepared by the International Energy Agency, in the last decade, GDP dropped in the Slovak Republic, Romania, Hungary, Slovenia, Czech Republic and Poland to 80-93% of the 1990 level. The economic decline was deeper only in Croatia and Bulgaria – amounting to 64.1% and 73.2%, respectively. The period of economic slump was comparatively short in these countries. In the Commonwealth of Independent States (CIS) the processes of transition have been more dramatic and the decline of the economy much higher – GDP dropped in Georgia to 25.6%; in Republic of Moldova to 34.2%; in Azerbaijan to 36.5%; in Ukraine to 40.7%; in Tajikistan to 50.1 % and in Russia to 57.4 % of the 1990 level.

The economic slump in Lithuania was smaller than in the majority of the CIS countries: at the end of 1994, the GDP had

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fallen to 56.1% of the 1990 level. GDP began increasing in 1995. In 1996, the GDP increased by 4.7%; in 1997 by 7.3% and in 1998 by 5.1%. In 1999, as a consequence of the financial and economic crisis in Russia, the GDP decreased by 3.9%. Analysis of the basic macroeconomic indicators shows that the Lithuanian economy was able to recover from this crisis in 2000 as GDP once again climbed by 3.8%. In 2001, according the provisional estimations, GDP went up by 5.9%. The most recent forecast indicates GDP growth of 5.2% in 2002 and 5.5% in 2003.

The transition period in Lithuania was prolonged and rather severe in many aspects. However, steady progress in strengthening the performance of market-supporting institutions and undertaking the necessary reforms gives hope of a strong and long-term economic recovery. This progress could be characterized by several transition indicators, such as a growing private sector share of the GDP, the pace of privatization, liberalization of prices, removal of restrictions and tariff barriers on trade and foreign exchange, progress on creation of competition policy, etc.

According to an assessment prepared by the European Bank for Reconstruction and Development, Lithuania has made significant progress in several important areas of reforms required in the transition to a market economy.

One of the most important indicators of the attractiveness of the Lithuanian economy and its openness to developed countries is the growth of foreign direct investment. At the beginning of 2002 foreign investment was almost \$2.7 billion. Until the middle of last decade foreign direct investment in the Lithuanian economy was very low. Since 1996 it has grown very fast. See Figure 1.

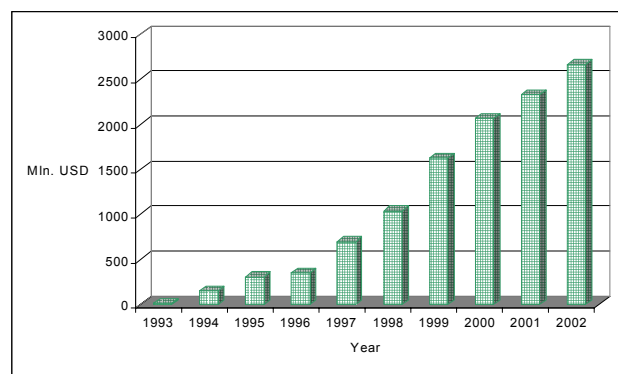
In 1993-1997 the major part (more than 70%) of foreign investment was oriented to manufacturing and wholesale and retail trade. In January 2002, foreign investment was more broadly spread with four economic activities dominating: manufacturing (25.6%), wholesale and retail trade (20.4%), financial intermediation (19.9%), transport, storage and communication (18.7%). The share of foreign investment going to the energy sector is still comparatively low (about 3%) because of delayed privatization of its infrastructure.

In 1997, the United States dominated Lithuanian foreign investment. Today, Denmark leads in foreign investment accounting for about 19% of the total, followed by Sweden.

Current Status of Energy Consumption

Lithuania inherited from its Soviet past a very powerful

Figure 1
Foreign Direct Investment in Lithuania



energy sector, which was created not only to meet local needs, but also to satisfy the requirements of the large FSU North-Western region. The excess capacity is a result of the common central planning policy of the FSU, trying to create a fully integrated energy sector and economy. The existing energy sector (rather modern power plants, powerful oil refinery, one of the most modern regional oil terminals, developed natural gas and district heating systems) to some extent was helpful to the Lithuanian economy, mitigating problems at the beginning of the transition to a free market economy. However, at present it is rather difficult to efficiently use the surplus of existing capacity in the energy sector because of the large reduction of energy consumption in all branches of the national economy and the economic recession in neighboring countries. In addition, Lithuania has no transmission lines to Western countries.

Lithuania has almost no primary energy resources. In 2001, indigenous energy resources (wood, peat, straw, hydro, etc.) represented 8.5% of the total energy supply (including the extraction of local oil, increases the figure to about 14%). Their share during the period of 1990-2000 increased more than 4 times. Nevertheless, the primary energy supply is still dominated by imports from Russia – all crude oil, natural gas and nuclear fuel are imported from there. During the transition period the share of nuclear, the cheapest imported fuel, was rather high – it fluctuated from 24,7% in 1994 to 36,9% in 1996. In 2001 its share was 35%. The role of nuclear fuel is very important when seeking to increase the security of the primary energy supply, especially in the power sector. In principle oil products are the most important fuels in the Lithuanian energy balance – their share fluctuates around 35%. In 2001, the share of oil products decreased to 30.5%. The share of natural gas, the most attractive fuel in long-term perspective, was about 20% during this period. It decreased from 26.8% in 1990 to only 16.1% in 1993, but it increased to 25.4% in 2001. The role of coal has decreased throughout the period – from 3.7% in 1990 to 0.9% in 2001.

The sharp decrease in primary energy consumption together with changes in its structure was an important factor that softened the economic and social problems of the transition period in Lithuania. However, the decrease of primary energy consumption at the beginning of the transition period and its recent changes were influenced not only by the decline of economic activity and the development of internal consumption in the country. Because of the existing overcapacities, the changes in primary energy demand in Lithuania are strongly related to energy consumption in the power sector that is dependent on the export of electricity. Lower primary energy demand in 1999-2000 was related to both – lower final energy consumption and lower exports of electricity.

Total final energy consumption in Lithuania decreased from 8.7 mill. toe in 1990 to 3.9 mill. toe in 2001. Energy consumption decreased in all sectors of the national economy. Analysis of final energy demand by sectors shows a sharp decrease in the shares of agriculture, construction and industry. In 2001 final energy consumption in these sectors dropped respectively to 12, 20 and 25% of the 1990 value. At the same time energy demand in the trade and services sector decreased almost 3 times but its share in the final energy balance decreased slightly. Energy demand in the household and transport sectors decreased during the transformation period respectively to 74 and 79% of the 1990 value. Therefore, their

shares increased significantly - from 21 and 17% in 1990 to 35 and 30% respectively in 2001.

When analyzing final energy consumption of different energy carriers (electricity, heat and fuel) one may notice that the final electricity consumption decreased from 12 TWh in 1990 to 6.4 TWh in 2001. District heat decreased almost 3 times and was about 10.0 TWh in 2001, and final fuel consumption decreased from 5 mill. toe in 1990 to 2.5 mill. toe in 2001.

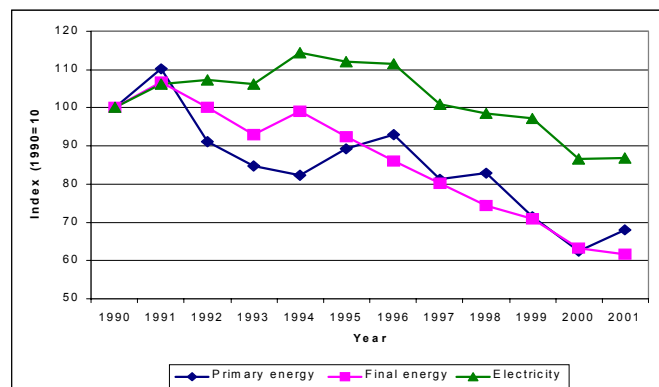
Changes in Energy Efficiency

One of the legacies of central planning is the inefficient use of energy in all transition countries. High energy intensity in these countries is caused by several factors: the past existence of very low energy prices; old and inefficient equipment and technologies; low thermal performance of dwellings and public buildings; comparatively large number of old private cars; inadequate or even non-existent metering and control of energy consumption, etc. Therefore, energy efficiency enhancement is one of the most important strategic objectives of the Lithuanian energy sector. At the beginning of the transition period, energy intensity in Lithuania was increasing because of the steep decline in economic activity in all sectors of the economy and the large share of the household and transport sectors in the total final energy demand. However, since 1994 final energy intensity in Lithuania has been decreasing steadily, and in 2000 it was lower in comparison to the 1990 level by almost 37%. See Figure 2. In 1993, Western experts were expecting that final 2000 energy intensity in Lithuania could be reduced by 32% of the 1990 level, on the assumption of fast reforms, but only by 18% on the assumption of a slow reforms scenario. Thus, the decrease of energy intensity by 37% in the past decade is one of the most important positive achievements of the Lithuanian economy.

Primary energy consumption in Lithuania depends very much not only on the total level of economic activity and changes in the GDP structure but also on the volume of electricity export. Therefore, the range of primary energy intensity fluctuation was comparatively large. As one can see from Figure 2, the relative decrease of electricity intensity in Lithuania is the lowest in comparison with other energy carriers. Nevertheless, the general tendency of more efficient energy consumption in Lithuania is evident – since 1994 the relative consumption of electricity, primary energy and especially final energy per unit of GDP has been decreasing.

Real changes of energy efficiency in various branches of

Figure 2
Changes in Energy Intensity in Lithuania



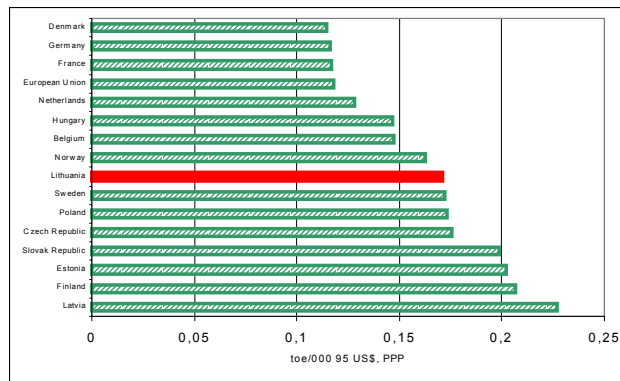
the economy could be explored using ratios of the final energy consumed in each sector per its value added. In many sectors these changes are very large. The energy intensity in agriculture and construction in 2001 was about 25% of the 1991 level. Energy intensity in the trade and services sector decreased during this period 3.5 times. Important changes in the structure of manufacturing and implementation of new technologies have decreased energy intensity in this sector by 2 times. Even energy consumption for freight and passenger transportation (including fuel consumption by private cars) per unit of gross value added in this sector decreased in 2001 to 73% of the 1991 level. At the same time the reduction of energy intensity (assessed as the ratio of energy consumption on total GDP) in the household sector was comparatively low – to 93% of the 1991 level. This reduction of energy consumption is a result not only of the implementation of energy saving measures but also of the lower level of comfort, especially in families with low social income.

Assessment of the energy saving potential in transition countries, in many studies prepared by the International Energy Agency, the European Commission and various statistical publications, is defined as a ratio of gross consumption of primary energy per unit of GDP using exchange rates. However, this indicator is not correct for comparison of real energy efficiency in Western countries and countries of the former Eastern Block because high energy intensity in the former centrally planned economies is determined not only by relatively high energy consumption but also by the low level of GDP. It is caused principally by price distortions and the differences of GDP evaluation. Therefore, a method of Purchasing Power Parity (PPP) should be used for comparison of the GDP level in developed countries and countries in transition. In this case the indicators of energy intensity in various countries could also be assessed more accurately. Using estimates of Purchasing Power Parity, primary energy intensity in countries of Central and Eastern Europe is about 1.3-1.9 times higher than the average of EU countries.

Indicators of primary energy intensity are not correct for the comparison of energy efficiency in various countries for other reasons as well. On the basis of analysis of energy balances one can see that the structure of primary energy consumption (losses of primary energy in a transformation sector, own use of power plants, non-energy consumption, transmission and distribution losses, and final energy consumption) in different countries varies greatly. Thus, primary energy consumption per unit of GDP depends very much on the structure of electricity generating capacities, on volumes of primary energy consumption for non-energy purposes, etc. In addition, the amount of primary energy consumption in Lithuania depends highly on the export of electricity and oil products because the capacity of the energy sector, constructed through 1990, considerably exceeds the requirements of the country. Lastly, final energy, i.e., that part of primary energy and secondary energy resources which is used by final consumers, is the real basis for the production of goods and the delivery of services.

Thus, seeking to compare more exactly the energy efficiency in various countries it is necessary to use the ratio of final energy consumption and GDP using estimates of Purchasing Power Parity. As shown in Figure 3, in 1999 this indicator for Lithuania was about 1.5 times higher than in Denmark and EU countries (on average), 1.3 times higher

Figure 3
Final Energy Intensity in 1999
(GDP assessed in PPP)



than in Belgium and Netherlands and only by 1.1 times higher than in the United States.

Further increases in energy efficiency should be based on implementation of advanced technologies in manufacturing, modernization of heating systems, improvement of thermal insulation of residential houses and public buildings, increased share of new vehicles, etc.

Future Changes in the Lithuanian Energy Sector

The Lithuanian government implements radical reforms in the legal basis of energy sector and a broad program of its restructuring and privatization. In 1997, district heat activities were separated from the Lithuanian Power Company, a former highly centralized and vertically integrated monopoly structure, and newly created independent companies were transferred to municipalities. After long discussions, at the end of 2001, Lithuanian Power Company was split into 5 new companies: 2 electricity generation companies (Lithuanian TPP and Mazeikiai PP), high voltage electricity transmission grid (including the main regime controlling devices, Kruonis HPSP and Kaunas HPP) and 2 distribution companies. Restructuring of the power sector will provide the preconditions for further liberalization of activities in the sector and preparation for the development of the internal electricity market. Restructuring of another vertically integrated company, Lithuanian Gas, and its privatisation also provides the necessary conditions for opening of the gas market according requirements of the EU directives. The oil sector is almost fully privatised. An independent regulatory body was created which regulates energy prices where market conditions do not exist.

Further development of the Lithuanian energy sector will be greatly influenced by many internal and external factors. These factors are assessed in the National Energy Strategy (revised for the second time since 1994), which is presented for approval of the Seimas of the Republic of Lithuania. Strategic objectives of the energy sector based on the main factors that determine Lithuanian energy policy are the following:

- 1 to ensure reliability and safety of energy supply with least cost, minimal environmental pollution and permanent increase of energy efficiency;
- 2 to liberalise electricity and natural gas markets according to requirements of the EU directives;
- 3 to continue privatization of energy units;
- 4 to prepare for implementation (in terms coordinated with

the EU) of measures seeking to meet requirements of the EU directives;

- 5 to prepare for decommissioning of the Ignalina NPP, disposal of radioactive waste and interim storage of spent fuel;
- 6 to develop regional cooperation and collaboration seeking to create a common Baltic electricity market in a 5-year period;
- 7 to increase efficiency of district heating systems and increase the CHP share in the total electricity production to at least 35%;
- 8 to increase the renewable energy share in the primary energy balance up to 12%;
- 9 to integrate the Lithuanian energy systems into structures of the EU in a 10 year period.

The most important changes in the Lithuanian energy sector are related to the decision on decommissioning of Unit 1 of the Ignalina NPP before 2005 and Unit 2 before 2010. This power plant presently supplies up to 80% of internal electricity demand in Lithuania. The current import possibilities from the EU countries are very limited due to the absence of a power link to the Western electricity network. Therefore, after closure of Unit 1 and especially of Unit 2 at Ignalina NPP, Lithuania will shift from nuclear to existing conventional capacities. In order to meet electricity demand, Lithuania will rehabilitate conventional electricity generation capacities and install necessary environmental measures so as to meet environmental standards and targets and keep the possibility of using different fuels (heavy fuel oil, orimulsion and natural gas).

The majority of the existing conventional power plants in Lithuania (Lithuanian Thermal Power Plant, and combined heat and power plants -Vilnius Power Plant, Kaunas Power Plant and Mazeikiai Power Plant) have been in operation for about half their 40 year design lifetime. They are kept in good technical condition. International experience indicates that lifetime extension of thermal power plants by refurbishment of some components is usually a least cost and very efficient option in comparison with construction of new power plants, providing those old power plants are not obsolete in their principal technological features. All main thermal power plants in Lithuania have comparatively good technological parameters: steam pressure and temperature, overall thermal efficiency, etc. In Lithuanian TPP, four 300 MW units are operating at supercritical pressure and efficiency indicators do not differ from the newest western thermal power plants using steam cycle.

Thorough economic analysis performed at the Lithuanian Energy Institute shows that further operation of Lithuanian TPP is the least cost option. This power plant will cover the main share of growing electricity demand. New power plants based on modern combined cycle gas turbine (CCGT) technology will compete with the Lithuanian TTP. However, for particular Lithuanian conditions the Lithuanian TPP will become the main producer of electricity and it has several very important advantages in comparison with new CCGT power plant:

- higher reliability of uninterrupted energy production because of multi-fuel (gas, heavy oil, orimulsion) usage;
- new site is not necessary;
- delay of big investments needed for new capacities and decommissioning of old units until Lithuania economy becomes stronger;

- creation of competition between different fuels and protection from monopolistic fuel prices.

Rehabilitation of existing combined heat and power plants in Vilnius and Kaunas is also foreseen in the National Strategy. In addition, new generating capacities will be required after closure of Unit 2 at the Ignalina NPP. Because almost all Lithuanian towns have district heating systems the most preferable new additional capacities are CHP plants, based on natural gas or local renewables. The needed new CHP's for existing district heating systems are not very big and individual capacities are comparatively small. Total potential for new CHP plants do not exceed 400 MW.

After closure of the Ignalina NPP, Lithuanian energy balance will be very dependent on the import of fossil fuel. It is foreseen that in the case of the basic scenario total primary energy demand will increase about 30% during the period 2000-2020. However, total fossil fuel demand will increase by 1.9 times – from 5 mill. toe in 2000 to 9.4 mill. toe in 2020. Natural gas will become the main energy carrier in the Lithuanian energy balance and its share will increase from 25.4% in 2001 to 53% in 2020. In order to avoid reliance of all power sectors on one fuel – natural gas - and to have a bigger diversity of fuel choice and greater security of supply it is reasonable to keep existing possibility to burn natural gas, heavy fuel oil and in future orimulsion in Lithuanian TPP and the biggest CHP. Lithuania, without any capacities of seasonal storage of natural gas, is very vulnerable when winter limitations of gas supply occur (up to now in every winter Russia introduced strict limitations on gas supply). On the other hand, Lithuania already has very big seasonal storage capacities for heavy fuel oil and orimulsion. Some of them are based on new capacities built with financial support of the World Bank and EBRD.

Lithuania has made good progress seeking to get out of the economic recession, to increase energy efficiency in all sectors of economy, to perform radical reforms in the legal basis and its harmonisation with the requirements of the EU energy policy, to create the necessary institutions and to implement a broad program of restructuring and privatisation of energy units. Thus, the country is ready to prepare the Energy chapter for accession into the EU and welcomes the readiness of the EU and the international community in exploring substantial assistance for the closure of the Ignalina NPP, modernization of existing energy units and installation of necessary environmental measures.

References

- Energy Statistics & Balances of Non-OECD Countries 1998-1999, International Energy Agency. – 2001.
- CO₂ Emissions from Fuel Combustion 1971-1999, International Energy Agency. Paris, 2001.
- National Accounts of Lithuania 2000. Statistics Lithuania. Vilnius, 2002.
- European Bank for Reconstruction and Development. Transition report 2001. Energy in transition. November 2001, London.
- Foreign direct investment in Lithuania. Statistics Lithuania. Vilnius, 2002.
- Energy balance 2001. Statistics Lithuania. Vilnius, 2002.
- Miskinis V. Energy Demand Forecasting in Economies in Transition//Energy Studies Review Vol. 10, No2, 2002, p. 100-120 (McMaster Institute for Energy Studies).