LITHUANIA

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1. ENERGY, ECONOMIC AND ELECTRICITY INFORMATION.

1.1. General Overview

The Republic of Lithuania is situated on the eastern coast of the Baltic sea, in central Europe. Lithuania is bordered by Latvia in the north, Belarus in the east, Poland in the south, Kaliningrad Region of the Russian Federation in the southwest and the Baltic sea in the west. Fig. 1.

FIG. 1. Map of Lithuania

Lithuania is situated in a temperate climate zone. The average annual air temperature in Lithuania is 5.5°C, with 17.8°C in June and -6.5°C in January. The absolute maximum-recorded temperature is 36°C and the absolute minimum -40°C. There are noticeable east-west weather variations. The western part, mostly influenced by the Baltic Sea, is characterized by the smallest temperature variations. The eastern part, where the Ignalina nuclear power plant is situated, has colder and longer winters and warmer but shorter summers. Western and south-western winds predominate.

The average annual amount of precipitation is 638 mm. About 70% of the precipitation takes place during the warm period of the year (April - October). The minimum relative humidity (53-63%) is in June and the maximum (exceeding 90%) in January.

Table 1 shows the historical energy statistics, Fig. 2 shows the share of the primary energy sources in the corresponding energy consumption and Fig. 3 the share of the various sectors in final energy demand.

TABLE 1. BASIC ENERGY SITUATION

Exajoule

	1970	1980	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Energy consumption															
- Total [1]	0.32	0.52	0.69	0.77	0.50	0.39	0.34	0.38	0.41	0.38	0.41	0.34	0.30	0.34	0.36
- Solids [2]	0.09	0.06	0.05	0.04	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
- Liquids	0.17	0.34	0.26	0.34	0.19	0.16	0.15	0.13	0.14	0.14	0.16	0.12	0.09	0.11	0.10
- Gases	0.05	0.11	0.2	0.20	0.12	0.06	0.07	0.09	0.09	0.08	0.07	0.08	0.09	0.09	0.09
- Primary electricity [3]	0.00	0.00	0.19	0.19	0.16	0.14	0.09	0.13	0.15	0.13	0.15	0.11	0.09	0.11	0.14
Energy production															
- Total	0.04	0.02	0.2	0.20	0.17	0.16	0.11	0.16	0.18	0.16	0.18	0.14	0.12	0.17	0.20
- Solids	0.04	0.02	0.01	0.02	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
- Liquids	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02
- Gases	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
- Primary electricity [3]	0.00	0.00	0.19	0.19	0.16	0.14	0.09	0.13	0.15	0.13	0.15	0.11	0.09	0.13	0.16
Net import (import - export)															
- Total	0.27	0.49	0.49	0.57	0.32	0.23	0.23	0.22	0.23	0.22	0.23	0.20	0.18	0.17	0.18
- Solids	0.05	0.04	0.04	0.03	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.002	0.01
- Liquids	0.17	0.34	0.25	0.34	0.19	0.16	0.15	0.12	0.13	0.13	0.15	0.11	0.08	0.08	0.08
- Gases	0.05	0.11	0.2	0.20	0.12	0.06	0.07	0.09	0.09	0.08	0.07	0.08	0.09	0.09	0.09

[1] Energy consumption = Primary energy consumption + Net import (Import - Export) of secondary energy.
[2] Solid fuels include coal, lignite and commercial wood.
[3] Primary electricity = Hydro + Geothermal + Nuclear + Wind.
Source: IAEA Energy and Economic Database; Country Information.

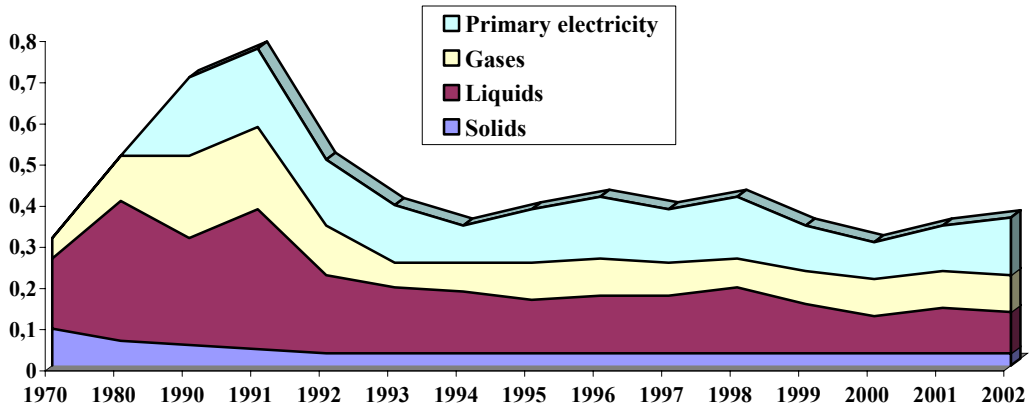

FIG. 2. Energy consumption (EJ)

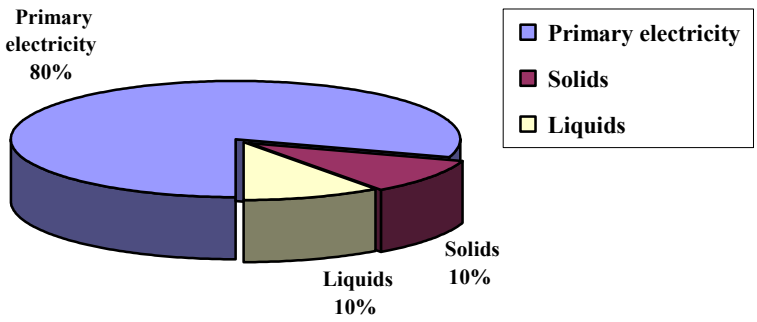

FIG. 3. Energy production in 2002

1.2. Energy Policy

The highest body of state power in the Republic of Lithuania is the Seimas (Parliament). Parliament has a number of standing committees on most sectors such as science, culture and education, but there is no specific committee for energy. Newly revised Energy Law of the Republic of Lithuania came into force on July 1, 2002 and regulates overall energy sector activities (electrical power, district heating, oil, natural gas, coal, local fuel and renewable energy recourses), power engineering development and management principles, effective use of the energy and energy recourses. According to this Law, the Ministry of Economy is responsible for preparing the National Energy Strategy. This document defines strategic objectives of the Lithuanian energy sector for a period of 20 years and is updated every five years. The Strategy is approved by Parliament.

The Government is responsible for establishment of rules for the use of energy and energy resources. It is also responsible for establishing procedures for new state or privately owned enterprises, joint ventures and foreign owned companies in the power sector.

The Parliament of the Republic of Lithuania approved the new edition of the National Energy Strategy of Lithuania on 10 October 2002, which includes national energy development directives taking into consideration that the first power unit of Ignalina NPP will be de-commissioned in 2005, and the second unit – in 2009, accordingly.

The National Energy Strategy is aimed for ensuring reliable, secure and environmentally-friendly energy supply at minimum costs, steady increasing the effectiveness of the energy, liberalising electricity and natural gas sectors, and opening the market according to the requirements laid down in the EU directives, privatising natural gas supply/distribution and electricity supply enterprises that can be privatised, continuing privatisation of oil refining and transportation enterprises, prepare for the decommissioning of Ignalina NPP; the document also covers disposal of radioactive waste and long-term storage of spent nuclear fuel, integrating Lithuanian energy systems into the energy systems of European Union, and further developing regional cooperation in order to create common electrical power system in the Baltic states. In addition it is planned to achieve that the share of the electricity generated in the co-generation plants would account for at least 35% of the electricity generation balance at the end of the period, and the share of renewable energy resources would account of up to 12% of the total primary energy balance by 2010.

When updating the Strategy account has been taken of significant changes in the economy and energy sector, experience gained and information required for the planning and forecasting of the development of individual energy sectors, and plans for the energy sector development in Lithuania and neighbouring countries as well as global trends in the area of environmental protection and market liberalisation.

Limited indigenous energy resources available and, the in-efficient use and conservation of energy resources are the basic conditions for the National Energy Strategy. The main directions for implementation of the National Energy Efficiency Programme, which is constantly up-dated, are the following:

- improvement of legal and normative basis;
- introduction of modern technologies and energy conservation measures;
- introduction of a pricing system stimulating energy conservation;
- creation of favourable conditions for investments into the energy conservation field;
- development of scientific, informational and educational activities.

1.3. The Electricity System

The Law on Electricity was passed and came into force on January 1, 2002. It sets electrical energy production, transmission, distribution, and supply regulation basis in the Republic of Lithuania, in pursuance of legal requirements of the European Union, relationship between electricity suppliers and consumers, as well as conditions to develop competition in the electricity sector. In addition, the law provides that electricity market will be created in phases in the country, i.e. gradually giving the right to independent consumers to draw direct electricity supply agreement with the manufacturers or independent suppliers. Independent consumer status is given by the National Price and Energy Control Commission.

The National Price and Energy Control Commission is established as energy regulator. The Commission will monitor the licensing activities and price application as well as exercise supervision over the compliance with the activity transparency principles. This Commission is proposed by the Government and approved by the President for a period of five years.

12 enterprises have received independent consumer status already, and together they consume over 20 million kWh of electrical power annually. Beginning year 2003, the number of these consumers will increase as enterprises that consumer over 9 million kWh of electrical power annually will be able to receive the status of independent consumer according to the foregoing law. Talking about all the consumers, including the least consuming ones, we can state that all the consumers will be able to choose their supplier freely by the year 2010. This could happen even earlier though, as the Law on Electricity regulates that the Government will be able to set market openness level (i.e. minimal electrical power consumption quota per year, and exceeding the quota would enable the consumer to become an independent one) by the year 2004. This regulation was defined in the abovementioned law taking into consideration that European Union intends to change the current directive for the creation of domestic electric energy market, in order to speed up the openness level of electricity market.

Generation of electric power in Lithuania is provided by Ignalina Nuclear Power Plant (Ignalina NPP), CHP plants belonging to municipalities and joint stock companies *Lietuvos Elektrinė* (Lithuanian power plant), power plant *Mažeikių Elektrinė*. All power generated at Ignalina NPP can be sold to joint stock companies *Rytų Skirstomieji Tinklai* (East Electricity Distribution Company) and *Vakarų Skirstomieji Tinkla*i (West Electricity Distribution Company) or joint stock company *Lietuvos Energija*. *Lietuvos Energija* is a specific joint stock with responsibility for managing and supervision of transmission grids and electricity transmission. *Lietuvos Energija* sells power to two regional network utilities: joint stock companies: *Rytų Skirstomieji Tinklai* and *Vakarų Skirstomieji Tinkla*i who, in turn, distributes and sells it to the end users and to abroad users. *Lietuvos Energija* exports electricity to Latvia, Estonia, Belarus and Kaliningrad province of the Russian Federation. Earlier responsibility of *Lietuvos Energija* for supplying heat was transferred to municipalities, responsibility of generation of electric power - to joint stock companies *Lietuvos Elektrinė*, power plant *Mažeikių Elektrinė*.

Restructuring of Joint Stock Company *Lietuvos Energija* laid the basis for the successive liberalization of the sector's operation, and preparation for the creation of domestic market in power engineering. Hence, we can safely say that the structure of Lithuanian power engineering economy is fully in tune with the requirements of European Union's legal acts. The recent scheme of the Lithuanian electricity sector is represented in Fig. 4:

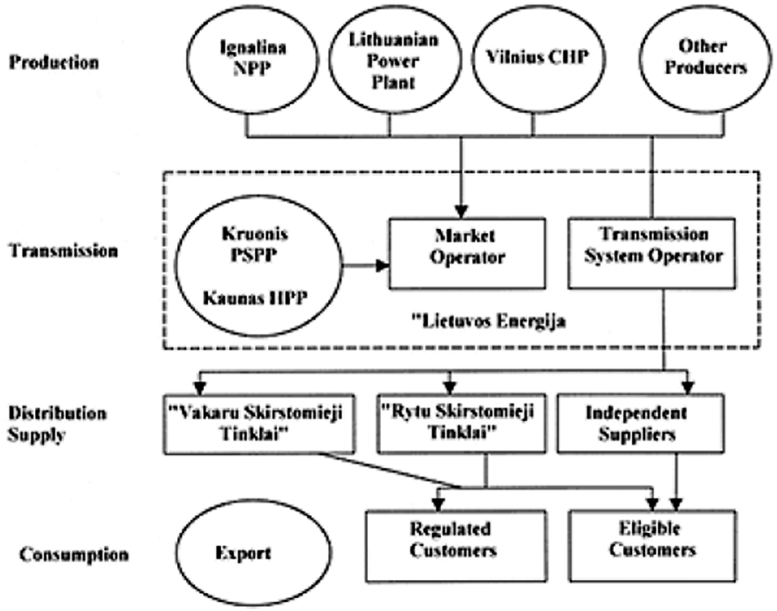

FIG. 4. Lithuanian electricity sector

The national transmission system in Lithuania comprises 330 kV and 110 kV grids, which connect all power stations to the load centres throughout Lithuania. Electricity export interconnections already exist with Latvia, Belarus and Kaliningrad region. At present, there is no power interconnection with the neighbouring Polish energy system.

Lithuania is continuing talks with Poland on possible transmission line across Poland connecting Lithuania's with other western countries into common market. Lithuania is considering building additional transmission lines from the Kruonis hydro pumped storage unit, through Alytus, to the border with Poland.

In 2001 a contract concerning the Lithuania – Poland electricity transmission inter-connector feasibility study has been signed between the EBRD and a consortium headed by a company *IPA Energy Consulting Ltd.* (United Kingdom). The recommendations and conclusions of the study will serve as a basis for making the decisions on further implementation of the project. In early 2003 the study received the approval and it was agreed to establish a common project development company.

The main source of electricity in Lithuania is the Ignalina NPP. Over the period of the last five years it has generated 80-85% of the total electricity production. There was 17.7 TWh of electrical energy generated in Lithuania in 2002 (Ignalina NPP generated 79.7%, thermoelectric power stations – 15.8%, hydroelectric power stations and hydroelectric pumped storage power station – 4.5%), an increase of 20% compared to 2001. This increase in electrical power generation was influenced by an increase in electrical power export.

Table 2 shows the historical energy balance and Fig. 5 the share of the primary energy sources in the 2002 energy production.

TABLE 2. ENERGY BALANCE

PJ

	1970	1980	1990	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Indigenous Production	42.6	21.9	202.9	177.9	154.3	110.1	157.1	182.8	163.6	185.8	145.8	133.7	172.0	204.4
Import (+)	281.6	495.2	628.5	320.3	295.6	317.3	317.6	333.7	352.4	396.3	283.3	307.4	390.8	377.7
Export (-)	12.9	0.4	166.0	42.2	71.3	95.2	83.1	118.2	150.7	194.8	107.5	151.4	227.2	222.2
Stock Changes (±)	4.1	1.6	20.9	15.5	3.6	14.6	-22.2	-4.0	3.0	1.1	7.3	8.6	8.7	8.0
Primary Energy Supply	315.3	515.1	686.4	471.5	382.3	346.8	369.4	394.3	368.3	388.4	328.9	298.3	340.6	363.5
Net Transformation Input	48.2	79.8	200.0	131.5	100.7	84.9	107.3	129.3	107.9	124.5	92.4	77.8	92.7	108.6
Energy Sector Own Use	1.8	14.0	38.1	23.7	37.5	18.5	15.6	17.2	19.9	23.4	17.1	18.3	38.4	39.6
Energy Losses	5.2	11.2	13.5	13.0	15.6	20.3	23.9	27.8	27.2	26.5	21.7	16.2	15.8	15.2
Non-Energy Use	12.4	36.7	39.5	19.3	9.0	15.2	22.0	25.2	24.5	27.5	27.0	27.5	30.2	30.9
Final Energy Demand	247.7	373.5	395.4	284.1	219.5	207.9	200.6	194.9	188.8	186.5	170.7	158.5	162.9	169.6
Industry	84.4	131.7	122.2	93.9	55.3	47.0	45.5	44.1	41.8	41.7	35.4	33.4	31.7	35.5
Transport	53.5	73.3	72.7	48.0	47.1	48.5	49.0	50.0	51.7	54.0	49.3	44.0	48.1	49.9
Other Sectors	109.7	168.0	200.4	142.2	117.1	112.4	106.1	100.8	95.3	90.8	86.0	81.1	83.1	84.2
Final Energy Consumption	79	109	106	76	58	56	54	53	51	50	46	43	162.9	169.6

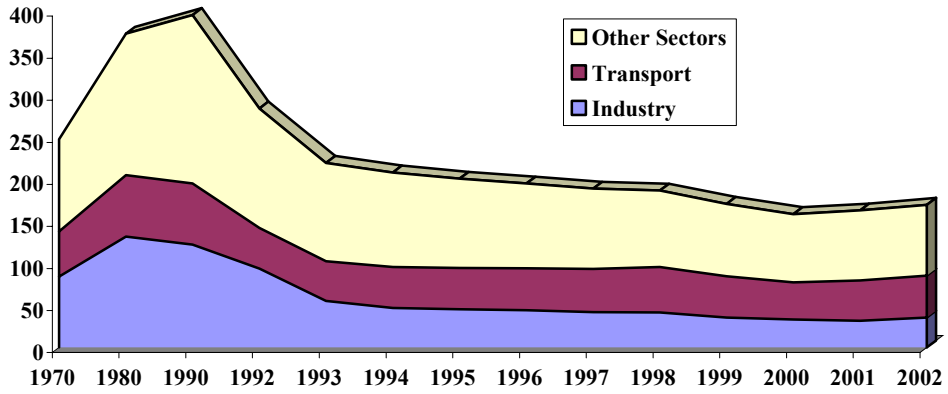

FIG. 5. Final Energy Demand (PJ)

2. NUCLEAR POWER SITUATION

2.1. Historical Development and current nuclear power organizational structure

2.1.1. Overview

The decision to build a nuclear power plant in the Baltic region for electricity supply to the Baltic States, Belarus and Kaliningrad was made by the former government of the Soviet Union at the beginning of the seventies. After the formal agreement of the Lithuanian Government, the site on the shore of Druksiai lake near the borders of Lithuania, Latvia and Belarus was selected. Construction of the first unit of the Ignalina NPP commenced in April 1978, the second unit followed in April 1980, and the third unit in 1985. The town of Visaginas (formerly named Snieckus) was built for the workers of the Ignalina NPP. The first unit was commissioned in December 1983 and the second in August 1987. In August 1988, the former USSR Council of Ministers suspended the construction of the third unit. In November 1993 the Lithuanian Government decided to abandon the construction of Unit 3 and dismantle the existing structure. In 1999 decision was made to close first unit of Ignalina NPP before 2005 and in 2002 it was decided to close second unit in 2009.

The development of the Ignalina NPP design was carried out by the Research and Development Institute for Energy Technology (Russian abbreviation - VNIPIET), St. Petersburg, (at that time Leningrad) Russia. This institute developed the design of the reactor internals and other radiation-

related structural components. The development of the Accident Localisation System was carried out by the Sverdlovsk branch, Ekaterinburg, Russia, of the above mentioned institute. Metal structures of the main building were designed by the Main Design Office "Leningrad Steel Design" (translation of the Russian - "Leningradstalkonstrukcija"), St. Petersburg, Russia. The turbine hall, the open distributive system and the auxiliary facilities were developed by the Atomic Energy Design Organisation (Russian abbreviation -"Atomenergoproekt"), Kiev, Ukraine.

It was intended that Ignalina NPP would be the pilot nuclear power plant for the RBMK-1500 reactor type. The scientific supervisor of the RBMK-1500 project was the Kurchatov Atomic Energy Institute (often referred to as the Russian Research Centre "Kurchatov Institute"), Moscow, Russia. The principal designer of the nuclear steam supply system was the Research and Development Institute of Power Engineering (RDIPE), Moscow, Russia. These two institutes prepared and published the Technical Safety Justification of the RBMK-1500 Reactor in 1987. These institutes, together with the Research and Development Institute for Energy Technology, prepared the Technical Safety Justification of the Ignalina NPP in 1988. This safety report came closer to the Western standard in comparison with the Technical Safety Justification of the RBMK-1500 reactor. However, the Technical Safety Justification of the Ignalina NPP was not officially approved.

2.1.2. Current Organizational Chart(s)

See Fig. 6 of interaction between governmental and regulatory bodies and Ignalina NPP.

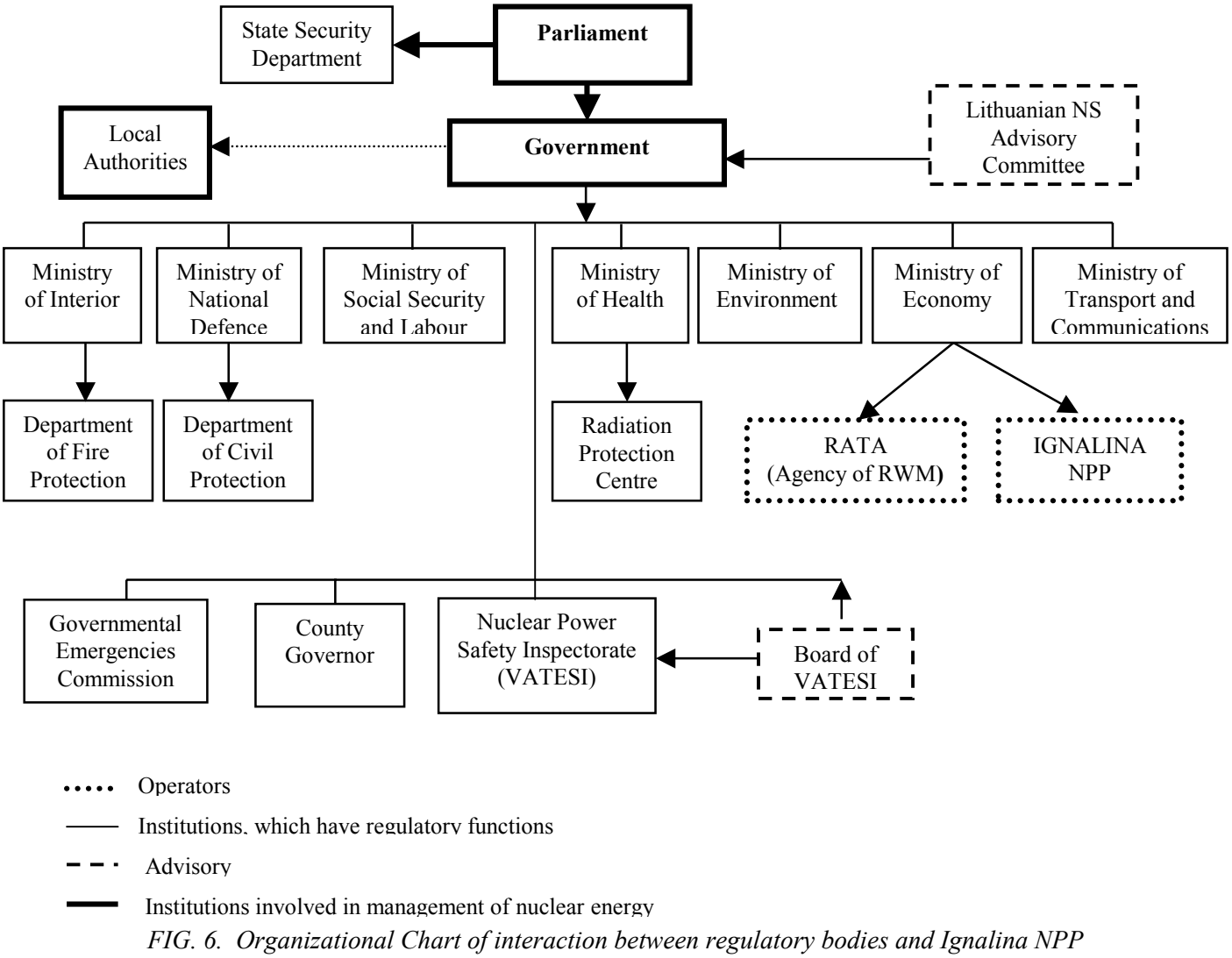

FIG. 6. Organizational Chart of interaction between regulatory bodies and Ignalina NPP

2.2. Nuclear Power Plants: Status and Operations

The following state institutions and bodies are involved in nuclear power related activities:

- Ministry of Economy
- State Nuclear Power Safety Inspectorate
- Ministry of Health
- Ministry of Environment
- Ministry of Social Security and Labour
- Ministry of Transport and Communications
- Ministry of National Defence
- Ministry of Interior
- State Security Department
- Governmental Emergencies Commission
- County Governors and
- Local Authorities

The Ministry of Economy is responsible for the implementation of state policy, organizes bilateral and multilateral international co-operation in the sphere of nuclear energy and is the responsible authority for promotion and ownership of nuclear facilities. The Ministry of Economy is the owner of the Ignalina NPP and is responsible for a broad scale of activities: tariffs, pricing system, organisation, and financial audits. The Ministry has two divisions related with nuclear energy. The Nuclear Energy Division supervises the nuclear energy sector and is responsible for the preparation of regulatory acts governing nuclear energy and nuclear safety and for co-ordination of assistance for nuclear safety improvements. The Ignalina NPP Problems Co-ordination Division was established in 2001 in connection with the closure of the Ignalina NPP's unit one. The task of the Division is supervision of the Ignalina NPP decommissioning sector and preparation of regulatory acts governing of the decommissioning and radioactive waste management. The Ministry of Economy also comprises a Strategic Goods Export Control Division, which is responsible for the issue of licences for the export, import and transit of nuclear, radioactive and other materials used in nuclear technology, nuclear equipment and dual-use items.

The Radioactive Waste Management Agency (RATA) was established by the Ministry of Economy for management and final disposal of all transferred to it radioactive waste, generated by the Ignalina NPP during the operation and decommissioning, as well as to collect, process and finally dispose of radioactive waste from. Agency's task is to construct and operate the repositories for both short-lived and long-lived radioactive waste.

Lithuanian Nuclear Power Safety Inspectorate (VATESI) exercises the state supervision of nuclear safety. The Prime Minister appoints the head of VATESI. VATESI is independent governmental institution and reports directly to the Lithuanian Government. According to the Nuclear Energy Law, VATESI is responsible for licensing: design, construction, reconstruction and operation of nuclear power plants, storage and disposal of radioactive waste, transportation of nuclear materials. Currently VATESI has a new task – to control and supervise the safe decommissioning of Ignalina NPP unit 1 and to assess the safety of the projects. VATESI consists of five main divisions. Nuclear Material Control Division organize state accounting and control of nuclear substances, set the rules of accounting, supervise the physical protection of nuclear materials and nuclear facilities, participate in controlling export, import, and transit of commodities used in nuclear activities, co-operate with the IAEA and other international organizations and counterparts in other countries in the area of accounting and control of nuclear materials, maintain contacts with the Comprehensive Nuclear Test Ban Organization, and co-ordinate the activities of Lithuanian governmental institutions related with this Organization. Decommissioning and Radiation Protection Division control radioactive waste management, license spent fuel storage facilities, control the level of Ignalina NPP

preparedness for emergencies, and notify international organizations and neighbouring countries about nuclear accidents. Licensing Division set the conditions for licensing the Ignalina NPP and its safety systems, develop rules and regulations that govern Ignalina NPP safety, assess the reliability of the safety-related systems, establish the operation conditions for Ignalina NPP, elaborate conditions for licensing other nuclear activities. On-site Division at Ignalina NPP carry out direct supervision at Ignalina NPP, inspect safety systems, control technological processes and repairs. Safety Assessment Division assess design decisions, produce reviews of safety analysis reports, check the adequacy of the computer software used for safety assessment, and analyze the physical issues of the reactors.

Board of VATESI supervises VATESI activities, assists the Government of Lithuania in forming the strategy of nuclear safety, addresses the issues raised by the Head of VATESI and Board members.

The Ministry of Health develops and approves guides and regulations for looking after the health of people working at nuclear sites, sets health requirements for radiation protection and defines the frequency and requirements for medical examination of people working with radiation sources and supervises their performance, etc.

The Radiation Protection Centre co-ordinates the activities of executive and other bodies of public administration and local government in the field of radiation protection, exercising state supervision and control of radiation protection, monitoring and expert examination of public exposure. The Centre drafts laws and other legislation on radiation protection, performs licensing of users of sources of ionizing radiation, organizes and controls monitoring of radioactive contamination of air, drinking water, foodstuffs and raw materials and other objects which may cause exposure of humans, carries out investigation of radiological accidents, forecasts their consequences and present proposals on ways of their prevention and remedial measures, and etc.

The Ministry of Environment is responsible for establishing environmental pollution norms, monitoring compliance and licensing of emissions. The Ministry of the Environment coordinates environmental impact assessments, establishes the limits of radioactive emissions into the environment, issues single authorizations for transport of radioactive substances and radioactive waste inside the country, export, import and transit. After consultation with the VATESI and the Ministry of Health establishes procedure for the import, export, transit and transportation of radioactive substances and radioactive waste within the country and for return of used sealed sources, defines handling and disposal, sets maximum permissible levels for radioactive releases in the environment and authorises the use of natural resources. Ministry is also responsible for establishing radiation protection standards and monitoring their compliance together with the Ministry of Health.

The Ministry of Social Security and Labour is responsible for compliance with the requirements of labour, safety at work and related statutory acts.

The Ministry of Transport and Communications participates in the drafting of laws and subordinate legislation and the training and certification of personnel for the transportation of nuclear and radioactive materials.

The Ministry of National Defence is responsible for the protection and security of transportation of nuclear and radioactive material cargoes across the territory of the country. In co-operation with Ignalina NPP and other local and national authorities Ministry develops plans for public protection in case of an accident at Ignalina NPP. Together with VATESI and other state authorities, the Ministry organises exercises for coping with nuclear accidents.

The Department of Civil Protection of the Ministry of Defence is the co-ordinating institution in respect of the preparation of emergency plans and their implementation in the event of an accident in the Ignalina NPP. The department organises of the training sessions of population protection in the event of nuclear accident.

The Ministry of Interior insures fire protection and physical safety of the nuclear power plant and other nuclear facilities, is responsible for preparing, co-ordination and implementation of the interdepartmental anti-terrorist and anti-penetration action plans, investigation the cases of theft and illegal possession of nuclear and radioactive materials and other dual-purpose commodities.

The State Security Department exercises prevention of subversive, sabotage and terrorist acts as well as other offences aimed at damaging the interests of state security at nuclear facilities, in their environment, and on transportation routes of nuclear and radioactive materials.

The Governmental Emergencies Commission is responsible for the co-ordination of the activities of all the bodies and forces taking part in the containment of a nuclear accident and its consequences.

The County Governors have powers that are delegated to them by the Law on County Government, the Law on Nuclear Energy and other laws and subordinate legislation of the Republic of Lithuania. Some of these have reference to nuclear facilities and emergency activities within their county.

The Local Authorities are responsible for municipal and public interactions with sitting applications, nuclear facilities and activities in the territories under their jurisdiction that are within the sanitary protection or monitoring zones.

The Government established the Nuclear and Radiation Safety Advisory Committee (NRSAC) in May 1993. In July 1997, this Committee was reorganised as the Nuclear Safety Advisory Committee. The Committee's members include nuclear experts from Lithuania, Germany, Finland, France, Japan, the USA, Sweden, Ukraine and the United Kingdom, who advices the Government in resolving problems in the field of nuclear energy. The Committee works with the Government, VATESI, the Ministry of Economy and with the managements of the state enterprise Ignalina NPP and state enterprise RATA, and provides advice on upgrading nuclear safety and on the development of an efficient regulatory infrastructure. The Committee receives full funding from the State budget.

2.2.1. Status of nuclear power plants

Lithuania operates one Nuclear Power Plant – Ignalina NPP, which contains two RBMK – type design reactors with a nominal capacity of 1500 MW(e) each. Both units of Ignalina NPP, down rated to about 1300 MW(e) for safety reasons, are supplying about 70% of the electricity consumption of Lithuania and allow export of electricity to Latvia and Belarus. In fact, the thermal capacity of the Ignalina units is down rated from 4 800 MW(th) to 4 200 MW(th), so the maximum electrical output depends on the cooling conditions. Table 3 shows the status of the nuclear power reactors.

Ignalina NPP is located in the North-Eastern part of Lithuania, near the borders with Latvia and Belarus. The site of the nuclear power plant covers an area of about 0.75 km^2. The buildings take up about 0.22 km^2. The total area of the Ignalina NPP, the city of Visaginas, the construction organizations and the auxiliary services occupy territory of about 26 km^2.

Ignalina NPP contains two RBMK-1500 reactors. This is the most advanced version of the RBMK reactor design series. The plant can be refuelled on line and uses slightly enriched nuclear fuel. Each nuclear fuel assembly is located in a separately cooled fuel channel (pressure tube). There are 1661 such channels. The design lifetime of the units is 30 years. Construction of the third unit was terminated in 1989, demolition of the structure of the third unit commenced in 1996.

TABLE 3. STATUS OF NUCLEAR POWER PLANTS

Station	Type	Capacity	Operator	Status	Reactor Supplier
IGNALINA-1	LWGR	1185?	INPP	Operational	MAEP
IGNALINA-2	LWGR	1185?	INPP	Operational	MAEP

Station	Construction Date	Criticality Date	Grid Date	Commercial Date	Shutdown Date
IGNALINA-1	01-May-77	04-Oct-83	31-Dec-83	01-May-84	before 2005
IGNALINA-2	01-Jan-78	01-Dec-86	20-Aug-87	20-Aug-87	in 2009

Source: IAEA Power Reactor Information System as of 31-Dec-2000.

2.2.2. Performance of NPPs

Both units of Ignalina NPP were operating steadily during the last few years. Nevertheless, the plant did not have good performance indicators because of the decreased demand for electricity. Even though the share of electricity produced by nuclear means was constantly growing due to the high prices of organic fuel, the units were shut down for four weeks in the summer of 1994, when Russia proposed to repay its debts back by electricity. During 1995–2002 production of electricity did depend strongly on the volume of export. Table 4 and Fig. 7 show the contribution of nuclear power to the total electricity generation.

TABLE 4. NUCLEAR POWER AND TOTAL ELECTRICITY GENERATION

TWh

Year	1985	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Nuclear	9.48	16.65	17.03	17.0	14.64	12.27	7.71	11.8	12.7	12.0	13.6	9.86	8.42	11.36	14.1
Total	20.96	29.16	28.40	29.39	18.72	14.10	10.02	13.9	15.2	14.9	17.6	13.5	11.4	14.7	17.7
Nuclear (%)	45.2	57.1	60.0	57.8	78.2	87.0	77.0	84.9	83.4	80.9	76.9	72.9	73.7	77.3	79.7

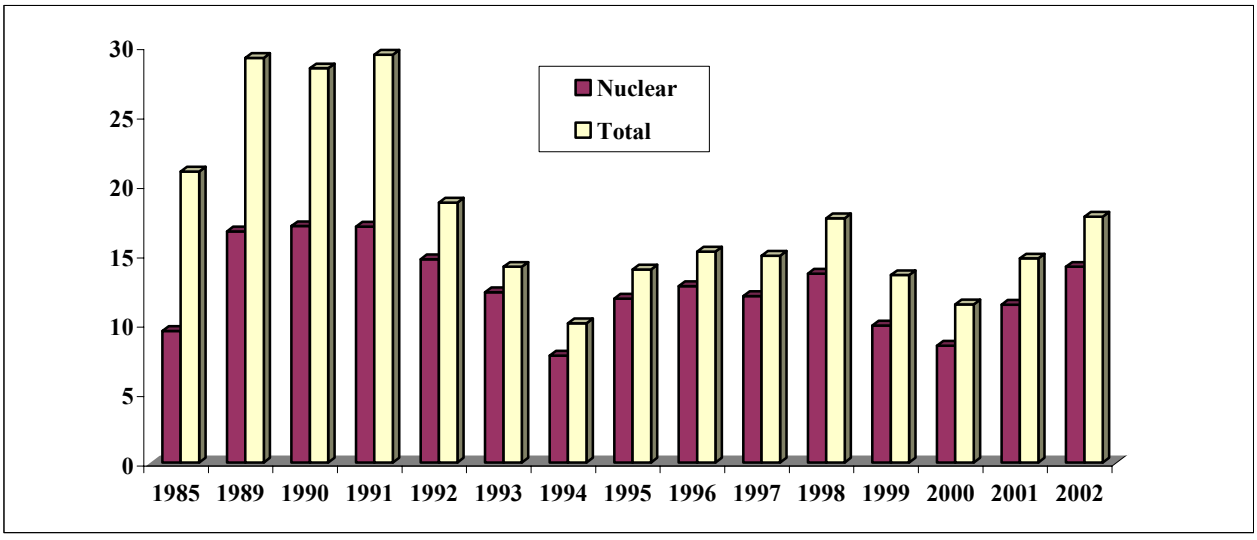

FIG. 7. Nuclear Power and Total Electricity Generation

2.2.3. Nuclear power development projections and plans

National Energy Strategy provides that 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). In May 2003 the Ministry of Economy

signed an agreement with Kaunas Technological University for the performance of such study. The objective of the study is to evaluate possibilities to continue use of nuclear energy in Lithuania, political, social, economical and environmental preconditions in the context of reliability of electricity supply, safety, electricity prices, macro economical expansion, EU politics and international environmental obligations.

2.2.4. Decommissioning information and plans

National Energy Strategy provides that the first unit of Ignalina NPP will be finally shut down by 2005, and the second unit – by 2010.

In order to manage, co-ordinate and monitor all aspects of the implementation of the main projects concerning the decommissioning of Ignalina NPP and to carry out associated engineering, procurement and other services Project Management Unit (PMU) was established in December 2001. The PMU prepared pre-decommissioning projects approved on the Donors' Assembly: new heat and steam source for Ignalina NPP and Visaginas town, storage for spent nuclear fuel, modernization of the technical documentation archive, new solid waste management and storage facility for existing, future operational and decommissioning waste. Tenders procedures for the projects already started. The Ignalina International Decommissioning Support Fund administrated by European Bank for Reconstruction and Development will finance the projects.

By the decision of the Government of the Lithuania on November 2002 Ignalina NPP Unit 1 decommissioning will be implemented by the immediate dismantling strategy in order to prevent heavy long-term social, economical, financial and environmental consequences. Existing technologies and techniques generally enable Ignalina NPP to proceed with immediate dismantling. The dismantling of some parts of the primary circuits and of the core of the reactors will however be of concern and will require sophisticated dismantling techniques and tools to be deployed. Even in such case at the time those highly contaminated and/or activated parts will be tackled (in some 15 years from now), it can be expected that those methods and tools will be commercially available.

The PMU is finalising the Final Decommissioning Plan. At the close of operations and during the decommissioning period, the Decommissioning Plan will be the principal document serving to prepare detailed plans (projects) of decommissioning activities.

In July 2001, the Law on Decommissioning Fund for Ignalina NPP was adopted by the Parliament. This Law determines the structure of the fund, the principles of its administration and defines the methods for provision and collection of the resources to cover the historical costs, related to radioactive waste generated earlier, as well as to cover the cost of spent nuclear fuel in process of dismantling Unit 1 of Ignalina NPP. In June 2002, pursuant to the Law on the Decommissioning Fund for the State Enterprise Ignalina Nuclear Power Plant, the Government established the Council of the Fund. The Council has responsibilities to take decisions, *inter alia*, as to which decommissioning measures will be financed from the assets of the Fund.

To implement the Unit 1 Decommissioning programme, a plan of measures has been prepared and approved by the Minister of Economy. It consists of two parts – technical-environmental and social-economic, specifies the terms of the implementation, as well as responsible organisations, cost and financing sources. Report on implementation of the measures every year is submitted to the Government. In year 2004 is foreseen preparation of the law and the programme on Ignalina NPP Unit 2 decommissioning.

One of the results of negotiations of Lithuania with European Union is the Treaty's of Accession to the European Union 2003 Protocol No. 4 on Ignalina NPP in Lithuania, in which European Community commit for the period 2004-2006 to provide Lithuania with additional financial assistance in support of its efforts to decommission and to address the consequences of the closure and decommissioning of the Ignalina NPP and to provide adequate additional Community assistance

to the decommissioning effort beyond 2006.

2.3. Supply of NPPs

Both units of the Ignalina Nuclear Power Plant are of the RBMK type reactors, designed and constructed by the former USSR's Ministry for Nuclear Power Industry. Only these two units of the new design RBMK-1500 were built, representing the most powerful nuclear units in the territory of the former USSR. An overview of the various institutions responsible for the design and construction of the RBMK type reactors is shown in Fig. 8.

The All-Union Research and Development Institute for Energy Technology (NIKIET) of Moscow, Russia, as the main designer, carried out the development of the Ignalina Nuclear Power Plant project. The institute originated the design of the reactor internals and other primary system components. The Accident Confinement System was designed by the Institute's Sverdlovsk branch in Ekaterinburg, Russia. Metal structures of the main building were designed by the Main Design Office "Leningrad Steel Design" ("Leningradstalkonstrukcija") of St. Petersburg, Russia. The turbine hall, the open distributive system, and auxiliary facilities were developed by the Kiev branch of the Atomic Energy Design Institute ("Atomenergoproekt") of Kiev, Ukraine.

The scientific supervisor of the RBMK-1500 project was the Kurchatov Atomic Energy Institute (often referred to as the Russian Research Centre "Kurchatov Institute") in Moscow, Russia. The main designer of the nuclear steam supply system was the Research and Development Institute of Power Engineering (NIKIET) in Moscow, Russia. Russia is also the main supplier of spare parts to the Ignalina NPP.

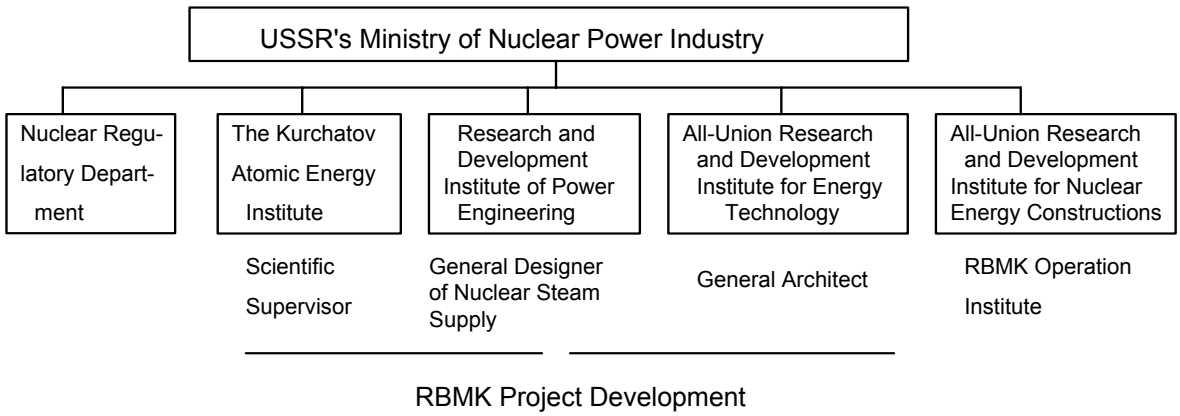

FIG. 8. Scope of responsibility for the RBMK-type reactor projects

2.4. Operation of NPPs

The Republic of Lithuania through the Ministry of Economy owns the Ignalina NPP. At the present time, Ignalina NPP entitles the rights as operator of a nuclear installation. For other purposes, such as liability to foreign countries, the State is assumed to be the operator. The Ignalina NPP management was substantially reorganized during 1995-1997.

The Training Centre was found in 1996 on the basis of the existing training unit and provides training for operator. All categories of operation personnel are trained there - managers, experts and qualified workers, as well as employees servicing equipment subject to the surveillance of the State Technical Inspectorate and performing potentially dangerous works.

2.5. Fuel Cycle and Waste Management

Lithuania has no nuclear fuel fabrication industry. All the nuclear fuel is supplied by Russia till now. Originally, spent nuclear fuel from Ignalina was to be managed by central Soviet agencies for reprocessing and final disposal of the radioactive waste. However, with the disintegration of the Soviet Union, Lithuania was obliged to find other solutions. Now Ignalina NPP itself manages operational radioactive waste from Ignalina NPP. There are facilities for processing and storage of liquid and solid waste. A repository for low and intermediate level RMI radioactive waste, located at Maišiagala near Vilnius, was in operation since 1963, but in 1989 it was closed. In November 1993, Lithuanian Government approved temporary storage of spent fuel in containers for forty to fifty years until solutions for final conditioning and disposal are found. Interim storage for spent fuel was built in 1999 on the site of Ignalina NPP. Twenty Castor casks and forty Constor casks manufactured by GNB in Germany have been delivered to the Ignalina nuclear power plant site. The spent nuclear fuel can be stored in these casks for 50 years. Previously, all spent nuclear fuel was stored in the water pools next to the reactors. A new Interim Spent Fuel Storage will be built on Ignalina NPP site as a pre-decommissioning project. It is planned to start operation of the first store of Interim Spent Fuel Storage in 2005 and to finish by 2011.

The Ministry of Economy established state enterprise Radioactive Waste Management Agency (RATA) in July 2001 to assume the responsibility for the safe management and final disposal of all radioactive waste. On February 2002 the Government approved the Radioactive Waste Management Strategy and the three-year programme of RATA. In the strategy is foreseen to modernize the management and storage of solid short-lived and long-lived radioactive waste of Ignalina NPP within 2002-2009, to perform necessary investigations and draft recommendations on implementation of a near surface repository for low- and intermediate-level short-lived radioactive waste until 2005.

RATA is an operator of a radioactive waste disposal facility of Radon type near Maišiagala, which was taken over from the Institute of Physics. In March 2003 RATA got a license for managing the institutional radioactive waste. For improving the Maišiagala repository, RATA drafted a project proposal for PHARE program Safety Assessment and Upgrading of Maišiagala Repository in Lithuania. The agreements on implementation of the project are to be signed by November 2004.

2.6. Research and Development

2.6.1. R&D Organizations and Institutes

Nuclear Installation Safety Laboratory at the Lithuanian Energy Institute performs thermal-hydraulic analysis of accidents and operational transients, thermal-hydraulic assessment of Ignalina NPP Accident Localization System and other compartments, simulation of radionuclides and aerosols transport in the compartments, structural analysis of plant components, piping and other parts of Main Circulation Circuit, assessment of RBMK-1500 reactor core modifications and analysis of postulated reactivity accidents, level 1 and Level 2 Probabilistic Safety Assessment of Ignalina NPP, assessment and prognosis of the graphite stack-fuel channel gap closure dynamics, development and validation of coupled neutron kinetics thermal-hydraulic RBMK-1500 model for RELAP5-3D code, single failure analysis and engineering assessment for complex technical systems, investigation of condensation implosion phenomena in water-steam contact, risk and hazard analysis of industrial sites.

Nuclear Engineering Laboratory at the Lithuanian Energy Institute performs experimental investigation of turbulent mixed convection heat transfer regularities in single-phase flows, numerical modelling of heat transfer and turbulent transport, fire hazard analysis in nuclear power plants, safety assessment of storage facilities for spent nuclear fuel, safety assessment of treatment technology and storage facilities for radioactive waste, long-term safety assessment of repositories for radioactive waste, assessment of different factors related to decommissioning of nuclear power plants.

Activities of Nuclear and Environmental Radioactivity Research Laboratory at the Institute of Physics are development and application of nuclear spectroscopy methods, radionuclide metrology and standardization, investigations in environmental radioactivity, radionuclide tracer studies, radioecological monitoring and dose assessment.

The State Information Technology Institute designs information systems, software and automatic control system elements of computer systems at Ignalina NPP.

Apart from above mentioned institutes, there are some other technical support organizations. As the first step to develop better technical support, the Centre for Non-Destructive Testing at Kaunas University of Technology and the Laboratory of Welding and Material Analysis at Vilnius Technical University were created. With the aid of the European Commission, these facilities were equipped with modern instrumentation.

2.7. International Co-operation and Initiatives

Lithuania has or had multilateral and bilateral projects, mostly concerning safety of nuclear power plants, with several highly developed Western countries, including Sweden, Germany, the USA, the UK, France, Belgium, Italy, Switzerland, Denmark, Canada, Finland and Japan.

The main multilateral projects were the TACIS founded International RBMK Safety Review Consortium, Lord Marshall's Users Group for Soviet Designed Reactors and the IAEA extra budgetary programme on RBMK reactors. One of the most important projects for Lithuania was the international project “Safety of Design Solutions and Operation of NPP’s with RBMK Reactors“ covering a broad range of safety related topics with Unit 2 of the Ignalina NPP used as a reference plant.

The BARSELINA project (1992-2001) – level 1 and 2 probabilistic safety assessment of the Ignalina NPP conducted by Sweden, Lithuania and Russia. At different stages of the project the study was reviewed by USA (1994) and IAEA (2000 and 2001) experts. This project provides a unified basis for the assessment of severe accident risks for RBMK type reactors and the preparation of remedial measures. Some of the improvements highlighted by PSA have already been implemented at the Ignalina NPP.

Another project of the Lithuanian-Swedish bilateral programme is the application of modern non-destructive testing (NDT) systems for in-service inspection of the pressure boundary system. One other project is the preparation of an "Overall Plan for Radioactive Waste Management" in Lithuania by Swedish Nuclear Fuel and Waste Management Co., SKB. Project “Fire and flooding protection” helped to improve the whole fire protection system at Ignalina NPP.

SAR (1995-1996) – first Western-style safety analysis for any Soviet-design NPP. Specialists from the Ignalina NPP, Russia (main RBMK designer RDIPE), Canada, UK, USA and Sweden participated in the project. The SAR team supported the Ignalina NPP management convincing that (1) an adequate safety case for continuing operation of plant had been demonstrated; (2) the safety case would be adequate to the point of first gap closure, which will be the lifetime limiting factor; and (3) the plant’s safety standards and practices had been assessed and recommendations for improvement had been made and accepted by Ignalina NPP. A significant conclusion stated in the SAR is that none of the analysed safety concerns require the immediate shutdown of the plant.

RSR (1995-1997) – an independent review of the SAR, which was performed by Western (France, Germany, Italy, UK and USA) and Eastern (Lithuania, Russia) experts. The RSR team agrees with almost all the SAR team’s recommendations for improvement and made some additional recommendations. They, however, were not able to agree that a fully adequate safety case had been demonstrated and gave a set of recommendations both on the additional analyses and safety improvement measures to be implemented. These recommendations formed a basis for the Ignalina

NPP's Second Safety Improvement Program (SIP-2) approved in 1997.

SAR-2 (2001-2003) – Safety Analysis Report for power Unit 2 is performed by Ignalina NPP specialists with participation of Lithuanian Energy Institute. A review of SAR-2 is performed mainly by Lithuanian experts. Safety Analysis Report for Single Operating Unit (2003) is performed by INPP specialists.

Safety analyses recommended by SAR, RSR and Ignalina Safety Panel (1997-1999) - these analyses had been conducted by Lithuanian or Russian experts, but had been independently reviewed by Western experts, mainly by experts from former RSR team.

Lithuania, Russia, USA, Sweden, Great Britain and European Bank for Reconstruction and Development participated and still are taking part in performance of Safety Improvement Program SIP-2, which was started in 1997. Objective of SIP-2 program is - improvement of safety of Ignalina NPP both power Units with reference to equipment, operating procedures and management to the level of Western standards.

Level 2 Probabilistic Safety Assessment of the Ignalina NPP (2000-2001) – the study had been conducted by joint Lithuanian-Sweden team and reviewed by UK experts. IAEA IPSART mission to review this study was completed in October 2001.

In December 1994 an agreement was signed between European Bank for Reconstruction and Development and the Republic of Lithuania for safety improvement at Ignalina NPP. Nuclear Safety Project for Ignalina Units 1 and 2 (RBMK 1500) was dedicated to reduce the seriousness of operational and design deficiencies. First comprehensive Safety Analysis Report (SAR) – investigation and analysis of factors that could limit a safe operation of the plant - was prepared as a part of a Grant Agreement. Based on the recommendations of the SAR Ignalina NPP has developed extensive Safety Improvement Programme.

On 5 April 2001, a Framework Agreement was signed between the Republic of Lithuania and the European Bank for Reconstruction and Development relating to the activities of the Ignalina International Decommissioning Support Fund in Lithuania for the decommissioning of Unit 1 of Ignalina NPP. The European Commission supported the project "Assistance in the Enhancement of Lithuanian Technical Safety Organizations Capability to Support Nuclear Safety Regulatory Authority", which enables future development of the Metal Control Laboratory.

International Atomic Energy Agency offers a lot of courses for nuclear specialists' training. One of the most important national Technical Co-operation projects - Systematic approach to training (SAT) for NPP personnel, completed in 2000, helped to strengthen safety and reliability of the Ignalina NPP. For the 2003-2004 year period Lithuania has four national Technical Co-operation projects. The most important is Support for Decommissioning of Ignalina NPP, which started in 2001.

There have been implemented a number of projects with the USA financed by the Department of Energy and USAID framework of Nuclear Safety Assistance Programme for Lithuania. The Ignalina Source Book was prepared and printed in 1994 in close co-operation with the University of Maryland. Brookhaven National Laboratory (BNL) and Science Application International Corporation (SAIC) from the USA together with Nuclear Installation Safety Laboratory have developed the RELAP5 model for the Ignalina NPP. BNL also assisted with the development of the Ignalina NPP Analyser, and the University of Maryland is conducting an assessment of the Accident Confinement System using the software code CONTAIN. Other project with USA helped to develop western style Configuration Management programme for Ignalina NPP and provided plant staff technical support. This Project provided Ignalina NPP with DC Power Supply System consisting of safety class batteries, battery racks and switch board. One of projects, "Symptom-Based Emergency Operating Instructions (SBEOI) Support", in Nuclear Safety Assistance Programme with US is very useful for bringing safety level of Ignalina NPP to internationally approved standards.

Co-operation in nuclear safety improvement at the Ignalina NPP with Japan specialists started in 1994. In the frame of the Agreement of Co-operation for Safety Improvement at the Ignalina NPP signed in 1996, Science and Technology Agency of Japan started two big projects: "Co-operation on plant operation management" and "Co-operation on fuel channel integrity". In November 1998 Japanese experts installed at Ignalina NPP a data server system as result of the first project. The second project includes problems of inspection equipment for oxidized layer thickness of fuel channel and investigation of corrosion of fuel channel.

GRS (Germany) and Nuclear Installation Safety Laboratory are involved in the co-operative project of Analysis of Safety Aspects of Ignalina NPP, including the studies of neutron dynamics and thermal hydraulics. A compact simulator for operator training of normal and accident scenarios was developed by CORYS (France) and TRACTEBEL (Belgium). Canada mainly provides educational and training courses in the formation of organizations, safety design, waste management, maintenance and inspection of NPP's. The Lithuanian-Sweedish co-operative project of seismic evaluation of the Ignalina NPP is finished. A seismic network is placed in and 30 km around the plant. The British authority AEA has launched two Ignalina specific programs: checking the reliability of the Ignalina ultrasonic inspection devices on British mock-ups during the plant operation and a leak before break analysis, including the use of a code treating a transition weld. A Swiss consortium of independent engineers evaluated the design concepts for interim storage of spent fuel elements. Project on radiation monitoring was implemented together with DS&D (USA).

2.8. Human Resources Development

Administrative capacity of Nuclear Regulatory Authority VATESI is established and currently has 58 positions and a staff of 50. VATESI is responsible for licensing: design, construction, reconstruction and operation of nuclear power plants, storage and disposal of radioactive waste, and purchase and transportation decommissioning of Ignalina NPP unit 1 and to assess the safety of the projects. In connection with that a new Department was established - Decommissioning and Radiation Protection Department.

State Enterprise Radioactive Waste Management Agency RATA currently has 17 employees. New divisions of the Agency were set up. The Division of Analysis of Radioactive Waste from the Ignalina NPP with a staff of 2 is working in rooms rented from Ignalina NPP. Additional 2 specialists were employed at the Division of Management of Radioactive Waste from Small Producers. They comprise the team of processing of radioactive waste from Small producers. Three watchmen were hired for the radioactive waste facility of Radon type near Maišiagala after the storage facility was taken over from the Institute of Physics in accordance.

3. NATIONAL LAWS AND REGULATIONS

3.1. Safety Authority and the Licensing Process

In October 1991, just after Lithuania regained independence, the national regulatory authority - State Nuclear Power Safety Inspectorate (VATESI) - was established with responsibility for the functions of safety and control of nuclear facilities and the supervision of accounting for nuclear materials and in October 1992, the Government approved the statute of VATESI, regulating its activities and determining the basic objectives, functions, and rights of the inspections. The new statute of VATESI was approved in July 2002.

Pursuant to its statute, VATESI is responsible for the state regulation of nuclear safety at the Ignalina NPP and other nuclear facilities and the safety of radioactive waste management. The duties of VATESI in its capacity as national nuclear regulatory authority include:

- drafting and, under the authority of the Government, approving safety standards and rules for the design, construction and operation of nuclear facilities, storage of nuclear and radioactive materials and waste disposal;

- ensuring adherence to the requirements set out in licences and safety rules through assessment of the safety of nuclear facilities;

- establishing the system of accounting for and control of nuclear materials; and issuing licences for the acquisition, possession and transportation of nuclear materials and the storage and disposal of radioactive waste

In 1997 the Board of VATESI was established. The task of the Board is to supervise VATESI activities, to assist the Government of Lithuania in forming the strategy of nuclear safety, to address the issues raised by the Head of VATESI and Board members. The new Board was appointed on 2001.

Most of the existing Soviet laws and rules, as well as earlier decisions, were accepted as valid in Lithuania. So until 1994 VATESI was not directly involved in the licensing of nuclear power plants. In autumn of 1994, VATESI, aided by Swedish experts, started the first licensing activity - licensing of spent fuel storage at the Ignalina Nuclear Power Plant site**.** Later, in 1999 using close co-operation with the experts of international Licensing Assistance Project VATESI issued the license for the operation of Ignalina NPP Unit 1 for 5 years. Licensing process for Unit 2 of Ignalina NPP is under development now.

3.2. Main National Laws and Regulations in Nuclear Power

- Law on Nuclear Energy, adopted on November 14, 1996.
- Law on the Enforcement of Application of the Vienna Convention on Civil Liability for Nuclear Damage of May 21, 1963 and the Joint Protocol Relating to the Application of the Vienna Convention and the Paris Convention of 21 September 1988, adopted on 30 November 1993. The Law gives the main articles of Vienna Convention and Joint Protocol the validity of the law with direct applicability before the courts.
- Decree of the Lithuanian Government No. 1403 of November 2, 1995 defines regulation rules of Ignalina NPP decommissioning fund. Decree No. 964 of July 31, 1998 provides for deduction of 6% of internal electricity cost for that fund.
- Law on the Amendments and Supplements to the Law on Taxes on Profit of Legal Persons, adopted on April 11, 1995. Item 10, allowing the inclusion of other expenses associated to the Ignalina NPP, provided by Government decrees, is added to the earlier Law. Corresponding Government decrees on the deductions for the management of radioactive waste and increasing the rate of deductions for decommissioning fund were adopted in 1995.
- Law Concerning Control of Import, Transit and Export of Strategic Goods and Technologies, adopted on July 5, 1995.
- Environmental Protection Law, adopted on May 28, 1996.
- Law on Waste Management, adopted on June 16, 1998.
- Civil Protection Law, adopted on December 15, 1998.
- Law on Radiation Protection, adopted on January 12, 1999.
- Law on the Management of Radioactive Waste, adopted on May 20, 1999.
- Resolution on State Accounting and Control of Nuclear Material, adopted on September 8, 1997.
- Regulation on Licensing of Nuclear Power Related Activities, adopted on January 27, 1998.
- Law on the Decommissioning of Unit 1 at the State Enterprise Ignalina Nuclear Power Plant, adopted on May 2, 2000 establishes the legal basis for the decommissioning of

Unit 1 at the Ignalina NPP. It states that preparatory activities for the decommissioning of Ignalina unit 1 shall end no later than 1 January 2005. The exact date of its final shut-down shall be decided by the government, following its consideration of a decommissioning programme and a decommissioning plan, including the future financing of such decommissioning by the Republic of Lithuania and sources of international financial assistance. Decommissioning of Ignalina 1 shall be financed from the Ignalina NPP Decommissioning Fund, international financial assistance and bank loans.

- Law on Electricity, adopted on July 20, 2000.
- Program on Safe Exploitation of State Enterprise Ignalina Nuclear Power Plant, approved by the resolution of the Parliament on September 26, 2000.
- Law on the State Enterprise Ignalina Nuclear Power Plant Decommissioning Fund, adopted on July 12, 2001 provides for the establishment of a new Ignalina NPP Decommissioning Fund. This Fund is financed in particular from a percentage of the profit made by Ignalina NPP through electricity production; voluntary contributions from foreign countries, international organisations, financial institutions and legal entities of Lithuania; and income gained from the sale of property during decommissioning. The assets of the Fund is used to finance technical and social projects related to the decommissioning of Ignalina NPP; management, final disposal and long term storage of radioactive waste and spent fuel from Ignalina NPP; and compensation for nuclear damage.
- Radioactive Waste Management Strategy, approved on February 6, 2002.
- Energy Law of Republic of Lithuania, adopted on July 1, 2002.
- National Energy Strategy, approved by the resolution of the Parliament on October 10, 2002.
- Resolution No 103 on the Approval of Regulations for Licensing of Nuclear Power Related Activities of 27 January 1998.
- Resolution No 786 on the Approval of Statute of the State Nuclear Power Safety Inspectorate of 21 October 1992 (with amendments - Resolution No.722 of 4 Jul 1997 and Resolution No.963 of 31 July 1998);
- The Resolution No.172 of the Government of the Republic of Lithuania 19 February 2001 On the Approval of the Programme on the Decommissioning of Unit 1 at the State Enterprise Ignalina Nuclear Power Plant;
- The Resolution No.1074-14 of the Government of the Republic of Lithuania 17 September 1996 On the Approval of Special Safety Requirements at the State Enterprise Ignalina Nuclear Power Plant;
- The Resolution No.716 of the Government of the Republic of Lithuania August 8, 1994 on the Approval of the Procedure for the Transportation of Secret Cargoes to the Republic of Lithuania and out of the Republic of Lithuania LRV Resolution (amendments - Resolution No.466 of 15 May 1997);
- The Resolution No. 718 of the Government of the Republic of Lithuania 19 May 1995 on the Approval of Goods which are Prohibited for the Import, Export and Carrying in Transit in the Republic of Lithuania without Special Permissions (amendment - Resolution No.653 of 23 June 1997);
- The Resolution No 955 of the Government of the Republic of Lithuania September 8, 1997 On the State Accounting for and Control of Nuclear Materials.

4. CURRENT ISSUES AND DEVELOPMENTS ON NUCLEAR POWER

4.1. Energy Policy

Until December 1994, Ignalina NPP had a status of State Enterprise for Special Purpose with some restrictions on privatization issues, after which it was excluded from the list of Special Purpose enterprises. In July 2002 Law on Nuclear Energy was changed forming the possibility for private capital to participate in the nuclear power sector. But in October 2002 Law on Enterprises and Installations Which Have Strategic Significance for National Security and Other Enterprises Which are Important for National Security states, that Ignalina NPP is strategic object and could be reorganised or restructured only if Parliament approves new law.

The safety level of the Ignalina NPP during the times of very limited financial resources was one of the main concerns of the Lithuanian Government. In 1993, after numerous consultations with Western, Russian and Lithuanian experts, the Ignalina Safety Enhancement Programme was developed. Main safety issues were ranked in order of importance. A Grant Agreement between the European Bank for Reconstruction and Development and the Government of Lithuania, signed in February 1994, was very helpful in the resolution of most urgent safety issues. In the frame of this agreement, during 1995-1996 the first comprehensive Safety Analysis Report (SAR) for RBMK type reactors was prepared for Units 1 and 2 of Ignalina NPP. Several generic safety issues for RBMKs were also defined. The SAR-2 for Unit 2 is under preparation and will be completed in 2003. On the basis of SAR conclusions Ignalina NPP started new Safety Improvement Programme (SIP)–2 in April 1997. SIP–2 consisted of almost 160 positions and most of them are completed. Every year SIP-2 is revised and additional positions are added. Now for the period of 1997-2005 SIP-2 consists of 222 measures. One of the biggest and most important items is “Second Independent Diverse Shut-Down System”, which is planned to be installed and commissioned by the end of 2004. Actively seeking Western assistance in the form of bilateral assistance programmes, Lithuania took an equivalent effort to take part in multilateral efforts where experts from the East were actively involved. Possibly because of this policy of transparency, Ignalina Unit 2, together with Unit 3 of Smolensk NPP, was selected as representative models of second and third generation RBMKs for analysis of the generic safety issues and specific safety features in the framework of the IAEA Extra budgetary Programme.

Lithuania will completely fulfil all recommendations of the earlier developed Safety Analysis Report, its Independent Review and international Ignalina Safety Panel. Ignalina NPP has already implemented these recommendations and in July 1999 the VATESI issued a license corresponding with international requirements, which allows operating Unit 1 until July 2004. Licensing process for Unit 2 of Ignalina NPP is under development now. Government of Lithuania is committed to continue operating and safety upgrading Ignalina NPP according to Western European practices.

Cost of electricity generated at the Ignalina NPP is presently lower than at the other existing plants (except of hydro power plants) as well as potential new power plants that could be built in Lithuania. Uncertainties on the future investments needed for safety upgrade of Ignalina NPP, a predicted relatively slow growth rate of national energy demand and limited opportunities for profitable power-export, however, complicate an efficient use of the full capacity of Ignalina NPP in the future.

Lithuanian Parliament decided that the first unit of Ignalina NPP will be closed before 2005, and the second unit – in 2009, accordingly, while stressing the need for Lithuania to remain a ‘nuclear state’. In case of failure to secure the necessary financing from the EU and other donors, the operation of Ignalina NPP Units 1 and 2 will be extended in accordance with their safe operation period. Adopted plan of technical-environmental and social-economic implementation measures of the Ignalina NPP Unit 1 decommissioning laid down relevant timetable as well as indicated the responsible organizations and financing sources. The plan of measures is an integral part of National Energy Strategy Action Plan, which was adopted by the Government in May 2001.

During preparation of the National Energy Strategy a preliminary analysis of Ignalina NPP closure and decommissioning costs, the cost of replacing Ignalina NPP in the power supply and macroeconomics impact was evaluated.

The impact of the final closure of Unit 1 and management of all waste are evaluated at approximately 10.4 billion LTL. The costs of management, storage and disposal of waste and spent fuel accumulated before 1999 (about 8 billion LTL) should be proposed to be covered by the international grants and the costs from 2000 to be covered by increasing electricity tariffs and improving efficiency of the whole power sector.

Investments into modernization of the power sector related to closure of Unit 1 up to 2020 amount to approximately 2.8 billion LTL. Financing of this should be investigated through international loans and discharged from the revenues from energy.

Financing for spent fuel and radioactive waste storage and funding for decommissioning of Nuclear Power Plant is partially resolved. State Enterprise Ignalina NPP Decommissioning Fund was approved in 1995 from income received for sold power. The price of sold power includes the expenses of spent fuel and radioactive waste management. An interim storage for spent fuel in CASTOR and CONSTOR type containers was built and commissioned in 1999 on the site of Ignalina NPP.

Implementing Lithuanian power sector reorganization, Lithuanian power market will be gradually opened internationally. The first step being planned is integration into Baltic common electricity market, when afterward the integration into Western European and Scandinavian electricity markets is foreseen.

Currently synchronous interconnection between Baltic's and Europe is impossible due to different frequency regulation systems installed, therefore, the asynchronous interconnection is proposed. Joint Lithuanian – Polish task force evaluating possibilities of such interconnections came up with solution that the most applicable option is construction of double chain 400 kV line and 1000 MW capacity direct current insertions on Lithuanian side. The transmission capacity of such a line would be 3.6 TWh per year. The costs of the project can amount to 354 m EUR, when investments from Lithuanian side would make up to 154 m EUR. Such interconnection would positively affect European electricity market as well as would increase security and quality of electricity supply.

At present, the electricity generating capacities can meet the needs of Lithuanian consumers in full and enable electricity exports. However, Lithuania retains the electricity generating overcapacity. Therefore, the construction of large generating facilities is not planned. The investments must be channelled for the renovation and upgrading of the existing capacities. The negative aspect of this situation is that the development of the use of renewable energy sources and co-generation for electricity production is complicated. In principle, electricity transmission and distribution networks meet the present-day power system demands, however 75 per cent of the transmission and distribution facilities have been in operation for more than 20 years and 25 per cent for more than 30 years. Therefore, the investments will be required not only for the maintaining the present power networks level, but also for the improvement of their condition in a view to meeting the growing requirements set for energy supply security and stability and also aiming at the establishment of the common electricity market of three Baltic States.

4.2. Privatisation and deregulation

The Electricity Law came into force in January 2002, and calls for a partial opening of the market from 2002 and a full opening by 2010. The competition is allowed in the fields of electricity generation and supply, while the transmission and distribution activities remain subject to regulation.

Since Ignalina NPP generates more than 25% of the domestic demand, the Electricity Regulator

according to the Electricity Law has the right to regulate prices, and currently sets a price for generating capacity and for reserve capacity as well as for kwh, as opposed to the previous simple kwh price. Since only one Unit of Ignalina NPP is needed to meet domestic electricity demand, the rates set by the Regulator do not fully cover the fixed costs of operating the second Unit, and so additional income from electricity exports is necessary to cover the costs for two Units. The Transmission System Operator, who also functions as Single Buyer at the moment, has so far been relatively successful in finding export markets at a price sufficient to cover costs. Otherwise, the Second Unit would need to be considered a stranded asset.

To change the legal status of Ignalina NPP from a State Enterprise to a limited liability company, owned by the State is necessary to comply with EU legislation on competition and state aid. The amendments to the Law on Nuclear Energy adopted in July 2002 enabled the reorganization of the state enterprise Ignalina NPP into a joint stock company. The second step was separation of five subdivisions not directly related to energy generation from the Ignalina NPP and establishing state enterprises thus preparing to change legal status of state enterprise Ignalina NPP.

The electricity market in the country shall be established in stages, by gradually giving the right of regulated third party access to the grid and the right to conclude direct electricity purchase contracts with producers having electricity supply licenses for the following eligible customers.

On the Lithuanian initiative, the main principles of the first phase of the market opening among three Baltic States were drawn up in October 2001. In November 2001 a Resolution regarding the Basic Principles of Establishing of Common Baltic Electricity Market was signed. The principles cover the functions of both transmission system operators and market regulators. The principles should be co-ordinated with respective institutions in Latvia and Estonia.

In November 2002 Memorandum between Energy Market Inspectorate of the Republic of Estonia, Public utilities Commission of the Republic of Latvia and National Control Commission for Prices and Energy of the Republic of Lithuania concerning the Common Baltic Electricity Market was signed. At present the energy companies (future transmission system operators) of the three Baltic countries are negotiating the common activities under market conditions.

The main impact so far of the market on Ignalina NPP is to clarify the real cost of generation in comparison with other plants in the country, since generation costs are now unbundled and ownership separated in the previously vertically integrated State power company. New pricing mechanisms are applied, with two part capacity and energy prices.

4.3. Role of the government in the nuclear R& D

The first Lithuanian text-books in Nuclear Engineering were published; seminars, conferences and different meetings together with the post graduates of the secondary schools organized; the articles in the popular journals were published; a continuation of studies in the foreign countries organized; additional scholarship for Nuclear engineering students; guarantees of employment; changed training programs from operational needs to decommissioning needs and etc. Unfortunately all these actions are condemned to failure because of the early shutdown of the Ignalina NPP.

4.4. Nuclear Energy and Climate Change

4.5. Safety and waste management issues

After the Chernobyl accident hardware changes were implemented to ensure that a negative power coefficient of reactivity exists at all operating regimes. The changes include the modification of control rods, the introduction of additional absorbers, implementation of a fast reactor scram system and the upgrading of operating regulations with regard to core control.

Efforts to upgrade the Ignalina NPP safety were accelerated when Lithuania assumed control of the plant. A short-term Safety Improvement Program (SIP) has been prepared by the plant with the assistance of Western experts and was approved by VATESI in 1993. To realise part of this program a Grant Agreement was approved by the European Bank for Reconstruction and Development on behalf of the Nuclear Safety Account. The grant supported 20 projects in three areas: operational safety, technical improvements, and services. Operational safety improvements include non-destructive testing, seals for pressure tubes, routine maintenance instruments and equipment, radiation monitors, upgrading of design and maintenance documentation, upgrading and the design, delivery and implementation of a full-scope simulator. Short-term safety improvements include upgrading of the information computer system TITAN, low flow and low reactivity margin reactor trip system, engineering study of the second emergency shutdown system, seismic, fire and hydrogen explosion prevention and others.

The follow-up to SIP is the new Safety Improvement Program (SIP-2) of the Ignalina NPP, which is based on the recommendations of the Ignalina Safety Panel, the Safety Analysis Report, its independent review and incorporates the experience gained during implementation of the first Safety Improvement Program. The Lithuanian governmental authorities approved the SIP-2 in 1997. It is continuously up-dated and revised annually. All activities within the new Safety Improvement Program are divided into three categories:

- Design modifications.
- Management and organisation development.
- Safety Analyses.

SIP-2 implementation is progressing satisfactorily. The Ignalina NPP, and in particular its Director, have shown a very positive approach regarding the recommended implementation of changes in the safety culture. This applies at all levels of the plant and includes a well-developed plan to employ outside technical expertise for some tasks.

Ignalina NPP plans to introduced an additional emergency protection system (DAZ) based on a high pressure signal from the steam separators and a low flow indication through Main Circulation Pumps. The work for development of the second fully independent diverse shutdown system has been also started in 2002 under PHARE sponsorship.

REFERENCES

[1] Republic of Lithuania. National Energy Strategy. October 10, 2002.

[2] Republic of Lithuania. National Energy Efficiency Programme. September 19, 2001

[3] Almenas, A. Kaliatka, E. Uspuras. Ignalina RBMK - 1500. A Source Book. Ignalina Safety Analysis Group, Lithuanian Energy Institute, 1994.

[4] Ignalina Safety Analysis Report. Final Edition, 12 December 1996, Vattenfall Nuclear, Project AB for Ignalina Nuclear Power Plant.

[5] Ministry of Economy of the Republic of Lithuania Annual Report 2002, 2003.

[6] State Nuclear Power Safety Inspectorate (VATESI) Annual Report 2002, 2003.

[7] Radioactive Waste Management Agency Annual Report 2002, 2003.

[8] Report 2001 of the National Price and Energy Control Commission, 2002.

[9] Monitoring report „Supply Security in the Lithuanian Electricity Market“. Ministry of Economy of the Republic of Lithuania, 2002.

[10]Energy in Lithuania 2002. Lithuanian Energy institute, 2003.

[11]IAEA Energy and Economic Data Base (EEBD).

[12]IAEA Power Reactor Information System (PRIS).

Appendix 1

INTERNATIONAL, MULTILATERAL AND BILATERAL AGREEMENTS

AGREEMENTS WITH THE IAEA

• Membership in IAEA		18 November 1993
• NPT related agreement INFCIRC/413	Entry into force:	15 October 1992
• Additional Protocol	Entry into force:	5 July 2000
• Improved procedures for designation of safeguards inspectors		Accepted
• Supplementary agreement on provision of technical assistance by the IAEA	Entry into force:	22 February1995
• Agreement on privileges and immunities	Entry into force:	28 February 2001

OTHER RELEVANT INTERNATIONAL TREATIES

• Treaty on the Non-Proliferation of Nuclear Weapons	Entry into force:	23 September 1991
• Convention on the physical protection of nuclear materials	Entry into force:	6 January 1994
• Convention on early notification of a nuclear accident	Entry into force:	17 December 1994
• Convention on assistance in the case of a nuclear accident or radiological emergency	Entry into force:	22 October 2000
• Agreement for the application of safeguards in connection with the treaty on the non-proliferation of nuclear weapons	Entry into force:	15 October 1992
• Vienna convention on civil liability for nuclear damage	Entry into force:	15 December 1992
• Protocol to amend the Vienna convention on civil liability for nuclear damage	Signature:	30 September 1997
• Joint protocol relating to the application of the Vienna convention and the Paris convention	Entry into force:	20 December 1993
• Convention on supplementary	Signature:	30 September 1997

compensation for nuclear damage

• Convention on nuclear safety	Entry into force:	24 October 1996
• Joint convention on the safety of spent fuel management and on the safety of radioactive waste management	Signature:	30 September 1997
• Comprehensive nuclear test ban treaty	Entry into force:	7 February 2000
• ZANGGER Committee		Non-Member
• Nuclear Export Guidelines		Not Adopted
• Acceptance of NUSS Codes		Accepted

BILATERAL AGREEMENTS

• Agreement between the Government of the Kingdom of Denmark and the Government of the Republic of Lithuania concerning information exchange and co-operation in the fields of nuclear safety and radiation protection	16 March 1993
• Agreement between the Government of Republic of Lithuania and the Government of Canada for the co-operation in the peaceful uses of nuclear energy	17 November 1994
• Agreement between Commissariat a l'Énergie Atomique de France and Ministry of Energy of Lithuania on the co-operation in the peaceful use of nuclear energy	26 April 1994
• Agreement between the Government of the Republic of Lithuania and the Government of the Kingdom of Norway on early notification of nuclear accidents and on the exchange of information on nuclear facilities	13 February 1995
• Agreement between the Government of the Republic of Lithuania and the Government of the Republic Poland on early notification of a nuclear accidents, and on co-operation in the field of nuclear safety and radiation protection	2 June 1995

Appendix 2

DIRECTORY OF THE MAIN ORGANIZATIONS, INSTITUTIONS AND COMPANIES INVOLVED IN NUCLEAR POWER RELATED ACTIVITIES

NATIONAL ATOMIC ENERGY AUTHORITY

Ministry of Economy Gedimino ave. 38/2, LT-2600 Vilnius	Tel. 370 5 261 88 96 Fax. 370 5 262 39 74 http://www.ukmin.lt
Ministry of Environment A.Jakšto str. 4/9, LT-2694 Vilnius	Tel. 370 5 261 05 58 Fax. 370 5 222 08 47 http://www.gamta.lt

NATIONAL REGULATORY AUTHORITY

State Nuclear Power Safety Inspectorate VATESI Šermukšnių str. 3, LT-2600 Vilnius	Tel. 370 5 266 16 20 Fax. 370 5 261 44 87 http://www.vatesi.lt

MAIN POWER UTILITY

State Enterprise Ignalina Nuclear Power Plant Visaginas LT-4761 Ignalina	Tel. 370 (386) 28 350 Fax. 370 (386) 29 350 http://www.iae.lt

OTHER ORGANIZATIONS

Lithuanian Energy Institute Breslaujos str. 3, LT-3035 Kaunas	Tel. 370 37 35 14 03 Fax. 370 37 35 12 71 http://www.lei.lt
Joint-Stock Company “Lietuvos Energija” Žvejų str. 14, LT-2748 Vilnius	Tel. 370 5 275 07 93 Fax. 370 5 222 67 36 http://www.lpc.lt
Radiation Protection Centre Kalvarijų str. 153, LT-2042 Vilnius	Tel. 370 5 276 36 33 Fax. 370 5 275 46 92 http://www.rsc.lt
Kaunas University of Technology	http://www.ktu.lt
Lithuanian University of Agriculture	http://www.lzua.lt
Vilnius Gediminas Technical University	http://www.vgtu.lt
Vilnius University	http://www.vu.lt
Vytautas Magnus University	http://www.vdu.lt