BULGARIA

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1. GENERAL INFORMATION

1.1. General Overview

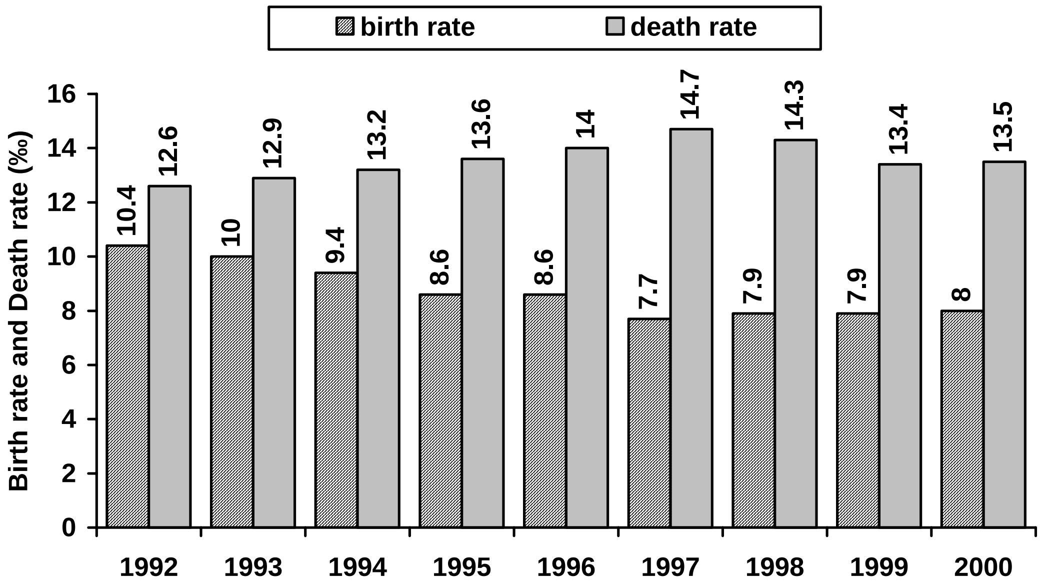
Bulgaria is a country situated in the south-eastern Europe and it occupies the biggest part of the Balkan peninsula. The northern border of Bulgaria continues for 470 km on the Danube River and later in south-eastern direction to the Black Sea for about 139 km on land. In eastern direction, Bulgaria borders the Black Sea while to the south there is a 752 km long border with Turkey and Greece. To the west, the country has a border with the Former Yugoslav Republic of Macedonia and Yugoslavia. Within these borders, Bulgaria has 110,975 km^2 surface, including an altitude correction.

The demographic situation in the country is characterized with a clear tendency of decrease in the population (Table 1). For the period between 1985 and 1998, the population has decreased by 719,509 people (8.0%). At the end of 1994, the population of the country numbered 8.43 million people and population density of 76 persons per square kilometre. There exists a negative trend in the change of the population, which was for 1990 -0.4%; for 1991 -1.7%; for 1992 -2.2%; and for 1993 -2.9%; see Figure 1, which shows the birth and death rates from 1992 to 2000. According to the National Institute of Statistics, the total number of the population is expected to decrease by another 320,000 (319,392) people around the year 2000, compared to 1993 (Table 2 and Figure 2).

TABLE 1. POPULATION INFORMATION

										Growth rate (%)
	1960	1965	1970	1975	1980	1985	1990	1999	2000	2001
Population (millions)	7.9	8.2	8.5	8.7	8.9	8.9	8.7	8.0	7.9	-0.5
Population density (inhabitants/km^2)	71	71	77	77	80	80	78	73	72	-0.5
Urban population as percent of total	38	38	53	53	63	63	67	69	68	
Area (1000 km^2)	111.0									

Source: IAEA Energy and Economic Database; Country Information.



Source: Bulletin “Population 98”, National Institute of Statistics, 1999, Sofia

FIG. 1. Birth and Death Rate of the Bulgarian Population

TABLE 2. POPULATION OF BULGARIA (1993 - 2000)

Year	Inhabitants		
	Total	Men	Women
1993	8,459,763	4,151,638	4,308,125
1994	8,427,418	4,129,966	4,297,452
1995	8,384,715	4,103,368	4,281,347
1996	8,340,936	4,077,501	4,263,435
1997	8,283,200	4,044,965	4,238,235
1998	8,230,371	4,014,071	4,216,300
1999	8,190,900	3.964.042	4.226.857
2000	8,149,500	3.944.006	4.205.493
2001	7.974.000	3.889.000	4.085.000

Source: Country Information.

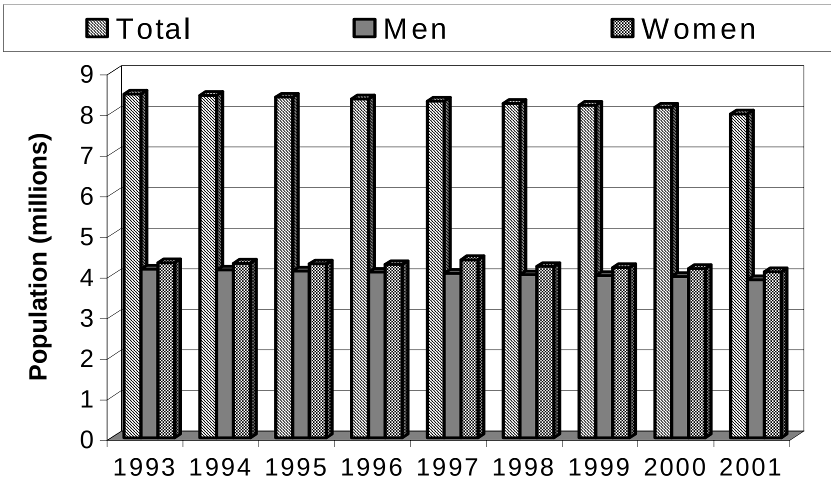


FIG. 2. Population of Bulgaria (1993 - 2001)

Bulgaria has four distinct seasons, which create changes in the demand for energy and in particular for electricity. The annual fluctuation of Bulgarian's electric power demand has one peak period in winter, which has been identified to be the result from using electricity for space heating. The average temperature of 12^{o}C, below which space heating is necessary, lasts about 200 days. The average temperature in November is 5.1^{o}C, in December – 0.0^{o}C, in January –1.8^{o}C, in February – 0.3^{o}C, in March 4.6^{o}C.

1.2. Economic Indicators

Table 3 shows the historical Gross Domestic Product (GDP) data from the IAEA Energy and Economic Database (EEDB) in USD. GDP in 1998 was 21 577 billion levs at current prices, which amounts to 112 325 million levs at 1991 prices. The economic crisis of 1996 and 1997 led to a decline in real GDP, which dropped by -10.1% and -7.0% respectively. The economy picked up again in 1998, with real growth estimated at 3.5% and remained on that level. Figure 3 shows the real GDP index for 1990 through 2006, where 1990 was taken as the base year.

1.3. Energy Situation

1.3.1 Current status

Bulgaria has very few domestic energy resources (Table 4). Proven oil and gas reserves for the country have declined for a number or years and are only about 5 million tons of oil equivalent. In fact, it is less than six months normal hydrocarbon consumption for Bulgaria. Hydropower potential is also limited since most of Bulgaria's rivers are small and the only large river, the Danube, has a small drop in altitude where it forms Bulgaria's northern border with Romania. Largely because of this constraint, hydro capacity accounts for about 12% of the country's total installed generating capacity and an even smaller percentage of generation. The actually utilized hydropower capacity of the country is about 33% of the technically possible capacity.

TABLE 3. GROSS DOMESTIC PRODUCT (GDP)

	1970	1980	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	Growth rate (%) 1980 to 1998
GDP [(1)]	6,619	19,993	20,726	7,625	8,603	10,833	9,708	13,106	9,831	10,141	12,257	12,405	11,990	-2.7
GDP [(2)] per capita	780	2,256	2,377	887	1,014	1,279	1,150	1,558	1,189	1,224	1,489	1.514	1.471	-2.3
GDP by sector (%) :														
-Agriculture	N/A	14	18	15	12	10	12	13	15	24	21	17	14	2.8
-Industry	N/A	54	51	47	45	39	38	31	28	26	29	27	28	-4.0
-Services	N/A	32	31	38	43	51	51	56	57	50	50	56	58	2.5

[(1)] Millions of current US$. [(2)] Current US$.

Source: IAEA Energy and Economic Data Base; Data & Statistics/The World Bank; Country Information.

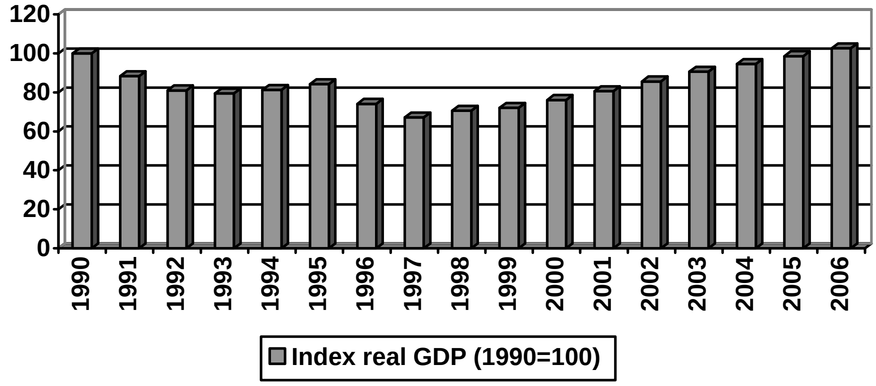


FIG. 3. Index of the real Gross Domestic Product of Bulgaria

TABLE 4. ESTIMATED ENERGY RESERVES

Exajoule

	Solid	Liquid	Gas	Uranium [(1)]	Hydro [(2)]	Total
Total amount in place	19.26	0.08	0.14	4.26	2.51	26.24

[(1)] This total represents essentially recover reserves.

[(2)] For comparison purposes, a rough attempt is made to convert hydro capacity to energy by multiplying the gross theoretical annual capability (World Energy Council - 1998) by a factor of 10

Source: IAEA Energy and Economic Database

The country has significant but very low-grade coal reserves (Table 5). The mineable reserve amount to around 2.6 billion tons including lignite, of which 2.2 billion tons are situated in the Maritsa East deposit. The production in 2000 amounted to about 26 million ton per year (Table 6 and Figure 4). About 90% of these reserves have a heating value of only 1 200-1 500 kcal/kg, which is 20-25% of the heating value of internationally traded, steam coal. In addition, these lignite reserves have a very high sulphur content. Consumption of coal in Bulgaria reached its historically highest level in 1987. In that year, 40.5 million tons of coal were consumed.

Bulgaria imports almost all of its petroleum since domestic production is negligible, for example in 1997 domestic production was 27.800 tons of oil and 35 million cubic meters of gas. Imported petroleum is in the form of crude oil and is being refined in Bulgaria or directly imported as products. Typically, about 90% of petroleum are imported as crude and most of the rest is imported as heavy fuel oil. Bulgaria has three refineries located respectively at Burgas, on the Black Sea Coast, and at Pleven and Ruse on the Danube plain in the northern part of the country. The Burgas refinery accounts for about 85% of the country refining capacity with the other two refineries being very small with insertion economics.

TABLE 5. BULGARIA COAL RESERVES

	Mineable Reserves (million tons)	Present Production (million tons/year)	Lifetime (years)
Lignite	2350	28	85
Sub-bituminous coal	210	5	40
Bituminous	10	<1	40
Anthracite	1	<1	20

Source: Country Information.

TABLE 6. STRUCTURE OF THE COAL PRODUCTION IN BULGARIA

million tons

	1993	1995	1996	1997	1998	1999	2000
Bituminous	0.263	0.195	0.138	0.102	0.079	0.099	0.101
Sub-bituminous	3.419	3.187	3.060	2.677	2.902	2.589	2.603
Lignite	25.350	27.449	28.104	26.929	27.117	22.586	23.715
Total	29.032	30.831	31.302	29.708	30.098	25.274	26.419

Source: Country Information.

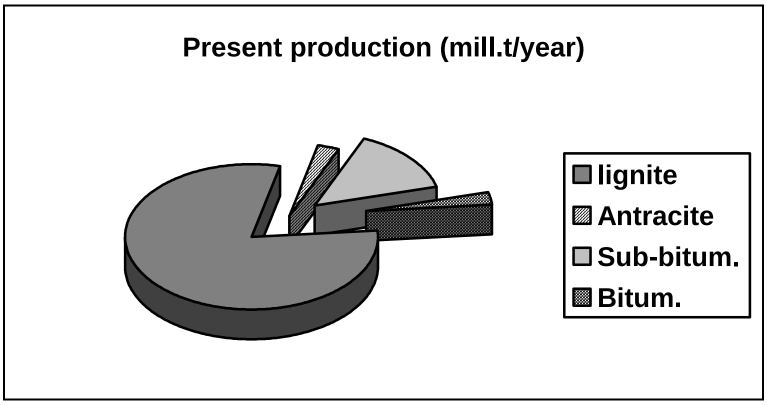


FIG. 4. Structure of the coal production in Bulgaria

Bulgaria on average consumes about 5.5 billion cubic meters of gas per year. This represents 17-20% of its energy requirements. In recent years decrease of gas consumption is observed. Almost all of the gas is used by industry. The largest user was the energy sector, which uses the gas to generate heat and to produce electricity, i.e. 41% of total gas consumption in 2000. Most of the gas used in Bulgaria is imported from the Russia. Domestic production of natural gas in 1999 was 27,267 thousand m^3 and currently has been less than 1% of Bulgaria's supply. Alternatives to Russian supplies are very limited.

In order to fulfil Decree No 162, August 20, 1992, and Decree No 56, March 29, 1994 of the Council of Ministers, the technical liquidation of the uranium mining sites have been completed. The liquidation of the processing plants have been finalized. By 2002, the projects of technical and biological re-cultivation of the uranium mining regions shall be completed, and by 2005 - sanitary treatment and safeguarding of the tailings ponds of the processing plants. Special attention shall be paid to the regions of Buhovo, Eleshnitsa and Sliven, where the damages to the environment are most markedly pronounced, and where their effect on the population is the most direct. In parallel to performance of the re-cultivation and sanitary treatment projects, the required treatment facilities for purification of radionuclide polluted waters and monitoring networks will be built in the uranium mining regions. For performance of the projects in these regions, we will depend on the co-operation and assistance of the European Union and the PHARE Programme, especially to avert the danger of cross-border water pollution.

The energy intensity of Bulgarian Gross Domestic Product (GDP) does not appear to have decreased, with energy consumption and output roughly at the same rate. However, this pattern should start to change as the economic restructuring occurs and as relative energy prices continue to increase. Reduction of energy consumption and, therefore, of net energy imports is likely to be an important component of any improvement of Bulgaria's balance of trade. Table 7 shows the national primary energy data (production, primary energy balance and consumption) in their typical units and Table 8 the IAEA Energy and Economic Database (EEDB) energy statistics in exajoules.

TABLE 7. NATIONAL PRIMARY ENERGY DATA

Energy Source	Unit	1993	1994	1995	1996	1997	1998	1999
Primary energy								
Hard Coal	Mt	0.26	0.17	0.19	0.14	0.10	0.08	0.10
Lignite	Mtt	25.35	25.43	27.45	28.10	26.93	27.12	22.59
Brown Coal	Mt	3.42	3.16	3.19	3.06	2.68	2.90	2.58
Oil	Mt	0.03	0.04	0.04	0.03	0.03	0.04	0.04
Natural Gas	Gm^3	0.04	0.06	0.05	0.04	0.04	0.02	0.03
Hydro	TW·h	1.94	1.51	2.51	2.98	2.93	3.10	2.75
Wood	Mm^3	1.72	1.82	1.79	2.39	2.39	4.45	4.43
Primary energy								
Production	Mtoe	9.23	9.47	10.70	10.68	10.29	10.54	9.41
Import	Mtoe	12.93	13.15	14.82	14.06	12.08	11.71	10.93
Export	Mtoe	0.68	2.02	2.27	1.80	1.92	1.64	2.00
Bunkers	Mtoe	0.52	0.52	0.51	0.15	0.48	0.07	0.01
Stock Changes (+. -)	Mtoe	0.17	0.37	-0.26	-0.55	-0.13	-0.04	0.32
Total	Mtoe	22.23	21.49	23.49	22.54	21.06	23.91	22.67
Energy consumption								
Hard Coal	Mt	4.94	3.86	3.43	3.53	4.13	3.48	3.09
Lignite	Mt	25.62	25.78	27.68	27.87	27.17	26.68	22.99
Brown Coal	Mt	3.66	3.34	3.19	2.54	3.11	3.05	2.66
Oil	Mt	5.70	6.11	6.49	5.59	4.95	4.75	4.41
Natural Gas	Gm^3	4.79	4.81	5.78	5.89	4.66	3.65	3.37
Hydro	TW·h	1.94	1.51	2.51	2.98	2.93	3.09	2.75
Nuclear Fuel	Mtoe	3.73	4.08	4.53	4.75	4.66	4.72	4.35
Net Electricity	TW·h	0.11	-0.41	-0.83	-0.94	-3.88	-3.64	-1.95
Wood	Mm^3	1.72	1.82	1.79	2.39	2.39	4.34	4.28

Source: Country Information.

The pattern of energy use in Bulgaria is significantly different from the West. The main area of difference is in the direct use of gas. In most western industrial countries households and the service sector use gas. In Bulgaria, gas is almost entirely used in the industrial sector and in power generation, including district heating plants (many plants being combined heat and power or CHP plants), with a negligible amount being used in services and households. Furthermore, this pattern of usage will not change rapidly since Bulgaria lacks a distribution network for gas so that it cannot currently be supplied to most households and commercial establishments. Indirectly, of course, the household and service sectors use some gas since a small part of the electricity they consume and most of the heat supplied by district heating plants, comes from gas. Even considering this indirect use, however, the use of natural gas in Bulgaria is still heavily skewed towards the industrial sector.

1.3.2. Bulgarian National Energy Development Strategy until 2010

The main objectives guiding the energy development are:

- maintaining the nuclear safety at the acceptable level;
- continuous and safe coverage of the national energy needs with minimum public cost;
- providing energy independence for the country;
- improvement of energy effectiveness;
- ecologically oriented development;

- establishment of competitive internal energy market;
- integration of the Bulgarian energy system and energy market with that of the EC.

TABLE 8. ENERGY STATISTICS

Exajoule

	1960	1970	1980	1990	1999	2000	Average annual growth rate (%) 1960 to 1980	1980 to 2000
Energy consumption								
- Total [1]	0.26	0.75	1.10	1.21	0.78	0.79	7.52	-1.63
- Solids [2]	0.20	0.37	0.40	0.41	0.31	0.31	3.61	-1.25
- Liquids	0.04	0.35	0.42	0.39	0.19	0.18	12.19	-4.27
- Gases		0.02	0.15	0.23	0.15	0.14		-0.36
- Primary electricity [3]	0.02	0.02	0.13	0.18	0.14	0.17	10.37	1.18
Energy production								
- Total	0.22	0.28	0.35	0.41	0.40	0.45	2.34	1.29
- Solids	0.19	0.23	0.23	0.26	0.22	0.22	0.99	-0.22
- Liquids	0.01	0.01	0.01				1.61	-10.30
- Gases		0.02	0.01					-9.54
- Primary electricity [3]	0.02	0.02	0.10	0.15	0.18	0.22	8.63	4.31
Net import (Import - Export)								
- Total	0.04	0.47	0.74	0.73	0.43	0.41	15.47	-2.91
- Solids	0.01	0.14	0.18	0.15	0.10	0.10	16.98	-2.87
- Liquids	0.03	0.33	0.42	0.35	0.19	0.17	13.40	-4.35
- Gases			0.14	0.23	0.15	0.14		-0.16

[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 +Net import.
Source: IAEA Energy and Economic Database.

The basic economical factors that influence the energy consumption in the country are:

- reducing the share of the industry;
- closing down of the non-effective productions;
- increasing the share of the productions having relatively low energy consumption;
- liberalization of the price of energy resources.

All that will be carried out in parallel with the implementation of the national policy for energy effectiveness in both the industry and the consumption sectors. According the national strategy, the expected energy consumption will grow as cited in Tables 9 and 10. However, the energy strategy is currently under review.

TABLE 9. EXPECTED ENERGY CONSUMPTION

PJ (million toe)

1996	Development	2000	2001	2005	2010
577(19,7)	Basic scenario	623 (21.2)	640 (21.8)	720 (24.6)	785 (26.8)
577(19,7)	Minimum scenario	611 (20.9)	622 (21.2)	670 (22.9)	713 (24.3)

Source: Country Information.

TABLE 10. RATIO OF EXPECTED ENERGY CONSUMPTION AND GDP

Year	Dimension	Basic Scenario	Minimum Scenario
1996	tonnes of reference fuel / million $	1978	1978
2000	tonnes of reference fuel / million $	1825	1927
2001	tonnes of reference fuel / million $	1788	1857
2005	tonnes of reference fuel / million $	1607	1665
2010	tonnes of reference fuel / million $	1256	1332

Source: Country Information.

1.4. Energy policy

The energy strategy of the Republic of Bulgaria is based on the national priorities and corresponds to the new lasting positive political and economic trends in the country as well as to the requirements of the European guidelines, the principles of market mechanisms and the Government's Programme. It is determined by the requirements for ensuring sustainable economic growth, and raising the living standard. The strategy has been developed in conformity with the natural and geographic factors determining the inherent role of the country in this region, and the optimal mix of energy resources used in accordance with the specific conditions.

The main goals of the Bulgarian energy industry are focused in energy efficiency improvement, integration of the national energy system and energy market into the European ones, guaranteed nuclear safety and establishment of a competitive domestic energy market. Special attention is paid on observing International Regulation in the nuclear power sector and on nuclear safety of the Kozloduy NPP. The EU essentially requires to find a solution for long-term storage of radioactive waste.

The energy sector is a determinative section of the Bulgarian industry, especially taking into account that its structure and development are based predominantly on imported energy sources and Bulgarian Lignite Coal. Moreover, the development of the sector is highly dependent on our geopolitical location on the Balkan Peninsula and in Europe. In this complicated stage of its development, Bulgaria unambiguously proves the willing to conform to the priorities of European Union and make the needed steps for technical and political integration with these structures.

The main goal of the Energy Industry is to provide fuel and energy for the country with least cost generation, transmission and distribution, observing the requirements for environmental generation and mining according to the nuclear safety level and to following continually the reform direction of the sector in order the market principles to be established. During the transition period and according to the stated intention of the country to be a Member of the European Union, Bulgarian Energy Industry fulfils its main goal satisfying the fuel and energy needs of the population and industry at affordable social price. At the same time, a structural reform will start in all energy subsections following the goals of the European Union to stimulate the competition, provide reliable power supply and protect environment. The main direction during the whole process of preparation for integration with the European Union is to harmonize the Bulgarian Energy Policy with the policy of the European Union and with the legislation and structural reforms as a way for closer relations and integration with the European structures.

As a country with limited energy resources, the basis of the energy sources of Bulgarian Energy Sector is too large - solid fuel, nuclear power, natural gas, hydro resources and utilization of the new energy sources. This multiformity will be kept for the future and the specific priorities of the country will be determined as follows:

- i) to increase the energy independence of the country;
- ii) rational utilization of the local energy resources;
- iii) reliability of the power supply;
- iv) interconnection to the European Electric Power and Gas Networks.

2. ELECTRICITY SECTOR

2.1. Structure of the Electricity Sector

The structure of the energy sector is shown in Figure 5.

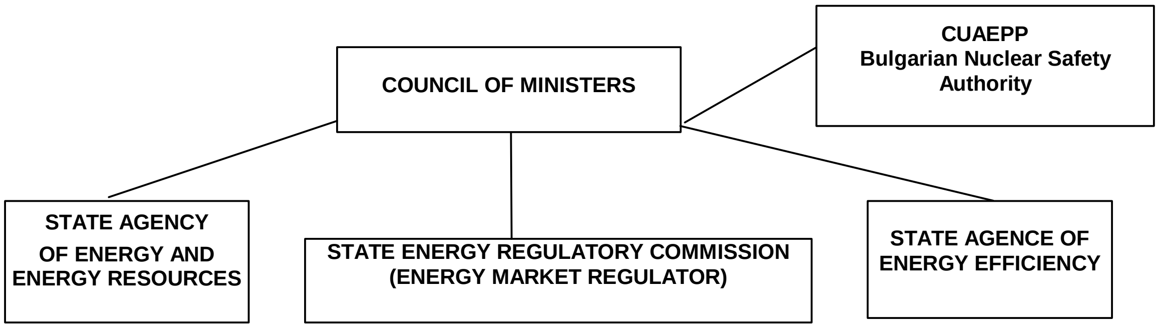


FIG. 5. Organization of the Energy Sector

2.2. Decision Making Process

The energy policy of the Bulgaria was developed and implemented by the State Agency of Energy and Energy Resources (SAEER). The SAEER has obligations to propose a strategy of energy development and efficient utilization of energy and energy resources to be carried by the Council of Ministers and passed with a resolution of the National Assembly. For nuclear, SAEER manages the Radioactive Waste Safety and Storage Fund and the Nuclear Facility Decommissioning Fund.

State regulation in the field of energy was by the State Energy Regulatory Commission (SERC). The Commission has obligations for developing instruments and take the required steps to issue the permits and licenses provided by the Energy and Energy Efficiency Act. The SERC issued licenses for construction of generation capacities, heat transmission systems, gas transmission systems, natural gas storage facilities, direct power lines and gas pipelines, and for decommissioning of energy facilities. In the process of performing its regulatory functions under the Act, the Commission was guided by the several basic principles, as achievement of energy efficiency, environmental protection and nuclear safety, radioactive waste storage and decommissioning of nuclear facilities.

The State Energy Efficiency Agency implemented the state energy efficiency policy. The Agency participates in the development of a National Strategy of Energy and Energy Efficiency Development, for the improvement of energy efficiency, for promotion of the utilization of renewable sources of energy.

2.3. Main Indicators

The domestic electricity production amounted to 40.4 TW·h in 2000. The main producers of electricity are the utility NEK, which owns the fossil and hydro power plants, and Kozloduy NPP plc, which owns the nuclear power plant. The thermal power plants produced 48.6% of total electricity, hydropower 6.5% and the nuclear power plants 45.0%, respectively. The remaining producers have generated 4.5 TW·h (Table 11 and Figure 6).

The total electrical installed capacity of NEK in 1998 amounts to 11,092 MW of which 4,929 are thermal. 3,760 MW nuclear, 1,975 hydro and 432 pumped storage (Table 12). Later, the Kozloduy NPP separated from the NEK forming a stock company owned by the Government. Additionally in the country, there is 1,606 MW thermal power capacity: 644 MW for combined generation of heat and electricity owned by district heating companies and 995 MW from large industrial enterprises. Table 13 shows the historical electricity balance from the IAEA Energy and Economic Database and Table 14 the energy related ratios.

The electricity purchased from industrial and district heating plants till 2001 is determined on the basis of forced co-generation of electricity depending on heat demand at the level of 1,500 million kW·h/year. No electricity imports are envisaged during the period considered to cover the electricity balance.

TABLE 11. ELECTRICITY AND HEAT PRODUCTION FROM 1993 TO 2000

GW·h

	Unit	1993	1994	1995	1996	1997	1998	1999	2000
Electricity Production									
-Thermal Power Plants	GW·h	17.30	16.76	17.67	17.06	17.46	16.96	16.31	19.63
-Hydro Power Plants	GW·h	1.94	1.51	2.51	2.98	2.93	3.32	3.16	2.62
-Nuclear Power Plants	GW·h	13.9.	15.33	17.26	18.08	17.75	16.90	15.8	18.2
-Total electricity production	GW·h	33.14	33.60	37.44	38.12	38.14	37.19	35.29	40.40
Heat Production									
-HGC-Kozloduy	thGcal	77	72	85	99	107	110	N/A	N/A
-Thermal Power Plants	thGcal	2081	1551	1409	1595	1439	1500	N/A	N/A
-Total heat production	thGcal	2158	1623	1494	1694	1546	1610	N/A	N/A

Source: Country Information.

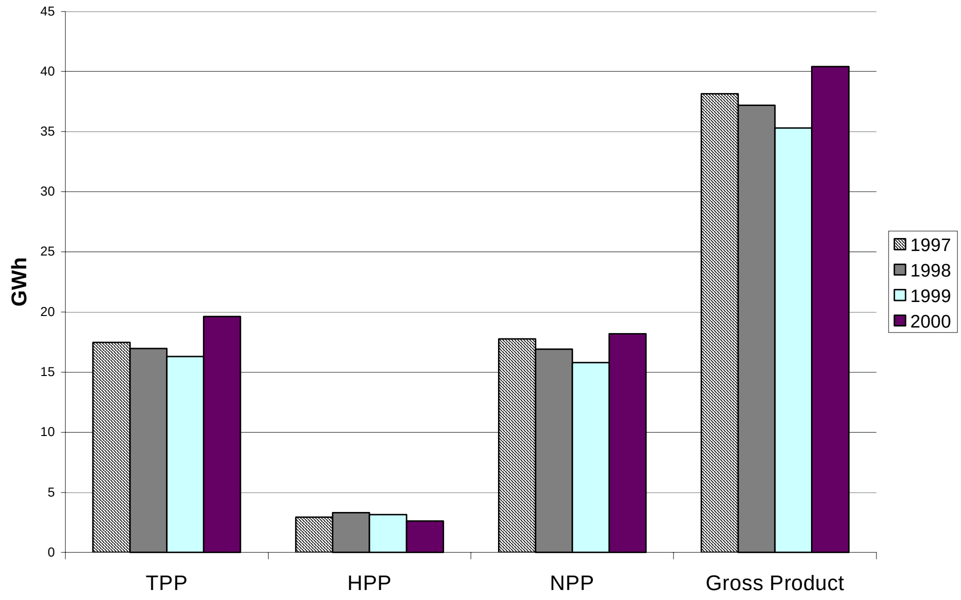


FIG. 6. Electricity Production Structure

TABLE 12. NATIONAL ELECTRICITY DATA FOR 1997/1998

Source	Abbr.	1997 Load Factor	1997 Generated Electricity		1998 Generated Electricity		I998 Installed Capacity	
		%	GW·h	%	GW·h	%	MW	%
Thermal Power Plant	TTP	41	17.457	44	16.965	45	4.925	39
Nuclear Power Plant	NPP	55	17.751	45	16.899	44	3.760	30
Hydro Power Plant	HPP	16	2.746	7	2.460	6	1.975	16
Chaira Pumped Storage	CPS	4	0.182		0.855	2	432	3
TOTAL (NEK)			38.136		37.179		11.092	88
District Heating	DH	32	1.825	5	1.936	5	644	4
Industrial Power Producers	IPP	33	2.868	7	2.571	7	995	8
Imports			0.785	2	0.564	1		
Exports			(4.334)	(11)	(4.211)	(11)		
Overall Total			39.280	100	38.039	100	12.731	100

Source: Country Information.

The 87 hydropower plants, built between 1912 and 1984 have an installed capacity of around 2,000 MW but the available capacity in all hydropower plants is estimated at 1 600 MW. Since 1991 several small hydropower plants have been returned to their previous private owners. Most or the power plants (58) are of the run-of-river type with total capacity 177 MW. There are 12 power plants with total capacity 237 MW connected to seasonal, storage reservoirs and 17 power plants with total capacity 1,560 MW connected to multi-annual storage reservoirs. The majority of hydropower plants (89%) have been in operation for more than 30 years now. In 1994 was finishing the first stage of pump-storage power plant Chaira. In operation were 2 turbines with 432 MW generation capacity and 395 MW pump capacity.

TABLE 13. ELECTRICITY PRODUCTION AND INSTALLED CAPACITY

	1960	1970	1980	1990	1999	2000	Average annual growth rate (%) 1960 to 1980	Average annual growth rate (%) 1980 to 2000
Electricity production (TW·h)								
- Total [1]	4.66	19.51	34.84	42.14	42.70	42.93	10.58	1.05
- Thermal	2.77	17.36	24.96	26.77	24.02	19.94	11.62	-1.11
- Hydro	1.89	2.15	3.71	1.88	4.14	4.81	3.44	1.30
- Nuclear			6.17	13.50	14.53	18.18		5.56
Capacity of electrical plants (GWe)								
- Total	0.93	4.12	8.81	11.13	12.09	12.09	11.93	1.59
- Thermal	0.47	3.30	5.62	6.57	7.15	7.15	13.27	1.21
- Hydro	0.46	0.82	1.87	1.97	1.40	1.40	7.26	-1.42
- Nuclear			1.32	2.59	3.54	3.54		5.05

(1) Electricity losses are not deducted.
Source: IAEA Energy and Economic Database

TABLE 14. ENERGY RELATED RATIOS

	1960	1970	1980	1990	1999	2000
Energy consumption per capita (GJ/capita)	33	89	125	139	98	100
Electricity per capita (kW·h/capita)	596	2,045	3,962	4,897	4,193	4,141
Electricity production/Energy production (%)	21	60	87	91	91	83
Nuclear/Total electricity (%)			20	35	38	47
Ratio of external dependency (%) [1]	16	63	67	60	55	51
Load factor of electricity plants						
- Total (%)	57	54	45	43	40	41
- Thermal	68	60	51	47	38	32
- Hydro	47	30	23	11	34	39
- Nuclear			53	60	47	59

(1) Net import / Total energy consumption.
Source: IAEA Energy and Economic Database.

Since 1975 on, nuclear power has been constantly increasing its share in the overall production of electricity in the country. This has been especially visible after the commercial start up of the two 1000 MW units at Kozloduy in 1987 and 1992 respectively. It can be seen that in 1998 the Kozloduy nuclear power plant represented 30% of total installed capacity, or 34% of NEK capacity.

Prognoses

Since 1991, the energy consumption in the Republic of Bulgaria is characterized by large fluctuations determined by the unstable and dynamic social and economic conditions. The prognosis for development of the energy consumption is based on the policy for economical stabilization and development. According to the recently approved National Energy Strategy Plan, a new nuclear unit with 600 MW(e) capacity should be in operation in the period 2006-2010. The site and the type of the power plant are not yet determined. The forecast was elaborated according to two scenarios: basic and minimum, which correspond to the basic and minimum scenarios of GNP development and energy demand development. They define the area of most probable power demand development (see Figure 7).

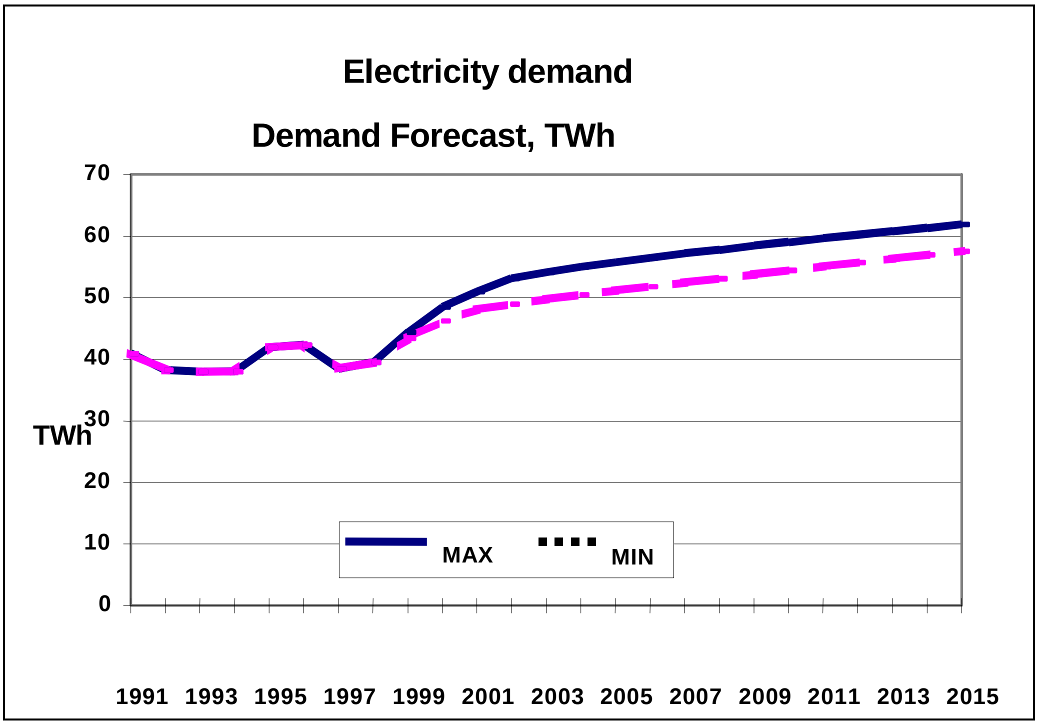


FIG. 7. Energy Consumption Prognoses

The Government regulates the energy price in the country. The average selling price of the energy is $US 0.035 per kW·h and is calculated to cover the production expenses from different energy sources as shown in Figure 8.

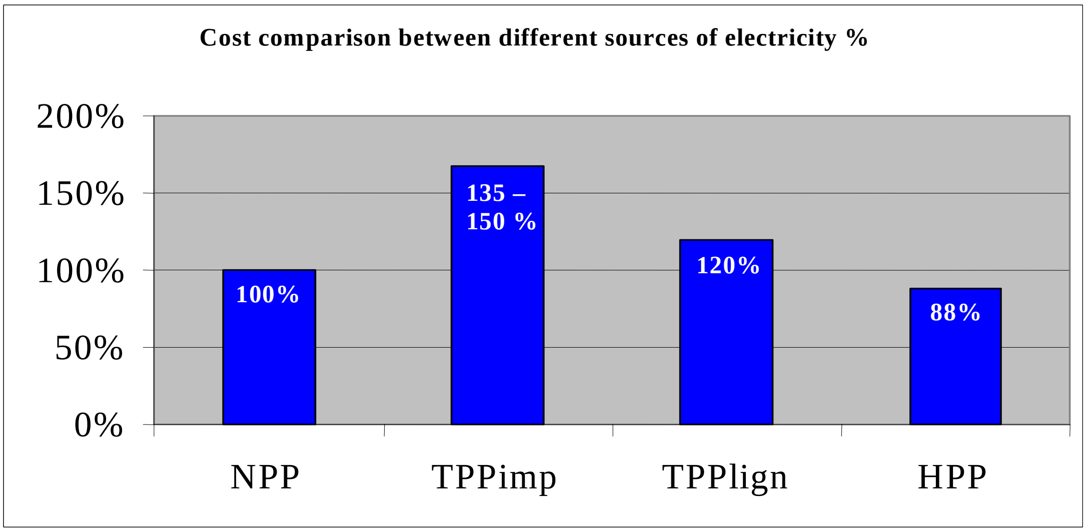


FIG. 8. Comparison of the Average Production Costs

2.4. Influence of open electricity market in the nuclear sector

The policy of joining the European Union conducted by the Government, as well as the need to attract foreign capital into the energy industry require radical organizational restructuring of the country's energy in conformity with the EU energy policy. That policy conforms to the EU policy of economic and social closing up based on market integration, limited Government intervention reduced to what is absolutely necessary in order to safeguard the public interest, consumer protection and welfare.

The main prerequisite and condition for the implementation of the structural reform and privatization in the energy sector is the creation of new, modern energy law harmonized with the law of the European Union, as well as appropriate institutional base. In order to achieve the aims stated, it is necessary to institutionalize legally the governmental bodies responsible for the development and implementation of the government policy and regulation in energy. The distribution of power of the governmental bodies by the regulation provided in the Energy and Energy Efficiency Act.

On the General Rules of the Domestic Natural Gas Market, plays an essential role in the success of the reform. Establishment of such a regulatory body is necessary in order to guarantee fair and equal conditions of competition on the respective markets and to provide efficient supervision, because of the existence of natural monopolies in the energy sector (the transfer and distribution networks in the electric power generation, heat supply and gas supply).

3. NUCLEAR POWER SITUATION

3.1. Historical development

The nuclear development of Bulgaria started after the Geneva conference "Atoms for peace" in 1956 and was the favoured strategy of the political leadership ever since. The first step was the construction and the start of operation of IRT-2000 research reactor and a large programme of isotope applications and scientific research. Later, in 1966, an agreement was signed with the Soviet Union to deliver commercial reactors for electricity production. This agreement laid down the foundations of the Bulgarian nuclear power programme. The main articles of this agreement described the role of the reactor manufacturer and designer as well as the participation of the Bulgarian organizations and industry.

The Soviet nuclear industry was designing and supplying the nuclear island as well as the conventional part of the plants, while the architect engineer of the conventional plant and the auxiliary systems was the Bulgarian Company "Energoprojekt". The Soviet safety rules and norms were supposed to be used as long as there was no special Bulgarian legislation available. Unfortunately, there was no nuclear law adopted and no provisions for a regulatory authority. During the construction and start up period, the Russian representatives at the site adopted the role of supervisors, but later they have only taken the position of manufacturer and supplier representatives. A number of Russian organizations also carried out all of the important assembly operations.

The first two units, which are a typical WWER 440 /230 model, were built and put into operation for a period of less than 5 years and, even if a parity of the rouble to the dollar is assumed the investment cost was less than 500 $ per kW installed. The second pair of reactors was completed and connected to the grid in 1980 and 1982 accordingly. By that time, the model 230 developed towards model 213, which is the reason why Units 3 and 4 incorporate some of the safety characteristics of the 213's. The further increase in the demand for electricity resulted in the construction of additional two units of 1000 MW each from the model known as WWER-1000 /320. A second site was chosen in the early eighties near the city of Belene. The site was prepared with the entire necessary infrastructure to host six 1000 MW units. Completion of the first unit reached about 40% on view point construction, and 80% on delivery of equipment, in 1990, when due to lack of financial resources and some opposition from the near by communities the construction was frozen.

3.2. Status and Trends of Nuclear Power

Bulgaria has six nuclear power units in operation at Kozloduy of which operation started between 1974 and 1991 comprising four 408 MW(e) WWER-440 units and two 953 MW(e) WWER-1000 units, all imported from the former USSR (Table 15).

TABLE 15. STATUS OF NUCLEAR POWER PLANTS

Station	Type	Net Capacity	Operator	Status	Reactor Supplier
KOZLODUY-1	WWER	408	“Kozloduy NPP”-	Operational	AEE
KOZLODUY-2	WWER	408	“Kozloduy NPP”-	Operational	AEE
KOZLODUY-3	WWER	408	“Kozloduy NPP”-	Operational	AEE
KOZLODUY-4	WWER	408	“Kozloduy NPP”-	Operational	AEE
KOZLODUY-5	WWER	953	“Kozloduy NPP”-	Operational	AEE
KOZLODUY-6	WWER	953	“Kozloduy NPP”-	Operational	AEE

Station	Construction Date	Commissioning Date	Criticality Date	Commercial Date
KOZLODUY-1	01-Apr-70	30-Jun-74	24-Jul-74	24-Jul-74
KOZLODUY-2	01-Apr-70	22-Aug-75	01-Oct-75	01-Nov-75
KOZLODUY-3	01-Oct-73	04-Dec-80	04-Dec-80	01-Jan-81
KOZLODUY-4	01-Oct-73	25-Apr-82	01-May-82	01-Jun-82
KOZLODUY-5	01-Jul-80	05-Nov-87	29-Nov-87	01-Sep-88
KOZLODUY-6	01-Jul-84	01-Feb-91	02-Aug-91	01-Dec-93

Source: IAEA Power Reactor Information System as of 31 December 2000

The output of the Kozloduy Nuclear Power Plant was 18,339 million kW·h in 1998. A lower growth rate of nuclear generation has been forecasted in view of the envisaged programmes for improvement of the nuclear and radiation safety of the 440 MW units as well as the rehabilitation programme for the 1000 MW units.

During the 70’s, a site for the construction of a second nuclear power plant was selected near the town of Belene. In 1980, the Ministry of Energy started its construction. Initially the construction of 4 units with WWER-1000/V320 reactors was envisaged with a possibility for exceeding this capacity with additional new facilities. The engineering works on the site and the construction of the infrastructure started at the end of the year 1980. The construction of unit 1 started in 1987. In the year 1991, the Belene NPP construction was halted mainly due to lack of funds. At that time the first unit was 40% complete. In recent years, certain investigations were carried out and are being carried out now concerning the possibilities for the construction to be continued. There is no decision taken regarding this question and there are no plans for continuing the construction for the present moment.

3.2.1. Status Kozloduy Plant

3.2.1.1. Units 1-4

The Kozloduy NPP units 1, 2 and 3, 4 (advanced V230 and V213 type respectively) have power reactors of the WWER-440. They are constructed in modules with 2 units each: 2 reactors are situated in one reactor building and they use jointly some systems for normal operation. The safety systems of each unit are separate and independent from the other one. Each unit has two 220 MW main generators. The main mechanical equipment can be considered as standard design and it is produced by standard procedures. The design of the units has been done by regular industrial standards, only the design and the manufacturing of the reactor equipment and the pipelines of the primary circuit comply with special requirements.

However, their design was developed in the late 60's. They carry a number of positive features of units, which are safe by their design. At the same time, some discrepancies with the current requirements for ensuring safe operation were identified. For this reason during the 80’s, a number upgrading activities were carried out, based on the operational experience as well as on the recommendations of the Chief Designer.

Since 1990, a systematic and step-by-step enhancement of their safety was started with the participation of international expert organizations. In the period between 1990-1994 several missions of the IAEA for safety analysis of units 1-4 were carried out: Assessment of Safety Significant Event

Team. (ASSET) - carried out in 1990. 1992. 1993; Safety Review Missions, (SRM) - carried out in 1991, 1993. 1994. In the period 1996-1997, a probabilistic safety analysis (PSA)-level I was carried out for units 1-2 and 3-4. The results of the study were discussed with experts from the IAEA during the (IPERS) mission in November 1997 and during follow-up mission in April 1999. A number of recommendations were made and their implementation is under way. In January 1999, an OSART mission took place in Kozloduy units 1-4.

The Short-term three-stage programme for ensuring the functional operation of the systems and equipment of the units was implemented in the period 1990-1997. It was elaborated in co-operation with the World Association of Nuclear Operators (WANO) and approved by the CUAEPP. Detailed studies of different aspects concerning safety were carried out. Some examples are: an assessment of the reactor pressure vessels' characteristics (including an analysis of metal samples), analyses of the applicability of the principle "leak before break" for the main pipelines of the primary circuit, qualification of the systems' equipment related to the safety, etc. The measures carried out lead to a considerable safety improvement.

In 1998 the implementation of the measures from the Complex Programme for the further enhancement of the safety was started. This Programme contains certain technical measures, elaborated based on deterministic and probabilistic analyses (Moscow IAEA meeting on September 1999, established the main goals, criteria, as follows: Dy 200 DBA, Dy 500 best estimate, confinement upgrading and public exposure). Their implementation will bring the safety to an acceptable level in compliance to the current international practice for reactors of this generation. The implementation of all misfires is scheduled until end of 2001.

The major measures which are characteristic of the next modernisation stage have already started, namely: installation of a jet vortex condenser, development of a rest life time management programme, revision of the reactor mode tables, analysis of the accident scenarios with Dn-200 and Dn-500 breaks, development of SAR calculation of the spent fuel pond racks, replacement of the automatic step-up loading system at Units 1-4, implementation of new digital systems for the SG level monitoring at Units 3 and 4 etc.

The safety upgrading measures for Units 3 and 4 were separated in an independent package based on PRG-97/A. Its purpose is to implement the necessary measures, to make an analysis and modification of the engineering documentation in order to change the design basis of the units into a new reactor model – VVER-440/V-209M and demonstrate the compliance of the new design with the up-to-date safety requirements. The design was approved by the Safety Council of Units 1-4 and the company Safety and Quality Council.

Forty measures out of total 62 measures were at different stages of their implementation by the moment this project was set up. The total cost of the project implementation is estimated at 66,165,000 USD and the funds are provided entirely within the framework of the Investment programme of Kozloduy NPP Plc. The company will use all possible sources of external financing. The activities on all units were highly estimated by an IAEA mission held to evaluate the programme.

The OSART (Operational Safety Assessment Review Team) mission, which ended on January 28th 1999. The Follow-up OSART mission took place in January 2001. The mission identified that, the plant had performed some activities in a number of areas, which were well above the recommendation objectives.

In October 1999, a WENRA (Western European Nuclear Regulators Association) Mission was carried out. Prior to the Mission, the reviewing team sent a set of 120 questions, for which the plant should provide detailed written answers. The answers, together with a summarized review of the current plant status, concerning the technical and the operational safety aspects were submitted to the team during the mission. In general, the units safety level was assessed as an adequate one, as some deviations from the current requirements were mentioned considering units 1-4 design. This statement is included in WENRA Mission Report, published in 2000.

In October 2000, an IAEA Mission was performed for the Assessment of Units 1-4 Modernization Programme. At the same time the Mission did a review of the degree of implementation of previous missions recommendations, considering their technical aspects included in the programme document of IAEA –TECDOC-640. The Modernization Programme itself was assessed as sufficiently comprehensive, realistic and that as a result of its implementation units 3 and 4 will reach the acceptable safety level according to the current standards. The Report of the Mission is available at IAEA.

Bulgaria maintains and will continue to maintain its open policy of inspection and phased safety improvement in conformity with the international practices. The findings of the missions registered the progress and closer approach to the up-to-date methods of safety assurance for nuclear power plants.

3.2.1.2. Units 5 and 6

The Kozloduy NPP units 5 and 6 are equipped power reactors of the WWER-1000/V320 type. The design of these reactors meets entirely the international requirements for nuclear safety. The main principle for NPP safety is applied: defence in depth with several physical barriers, including the redundancy, variety, independence, protection against failures, and passive elements. The active safety systems have 3x100% capacity, functional independence and they are physically separated. Their confinement is designed for full pressure (0.5 MPa).

Two OSART missions of the IAEA in 1990 and in 1991 were carried out for assessment of the operational safety. They established a good functional order concerning the analysis of the operational events, the management of operation, the programmes for control over the state of the equipment, and the control over radiation protection. The organization of the operation needs improvement as well as the maintenance activities and the technical support. Additional recommendations were made concerning the interaction between the CUAEPP and the NEC-PLC. The recommendations were implemented in accordance with an elaborated programme. The IAEA ASSET mission carried out during 14-25 November 1994 reviewed over 400 events.

Based on the analysis of the operational experience, the comparison with similar reactors of the PWR type and the enhanced international requirements for safety, a programme for modernization was elaborated and its implementation has already started. Generally, the aims of the programme are to enhance both the safety and the availability of the units. The last IAEA mission (SRM) carried out from 26 June to 1 July 1995 reviewed the programme for modernization of units 5 and 6 and defined 7 additional measures. The last version of the programme for modernization was accepted with a positive evaluation by Riskaudit in 1997 and was approved by the CUAEPP. It was established that the programme is elaborated in compliance with the existing assessments and analyses of the IAEA on the safety of the WWER-1000/V320 type reactors. In 1996, a tender was announced by the NEC-PLC for implementation of the programme. The implementation of the main part of the measures was consigned to the European Consortium "Kozloduy", including Atomenergoexport-Russia, Siemens-Germany and Framatom-France. Westinghouse (USA), undertook the implementation of a number of measures. In 1998-1999, the contracts were signed and the implementation started.

The phase preparing the development of the modernisation projects ended in 2000. The purpose of the basic engineering phase was to develop technical projects for the hardware measures and studies, which will be used as a basis for the decision to be made in the next phase beginning in 2001, when the implementation of the Modernization programme itself is to start. The conditions of the contract with ECK and Westinghouse were updated. The technical scope of measures was optimized and on this basis started the implementation of the priority measures of both contractors. In order to provide the necessary financial support Loan agreements were signed with City Bank USA, Euratom and Rosseximbank. The overall financing of the project is complemented with the plant own funds.

The remaining part of the programme is carried out by using company own resources. The replacement of boronmeters and superheaters has been completed. The reliable power supply equipment of the safety systems is being replaced on schedule. This measure will be completed in 2001. The implementation was reviewed by two missions of the International Atomic Energy Agency. The IAEA experts expressed their high opinion of the current state and plans for future activities.

Probabilistic Safety Analysis – level 1 was performed for units 5 & 6. In 1996, an IAEA mission was held for methodology and analysis results assessment - International Peer Review Service (IPERS). Terms of Reference were developed and Probabilistic Safety Analysis – level 1 for units 5 & 6 updating is pending, considering the implemented changes in the 5 & 6 units design by the end of 2000.

Unit 5 experienced no reactor scrams during the last six years and unit 6 not during the last four years. The implementation of units 5 & 6 Modernization Programme second phase is planned to be executed for the period 2001÷2006.

3.2.2. Data on the Nuclear Installations

3.2.2.1 Basic Data and Main Characteristics of Nuclear Facilities at the Kozloduy NPP site

Table 16 shows information about Kozloduy units.

3.2.2.2. Kozloduy Site Description

Location and Hydrogeological Characteristics

The Kozloduy NPP site is located 3.5 km south-east from the town of Kozloduy and 12 km north-west from Miziya town, region Montana. At about 3 km away from the NPP is the border with the Romania - the Danube River.

The Danube River lowland (20m absolute altitude) surrounds the site from north and by the water shed plateau slope (90m absolute altitude) from south. The NPP Kozloduy site can not be submerged, it has +35 m absolute altitude. The relief of the region represents a hilly plain with 100-200 m absolute altitude, segmented by the Tsibritsa, Ogosta and Skat rivers. Wide elongated and flat new soil elevations, the biggest of which is the Zlatia plateau, have been formed between them. The Danube river bank is higher (up to 100-110 m) in the Oryahovo region and westward from Kozloduy, while the lowest point (25-30 m) is in the Kozloduy low land.

Concerning the geology, the site consists of Pliocene and Quaternary sediments. The overlayer has 14-15 m thickness and consists of loess and loess type clay. The surface layer has about 7 m thickness of sediment loess and Pliocene deposits (dense marl clays and sands) are observed at 18-20 m depth. There is a sand layer at about 35 m in depth, about 10 m thick. The overall thickness of the Pliocene deposits is about 100 m.

The underground water is connected with the water bearing alluvial gravel-sandy deposits and the Pliocene sands. The hyposometric level of the existing underground water is 29 m with a flow direction from south-west to north-east. The underground water is not "aggressive" towards concrete.

TABLE 16. WWER-440 AND WWER-1000 GENERAL DESIGN FEATURES AND PARAMETERS

Reactor type		WWER-440 type V-230 Unit 1-4	WWER-1000 type V-320 Unit 5-6
Parameter	Dimension		
Reactor power			
- Thermal	MW	1375	3000
- Electrical	MW	440	1000
Primary circuit pressure	MPa	12.3	15.7
Reactor inlet coolant temperature	°C	268.7	289
Reactor outlet coolant temperature	°C	301.3	320
Average coolant temperature difference of the reactor core	°C	28	3 0.3
Fuel assemblies	number	349	163
Reactor control rod assemblies	number	37	61
Fuel rods in a fuel assembly	number	126	312
Average density of the thermal flow	W/cm^2	44	57.9
Average linear thermal flow	W/cm	125	165.7
Loops in primary circuit	number	6	4
Coolant flow rate	m^3/h	45000	84800
Maximum fuel enrichment in U-235	%	3.6	4.4
Steam Generators			
Type		PGV-4E	PGV- 1000
Quantity per unit	number	6	4
Steam capacity	t/h	425	1480
Thermal power	10^6kJ/h	827	2690
Steam pressure	MPa	4.6	6.3
Feed water temperature	°C	225	220
Turbines			
Type		K-220-44	K-1000-60
Quantity per unit	number	2	1
Power	MW	220	1000
Main steam parameters			
- Pressure	MPa	4.3	5.9
- Temperature	°C	256	274
Main Coolant Pumps			
Type		GCN-310	GCN-195M
Quantity per unit	number	6	4
Generators			
Type		TVV-220-2	TVV- 1000-4
Rated Power	MW	220	1000
Generator voltage	kV	15.75	24
Grid voltage	kV	400/220	400

Source: Country Information.

Seismic Characteristics

NPP site is located in a seismic region, but there are no active tectonic structures. The maximum design basis earthquake is evaluated to be 8 on the MSK-64 scale and the design basis earthquake according to the same scale is evaluated to be 7. In case of an earthquake, no residual deformations and other resulting phenomena are expected. The plant site is located on the so-called Miziya platform, which is classified as 7^{th} degree on the MSK-64 seismic scale.

Meteorological Data

The climate is "moderate continental" with cold winter and hot summer, which is representative of the north climatic region of the Danube lowland. The NPP Kozloduy surrounding landscape is such, that cold and strong winds especially from the west and north-west are possible during winters. The absolute maximum temperature measured for Kozloduy is +43.2 °C (August). The absolute minimum temperature measured is -26.6°C (January). The average annual air temperature is +11.5 °C.

Data about the air temperature and relative humidity for the period 1977-1986 provided by the Kozloduy meteorological station is presented in Table 17. The analyses have been performed for the hottest months June-September. The strongest winds with speed up to 25 m/s are observed during spring. Data for the period 1977-1986, provided by the Kozloduy meteorological station is presented in Table 18. Measurements of the Danube River water temperature have been performed at the Oryahovo post for the period 1937-1967. The specific temperatures are presented in Table 19.

TABLE 17. AIR TEMPERATURE AND RELATIVE HUMIDITY AT KOZLODUY

Air temperature °C	Average relative humidity %
>30	71.0
29-30	71.0
28-29	54.4
27-28	59.8
26-27	60.2
25-26	63.5
24-25	63.0

Source: Country Information.

TABLE 18. AVERAGE WIND SPEED WITH CORRESPONDING FREQUENCY AND DIRECTION (m/s)

Direction	N	NE	E	SE	S	SW	W	NW
Frequency (%)	12.4	14.7	12.8	2.3	2.2	4.1	26.3	25.2
Average speed	2.0	2.0	1.9	2.1	2.3	2,1	2.4	2.5

Source: Country Information.

TABLE 19. SPECIFIC DANUBE WATER TEMPERATURES (°C)

Month	Maximum	Average	Minimum
January	5.8	1.4	0
February	8.1	1.7	0
March	11.2	5.0	0
April	17.9	1 1.2	4.1
May	23.9	16.7	10.9
June	25.8	20.7	15.2
July	27.3	22.9	17.6
August	27.5	22.9	17.0
September	25.3	21.3	14.2
October	21.3	13.9	7.5
November	14.0	8.3	1.7
December	8.2	3.5	0
Year Average	27.5	12.2	2.0

Source: Country Information.

Demographic Data

The population density in the region is non-uniform. The towns with highest density are Oryahovo (100-120 persons per km^2). Kozloduy (80-100 persons per km^2) and Miziya (20-30 persons per km^2). The average population density for the area is 60-80 persons per km^2.

3.2.2.3. Belene site description

The Belene site is situated in the lowland of Svishtov and Belene on the bank of the Danube River, 571st km. The site is located 7.5 km from the border with the Republic of Romania, across from the largest island in Danube River - the Belene (Persin) island.

In 1987, experts from Atomenergoproekt - Kiev and Energoprojekt Sofia, developed an engineering design for construction of four units with WWER 1000N-320 type reactors. The construction activities started up in 1987. The all-out NPP construction was performed in the period 1988- 1990. In 1991 the construction activities were stopped.

In the period of 1-20 July 1990, IAEA experts, including observers from Romania and Cuba held a PREOSART mission on review of the construction. The conclusion of the mission was that the project organization is an integral and centralized formation, valid for the member states of the former Council of Mutual Economical Assistance. It functions on the basis of the accepted unified design of WWER-1000 aimed to achieve a high level of reliability and safety with minimum cost and optimal construction schedule. The mission gave a positive evaluation of the management, construction and preparation for operation. The main recommendation was for a Quality Assurance Programme to be developed.

In 1990, another IAEA mission took place to assess the safety aspects of the design. The duration of the mission was two months. A review of the reactor core design, safety systems design and safety analyses was performed. The conclusion of the mission was that in consideration of the topics reviewed, the design of Belene NPP is similar to the modern Pressurized Water Reactors. No significant safety deficiencies were recognized. The recommendations made by the experts related to possible future safety upgrading.

After stopping the construction activities of the Belene NPP, a programme was implemented with conservation measures for the main building constructions, and re-conservation of the main equipment stored at the site. A current control of the building construction conditions is performed and the deficiencies identified are removed. Recommendations by the manufacturers delivered the main equipment are used in the conservation process. So far, no final decision has been taken relating to the continuation of the Belene site construction.

3.3. Current Policy Issues

Considering the importance of the Kozloduy NPP to the electricity supply of the country on one hand and the important safety concerns raised in 1990 and 1991by the IAEA on the other hand, the regulatory authority took urgent steps and requested emergency maintenance and safety upgrading. This was done based on the IAEA recommendations as well as the requirements of the Regulator - CUAEPP (Committee on the Use of Atomic Energy for Peaceful Purposes). A detailed programme for safety improvement had been set and its implementation has been underway since 1991.

The main goals of the programme are in a stage by stage manner to upgrade the operational reliability and safety of Kozloduy units 1 to 4 by means of:

i) Restoring the design functional availability of the units' systems and equipment, especially those related to nuclear safety and radiation protection;
ii) Improving the reliability and performance of the safety systems for single and common cause failures, including human errors;
iii) Upgrading the reliability of the 3 main barriers (fuel cladding, primary circuit and confinement);
iv) Upgrading the safety culture in the operation of the plant;
v) Improving the " man- machine" interface;
vi) Improving the personnel training;

vii) Developing a quality assurance programme;
viii) Improving radiation protection practices and emergency planning.

The National Electric Company secured the financial resources until May 2000. After that the establishment of the new company “Kozloduy NPP” plc itself secured the financial resources for the implementation of the programme. A substantial portion of the "soft" assistance in performing some of the additional safety assessments, studies as well as training, upgrading safety culture etc. are coming through the assistance programmes of the European community, the IAEA and through bilateral programmes with USA, France, Germany and others. One of the important features of this programme is the acceptance methodology and the interaction of the different participating parties: NPP Kozloduy, CUAEPP, WANO assistance team and the CONSORTIUM of European safety organizations.

Ensuring stable power generation by maintaining of the safety and security of nuclear power capacities through the following actions:

- to refurbish and upgrade the generating capacities at the Kozloduy Nuclear Power Plant for the purpose of improving the nuclear and labour safety, and the level of automation;
- to ensure safe operation of Units 1-4 of the Kozloduy NPP, the realistic term for decommissioning of units 1 and 2 is after implementation of the modernization of units 5 and 6 that is expected to be completed towards 2004; and for units 3 and 4, upon implementation of a comprehensive programme of ensuring the cost efficient time limit of safe operation, decommissioning will be carried out until 2008-2010;
- to solve the problems related to spent fuel storage and radioactive waste treatment.

These objectives conform to the spirit and principles underlying the nine international agreements in the nuclear energy field, which were signed and ratified by the Republic of Bulgaria including the Nuclear Safety Convention.

These documents, as well as the provisions of the Agreement with the Nuclear Safety Account managed by the EBRD were taken into account in elaborating a National Safety Report. A major component in the policy of the Bulgarian country in the energy industry is the implementation of measures related to covering the energy balance that would provide a possibility for natural proceeding with the decommissioning of certain energy capacities.

These goals will be accomplished through specific activities and programmes:

- Integrated Programme of Ensuring the Cost Efficient Time Limit of Safe Operation of Units 1 to 4. The programme shall be performed during the period 1998-2001 within the limits of the annual planned repair campaigns of the units. The programme has been elaborated based on the measures implemented until 1997 and reflects the changes occurred on a world-wide basis in the norms and standards for nuclear safety. It is being implemented within the limits of the annual repair campaigns of the indicated units with equity funds of the National Electricity Company.
- VVER-1000 Reactor Units 5 and 6 Modernization Programme. In 1996, an international bid was held for selecting a contractor under the Kozloduy NPP VVER-1000 Unit Modernization Programme (for Units 5 & 6). The programme will be implemented within the limits of the annual planned repairs of the units during the period until 2006.
- Policy with respect to the nuclear fuel cycle, and radioactive waste treatment and storage, with respect to new and spent nuclear fuel, radioactive waste treatment and storage and decommissioning of nuclear facilities.

The process of restructuring and privatization in the energy sector started in September 1997. At the end of 1997, the National Electric Company (NEC) came up with a Programme for the Structural Reform and Privatization in NEC until the Year 2005. At present, the basic concepts of the

Programme are performed – the separate energy production and energy distribution units are established. That programme foresees the possibility of privatization of 63 small Hydro Power Stations with overall electricity generation capacity of 374 MW and thermal coal power plants in Maritza Iztok complex.

3.4. Organizational Chart

The utility in Bulgaria, which produces, distributes and sells 85% of the total electricity, is the National Electricity Company (NEK). Its organizational chart is given in Figure 9. Preparations are under way for restructuring of the company aimed at future privatization of different branches like: distribution, maintenance, etc. According to the Atomic Energy Act, the nuclear branch of the company - the Kozloduy NPP will stay under state ownership, see Figure 10 for its structure.

4. NUCLEAR POWER INDUSTRY

Bulgaria has not developed its own nuclear industry, since it uses a "once through" fuel cycle and all fuel cycle services and the nuclear steam supply systems have been delivered from the Former Soviet Union (now Russia). The country has been a member of the co-operative effort of the former COMECON countries and the RADOMIR METAL company near Sofia has been selected to produce some equipment for the 1,000 MW reactors containment buildings (heavy isolation doors, penetrations, seals, etc.). A number of companies from Bulgaria, Russia and other countries participate in the regular maintenance of the different systems of the plants. Several smaller local companies specialized in different aspects of the plant operations deliver several services.

From Bulgaria the most important are:

i) ENERGOPROJEKT - for design, engineering, safety assessment etc.;
ii) RISK ENGINEERING - for safety assessment, design, etc.;
iii) ENERGOREMONT - the largest maintenance company in the energy sector;
iv) ATOMENERGOREMONT - maintenance company specialized for the NPP.

Important Russian organizations are:

- GIDROPRESS;
- IZORA JSC;
- VNIIAES Institute;
- KURCHATOV NATIONAL RESEARCH CENTRE;
- PODOLSK METALLURGICAL WORKS.

Western companies also participate in the maintenance and support of the NPP Kozloduy.

- INETEC-Zagreb is the main contractor for performing ISI of the SG, Pressure vessel and other important components;
- WESTINGHOUSE is supplying the radwaste reprocessing and packaging plant;
- SIEMENS have been important supplier of safety equipment.

The State Agency of Energy and Energy Resources is the organization, responsible for the development of the power industry, including nuclear power. The State Nuclear Regulatory Body is Committee on the Use of Atomic Energy for Peaceful Purposes. According to the Law on the State Administration, the Committees had to be transformed into one State Agencies. The operator of the nuclear power plant "Kozloduy" is the “Kozloduy NPP”-plc. In April 2000, was the NPP Kozloduy separated from the National Electric Company and became a shareholder entity with 100% state ownership. The main technical support organizations to the nuclear power are: Energoprojekt PLC, EQE-Bulgaria, Risk Engineering, Enpro Consult, Institutes of the Bulgarian Academy of Sciences - Institute of nuclear research and nuclear power, Institute of metal science, Institutes of the earth, etc.

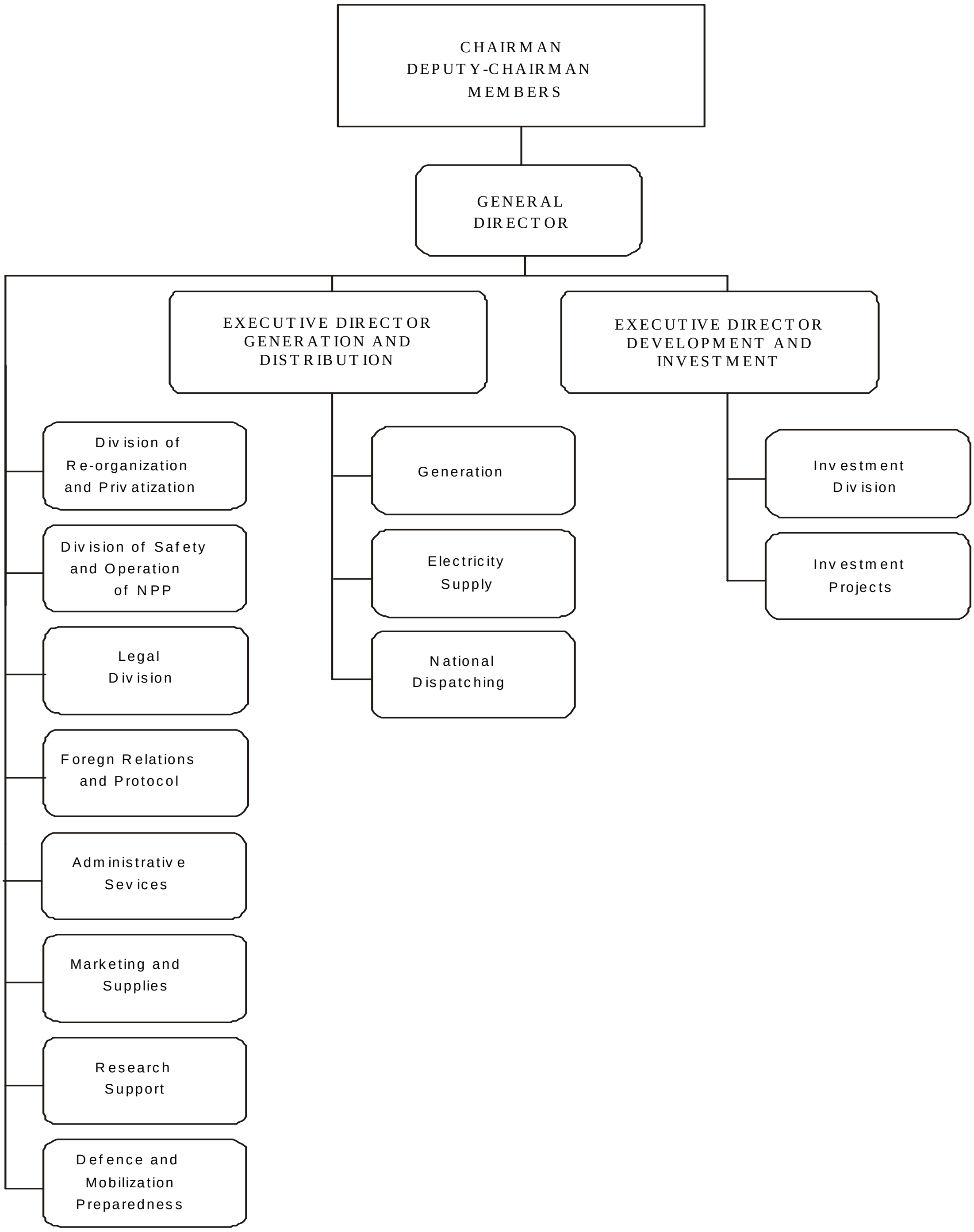


FIG. 9. Structure of NEK

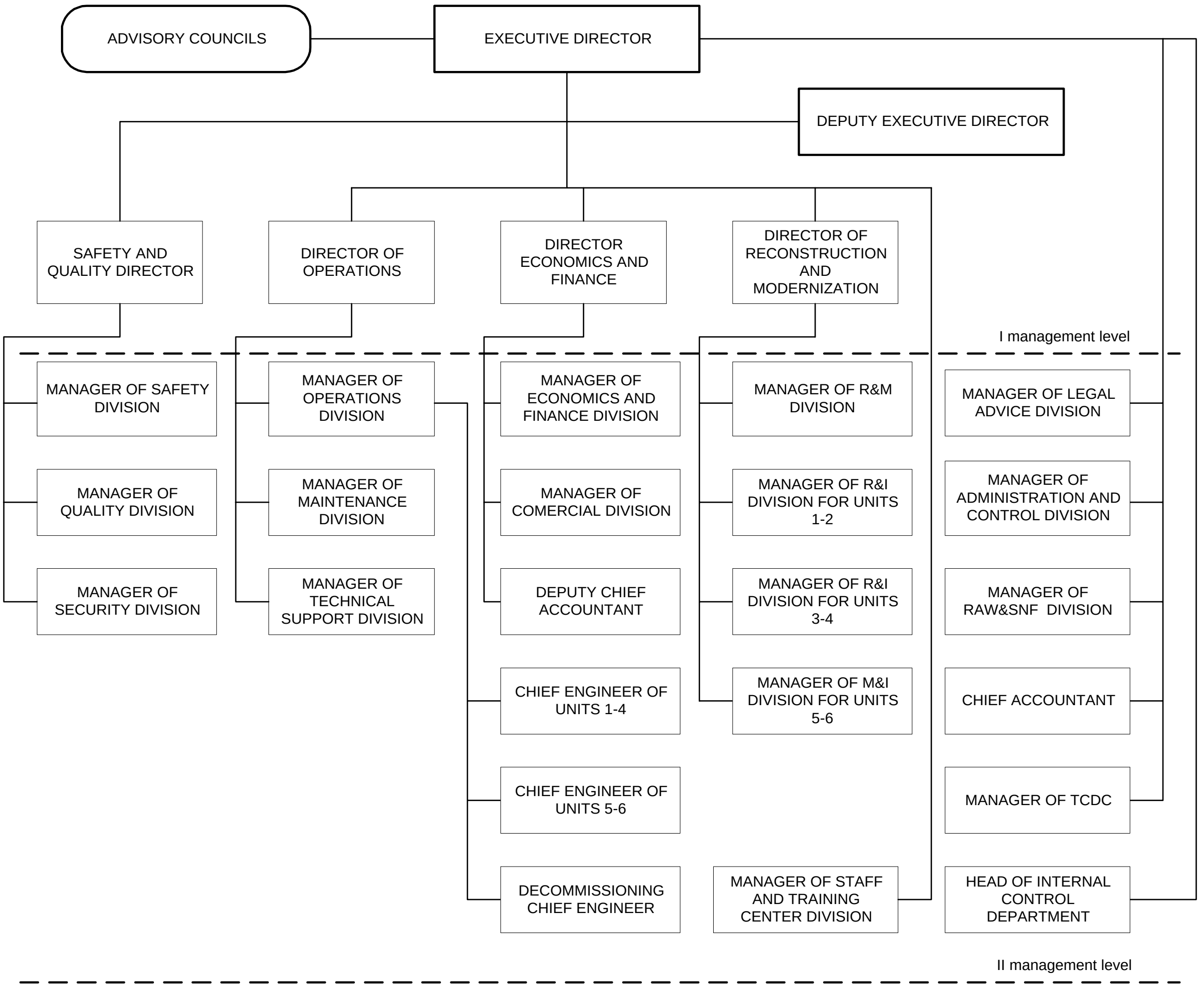


FIG. 10. Management Structure of Kozloduy NPP plc

Description of the national system for monitoring the use of atomic energy

Under the Constitution of the Republic of Bulgaria, the Council of Ministers pursues the state internal and external policy in compliance with the Constitution and the laws. The Council of Ministers governs the implementation of the state budget, organizes the management of the Governmental property, signs, approves and denounces the international contracts in cases envisaged by the law. In fulfilling its functions the Council of Ministers has the right to establish bodies such as committees, commissions, agencies, councils, in order to pursue the state policy in a definite area. The Committee on the Use of Atomic Energy for Peaceful Purposes (CUAEPP) is the main regulatory body in the field of nuclear safety and radiation protection. It exercises the state control through the Inspectorate on Safe Use of Atomic Energy (ISUAE). The Ministry of Health, the Ministry of Internal Affairs, the Ministry of Environment and Waters and other state authorities, exercise control within the framework of their competence.

Ministry of Health

The Public Health Act and the Public Health Act Enforcement Regulations determine the Ministry of Health's and its control bodies' functions. The organization of radiation safety control activities is determined by the Regulations on Radiation Safety Control Bodies' Structure. The Ministry of Health in co-operation with other state authorities permits and controls the labour conditions related to import, export, production, storage, use, transportation and making harmless of nuclear material and other sources of ionizing radiation, within the framework of their legal competency. The Ministry of Health is the authority that permits and controls the use of sources of ionizing radiation for the purposes of medicine. In case of radiological emergency, the Minister of health sets additional sanitary standards, aiming public protection. In addition, the Minister of health determines the obligatory sanitary standards in all radiation protection areas. The National Centre on Radiology and Radiation Protection is the specialized sanitary control authority in the field of safe atomic energy utilization. Subjects of state sanitary control are all activities with ionizing radiation.

Ministry of Internal Affairs

The structures of the Ministry of internal affairs are mainly responsible for the physical protection and the fire protection of the NPP. The Security Services of the Ministry of Internal Affairs performs the following activities:

- collection of information from different sources about intention of persons or groups of persons for planning and preparing for implementation of illegal actions or inaction, related to nuclear facilities and nuclear material;
- collection of information on deliberate activities or inaction, leading to violation of technological processes and instructions and causing premises for nuclear accidents and radiological emergencies;
- distribution of gained information among corresponding boards of the interested authorities, which are able to apply necessary measures for mitigation or prevention of injurious sequences;
- preliminary inspection of the reliability of candidates to pass to the security area or internal areas for work with secret materials or physical protection information, as well as external persons visiting the nuclear facility;
- preliminary inspection of accidents, for which malice aforethought is suggested, as well as other accidents with casualties (victims) or danger for the public health;
- control over the protection of state secret and physical protection information.

Security activities are carried out in close co-ordination with organizations and persons possessing permits for exercising of atomic energy utilization activities, physical and fire protection services, as well as with corresponding national, central and territorial services of the Ministry of Internal Affairs.

Ministry of Environment and Waters

The Protection of Environment Act determines the control over environment states and over sources of contamination, as a basic function of the Ministry of Environment and Waters (MEW). All activities of physical persons and legal entities can be put under assessment of the impact on environment. For energy industry projects of national and regional importance, it is obligatory an impact assessment to be carried out. Among them are: nuclear power plants and other nuclear reactors, except research reactors with power less than 1 kW; facilities, exclusively aiming storage, final disposal and/or reprocessing of radioactive wastes and irradiated burning materials; facilities for nuclear fuel mining and enrichment.

MEW operates national automated system for monitoring of the gamma-background in the Republic of Bulgaria. The system comprises of 26 local monitoring stations, each of them contains a gamma-probe and a detector for rain. 9 are equipped with meteorological detectors. In addition there is a mobile monitoring station, which gives the possibility of monitor the radiological and meteorological parameters, and to perform on-site gamma-spectrometry sampling. The central station of the system is in MEW. Additional monitoring centres exist at the CUAEPP and Civil Protection Directorate. In addition, the regional structures of the MEW operate 16 laboratories on radiological measurements.

Ministry of Defence-Civil Protection Department

The State Agency “Civil Protection” was established to the Council of Ministers in February 2001 as a successor of the Civil Protection Department to the Ministry of Defence. This act guaranteed the independence of this institution and approved its over-institutional character. The State

Agency “Civil Protection” exercises the functions of the operative headquarters of the Public Protection in Cases of Calamities and Emergencies Permanent Commission within the Council of Ministers. The State Agency “Civil Protection” is responsible for the development of the National Emergency Plan in Radiological Emergency in NPP and for approval of the Kozloduy NPP Emergency Plan. Stations for monitoring and notification of the Civil Protection authorities are established based on the on duty officers at regional and municipal authorities. Thirty of the total 335 stations are equipped with highly sensitive apparatus for gamma-background measurement. Based on the data obtained, a daily report is prepared on the status of the radiation situation. Additionally there are 5 stations in the emergency-planning zone of the Kozloduy NPP (30 km). The gamma-background is measured 3 times per day at the rest of the stations located in the country. The data are reported to the State Agency “Civil Protection” and then to the Emergency Response Centre of the CUAEPP.

4.1. Supply of Nuclear Power Plants.

Bulgaria does not supply nuclear power plants and/or equipment for nuclear power plants. The equipment for the existing plants have been purchased from Russia, but some parts and systems have been supplied from western suppliers like Siemens, Westinghouse, Sempel, Sebim, Framatome and others.

4.2. Operation of Nuclear Power Plants

The Council of Ministers of Republic of Bulgaria adopted Resolution No.70 dated 20 February 2001, according to which all nuclear power plants and other equipment on “NPP Kozloduy” PLC are defined as one nuclear installation and “NPP Kozloduy” PLC is its operator according to the Vienna Convention on Civil Liability for Nuclear Damage.

“NPP Kozloduy” PLC as “nuclear installation operator” according to the Vienna Convention on Civil Liability for Nuclear Damage is the bearer of the corresponding civil responsibility. As “license holder” according to Nuclear Safety Convention, the company bears the responsibilities for nuclear equipment safety. This is reflected in the NPP “Kozloduy” PLC Statute (art.2, para 2 and para 3) and in Corporate Structure and Activities Code (art. 5 and art. 6). In this respect, the company holds a license, given by the State Energy Regulation Committee on electrical and thermal energy production (Verdict No.Ë -049 dated 11.12.2000 of SERC).

According to art.15 of LUAEPP the operating organization is responsible for ensuring safety requirements fulfilment. “NPP Kozloduy” PLC rights and obligations are defined in the Statute, Corporate Structure and Activities Code, company structural subdivision and sections activity organization regulations, as well as in the personnel job descriptions for the whole hierarchy managing chain.

“NPP Kozloduy” PLC responsibilities and obligations are summarized in art. 7 of Corporate Structure and Activities Code and are performed through “ implementation of activities for nuclear safety maintenance and enhancement, radiation protection, physical protection, emergency preparedness, technical safety, preserving the health of personnel and population and environment.”

In “NPP Kozloduy” PLC Corporate Structure and Activities Code” (art.8) the implementation of overall company activity, the following principle is of top priority: “Following the requirements for nuclear safety, radiation protection, as well as preserving the life and health of personnel, population and environment has priority over operational and other public needs.”

“NPP Kozloduy” PLCC is a separate corporate body, registered according to Commercial Law, which has an independent balance and bank accounts. The Company is managed by General Meeting and Board of Directors. “NPP Kozloduy” PLC organizes and manages its commercial activities in accordance with the Statute and “NPP Kozloduy” PLC Corporate Structure and Activities Code”.

In compliance with the Constitution of the Republic of Bulgaria, through the Act on the Use of Atomic Energy for Peaceful Purposes (AUAEPP) a state monopoly is established over the use of atomic energy.

For ensuring safe operation, the Kozloduy NPP management:

- develops and implements an administrative structure, assigns responsibilities and powers within the structure and exercises the overall management;
- develops, introduces and supervises the implementation of the programmes for administrative control (guiding documents for systematic implementation of planned works-schedules. procedures, inspections and revisions provided with adequate resources for their implementation);
- establishes a system for the accomplishment and control of the license conditions and terms of duration;
- establishes and maintains openness and correctness with the Regulatory Body, other state control bodies, organizations and the public, concerning the supervision, inspections and discussions on the fulfilment of the prescribed and universally accepted safety requirements;
- for exchange of experience and information, keeps in contact with the design, engineering, maintenance, mantling and construction organizations, and the manufacturers of equipment for nuclear power plants;
- ensuring the necessary resources and services for safe operation.

4.3. Fuel Cycle, Spent Fuel and Waste Management Service Supply

Bulgaria utilizes a "once through" fuel cycle. Nuclear fuel is supplied from Russia. At present, the JSC TVEL company is the only foreign supplier of nuclear fuel licensed by the CUAEPP. Kozloduy NPP - plc is the sole Bulgarian organization that has been given the authority to purchase, use and handle special nuclear material. Until 1988, the spent fuel was being returned to the Soviet Union for reprocessing after a 5 year cooling period in the fuel ponds in the reactor building.

4.3.1. Management of the Spent Fuel

The SF removed from the reactors is stored in pools situated near by the reactors. Since the start of the operation of the Kozloduy NPP until 1988 the spent fuel was transported to the former Soviet Union.

In 1990, the construction of a pool type spent fuel storage facility (SFSF) on the site of the Kozloduy NPP was accomplished. The SFSF is of a pool type. It is situated in a separate building on the territory of the Kozloduy NPP, nearby units 3 and 4. According to the design, the SFSF is to be filled in 10 years and the assemblies can be stored in it for a period of 30 years. After 3-5 years storage in the near reactor pools, the SF is transported to the SFSF. The state of the SFSF was not complying with the current requirements for safety and the re-evaluated seismic characteristics of the site.

In 1991, a programme for enhancement of the SFSF safety was elaborated which is now being updated. In 1992, the new seismic characteristics of the Kozloduy NPP site were taken in account in the Programme.

Two independent ecological assessments of the SFSF were carried out: an expertise made by a team from the Risk-Engineering company as well as a complete report of the impact on the environment made by a group of specialists from the Sofia University "Kliment Ohridski". The results of these assessments do not show any considerable negative impact on the environment from the SFSF operation.

In 1998-2000, measures for the enhancement of the reliability of the systems and equipment were implemented as well as seismic stability of the SFSF as follow:

- upgrading the reliability of the SFSF systems' power supply;
- upgrading of the reliability of the SFSF supply with de-mineralized water;
- upgrading the reliability of the SFSF supply with service water;
- seismic, anchorage of the safety related equipment;
- seismic anchorage of the SFSF building.

In March 2001, the SFSF has been licensed by CUAEPP. Since 1988, the generated SF has been stored in the spent fuel pools at the reactors and SFSF. In 1998, 240 assemblies with SF from WWER-440 were shipped to Russia. By 1 July 2001, there were 4,808 assemblies with SF from both types of reactors WWER-440 and 919 assemblies with SF of reactors WWER-1000 stored on the site.

The National Strategy on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management has been elaborated. In July 1999, the Government adopted the National Strategy.

Major measures include:

- Construction by stages of new dry storage facility for spent fuel of the VVER-440 and VVER-1000 reactors;
- Investigation of the possibilities for increasing the storage capacity of the storage pools at reactors 3 and 4 and the exist SFSF;
- Partial shipping back of spent fuel to Russia;
- Investigation of the possibilities for long term storage of spent fuel in regional storage facilities.

4.3.2. Management of Low and Intermediate Level RAW

The generated from the NPP operation RAW are stored in auxiliary buildings (AB), one for two units. In recent years, the NPP generates annually average of about 400 m^3 liquid RAW. 360 m^3 solid RAW and 20 m^3 low and intermediate ion exchange resins.

By the middle of 2000, there were about 6,173 m^3 low and intermediate solid RAW in the storage of the Kozloduy NPP and about 7,100 m^3 liquid RAW. The total radioactivity of the stored low-and intermediate RAW is about 400 TBq. The elements contaminated in the core are stored in the disposal areas of units 1 to 6 according to the design. Half of the available volume of about 200 m^3 for units 1-4 is already filled. In the storage of units 5 and 6, which volume is 86 m^3, is stored about 5 m^3 waste.

Extensive work on the completion of construction of the RAW Treatment and Storage Facility for LILW at the Kozloduy NPP site is carried out. Westinghouse and the equipment of the auxiliary systems delivered the main equipment and technology and construction works were ensured through a PHARE project. This treatment facility is extremely useful for the future operation of the NPP as the capacity for storage of RAW is nearly completed By using the treatment facility the stored RAW are expected to be treated, conditioned and stored on-site until a national RAW repository is constructed. The Treatment and Storage Facility is in the process of commissioning.

The fund for Safe Management of Radioactive Waste was established at the beginning of 1999. NPP Kozloduy pays a special fee to the fund: 3% of the average market price of energy sold to the National Electric Company. The State Agency of the Energy and Energy Resources through relevant Steering Committees manages the funds.

According to the National Strategy on RAW and SF Management are under preparation:

- A programme on development of complete legislation on the safety of the RAW and SF management. This programme is part from the National Programme for Adoption of the Acquis (NPAA).

- A draft of the amended Basic Safety Standards is under preparation in compliance with the EC Directive 96/29.

The programme has to consider too, the development of an Act on the Safety of the RAW and SF management and Act on Ratification of the Joint Convention, Establishment of a Radioactive Waste Management Organization; Construction of a National RAW disposal facility; Partial shipping back of spent fuel to Russia.

4.4. Research and Development Activities

According to the Act on the Use of Atomic Energy for Peaceful Purposes, nuclear research and development activities in Bulgaria are co-ordinated by the CUAEPP. Research and development activities are carried out in several institutes, the most important of which are:

- The Institute of Nuclear Research and Nuclear Energy at the Bulgarian Academy of Sciences;
- The University of Sofia Department of Nuclear Physics, Dept of Nuclear Technology and Nuclear Power Engineering and the Radiochemical laboratory;
- Technical University of Sofia, Department of Power and Nuclear Engineering;
- Engineering companies: ENERGOPROEKT, EQE Bulgaria, ENPRO (Consult and Risk) Engineering;
- Institute of Radiation Protection, at the Ministry of Health;
- Plovdiv University, Department of Nuclear Physics; and
- other smaller Institutes and research organizations.

4.5. International Co-operation in Nuclear Power Development and Implementation

An important part of the Research and Development activities is being carried out through co-operation with international organizations like: the Joint Institute of Nuclear Research in Dubna, Russia; the Institute of Theoretical Physics, Trieste; CERN and other foreign institutes.

Scientific and Technical Co-operation of the CUAEPP

After 1992, with the assistance of the European Community, the Consortium of Western Regulators, which included AEA-Technology (United Kingdom), AVN (Belgium), GRS (Germany) and IPSN (France), assisted the Bulgarian Regulatory Body. Assistance is received also by the operating organization from the World Association of Nuclear Operators (WANO). In the process of development and licensing of the Programme for safety and operational reliability improvement of WWER-440 (V-230) units of the Kozloduy NPP, the so called “2+2” schedule was created in the documentation assessment process related to issuing of licenses for implementation of the modifications. Co-operation with the Consortium of Western Regulators is foreseen also during the licensing of the measures of the Complex Programme for Safety Reconstruction of the Kozloduy NPP units 1-4 and the Programme for Modernization of the Kozloduy NPP units 5-6.

On a number of nuclear safety issues, the CUAEPP receives technical support from Bulgarian engineering organizations and institutes. The CUAEPP receives technical support from the IAEA, European Union, United States and Japan for getting acquainted with the methodologies and existing practices of the developed countries in the areas of control, licensing and inspection practices.

The CUAEPP is in co-operation with:

- the Co-operation Forum of WWER Regulators;
- the Working Group of Nuclear Regulators to the European Union;
- the Working and Consultative Groups of the IAEA;
- the United States Nuclear Regulatory Commission (US NRC);
- the Regulatory Body of the Russian Federation;
- the Regulatory Body of Ukraine;
- the Regulatory Body of Slovak Republic.

5. REGULATORY FRAMEWORK

5.1. Safety Authority and Licensing Process

The National Regulatory Authority in the field of safe use of atomic energy is the Committee on the Use of Atomic Energy for Peaceful Purposes (CUAEPP). The legal framework in respect of the CUAEPP is provided for in the Law on the Use of the Atomic Energy for Peaceful Purposes (LUAEPP). The CUAEPP implements the state policy in the matter of safe use of atomic energy (Article 12 (1) of the LUAEPP). The functions of the CUAEPP are effectively separated from those of the bodies and organizations involved in atomic energy utilization issues. The Committee is a state body reporting to the Council of Ministers.

5.1.1. Safety Authority

Pursuant to Article 13, paragraph 1 of the LUAEPP, the Committee on the Use of Atomic Energy for Peaceful Purposes shall have the following powers:

i) Participates in the elaboration of concepts and programmes, co-ordinates research and studies in the field of atomic energy;
ii) Establishes the requirements for safe use of atomic energy and the order for accountancy, storage and shipment of nuclear material;
iii) Establishes criteria and requirements with regard to training, qualifications and capacities of human resources employed in the nuclear field;
iv) Collects and provides information to relevant bodies and organizations on circumstances and events related to nuclear and radiation safety;
v) Performs the state control over the safe use of atomic energy and during shipment, storage and accounting of nuclear material and radioactive substances;
vi) Co-ordinates control over the safe use of atomic energy;
vii) Determines measures and is in charge of remedial action in respect of contaminated environment;
viii) Carries out the international co-operation activities of the Republic of Bulgaria in the field of atomic energy and participates in the activities of international organizations in this field.
ix) Co-ordinates fulfilment of the obligations of the Republic of Bulgaria following from the international treaties and agreements in connection with the safe use of atomic energy;
x) Co-ordinates elaboration of the national reports on fulfilment of obligations of the Republic of Bulgaria following from the Convention on Nuclear Safety and from the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management.

The activities referred to above in i) – viii) shall be implemented jointly with the ministries and other institutions within their legal powers.

State control over the safe use of atomic energy is exercised by the CUAEPP through its Inspectorate on the Safe Use of Atomic Energy (ISUAE). Pursuant to Article 18 of the LUAEPP, the following specific powers shall be vested with the ISUAE:

i) Exertion of control over all natural and legal persons in the matter of compliance with the established requirements for safe use of atomic energy and the procedure for accountancy, storage and shipping of nuclear material and radioactive substances;
ii) Issuance of licenses for conduct of activities in the field of atomic energy utilization. Atomic energy utilization activities shall only be carried out following the grant of license. Carrying out of such activities without a license or prior to the issuance thereof, or in deviation from the license constitutes a criminal act under Article 356 (1) of the Penal Code. Such license shall be requested for all activities relating to atomic energy utilization and more (pursuant to Article 23 (1) of the LUAEPP) specifically for: decommissioning and any modifications of designs and constructions, procurement, provision of supplies and services of significance to the safety of nuclear installations and sites designated for extraction, operation or storage of radioactive substances or intended for operations with other ionizing radiation sources; obtaining, production, import, selection of site, design, construction, fabrication of equipment, commissioning, operation, export, trade, storage and shipping of nuclear material, radioactive substances and other ionizing radiation sources;
iii) Exercise of extended control in concomitance with specialized controlling bodies in respect of the safe use of atomic energy;
iv) Registration of ionizing radiation sources;
v) Assignment of studies, surveys, expertise and other activities concerning exercise of controls.

In its capacity as a governmental authority, the CUAEPP is composed of 19 members, including the chairman and two deputy-chairmen. Other members are deputy ministers of justice, agriculture and forests, environment and water, transport and communications, public health, culture, economy, finances, defence, education and science, labour and social policy, interior, foreign affairs and the deputy chairmen of the State agency on energy and energy resources, the State agency “Civil protection” and the State agency on standardization and metrology. The administration helps the CUAEPP in implementation of its authorities, assures technically its activity, and performs activities on administrative service provided to legal persons and citizens. The administration is organized in a directorate general and 4 directorates, distributed into general and specialized administration. The specialized administration is organized into ISUAE.

5.1.2. Organizational Structure of the CUAEPP

As an administration, the CUAEPP is governed by a Chairman, supported by:

- Two Deputy Chairmen;
- Executive Secretary responsible for the administrative support;
- Representative of the CUAEPP in the Permanent Mission of the Republic of Bulgaria to the UN, the OSCE and other International Organizations in Vienna, Austria.

The total number of the CUAEPP staff is 88 persons. Currently, the ISUAE has in its structure 63 positions, including 26 nuclear safety inspectors, 14 radiation protection experts, 6 specialists in emergency planning and preparedness, 8 specialists in the international co-operation and 2 in European integration. Eight of the inspectors work permanently at the Kozloduy site. 95% of inspectors have university education and more than 60% of them have over 15 years of experience in the nuclear field. Three CUAEPP employees have Ph.D. degree. In some fields there are no experts engaged. The organizational structure of the CUAEPP is shown in Figure 11. The CUAEPP budget is formed by the related part of the state budget for the CUAEPP support and by a part of the remised revenue from levies for issuing permissions collected by the CUAEPP according to the Tariff for the levies in force.

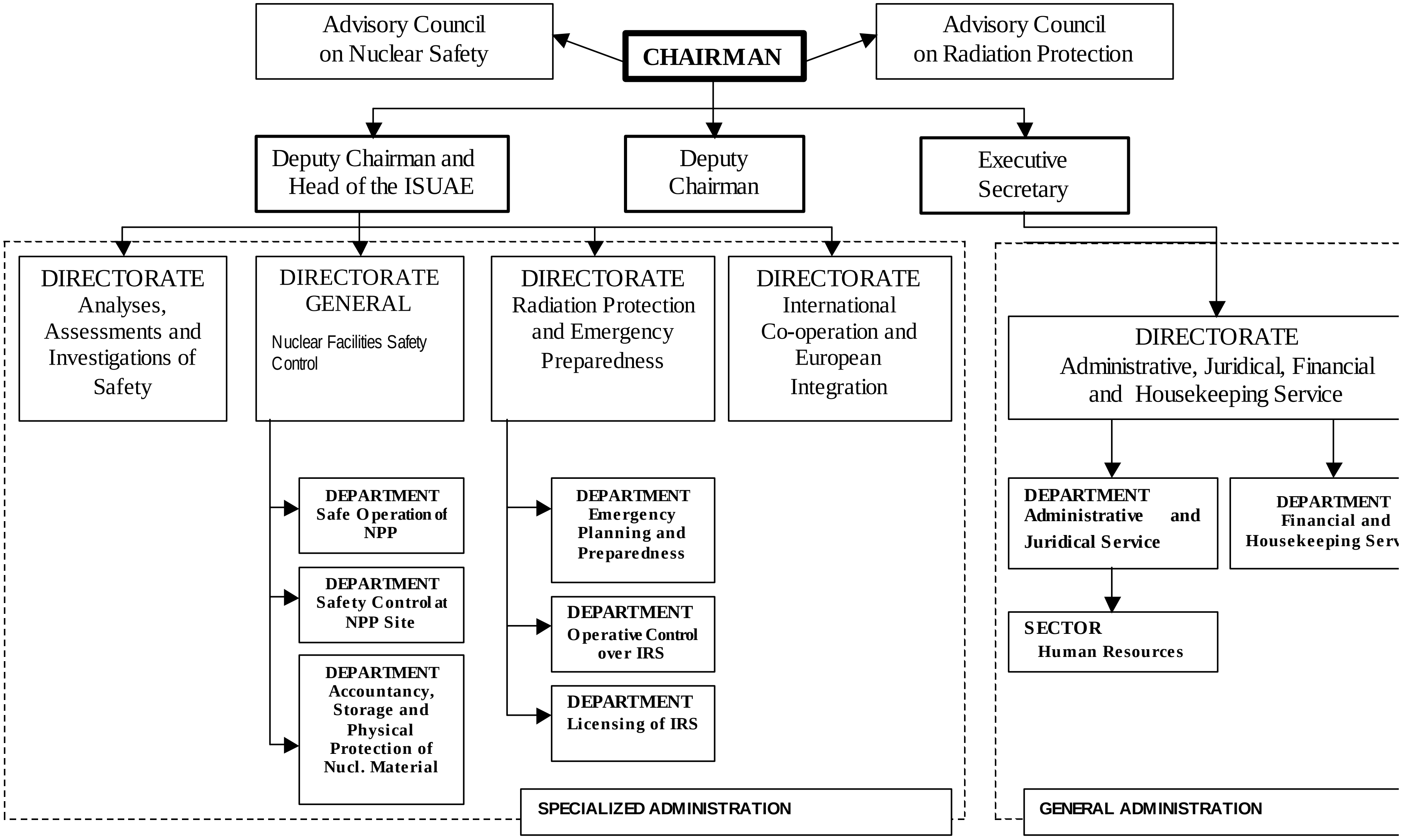


FIG. 11. Organizational Structure of the CUAEPP

The former Fund "Nuclear Research and Nuclear and Radiation Safety" was transformed into Activity "Nuclear Safety and Radiation Protection". It is managed by the Chairman of CUAEPP. The procedure for collecting and spending the resources of this Activity is determined by the Regulation, approved by a Decree of the Council of Ministers. Resources are collected mainly from the levies for licensing atomic energy activities. By funding from the Activity source, the CUAEPP deals with tasks related to the pursuing the state policy and control over the safe use of atomic energy. Following activities are funded:

- development of forecasts, concepts, programmes and rules and regulations related to the use of atomic energy, nuclear safety and radiation protection;
- conducting assessments, analyses and expertise related to the control and licensing activities of the CUAEPP and the control over the radiation contamination and the protection of the environment, including accident mitigation analyses;
- payment for scientific and technical services, related to the pursuing of the state policy on the safe use of atomic energy;
- provision for the necessary equipment, including maintenance and operational expenses - 32% of the income from licensing taxes and for motivation of the CUAEPP staff - 8%.

5.1.3. Functions of the CUAEPP Structural Units

The organizational structure and duties of the CUAEPP structural units are described in the Statute of the CUAEPP and its administration, adopted by the Council of Ministers Decree No.142 dated 6 of June 2001. The specialized administration is organized into the Inspectorate on Safe Use of Atomic Energy and consists of:

- Directorate General “Nuclear Facilities Safety Control” with a residential part at NPP Kozloduy;
- Directorate “Analyses, Assessments and Investigations of Safety”;
- Directorate “Radiation Protection and Emergency Preparedness”;
- Directorate “International Co-operation and European Integration”.

Directorate General “Nuclear Facilities Safety Control”

This directorate exercises control over the nuclear safety of nuclear facilities in the following areas :

- commissioning;
- operation;
- decommissioning;
- quality assurance;
- maintenance and tests;
- modifications of structures and systems;
- physical protection of nuclear facilities and special nuclear material;
- procurement and services to the operating organization;
- transportation, storage and accounting of special nuclear material.

Directorate “Analyses, Assessments and Investigations of Safety”

This directorate analyses and assesses the information submitted by the operating organization or the applicant/licensee in the following areas of control:

- siting of nuclear facilities;
- nuclear facilities design;
- construction of nuclear facilities;

- commissioning of nuclear facilities;
- operation of nuclear facilities;
- modification of safety related structures and systems;
- qualification of nuclear facilities personnel and persons, exercising procurement or services to the Operator;
- co-ordination of research and development.

Directorate "Radiation Protection and Emergency Preparedness"

The directorate exercises control over meeting the established requirements on radiation protection, in the following areas:

- use, ownership and registration of Sources of Ionizing Radiation (SIR);
- production, trade, import, export, storage, transportation and repository of radioactive substances and other SIR (devices, apparatus and installations), including initial nuclear material;
- siting of nuclear facilities and other installations with SIR, including radioactive waste storage and conditioning facilities;
- design of nuclear facilities and other installations with SIR, including radioactive waste storage and conditioning facilities;
- construction of nuclear facilities and other installations with SIR, including radioactive waste storage and conditioning facilities;
- commissioning, operation and decommissioning of nuclear facilities and other installations with SIR, including radioactive waste storage and conditioning facilities;
- modification of radiation safety related designs, structures and technologies of nuclear facilities and other installations with SIR, including radioactive waste storage and conditioning facilities.

In the field of emergency planning and response, the directorate exercises the following functions:

- fulfils the duties of a National Contact Point with the IAEA in compliance with the Convention on Early Notification of a Nuclear Accident and the Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency;
- takes part in the activities of the CUAEPP Emergency Response Teams, maintains and operates the communication and computer equipment;
- analyses, records and stores radiation monitoring data from the country;
- receives, processes and distributes within the CUAEPP the operational data of the nuclear facilities;
- keeps in contact with the National Centre for Management in Crisis Situations and the Permanent Commission to the Council of Ministers for Protection of the Population in Case of Calamities and Accidents.

The Directorate "International Co-operation and European Integration" exercises the following activities:

- organizes and co-ordinates the co-operation of the Republic of Bulgaria with international organizations and on bilateral basis with other states in the field of the safe use of atomic energy;
- participates in the elaboration of draft inter-governmental and inter-institutional agreements with other states in the field of safety in the use of atomic energy;
- organizes the submission to the international organizations of projects for technical co-operation in the field of peaceful use of atomic energy;
- submits proposals for training of Bulgarian specialists, working in different fields of the peaceful use of atomic energy, to the international organizations as well as to the other states on the basis of bilateral agreements;
- organizes the participation of Bulgarian specialists in international conferences, symposia and

seminars in the field of the peaceful use of atomic energy;

- practical implementation of the integration of the Republic of Bulgaria to the European Union in the field of atomic energy utilization;
- the support to the CUAEPP through the PHARE programme;
- provides the participation of the Republic of Bulgaria in the IAEA International Nuclear Information System (INIS) through the local INIS Centre.

5.1.2. Licensing Process

The main legal provisions for the licensing of nuclear installations in Bulgaria are outlined in Regulation No 5 of the CUAEPP. It regulates the requisite documentation, the conditions, the order, terms and time-limits for issuance of licences and permits for atomic energy utilization (atomic energy in the Republic of Bulgaria shall be used for peaceful purposes only). Licences and permits for utilization of atomic energy shall be issued by the ISUAE of the CUAEPP based on a written application by the applicant wherein the specific activity involving atomic energy utilization for which the grant of permission is requested shall be identified. Attached thereto shall be the documentation required for the issuance of the requested licence/permit as prescribed by this Regulation in question (inclusive of a Quality Assurance Programme for the respective activity or business) and by other relevant regulations in the matter of atomic energy utilization. All documentation submitted in respect of requested license issuance shall be in Bulgarian language. Submission of the original documents in a foreign language is permissible if a notarized translation into Bulgarian language is thereto attached.

Regulation No. 6 governs the criteria and requirements in respect of training, qualifications and capacities of human resources employed in the field of atomic energy utilization to the end of acquiring, sustaining and advancement of their professional qualifications and assurance of the requisite capacity for safe utilization of atomic energy.

5.2. Main National Laws and Regulations

The following fundamental acts of legislation are currently applicable in the matter of safe utilization of nuclear energy and in respect of nuclear material procurement, accountability, storage and transport:

- Law on the Use of Atomic Energy for Peaceful Purposes (Promulgated in the Official State Gazette issue No. 79 of 1985, amended SG No. 80 of 1985, amended and supplemented SG No. 69 of 1995, amended and supplemented SG No. 71 of 1998);
- Regulations for the Application of the Law on the Use of Atomic Energy for Peaceful Purposes (adopted by a Decree of the Council of Ministers No. 37 of 1 July 1986, promulgated SG No. 66 of 22 August 1986, amended and supplemented SD No.54 of 2001);
- Regulation No. 2 on the Cases and Procedures for Notification of the Committee on the Use of Atomic Energy for Peaceful Purposes about Operational Changes, Events and Accidents relating to Nuclear and Radiation Safety (Promulgated SG No. 26 of 1988, amended SG No. 28 of 1988);
- Regulation No. 3 on Nuclear Power Plants Safety during Design, Construction and Operation (Promulgated SG No. 27 of 1988);
- Regulation No. 4 on Accounting, Storage and Transportation of Nuclear Material (Promulgated SG No. 66 of 1988; amended SG No. 83 of 1993, updated April 2001). The name of the updated Regulation is “Accounting, Storage and Transportation of Nuclear Material and Application of Safeguards in connection with the Treaty on the Non-Proliferation of Nuclear Weapons;
- Regulation No. 5 on the Licence Issuance Procedure for Utilization of Atomic Energy (Promulgated SG No. 13 of 1989; amended and supplemented SG No. 37 of 1993);
- Regulation No. 6 on the Criteria and Requirements for Training, Qualifications and Certification of Personnel working in the field of Atomic Energy (Promulgated SG No. 47 of 1989; amended SG No. 43 of 1991);

- Regulation No. 7 on Collecting, Storage, Processing, Keeping, Transport and Disposal of Radioactive Waste on the Territory of the Republic of Bulgaria (Promulgated SG No. 8 of 1992);
- Regulation No. 8 on the Physical Protection of Nuclear Facilities and Nuclear Material (Promulgated SG No. 83 of 1993);
- Regulation No. 10 on Safety during Decommissioning of Nuclear Facilities (Promulgated SG No 12 of February 2001);
- Regulation No. 11 on Safety of Spent Fuel Storage Facilities (Promulgated March 2001);
- Regulation for Emergency Planning and Preparedness for Action in Case of Radiation Accident (Promulgated SG No. 33 of 1999);
- Regulation on Basic Standards for Radiation Protection – 2000 (Promulgated SG No. 5 of 2001)

After the adoption of the New Law on the Use of Nuclear Energy for Peaceful Purposes the above-mentioned regulations will be replaced. Table 20 lists the new draft acts.

TABLE 20. NEW DRAFT ACTS

Regulation/Project	Terms	Structure
1. Draft Law on the Use of Nuclear Energy for Peaceful Purposes	2002	The draft has been approved by the Council of Ministers. The draft Law will be adopted by the New Parliament
2. Draft Regulation on Safety in Management of Radioactive Waste	12/2001	The draft is developed and will be adopted by the CUAEPP
3. Standards for permissible radioactive contamination of foodstuffs and feeding stuffs in case of a nuclear accident or emergency radiological situation	2001	The Ministry of Health manages the project development. The Committee on the Use of Atomic Energy for Peaceful Purposes and the Ministry of Agriculture, Forestry and Agrarian Reform take part in the project.
4. Specific conditions for import and export of foodstuffs and feeding stuffs in case of a nuclear accident or emergency radiological situation	2001	The Ministry of Health manages the project development. The Ministry of Agriculture, Forestry and Agrarian Reform and the Ministry of Trade and Tourism take part in the project.
5. Regulation on the basic rules for work with ionizing radiation sources.	2002	The Ministry of Health manages the project development. The Ministry of Interior participates in the project.
6. Regulation on the conditions and order for issuing permissions on the use of ionizing radiation sources for medical purposes	2002	The Ministry of Health manages the project development. The CUAEPP participates in the project.
7. Regulations on border radiation control.		The Ministry of Interior manages the project development. The project will be developed by a team with participation of experts from the MI, CUAEPP and MH.
8. Standards for permissible radionuclide content in metal and non-metal raw materials, materials (incl. civil structure materials) and products	2002	The Ministry of Health manages the project development. The Ministry of Environment and Waters and CUAEPP take part in the project.
9. Regulations on radiation protection of the population in case of medical exposure	2002	Project is managed by the Ministry of Health. The CUAEPP takes part in the project

Source: Country Information.

5.3. International, Multilateral and Bilateral Agreements

AGREEMENTS WITH THE IAEA

- NPT related safeguards agreement INFCIRC/178 — Entry into force: 29 February 1972
- Additional Protocol — Entry into force: 10 October 2000
- Improved procedures for designation of safeguards inspectors — Entry into force: 16 October 1988

• Supplementary agreement on provision of technical assistance by the IAEA	Entry into force:	18 August 1980
• Agreement on privileges and immunities	Entry into force:	17 June 1968

OTHER RELEVANT INTERNATIONAL TREATIES, etc.

• NPT	Entry into force:	5 September 1969
• Convention on physical protection of nuclear material	Entry into force:	8 February 1987
• Convention on early notification of a nuclear accident	Entry into force:	26 March 1988
• Convention on assistance in the case of a nuclear accident or radiological emergency	Entry into force:	26 March 1988
• Vienna convention on civil liability for nuclear damage and joint protocol	Entry into force:	24 November 1994
• Protocol to amend the Vienna convention on civil liability for nuclear damage	Not signed	
• Convention on supplementary compensation for nuclear damage	Not signed	
• Joint convention on the safety of spent fuel management and on the safety of radioactive waste management	Entry into force:	18 June 2001
• Convention on nuclear safety	Entry into force:	24 October 1996
• Convention on Black Sea contamination protection		
• ZANGGER Committee	Member	
• Nuclear Export Guidelines	Adopted	
• Acceptance of NUSS Codes	No reply	
• Nuclear Suppliers Group	Member	

BILATERAL AGREEMENTS

- Agreement between the Government of the Republic of Bulgaria and the Government of the United States of America on Co-operation in the Field of Peaceful Uses of Nuclear Energy.
  - By way of this Agreement the Contracting Parties reaffirmed their commitment that they would ensure international development in the peaceful utilization of nuclear energy in compliance with all agreements which to the maximum possible extent contribute to the objectives of the Treaty on non-proliferation of Nuclear Weapons

- Agreement between the Government of the Republic of Bulgaria and the Government of the Russian Federation on Co-operation in the Field of Peaceful Uses of Atomic Energy.
  - The Agreement reaffirms the Republic of Bulgaria's membership to the United Institute of Nuclear Research in the city of Dubna, regulates the mutually advantageous co-operation of

the Parties in the field of peaceful utilization of atomic energy. The Parties guarantee their strict adherence to their obligations in respect of the Treaty on non-proliferation of Nuclear Weapons and the continued endeavors towards nuclear safety amelioration.
  - The Agreement covers a rather broad scope of possible joint research domains, such as nuclear physics, controlled thermonuclear fusion and plasma physics, condensed-matter physics (physics of the solids), radiochemistry, radiation chemistry, atomic energy engineering, inclusive of safe and reliable operation decommissioning of nuclear power plants, fuel cycle management, control and issuance of licences, betterment of nuclear fuel storage and transport technologies, prospective nuclear energy sources, nuclear safety and radiation protection, radiological protection from nuclear irradiation, normative and technical documentation, etc.

- Agreement between the Government of the People's Republic of Bulgaria and the Government of the Republic of Greece on Early Notification of a Nuclear Accident and Exchange of Information on Nuclear Facilities.
  - This Agreement governs the technical aspect of extended operational reporting and notification between the Contracting Parties in case of a nuclear accident after the Convention on Notification in Case of a Nuclear Accident, signed in Vienna on 26 September 1986.

- Financing Protocol between the Government of the Republic of Bulgaria and the Government of the French Republic.
  - To the end of strengthening the friendly relations that have traditionally linked them, the Government of the Republic of Bulgaria and the Government of the French Republic have agreed to conclude this Protocol with the purpose to contribute to the economic development of Bulgaria. 21/2 million French francs shall be lent to assist financing of the purchase from France of full-scale nuclear power plant simulators and the installation thereof.

- Agreement between the Committee for the Use of Atomic Energy for Peaceful Purposes with the Council of Ministers of the Republic of Bulgaria and the Federal Ministry of the Environment, Protection of Nature and the Reactor Safety of Germany on Issues of Mutual Interest Relating to Nuclear and Technical Safety and Radiation Protection.
  - The Contracting Parties shall notify and inform each other forthwith and directly of accidents under Article 1 of the Convention on Notification in Case of a Nuclear Accident, signed in Vienna on 26 September 1986. The Agreement also provides for the exchange of information and experience in nuclear and technical safety and radiation protection, favourable co-operation between the Parties and also provides that the Federal Ministry of the Environment, Protection of Nature and the Reactor Safety of Germany shall, upon request, endeavour within the limits of possibilities available under the national law to provide assistance on technical aspects of safety by way of attracting German consulting and expert organizations.

- Agreement between the Government of the Republic of Bulgaria and the Government of Romania on Early Notification of a Nuclear Accident and Exchange of Information on Nuclear Facilities.
  - The Agreement governs the technical aspect of extended bilateral operational reporting and notification to the Parties in case of a nuclear accident following the Convention on Notification in Case of a Nuclear Accident, signed in Vienna on 26 September 1986.

- Agreement between the Government of the Republic of Bulgaria and the Government of the Argentine Republic on Co-operation in the Field of Peaceful Use of Nuclear Energy.
  - The Contracting Parties shall collaborate in the development of scientific research and practical utilization of atomic energy for peaceful purposes. Specific fields of co-operation are listed. Co-operation shall be based on agreements between institutes, organizations and legal entities of the Parties in compliance with the national law.

- Agreement between the Government of the Republic of Bulgaria and the Government of the Republic of Turkey on Early Notification of a Nuclear Accident and Exchange of Information on Nuclear Facilities.
  - The Agreement shall apply in respect of activities on the subject of notification in case of a nuclear accident after Article 1 and Article 3 of the IAEA Convention.

- Agreement between the Committee on the Use of Atomic Energy for Peaceful Purposes of the Republic of Bulgaria and the Federal Nuclear and Radiation Safety Authority of the Russian Federation on Co-operation in Nuclear and Radiation Safety.
  - The Agreement provides for exchange of information on the organization of activities of the regulatory authorities, exchange of regulatory documentation as well as experience in conducting nuclear and radiation safety inspections, training of inspectors, etc.

- Agreement between the Committee on the Use of Atomic Energy for Peaceful Purposes of the Republic of Bulgaria and the Ministry of Environmental Protection and Nuclear Safety of Ukraine on Co-operation in the Field of the State Regulation and Control of Safety in the Use of Atomic Energy for Peaceful Purposes.
  - The Agreement provides for exchange of information on the organization of activities of the regulatory authorities, exchange of regulatory documentation as well as experience in conducting nuclear safety inspections, training of inspectors, etc. It also provides for exchange of information on control of the physical protection of nuclear material and facilities and of the system of accounting for and control of nuclear material.

- Agreement between the Committee on the Use of Atomic Energy for Peaceful Purposes of the Republic of Bulgaria and the Ministry of Economy of the Slovak Republic on Co-operation in the Field of the State Regulation and Control of Safety in the Use of Atomic Energy for Peaceful Purposes.
  - The Agreement provides for exchange of information on the organization of activities of the regulatory authorities, exchange of regulatory documentation as well as experience in conducting nuclear safety inspections, training of inspectors, etc. It also provides for exchange of information on control of the physical protection of nuclear material and facilities and of the system of accounting for and control of nuclear material.

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[1] Committee on the Use of Atomic Energy for Peaceful Purposes, Annual Reports 1991, 1992, 1993, 1994 and 1995.

[2] National Electric Company Annual Reports 1993, 1994 and 1995.

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[4] Strategy for Development of the Energy Sector, Committee of Energy December, (1995).

[5] Tariffs for Electricity and Heat Energy Bechtel Int. Inc., prepared for USAID, (June 1996).

[6] European Bank for Reconstruction and Development, Annual Reports 1994, 1995.

[7] Collection of Bulgarian Nuclear Regulatory Documents, Balbok ltd. Sofia, (1994).

[8] Social and Economic Development of Bulgaria 1990 -1993, National Institute of Statistics, Sofia, (1994).

[9] Additional unpublished materials have also been used, like:
a) Reports of NEK prepared for the Commission for State Energy Regulation.
b) Materials prepared for the Council of Ministers concerning the Association procedure of Bulgaria in the European Union.

[10] Data & Statistics/The World Bank, www.worldbank.org/data.

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

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

Appendix

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

NATIONAL ATOMIC ENERGY AUTHORITIES

Committee on the Use of Atomic Energy for Peaceful Purposes 69 Shipchenski Prokhod Blvd. 1574 Sofia, Bulgaria	Tel: +359-2-9406800 Fax: +359-2-9406919
State Agency of Energy and Energy Resources 8 Triaditza str., 1040 Sofia, Bulgaria	Tel: +359-2-9885932 Fax: +359-2-9865703 Telex: 22707/8

OTHER NUCLEAR ORGANIZATIONS

Bulgarian Academy of Sciences (BAS) Institute of Nuclear Research and Nuclear Energy (INRNE) 72 Tzarigradsko shosse Blvd., 1784 Sofia, Bulgaria	Tel: +359-2-7144616 Fax: +359-2-9753619 http://www.inrne.bas.bg/
Bulgarian Academy of Sciences Institute of Metallurgy 53 Shipchenski Prokhod Blvd. 1574 Sofia, Bulgaria	Tel: +359-2-703485 Fax: +359-2-703207 http://www.bas.bg/
National Electric Company 5 Vesletz Str., 1040 Sofia, Bulgaria	Tel: +359-2-54901 Fax: 875826; Telex: 22707
Kozloduy Nuclear Power Plant 3321 Kozloduy, Bulgaria	Tel: +359-973 7177 Fax: +359-973 80591;Telex: 33416 http://www.kznpp.org/index_e.htm
ENERGOPROJEKT JSC 51 J. Bourchier Blvd., 1407 Sofia, Bulgaria	Tel: +359-2-6321 Fax: +359-2-668529
ATOMENERGOREMONT JSC 3321 Kozloduy, Bulgaria	Tel: +359-973 7177 Fax: +359-973 2591 Telex: 33416
Technical University of Sofia 8,Kliment Ohridski St. Sofia- 1000, Bulgaria	Tel: +359-2-623073 Fax: +359-2-685343 http://www.vmei.acad.bg/
University of Sofia Department of Nuclear Physics and Nuclear Energy 5 J. Bourchier Blvd., 1126 Sofia, Bulgaria	Tel: +359-2-62561 Fax: +359-2-622028 http://www.uni-sofia.bg/
University of Sofia - Radiochemical Laboratory 1 J. Bourchier Blvd., 1126 Sofia, Bulgaria	Tel: +359-2-62565 Fax: +359-2-622127

RISK ENGINEERING LTD.	Tel: +359-2-521217
34 Totleben str., 1660 Sofia, Bulgaria	Fax: +359-2-9549100
BALBOK ENGINEERING JSC	Tel/Fax: +359-2-9634413
29-37 H. Smirnensky Blvd.	
Vh.B, Ap.13,1421 Sofia, Bulgaria	Tel/Fax: +359-2-9630252
EQE Bulgaria Ltd.	Tel/Fax: +359-2-660417
1 Hristo Smirnensky Blvd. Et. 11.	
1421 Sofia, Bulgaria	Tel/Fax: +359-2-9632049
ENPRO CONSULT Ltd.	Tel/Fax: +359-2-624873
12 Anton Naidenov Str.	
1700 Sofia, Bulgaria	Tel/Fax: +359-2-9625267
Black Sea Regional Energy Centre (BSREC)	Tel : +359-2-9806854
8,Triadiza Str.	Fax: +359-2-9806855
Sofia	http://www.bsrec.bg/