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Volume 5: Generation & Transmission Appendices

Final report

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Complete GIS Report

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A7.1 Introduction

This appendix of the Final Report presents a description of the existing electric power systems of Albania, Bosnia & Herzegovina, Bulgaria, Croatia, UNMIK, Macedonia, Montenegro, Romania and Serbia (excluding UNMIK). The information and data presented in this section were obtained from the following key documents and additional data received from the utilities:

- IEA ENERGY BALANCES OF NON-OECD COUNTRIES 2000 - 2001
- IEA International Energy Outlook 2003
- WB Country Study BULGARIA ENERGY - ENVIRONMENT REVIEW June 29, 2001
- MWH (Harza) Trans Balkan Power Line Study by Harza for Enron & U.S. Trade and Development Agency. May 2001
- MWH (Harza) Least Cost Expansion Planning Study for Macedonia 2000-2020 by Harza for EPC and WB. April 2000
- MWH USAID Role of Hydropower in Southeast Europe in 2005 by MWH for USAID and SECI. (Jan 2003)
- IEA KEY WORLD ENERGY STATISTICS 2003
- EKC Review of Electricity Supply and Demand in South Eastern Europe 2002-2020 by EKC for WB. (October 2002)
- KfW Regional Study of Electricity Supply and Demand in South East Europe 2002-2012 by Decon and Swedpower for KfW. November 2002
- EC Study on the Development of a Competitive Balkan Electricity Market 1999-2010 by the LDK Consortium for EC. (Est. 1999)
- HEP The needed development of new power plants and facilities in the Republic of Croatia in the period 2001-2020 (Master Plan), November 2001
- WB Albania: Power Transmission and Distribution Project - Energy Sector Study DECON - EDF - LDK Funded by World Bank - Client: KESH (Albanian Power Corporation) January 2003
- USAID Report on SEE candidate electricity

In parallel to the GIS, the Southeastern Europe Electrical System Technical Support Project (SEETEC), funded by the Canadian Government and led by SNC-Lavalin, had been collecting power system operational data in each country. SEETEC is also performing a number of studies and organizing workshops to develop the SEE regional electricity market.

An agreement was reached between SEETEC and PwC to jointly develop a comprehensive set of national databases for each individual jurisdiction. In addition to this study, these databases will be of great value allowing each jurisdiction to perform simulations of the behaviour of its own national power system within the context of its integration in the overall regional electricity market environment. Reciprocity agreements to share data were signed by each jurisdiction and the final version of the data base will be distributed with the final repot.

A7.2 Albania – Power Generation and Transmission Network Systems

KESH, established in 1992, is the vertically integrated state-owned company responsible for the generation, transmission, and distribution of electricity within Albania and for trading electricity with foreign entities. KESH owns and operates 1,684 MW of installed generation capacity, a transmission network of 2,468 km and a distribution network of 45,712 km.

The main problem faced today by the Albanian power sector is the limited generation capacity varying between 14 and 16 million kWh per day. Adding an average import of 8 to 10 million kWh per day, the total average supply varies between 22 and 26 million kWh per day. By comparison, the demand on a normal winter day is about 25 to 27 million kWh. As a consequence, the existing power system fulfils only 80-90% of the total demand during the peak winter period, causing power supply shortages. Albania has imported between 25 to 40% of the total electricity consumed during the last four years. This situation will continue in the future until new plants are constructed. The most urgent problems that the Albanian power sector is facing today are the following:

- ***Current generation capacity*** is insufficient to meet the actual demand of 6.60 TWh/year (for 2003). As a consequence, the electricity supplied to customers is partially interrupted. Also, about 99% of the total electricity generation is produced by the hydro plants and recent droughts have exacerbated the lack of generation.

- ***Non-technical losses***: In 1999, 1,295 GWh or about 20% of the total generation was classified as non-technical losses, either electricity taken from the network through illegal connections or unpaid consumption. Since 2000, non-technical losses have been were reduced due to a series of actions and measures taken by KESH and the Ministry of Industry and Energy (MIE), and supported by a Group of Donors.

- ***Technical losses in the transmission-distribution (T&D) networks:*** In 1999, T&D losses were 1,406 GWh (720 GWh for transmission and 685 GWh for distribution) or 22% of the total generation. Since 2000, KESH, in close cooperation with Group of Donors and ENEL, has prepared Investment Plans updated every year, in order to reduce these losses. Necessary investments for this objective are being funded by various Donors.

- ***Electric interconnection with neighbouring countries:*** Electric interconnections with neighboring countries include three lines: Elbasan-Kardia (400 kV) with a capacity of 1100 MVA, Fierza-Prizren (220 kV-250 MW) and Vau Dejes-Podgorica (220 kV-250 MW). Due to system instability, the effective capacity of these lines is reduced to 400 MVA. The capacity was considerably increased in 2001 due to additional transformer capacities at the Elbasan substation and the commissioning of a 220 kV line (4 km) between Elbasan 1 and Elbasan 2 substations (August 2002). MIE and KESH are in the final stage of negotiation with kfW and the Montenegro Power Company to build the 400-kV Elbasan-Potgorica interconnection line and a new 400/220/110 kV substation in Tirana.

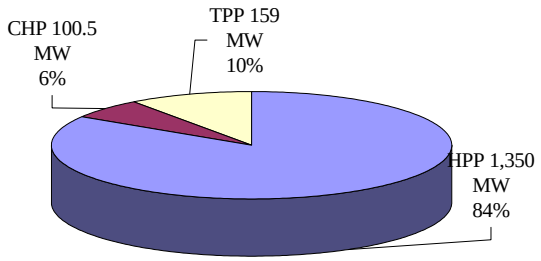
- ***High electricity consumption for space heating:*** Electricity consumption for space heating has increased drastically over the past few years. Peak load in summer season reaches about 750 MW, while in winter the peak reaches about 1,300 MW. The 550-MW increase is almost due entirely to space heating. Very high demand for space heating may not be avoided without well-defined plans to introduce alternative energy sources. The National Strategy of Energy has given a set of recommendations to address this issue. New legislation such as the law “On the conservation of Heat in Buildings”, as well as the Technical Regulations for Private and Public Buildings should have an impact by promoting the use of alternate fuels.

- ***Electricity tariffs:*** Different studies carried out by international and local institutions indicate that the long-term marginal cost of electricity (generation-transmission-distribution) is much higher than current tariffs. KESH Action Plan approved by the Albanian Government and the Donors recommends tariff increase in order to improve the financial situation of KESH.

A7.2.1 Generation Capacity

The Albanian power generation system is predominantly hydro, with hydro generation, mainly located in the northern part of the country, normally representing over 90% of the country's total power generation. Thus the power system reliability is very dependant on the hydro conditions.

Figure 1: KESH Installed Capacity



The three main hydro developments are located in the north of the country. These developments are:

- Drin River cascade, in the north of the country, representing a total installed capacity of 1,350 MW (90% of Albania's generation mix) with 3 hydropower plants: Fierzë HPP (500 MW), Komani HPP (600 MW) and Vau Dejës HPP (250 MW);
- Mati River cascade, also located in the north of the country, including Ulza and Shkopet HPPs with a total installed capacity of 50 MW;
- Bistrica River cascade, including Bistrica 1 and Bistrica 2 HPPs with a total installed capacity of 27.5 MW.

In addition, some small hydropower plants with a total capacity of 20 MW are in operation: Selita/Lanabregas, Bogovë, Smokthinë, and Gjanci.

Table A7.1: Albania Hydro Installed Capacity

Plant Name	Installed Capacity (MW)	Average Annual Generation (GWh)
Komani	600	1,600
Fierzë	500	1,100
Vau Dejës	250	810
Bistrica 1	27.5	158
Ulza & Shkopet	50	
Small HPPs	20	306
Total	**1,447.5**	**3,974**

The two thermal power plants are Fier and Ballsh. TPP Fier has six units with a total installed capacity of 135 MW, but only one unit 12 MW is in operational condition, while TPP Ballsh has two units with a total installed capacity of 24 MW, but since 1999 has operated only to provide heat. The maximum continuous power outputs of generating units are significantly lower than their rated power. The total available capacity of all Albanian thermal generating units in 2004 was estimated at about 12 MW.

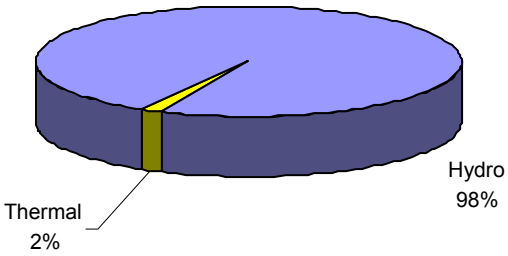
Table A7.2: Albania Thermal Installed Capacity

Plant Name	Installed Capacity (MW)	Type of Fuel	Retirement Year[1)]
Fier[2)]	72	Oil/gas	After 2020
Balsh[3)]	24	Oil/gas	After 2020
Total	**72**		

1. *Appendix 8 contains a discussion regarding the rehabilitations plans for these thermal plants.*
2. *After Rehabilitation (from 2007)*
3. *Heat Only*

The total generation in 2003 for the Albanian electrical system is presented in Figure 2. The figure shows a total net generation of 4,905 GWh, with the hydropower accounted for 4,824 GWh (98 %) while the thermal units generated 81 GWh (2 %).

Figure 2: Albania Production, GWh (2003)



A7.2.2 Transmission and Distribution

The transmission system includes the 400, 220 and 110 kV voltage levels, the transmission lengths at each transmission level are shown on Table A7.3. The Albanian power system has 220high voltage substations with a total installed capacity of 5,031 MVA. The table indicates the total substation capacity, for each voltage level.

Table A7.3: Albania Transmission Network

Overhead Lines	400 kV	220 kV	150 kV	110 kV	Subtotal	Below 110 kV
Length (km)	120	1,100	50	1,198	2,468	45,712

Substations (kV)	400/220	220/X	115/110	110/X	MT/LT	Total
No. of Substations No. of Transformers Installed Power (MVA)	600	1,699	40	1,732.8	1,259.2	5,331

The map of the 400 and 220 kV system is presented in Figure.3.

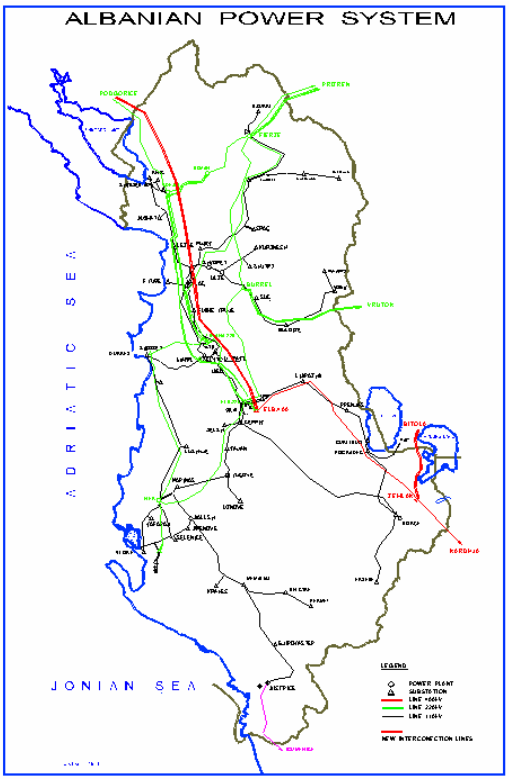


Figure 3: Albania Power Grid

The Albanian Power System is facing serious problems due to insufficient development of the transmission system and lack of rehabilitation and upgrading of the equipment during the last 15 years. This has considerably reduced the reliability of system operation and the quality of electricity supplied, and has limited the exchange capacity with neighbouring jurisdictions. The main existing problems are the followings:

- Overloading of several 220 kV transmission lines causes losses, a lower voltage level than standards and load shedding,
- Lack of system flexibility and the operation not in accordance with n-1 criteria, reduces the reliability and capacity of the transmission system,
- Lack of possibility to operate in an optimal way and non-balancing of the reactive power,
- Many assets of the 220/110 kV substations are old and during recent years maintenance operations barely existed,
- Limitation of electricity exchange capacity with neighbouring jurisdictions,
- Old and inefficient controlling system communications.

Based on the need for upgrading and development of the main transmission equipment, to support the network increasing capacity for electricity import and the development of the transmission and distribution system, the World Bank, in cooperation with other donors, has approved a package for the Transmission and Distribution System Rehabilitation Project. The project objectives are as follows:

- Improvement of all standards, quality and efficiency of the transmission system,
- Optimal operation, the reduction of technical losses and the improvement of voltage profile,
- Support and development of intermediate transmission and distribution equipment,

- Upgrading and extension of exchange capacities with neighbouring jurisdictions especially at times when the increased demand for electricity in Albania has to be met from import.

Since 1999, the Ministry of Industry and Energy, and KESH have started a number of rehabilitation projects for the distribution system. The plans are part of the rehabilitation project of the transmission and distribution system financed by the donors group, consisting of:

a) The rehabilitation of distribution system equipment in 10 main cities: Tirana, Durres, Shkodra, Vlora, Elbasan, Fier, Lushnje, Kavaja, Lezha, Berati as well as in the urban area in both sides of Tirana-Durres road. As regards the demand side, the substitution of the distribution system is a necessity, taking into consideration the introduction of the 110/20 kV network as a substitute for the existing voltage levels of 35/10 and 35/6 kV,
b) The rehabilitation of distribution equipment for the second group of smaller cities to reach covering of demand through the change of the voltage level from 6 to 10 kV and the total substitution of the existing equipment, and
c) Rehabilitation of the distribution system in rural areas by changing the voltage level from 6 to 10 kV.

In the framework of the Power Sector Action Plan, submitted to the donors on December 2000, KESH, assisted by ENEL, has developed an investment plan with projects for the upgrading, rehabilitation and enforcement of the transmission and distribution system. The most important investments of the plan are:

1. BISABU Project financed by the German Government. The project will rehabilitate Bistrica 1&2 HPPs, reconstruct Saranda, Permet and Tepelena distribution networks and improve Gjirokastra substation.
2. Transmission and Distribution Rehabilitation Project: World Bank and Donors, as described in the energy scenario analysis, will finance an investment package (following list) of approximately 23 million USD.
3. Construction of a new 220/110 kV substation in Rashbull (Durres), with an approximate cost of US$ 8 million. The project is under construction.
4. Construction of a new Dispatching Centre that will drastically improve the transmission network operation, prevent the emergency conditions and implement the electricity shortage procedures.
5. “March 2000” Package: KESH has received a fund of Italian Lt. 17 milliard from the Italian Government for the reconstruction of 5 new substations of 110/20 kV and the development of the 20 kV distribution network for Tirana, Shkodra, Durres and Kashar. Most part of the package has been fulfilled.
6. Projects financed by the Albanian Government: The state budget has provided a considerable fund for different projects in the distribution system.

A7.3 Bosnia and Herzegovina - Power Generation and Transmission Network Systems

There are three independent power companies operating in Bosnia and Herzegovina. These companies are Elektroprivreda BIH (EPBiH), Elektroprivreda Hrvatske Zajednice Herceg-Bosne (EPHZHB), and Elektroprivreda Republike Srpske (ERS). In the map shown in Figure 4, EPBiH is operating in the light-green-colored area, EPHZHB operates in the light-blue-colored area, and ERS operates in the white-colored area.

Figure 4: Bosnia and Herzegovina Power Grid

A7.3.1 Generation Capacity

As given in Table A7.4, the installed capacity in Bosnia and Herzegovina totals 3,714 MW. EPBiH has the largest generating capacity with a total of 1,654 MW or 45% of the installed capacity. With thermal power plants in Tuzla (4 units totaling 715 MW) and in Kakanj (three units totaling 450 MW) EPBiH also has the largest thermal share of all three companies. The oldest units in these two power plants (units with installed capacity of 32 MW) were commissioned before 1964 and are shut-down.

Table A7.4: Bosnia and Herzegovina Generating Capacity by Company

Generating Capacity (MW)	EPBiH	EPHZHB	ERS	Total
Hydro	489	742	718	1,949
Thermal	1165	0	600	1765
Total	**1654**	**742**	**1,318**	**3,714**

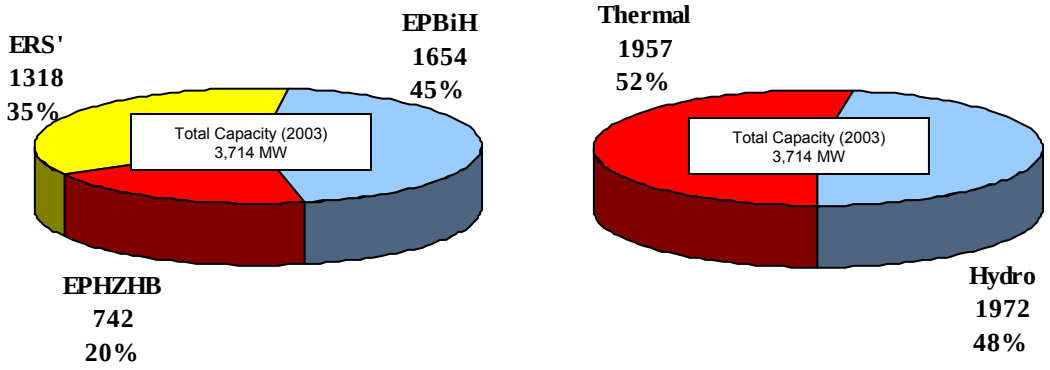


Figure 5: Bosnia and Herzegovina Installed Capacity

The second largest company is EPBiH with a total of 1,654 MW of generating capacity consisting of 30% in hydro and 70% in thermal power plants. With its 742 MW of hydro generating capacity, EPHZHB is the smallest utility in the country (20% of installed capacity). For the entire country, the thermal generating units account for 48 % (1,765 MW) of the total installed capacity. All thermal units are fired with brown coal, lignite, or a mix thereof.

Tables A7.5 and A7.6 presents a summary of the main generation plants on the Bosnia and Herzegovina power system.

Table A7.5: Bosnia and Herzegovina - Hydro Installed Capacity

Plant Name	Installed Capacity (MW)	Average Annual Generation (GWh)
Rama	160	515.6
Capljina S	420	-
Jajce 1	60	221.3
Jajce 2	30	165.1
Mostar	72	210.1
Trebinje I	180	492
Trebinje II	8	31.6
Dubrovnik[1)]	105[1)]	609.5
Bocac	110	301
Visegrad	315	1,090
Jablanica	165 (3x25+3x30)[2)]	610.5
Grabovica	114 (2x57)	292
Salakovac	210 (3x70)	421
Total	**1,949**	**4959.7**

1. *Under the current conditions, one unit is committed to deliver its energy production to the Croatian power system.*
2. *In HPP Jablanica three units rehabilitated and modernized with change characteristics nominal power from 25 MW to 30 MW.*

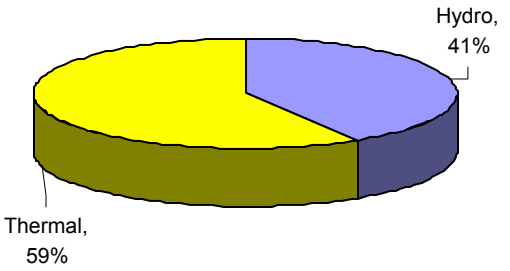
Table A7.6: Bosnia and Herzegovina - Thermal Installed Capacity

Plant Name	Installed Capacity (MW)	Type of Fuel	Retirement Year
Gacko	300	Lignite	2023
Ugljevik	300	Br coal	2025
Tuzla 3	100	Br coal & lignite	After 2020
Tuzla 4	200	Br coal & lignite	2021
Tuzla 5	200	Br coal & lignite	2022
Tuzla 6	215	Br coal	2023
Kakanj 5	110	Br coal	2023
Kakanj 6	110	Br coal	2024
Kakanj 7	230	Br coal	2028
Total	**1765**		

1. Appendix 8 contains a discussion regarding the rehabilitations plans for these thermal plants.

The total generation in 2003 for the Bosnia and Herzegovina electrical power system is presented in Figure 6. The figure shows a total net generation of 11,257 GWh, with the hydropower accounted for 4,628 GWh (41%) while the thermal units generated 6,629 GWh (59%). The breakdown of the total net generation by each of the three power companies is follow:

Figure 6: Bosnia Herzegovina Production, GWh (2003)



- EPBiH: total net generation of 5,362 GWh, with hydropower accounting for 1,248 GWh (23%) while the thermal units generated 4,114 GWh (77%);
- EPHZHB: total net generation of 1,238 GWh hydropower (100%);
- ERS: total net generation of 4,657 GWh, with hydropower accounting for 2,142 GWh (46%) while the thermal units generated 2,515 GWh (54%).

The total net generation from three power companies in the total generation in 2003 for the Bosnia and Herzegovina was split: EPBiH 48%, EPHZHB 11% and ERS 41%.

A7.3.2 Transmission and Distribution

Transmission lines connect the three systems with each other and also tie the country to its neighbours. Voltage levels and transmission line information are given in Table A7.7 by company and in Table A7.8 by voltage level (substations). The data refers to the position at the end 2003.

Table A7.7: Transmission and Distribution Lines by Company

Transmission Lines (km)	EPBiH	EPHZHB	ERS	Total
400-kV	179	89	430	698
220-kV	594	358	414	1,366
110-kV	1,362	453	1,655	3,470
Cable 110 kV	31	N/A	N/A	31
Total	**2,166**	**900**	**2,499**	**5,565**

Distribution Lines (km)	EPBiH	EPHZHB	ERS	Total
35 kV	800	N/A	N/A	N/A
10/20 kV	7,546	N/A	N/A	N/A
0.4 kV	20,151	N/A	N/A	N/A
Total	**28,497**	N/A	N/A	N/A

Table A7.8: Transmission and Distribution Substations

Substations (kV)	400/110	220/110	110/X	MT/LT	Total
No. of Substations	N/A	N/A	N/A	N/A	N/A
No. of Transformers					
Installed Power (MVA)	1,400	1,200	2,124	N/A	N/A

Transmission Substations (kV)	Company	400/220/110	220/110	110/X	Total
No. of Substations	EPBiH	2	4	48	**54**
	EPHZHB	N/A	N/A	N/A	N/A
	ERS	N/A	N/A	N/A	N/A
No. of Transformers	EPBiH	4	8	79	**91**
	EPHZHB	N/A	N/A	N/A	N/A
	ERS	N/A	N/A	N/A	N/A
Installed Power (MVA)	EPBiH	1,400	1,200	2,144	**4,744**
	EPHZHB	N/A	N/A	N/A	N/A
	ERS	N/A	N/A	N/A	N/A

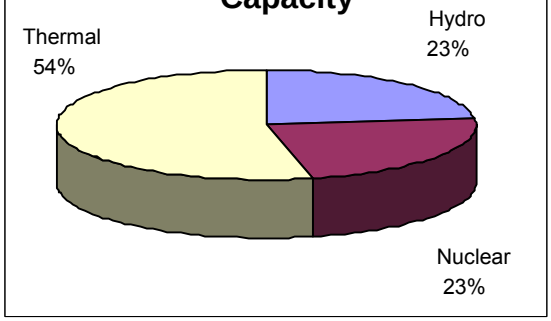
Distribution Substations (kV)	Company	35/X	10(20)/0.4	Total
Installed Power (MVA)	EPBiH	591	2,407	**2,998**
	EPHZHB	N/A	N/A	N/A
	ERS	N/A	N/A	N/A

A7.4 Bulgaria – Power Generation System

A7.4.1 Generation Capacity

The total installed capacity on the Bulgarian Electrical system is a total of 12357 MW. The breakdown based on the type of generation is: 2,864 MW hydro plants, 2,880 MW nuclear plants and 6613 MW thermal plants.

Figure 7: Bulgaria Installed Capacity



The total installed capacity of all hydro power plants in Bulgaria is 2,864 MW, which includes about 1399 MW of turbining capacity in the Chaira (864 MW), Belmeken (375 MW) and Orfei (160 MW) plants. The total installed pumping capacity in these plants is 934 MW.

There are 6 large complexes of cascading dams. Each one consists of at least three hydroelectric power plants, totaling 18 stations with maximum power generation of 4,571 million kilowatt-hours (kWh). The Belmeken-Sestrimo cascade and Iskar cascade are located in the Rila Mountains; the Vacha cascade, Batak cascade, and Arda cascade in the Rodopi mountains. Other cascades are at Iskar, in the Rila Mountains, and Sandanska Bistritsa, in the Pirin mountains. In 1995, Bulgaria completed the first stage of the largest pumped-storage hydroelectric power station in the country, located at Chaira. The second stage was commissioned in 1999.

The following table gives the main technical characteristics of the existing hydropower schemes.

Table A7.9: Bulgaria Hydro Installed Capacity

Plant Name	Installed Capacity (MW)	Average Annual Generation (GWH)
Sestrimo	240	152
Momina Klissura	120	67
Krichim	80	177
Devin	80	97
Teshel	60	166
Peshtera	125	447
Aleko	66	193
Batak	40	109
Kurdzhali	106	110
Ivailovgrad	104	140
Studen Kladenets	60	167
Chaira	864/784	
Belmeken	375/110[1)]	
Orfei	160/40[2)]	
Others	384	1100
Total	2,864	2925

1. *Belmeken has 5 installed turbines with single capacity of 75 MW each, and only 2 of them have pumps with single capacity of 55 MW each*
2. *Orfei has 4 installed aggregates with single capacity of 40 MW each, and only one of them can be operated in a PSHPP regime.*

Bulgaria has one nuclear power plant, Kozloduy, located 200 km to the north of Sofia on the Danube River. In 2003, the Kozloduy complex produced 17,278 GWh. The Kozloduy complex, the largest plant in the Balkan Peninsula, has four units, using the Russian-designed VVER reactors. Units 1, 2, 3, and 4 were commissioned in 1974, 1975, 1980 and 1982 respectively, and

Units 1 and 2 were retired in 2003. Units 5 and 6 were commissioned in 1987 and 1991, respectively. The total capacity of all four units is 2880 MW.

The EU is conditional on the early closure of the nuclear power units at Kozloduy, and the Government agreed to close Units 3 and 4 in 2006.

Most of the thermal generating units need rehabilitation and modernization. Preparatory work has been carried out for the rehabilitation of thermal power plants that would result in improvements in reliability and economy.

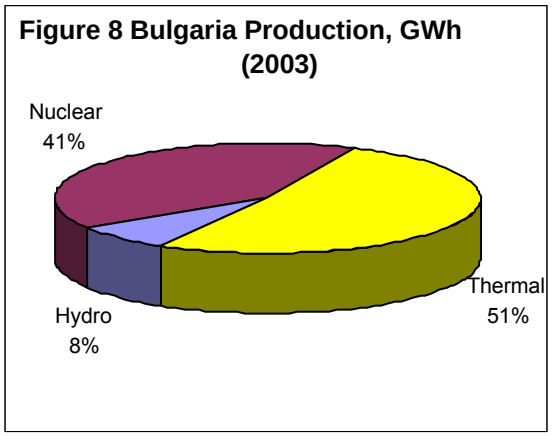
Bulgaria's thermal plants are shown in the following table, which provides key characteristics of these plants, including available capacity, type of fuel burned and retirement year. The plants shown in the table include all plants owned by NEK, as well as cogeneration and industrial units.

Table A7.10: Bulgaria Thermal Installed Capacity

Plant Name	Installed Capacity (MW)	Type of Fuel	Retirement Year[1)]
TPP Brike	200	Lignite	2010
TPP Maritsa East 2	600	Lignite	After 2020
TPP Maritsa East 2	840	Lignite	After 2020
TPP Maritsa East 3	840	Lignite	After 2020
TPP Varna	1260	Import.coal	After 2020
TPP Ruse	400	Import.coal	After 2020
TPP Maritsa 3	170	Lignite	2010
TPP Bobov Dol	630	Blend coal	2008,2012,2015
TPP Sofia	125	NG	After 2020
TPP Sofia-East	186	NG	After 2020
TPP Plovdiv	55	Residual	After 2020
TPP NHK Bourgas	130	Residual	After 2020
TPP Devnja-cogen.	60	NG	After 2020
TPP Sviloza	100	Import.coal	After 2020
TPP Chimko	50	NG	After 2020
Other Industrial	578	Residual	After 2020
Other CHP	389	NG	After 2020
Total	**6613**		

1. Appendix 8 contains a discussion regarding the rehabilitations plans for these thermal plants.

The total generation in 2003 for the Bulgarian electrical system is presented in Figure 8. The figure shows a total gross generation of 42,546 GWh, with hydropower accounting for 3,294 GWh (8 %), while exported thermal units generated 21,974 GWh (51 %) and nuclear 17,278 GWh (41%). Bulgaria exported a total of 5,489 GWh, during 2003.



A7.4.2 Transmission and Distribution

The power transmission network of Bulgaria consists of 85 km of 750 kV lines, 2,266 km of 400 kV lines, 2,650 km of 220 kV lines and 9,511 km of 110 kV lines. A brief summary of the transmission network is presented on the following table.

Table A7.11: Transmission Network

Overhead Lines	750 kV	400 kV	220 kV	110 kV	Total
Length (km)	85	2,266	2,650	9,511	14,512

Substations (kV)	750/X	400X/220X	110/X	Total
No. of Substations	1	28	248	277
No. of Transformers				
Installed Power (MVA)	2,500	14,654	13,095	30,249

The transmission network of Bulgaria is directly interconnected to the transmission networks of Ukraine (one 750 kV line), Moldova (one 400 kV line), Romania (one 750 kV line, two 400 kV lines and one 220 kV line), F.R. Yugoslavia (one 400 kV line), Greece (one 400 kV line) and Turkey (one 400 kV line).

Since 1988, a 750-kV transmission line serves the interconnection of the Bulgarian power system with the power systems of Ukraine and Romania (Isaccea substation). The line has been mainly used for improving the reliability of the Bulgarian power system, having large nuclear generating units of 3,500-MW. It is anticipated that the 400 kV transmission network, carrying most of the electricity generated, will remain the main transmission network in the future.

From the regional system point of view, the Bulgarian transmission system has a ring configuration, is interconnected with 400-kV tie lines with F.R. Yugoslavia, Greece, Turkey, and Moldavia and double circuit 400-kV and 750-kV tie lines with Romania. There are modern dispatching facilities, and telecommunication and data exchange facilities with Dispatching Centres of neighbouring jurisdictions are under development.

Figure 9: Bulgaria Power Grid

A7.5 Croatia – Power Generation System

Upon the independence of the Republic of Croatia in 1991, several state-owned public enterprises were formed, among them Hrvatska Elektroprivreda (HEP). The 119 independent electricity entities in the Croatian territory were then consolidated into a single enterprise organized on a functional-territorial basis. In the form of a government-owned stock company, HEP has operated since 1994; in July 1995 it was harmonized with the then new Companies Act.

HEP supplies 95 percent of electricity demand in Croatia. The remaining 5 percent is generated by industrial cogeneration plants and small private hydro power plants.

A7.5.1 Generation Capacity

The installed capacity is 3,965 MW. The generation capacity mix includes 1,935 MW of hydro capacity, 1,676 MW of thermal capacity and 354 MW of nuclear capacity.

The hydro plants on the Croatian system ranging from 6.5 MW to 486 MW in size. Their installed capacity and potential generation in a year of average hydrologic conditions are shown in the following table.

Figure 10 Croatia Installed Capacity

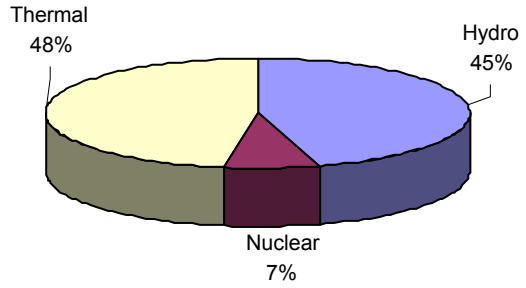


Table A7.12: Croatia Hydro Installed Capacity

Plant Name	Installed Capacity (MW)	Average Annual Generation (GWH)
Varazdin	90.0	489.2
Cakovec	76.0	385.3
Dubrava	76.0	358.0
Gojak	48.0	199.5
Rijeka	36.8	97.0
Sklope	22.5	78.3
Senj	216.0	981.5
Golubic	6.5	58.7
Vinodol	84.0	130.7
Miljacka	23.6	121.6
Velebit	276.0	334.7
Peruca	41.6	122.5
Orlovac	237.0	374.6
Zakucac	486.0	1610.2
Djale	40.8	133.2
Kraljevac	46.4	42.2
Dubrovnik[2)]	105.0	620.5
Others	22.7	N.A.
Total	**1935.0**	**6137.7**

1. Under the current conditions, one unit is committed to deliver its energy production to the Bosnia and Herzegovina power system.

The nuclear power plant Krsko was set in operation at the end of 1981 and was built by Westinghouse company. It is a PWR plant with 2 steam generators. It has an installed capacity of

707 MW and a net capacity of 676 MW. It is jointly owned by Croatia and Slovenia and the generated electricity is shared half and half.

The remaining generation capacity is entirely thermal plants, which are presented in the following table.

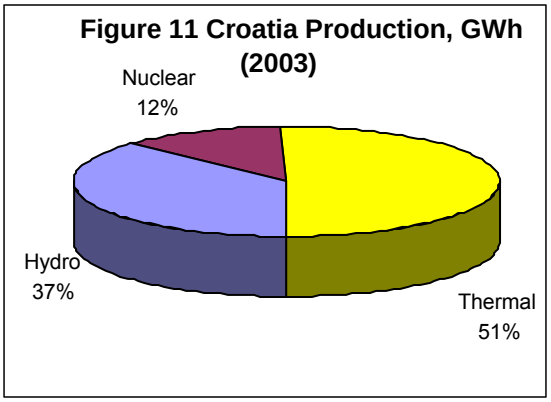
Table A7.13: Croatia - Thermal Installed Capacity

Plant Name	Installed Capacity (MW)	Type of Fuel	Retirement Year[1)]
Sisak	420	Oil/gas	(2013, 2017)
TE-TO Zagreb	345	Oil/gas	2009 (unit 1 - 25 MW) 2010 (unit 2 - 110 MW) unit 3 - 210 MW beyond 2020
Rijeka	320	Oil	2015
Plomin 1	120	Coal	2015
Plomin 2	210	Coal	beyond 2020
EL-TO Zagreb	77.8	Oil/gas	unit 1 - 11 MW out of oper. 2010 unit 2 - 30 MW unit 3&4- 47.8 MW 2018
Jertovec	83	Gas	2013
Osijek	48	Gas	2015
Osijek	42	Oil/gas	2011
Emergency Diesel	29	Oil	reserve capacity
Total	**1,676**		

1. Appendix 8 contains a discussion regarding the rehabilitations plans for these thermal plants.

The total generation in 2003 for the Croatian electrical system is presented in Figure 11. The figure shows a total net generation of 13,223 GWh, with hydropower accounting for 4,897 GWh (48 %) while thermal units generated 6,703 GWh (41 %) and nuclear generated 1,623 GWh.

Figure 11 Croatia Production, GWh (2003)



A7.5.2 Transmission and Distribution

The Croatian transmission system operates at the following levels: 400 kV, 220 kV and 110 kV. The transmission lengths at each transmission voltage level are: 157.4 km (400 kV), 1,245.1 km (220 kV) and 4,762.6 km (110 kV).

The transformation capacity allocated on the system substations is distributed as follows:

Table A7.14: Croatia Transmission Network

Overhead Lines	400 kV	220 kV	110 kV	Below 110 kV	Total
Length (km)	1,157	1,245	4,836	121,465	128,703

Substations (kV)	400/220	220/X	110/X	MT/LT	Total
No. of Substations	5	12	142	23,721	23,880
No. of Transformers					
Installed Power (MVA)	3,400[1]	3,150[2]	6,695[3]	10,690[4]	23,935

Notes:
1. *Including Generation (300 MVA)*
2. *Including Generation (750 MVA)*
3. *Including Generation (476 MVA), Industrial Consumers (851 MVA) and Railroad (232.5 MVA)*

The transmission system map is presented in Figure.12.

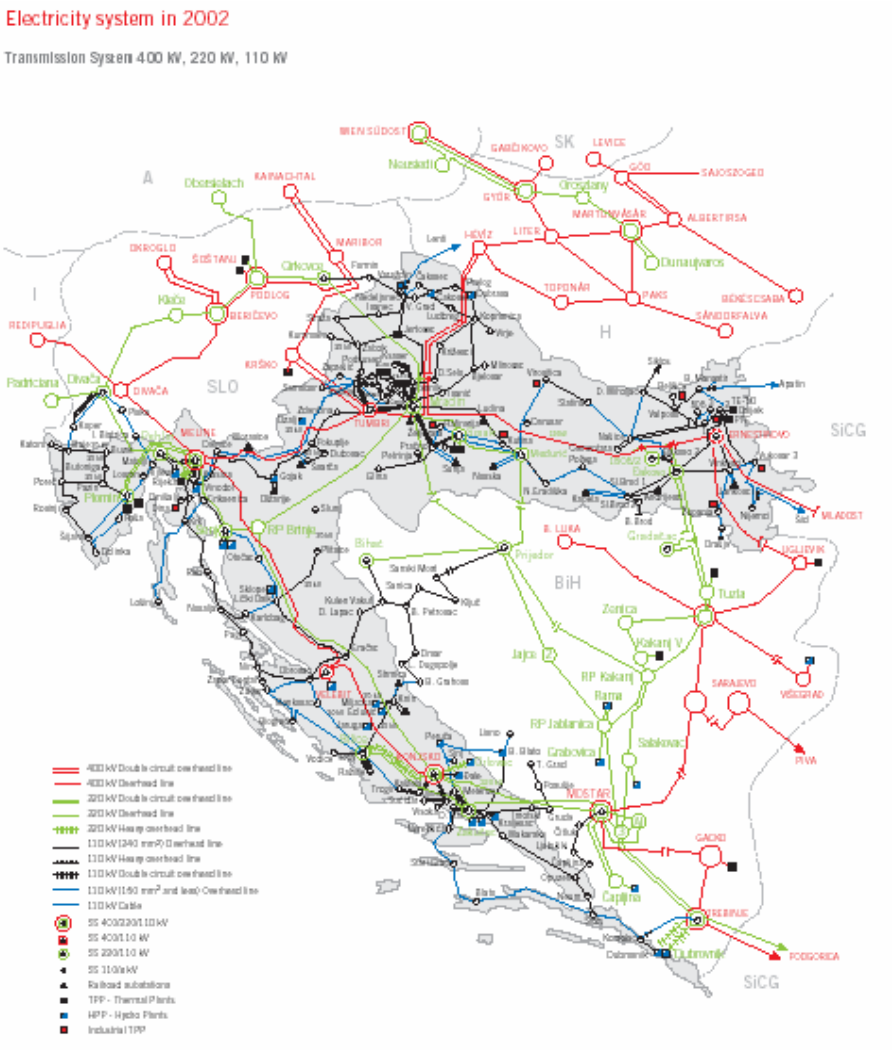


Figure 12 Croatia Power Grid

A7.6 Macedonia – Power Generation and Transmission Network Systems

Generation, transmission and distribution of electricity is performed by the public enterprise: Elektrostopanstvo na Macedonia (ESM). ESM controls about 97 percent of the total production capacity of the country. The new Energy Law provides opportunities for the private sector (domestic and foreign legal entities) to participate in all aspects of generation, transmission and distribution.

A7.6.1 Generation Capacity

Six large hydropower plants have been constructed and a new one, Kozjak, was commissioned in September 2004. Table A7.15 summarizes the main characteristics of these plants. Three of them (Vrutok, Vrben and Raven) form the Mavrovo system with a single useful storage reservoir of 277 million m^3. The capacity of the total system is 182 MW. Two other plants (Globocica and Spilje) are located on the Crni Drim River and the plant Tikves is located on the Crna River.

Table A7.15: Macedonia - Hydro Installed Capacity

Plant Name	Installed Capacity (MW)	Average Annual Generation (GWH)
Vrben	12.8	44
Vrutok	150.0	381
Raven	19.2	46
Globocica	42.0	191
Spilje	84.0	294
Tikves	92.0	184
Kozjak	80.5	147
Total	**480.5**	**1,287**

A number of small hydropower plants have been constructed. The total installed capacity is 35.8 MW but the energy contribution of these plants is small.

About seventy percent of the annual energy demand is provided by the Bitola thermal plant that is located near the Suvodol lignite mine. It has three units with a total capacity of 675 MW. The units were commissioned in 1982, 1984 and 1988. There are two other thermal plants. The Oslomej lignite-fired plant has one 120 MW unit and was commissioned in 1980. It produces about 10 percent of the total production in Macedonia. The third plant is the Negotino plant. It is the oldest thermal plant and was designed for two 210 MW units but only one unit was constructed and commissioned in 1978. The plant was designed to burn heavy fuel oil but it can also use natural gas. In recent years, the plant has not been used due to the high fuel cost and lack of demand. Table A7.16 summarizes the main characteristics of these plants.

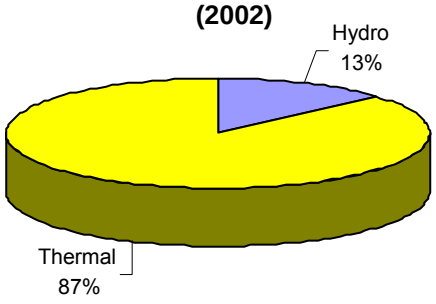
Table A7.16: Macedonia - Thermal Installed Capacity

Plant Name	Installed Capacity (MW)	Type of Fuel	Retirement Year[1)]
Bitola	675	Lignite	2012/2014/2018
Oslomej	120	Lignite	2010
Negotino	210	Oil/gas	2008
Total	1,005		

1. Appendix 8 contains a discussion regarding the rehabilitations plans for these thermal plants.

Figure 13 shows the energy generation for ESM system on the year 2002. Generation in 2002 was 5,618.8 GWh with 755.4 GWh (13%) coming from the hydro power plants, and 4,863.4 GWh (87 %) from the thermal units. The thermal units have been providing the majority of the energy consumed on the Macedonian electrical system.

Figure 13: ESM Production (2002)



A7.6.2 Transmission and Distribution

The main transmission network of Macedonia consists of overhead transmission lines rated at 400 kV, 220 kV and 110 kV. There is also one 150 kV line used as a connection with Greece. The characteristics of the network are shown in Table A7.17 (Including large consumers 110 kV substations.).

Table A7.17: Macedonian Transmission Network

Overhead Lines	400 kV	220 kV	150 kV	110 kV	Below 110 kV	Total
Length (km)	419	103	23	1,659	22,178	24,397

Substations (kV)	400/110	220/110	150/110	110/X	MT/LT	Total
No. of Substations	4	2	1	66	n.a.	n.a.
No. of Transformers	7	4	2	128	6,424	6,565
Installed Power (MVA)	2100	600	100	3,379	2,694	8,873

The 400 kV system is the backbone of the transmission network. It passes through the middle of the country, connecting the Bitola thermal plant to the main load centre of Skopje. Figure 14 shows the connections with the neighboring power systems.

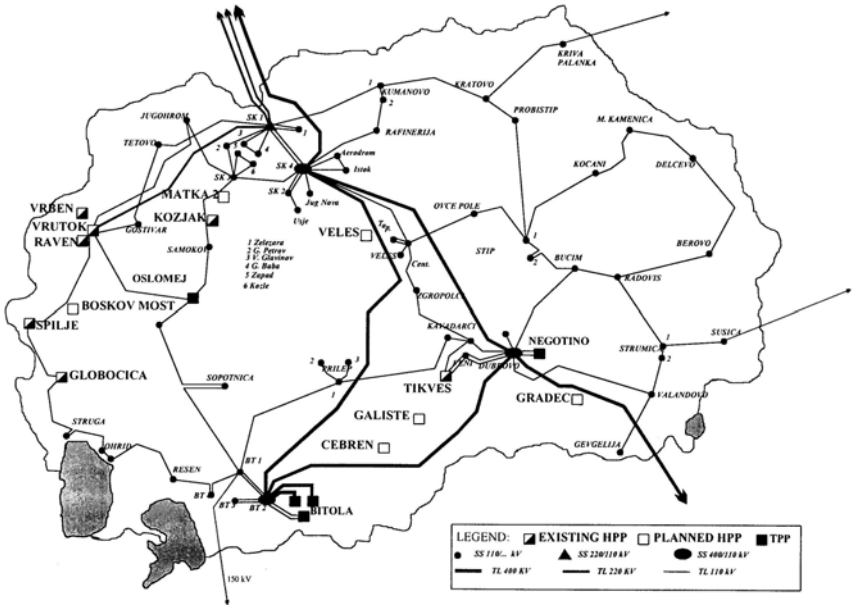


Figure 14: Macedonia Power Grid

A7.7 Montenegro - Power Generation and transmission Network Systems

The power system of Montenegro is operated by the Electric Power Company of Montenegro: Elektroprivreda Crne Gore (EPCG). Despite large imports of electricity (about 34% of total demand in 2001 and 62% in 2003), Montenegro's power sector still faces supply shortages. The shortages were caused by a continuing drought cutting the hydropower production combined with an increasing demand that reached 4,236 GWh in 2001 (a 6.9 percent increase compared to 2000) and 4393 GWh in 2003.

A7.7.1 Generation Capacity

With a total installed capacity of 849 MW in 2003 the Montenegrin system is relatively small and consists essentially of one thermal unit (Pljevlja with a net available capacity of 191 MW) and two hydro power plants (Piva with 342 MW and Perucica with 307 MW. Serbia and Montenegro have a long-term power exchange agreement in place for the Piva power output whereby Montenegro makes available the Piva power output (mostly peak energy) and receives a greater amount of base load power from EPS in return (about 105 MW to EPCG on 24 hours per day).

Figure 15: Montenegro Istalled Capacity, MW (2001)

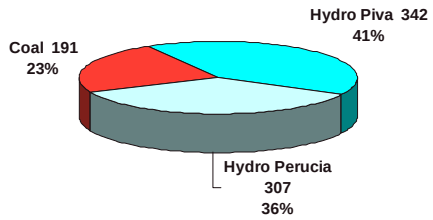


Table A7.18: Montenegro - Hydro Installed Capacity

Plant Name	Installed Capacity (MW)	Average Annual Generation (GWH)
Perucica	307	1,071
Piva	342	924
Total	**649**	**1,995**

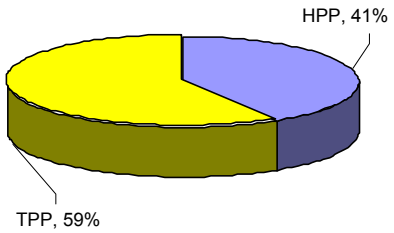
Table A7.19: Montenegro - Thermal Installed Capacity

Plant Name	Installed Capacity (MW)	Type of Fuel	Retirement Year[1)]
Pljevlja	191	Lignite	2025[2)]
Total	**191**		

1. Appendix 8 contains a discussion regarding the rehabilitations plans for these thermal plants.
2. After rehabilitation

Generation in the Montenegrin system is dominated by hydropower. In 2003, EPCG had a total net generation of 2,607 GWh. Hydropower accounted for 1,533 GWh (59%) while the Pljevlja coal unit generated 1074 GWh (41%), as presented in Figure 16.

Figure 16: Montenegro Production, GWh (2003)



A7.7.2 Transmission and Distribution

The system consists of 400 kV lines, 220 kV lines, and 110 kV lines. Interconnections exist with Serbia on 400 kV and 220 kV lines, with Albania on 220-kV lines, and with Bosnia and Herzegovina on all three levels.

Table A7.20: Montenegro Transmission Network

Overhead Lines	400 kV	220 kV	110 kV	Subtotal	Below 110 kV
Length (km)	254	318	657	1,229	19,380

Substations (kV)	400/220	400/110	220/110	110/X	Subtotal	MT/LT
No. of Substations	1	1	3	17	22	2,249
No. of Transformers	2	2	4	30	38	
Installed Power (MVA)	800	600	700	774	2,874	1,580

The following figure shows the power system of Montenegro.

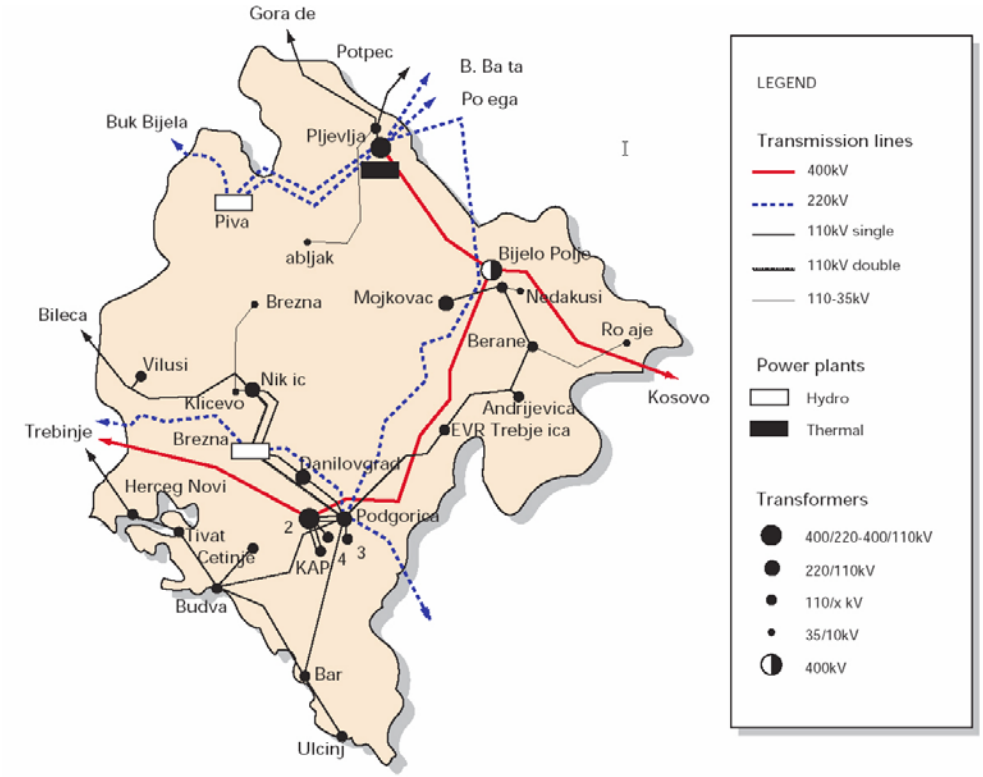


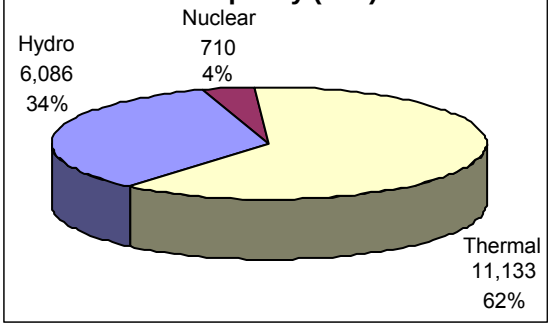
Figure 17: Montenegro Power Grid

A7.8 Romania – Power Generation System

A7.8.1 Generation Capacity

The installed capacity of Romanian power system, in the year 2003, was 17.926 GW, of which 11.133 GW was thermal power and CHP plants, 6086 GW was hydro and 0.707 GW was nuclear power. An important feature of the Romanian electricity production system is the presence of a significant amount of co-generation power plants with capacity of 3.513 GW.

Figure 18: Romania: Installed Capacity (MW)



With its many rivers, Romania has great potential for hydroelectric power (as much as 14,800 MWe), but the current generating capacity only contributes a relatively small amount of Romania's power needs. The total hydroelectric power potential is about 40 TWh per year of which 18 TWh per year has already been developed.

The Romanian government has encouraged foreign investment in hydropower through Hydroelectrica, the state-owned hydropower producer. In 1999, Sulzer Hydro of Switzerland won a contract from Hydroelectrica to refurbish six turbines at the Portile de Fier I (Iron Gates I) power plant on the Danube River. There are twelve turbines at the Iron Gates plant; six are operated by Romania and six are operated by Serbia. It is expected that the project will be completed in 2005 and the capacity of the six Romanian turbines will increase to 1,164 (6x194) MWe from their initial capacity of 1,050 (6x175) MWe.

In addition to Portile de Fier, there are eleven other hydroelectric facilities with capacities of at least 100 MWe, and dozens of medium-sized facilities of at least 30 MWe. Collectively, these power stations represent about 40% of Romania's currently-operating hydroelectric generating capacity. A summary of these major hydroelectric power plants in Romania is shown in Table A7.21.

Table A7.21: Hydro Installed Capacity

Plant Name	Installed Capacity (MW)	Average Annual Generation (GWh)
Portile de Fier	1,398	5890
Lotru	510	755
Retezat	335	201
Mariselu	221	366
Vidraru	220	393
Stejaru	210	557
Sugag	150	132
Gilceag	150	156
Ruieni	140	124
Bradisor	115	181
Tismana	106	121
Remeti	100	163
Others	2,431	3,970
Total	**6,086**	**13,009**

The Cernavoda nuclear power plant is located 90 miles east of Bucharest. The original plan for Cernavoda called for five 700 MW pressurized heavy water reactors (PHWRs) from Atomic Energy of Canada. The first one, Cernavoda 1, went online in December 1996. It was the first Western-designed nuclear reactor in Eastern Europe.

Most of the thermal power plants technologies are from the 1960's and early 1970's. Because of the decline in demand, many plants which have exceeded their operating life have been decommissioned or moth-balled. Only the higher efficiency plants are operated. A number of units are being refurbished to increase availability and efficiency.

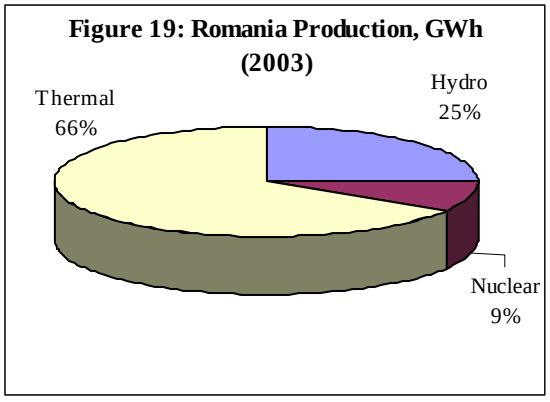
The 25 largest thermal-electric power plants in Romania represent about 95% of the fossil-fuel generating capacity. A summary of these power plants is shown in Table A7.22.

Table A7.22: Romania - Thermal Installed Capacity

Plant Name	Installed Capacity (MW)	Type of Fuel	Retirement Year[1)]
Turceni	1,650 (7x330)	Lignite	2007, 2009
Rovinari	990 (4x330)	Lignite	2008, 2010
Mintia-Deva	1,274	Black coal	After 2020
Isalnita	630 (2x315)	Lignite	2010, After 2020
Braila	644 (224+2x210)	Oil/gas	2013,2015,2017
Brazi	260 (2x105+2x50)	Oil/gas	After 2020
Ludus	800 (2x200+4x100)	Gas	2x2005, 2004, 2006,2x2007
Borzesti	210	Oil/gas	2009
Bucuresti Sud	550 (2x125+2x100+2x50)	Oil/gas	2005, 2008, 4x2005
Galati	375 (3x105+60)	Gas/coke Gas/furnace gas	After 2020
Doicesti	200	Lignite	2007
Paroseni	250(150+2x50)	Coal	After 2020, 2-2010
Bucuresti Vest	250 (2x125)	Gas	2005, 2010
Others	2,720		
Total	**11,133**		

1. Appendix 8 contains a discussion regarding the rehabilitations plans for these thermal plants.

The total generation in 2003 for the Romanian electrical system is presented in Figure 19. The figure shows a total net generation of 51,525 GWh, with hydropower accounting for 13,009 GWh (25%) while thermal units generated 33,952 GWh (66%) and nuclear 4,564 GWh (9%).



A7.8.2 Transmission and Distribution

Romania has an extensive interconnected power transmission and distribution network with an overall length of about 239,618 km, and a total transformer capacity of about 93,554 MVA. The national grid operates on 750 kV, 400 kV, and 220 kV for transmission and 110kV, 35kV, 20kV, 10kV, 6kV, 1kV and 0.4kV for distribution. The circuit lengths and transformation capacity at each voltage level are shown on Table A7.23.

Table A7.23: Romania Transmission Network

Overhead Lines	750 kV	400 kV	220 kV	110 kV	Below 110 kV	Total
Length (km)	155	4,475	4,132	18,441	212,415	239,618

Substations (kV)	750/X	400/X	220/X	110/X	MT/LT	Total
No. of Substations	1	32	43	859	38,486	39,421
No. of Transformers	2	42	90	1,872	60,610	62,616
Installed Power (MVA)	2,500	19,098	13,934	36,870	21,152	93,554

Romania has strong interconnections with Hungary, Ukraine, Serbia, Bulgaria and Moldova. These links will be even stronger after OHL 400kV Oradea (RO) – Bekescsaba (HU) and OHL 400 kV Suceava (RO) – Balti (MD) are completed.

The transmission network is linked by

- one 750 kV and one 400 kV line with Ukraine;
- one 400 kV and three 100 kV lines with Moldava;
- one 400 kV line with Hungary;
- one 750 kV (operated at 400kV) and three 400 kV lines with Bulgaria;
- one 400 kV and three 110 kV lines with Serbia.

The national power system was integrated in the European infrastructure in May 2003, when Transelectrica became an UCTE member. The Romanian electricity system operates within the 2nd UCTE synchronous zone.

The transmission system map is presented in Figure 20.

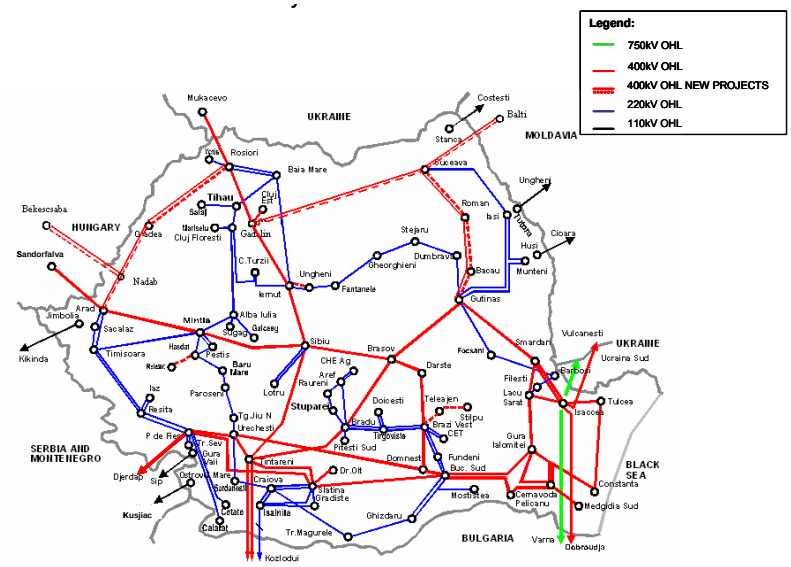


Figure 20: Romania Power Grid

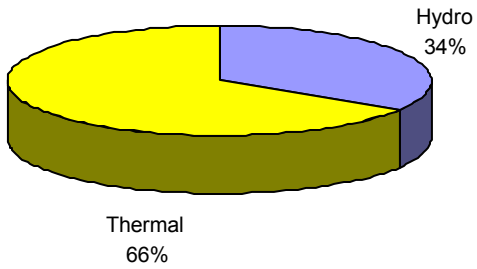
A7.9 Serbia (excluding unmik) - Power Generation and Transmission Network Systems

The power system of Serbia is operated by the Electric Power Industry of Serbia: Elektroprivreda Srbije (EPS). During the last three years, the international community provided and continue to provide assistance to Serbia in recovering its power sector with the aim to improve its operation and reduce frequent component outages. While the Serbian system used to export power (in early 1990's), it is now a net importer (2.4 TWh in 2001, 1.4 TWh in 2003).

A7.9.1 Generation Capacity

As of 2003, Serbia had an installed capacity of 7645 MW (net available capacity). All of this capacity is owned and operated by the EPS system, (Figure 21). About 5791 MW comes from 14 lignite-fired units in 4 plants located in the Kolubara coal basin and 4 lignite-fired units in 2 power plants located in Kostolac coal basin. The Nikola Tesla A and B plants combined account for 2,891 MW of the total. EPS's hydro power plants account for 2,866 MW. This consists of 31 run-of-river units (1,848 MW), 19 storage units (404 MW), and 2 pumped-storage units (614 MW). EPS also has 6 oil and gas-fired units (3 plants) totaling 425 MW of Serbia's installed capacity. The largest hydro power plant, Djerdap I, is located on the Danube and shared between Serbia and Romania, with Serbia's share being 1,058 MW or half of the total capacity. A similar arrangement is set up for Djerdap II located further downstream.

Figure 21: EPS Installed Capacity, MW (2003)



A summary of the hydro and thermal plants is presented in the following tables.

Table A7.24: Serbia Hydro Installed Capacity

Plant Name	Installed Capacity (MW)	Average Annual Generation (GWH)
Djerdap I	1058	5,730
Djerdap II	270	1,561
Pirot	80	99
Vlasinske HPP	129	223
Bajina Bašta	364	1,532
Bajina Bašta PS	614	--
Zvornik	92	456
Elektromorava	13	69
Potpeć	51	215
Bistrica	102	276
Kokin Brod	22	43
Uvac	36	59
Total	**2,851**	**10,263**

Table A7.25: Serbia Thermal Installed Capacity

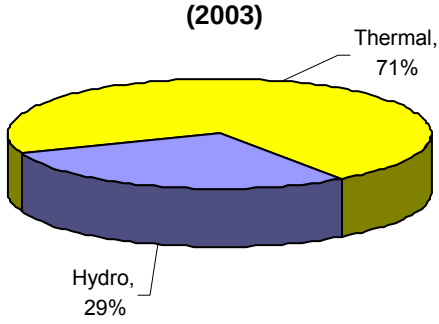
Plant Name	Installed Capacity (MW)	Type of Fuel	Retirement Year[1)]
Nikola Tesla A1	210	Lignite	After 2020[2)]
Nikola Tesla A2	210	Lignite	After 2020[2)]
Nikola Tesla A3	305	Lignite	After 2020[2)]
Nikola Tesla A4	309	Lignite	After 2020[2)]
Nikola Tesla A5	309	Lignite	After 2020[2)]
Nikola Tesla A6	309	Lignite	After 2020[2)]
Nikola Tesla B1	620	Lignite	After 2020[2)]
Nikola Tesla B2	620	Lignite	After 2020[2)]
Kolubara 1	32	Lignite	2011
Kolubara 2	32	Lignite	2010
Kolubara 3	64	Lignite	After 2020[2)]
Kolubara 4	32	Lignite	2009
Kolubara 5	110	Lignite	After 2020[2)]
Morava	125	Lignite	After 2020[2)]
Kostolac A1	100	Lignite	After 2020[2)]
Kostolac A2	210	Lignite	After 2020[2)]
Kostolac B1	349	Lignite	After 2020
Kostolac B2	349	Lignite	After 2020
Novi Sad 1	135	Gas/Oil	After 2020
Novi Sad2	120	Gas/Oil	After 2020
Zrenjanin	120	Gas/Oil	After 2020
S.Mitrovica 1	6	Gas/Oil	2005
S.Mitrovica 2	12	Gas/Oil	2005
S.Mitrovica 3	32	Gas/Oil	After 2020
Beograd	96	Oil	2005
Total	**4,814**		

1. Appendix 8 contains a discussion regarding the rehabilitations plans for these thermal plants.
2. After rehabilitation

Serbia and Montenegro have a firm power exchange long-term agreement in place for the HPP Piva power output whereby Montenegro makes available the HPP Piva power output (mostly peak energy) and receives a greater amount of baseload power from EPS in return.

Figure 22 shows the generation mix for the EPS power plants for the year 2003. Generation in 2003 (including generation of units installed in part of power system administered by UNMIK) was 33,436 GWh with the lignite units providing 23,712 GWh (71%), hydro power plants generating 9,118 GWh (27%), and the oil and gas units producing 606 GWh (2%). Lignite-fired power plants typically dominate the generation mix providing over 65% of total generation during the last several years.

Figure 22: EPS Production, GWh (2003)



A7.9.2 Transmission and Distribution

Total transmission line lengths are: 1,562 km of 400-kV, 2,196 km of 220-kV, and 6,465 km of 110-kV; Table A7.26 presents a brief summary for the transmission network.

Table A7.26: Serbian Transmission Network

Overhead Lines	400 kV	220 kV	110 kV	Subtotal	Below 110 kV
Length (km)	1,378	1,826	5,804	9,008	139,469

Substations (kV)	400/x	220/x	110/X	Subtotal	MT/LT (35/x, 20/x and 10/x)
No. of Substations	8	14	33	55	29,990
No. of Transformers	14	24	80	118	NA
Installed Power (MVA)	5,400	5,130	11,431	21,962	18,951

The power system is connected with its neighbours on the 400-kV level (Hungary, Romania, Bulgaria, Macedonia, Croatia, and Montenegro) as well as on the 220-kV level (Macedonia, Albania, Montenegro and Bosnia and Herzegovina). The 400-kV interconnection between Serbia and Croatia is now reconnected. The Serbian transmission grid is illustrated in Figure 23.

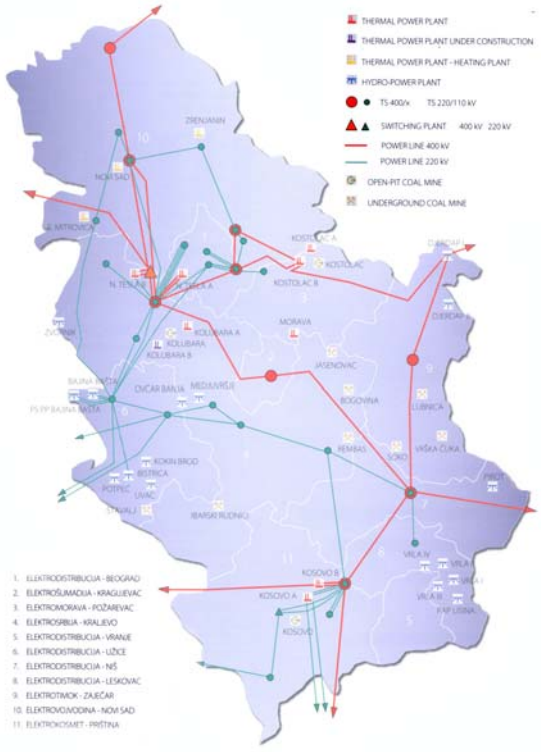


Figure 23: Serbia Power Grid

A7.10 UNMIK - Power Generation and transmission Network Systems

The UNMIK power system is dominated by a vertically integrated monopoly – public utility Korporata Enegjetike e Kosovës (KEK) - that operates two lignite mines, two lignite-fired power plants, the transmission and distribution networks, and a dispatching centre. The only significant power plant outside KEK is a hydro power plant Gazivode / Ujman (2x17.5 MW) that is operated by an irrigation company (Hidrosistem Ibar-Lepenac).

Although nominally the installed capacities are sufficient to meet the UNMIK demand, due to the years of inadequate maintenance, the reliability and the output of the plants and equipment is seriously affected, hence actually available capacities have been considerably reduced. Technical losses in the system are estimated as high and above industry average (~18%). This is further compounded by very high non-technical losses estimated at 27-30%, which resulted in overall commercial losses of 47.3% in 2001 and 41.1% in 2002.

A7.10.1 Generation Capacity

Electricity in UNMIK is produced by two lignite-fired TPPs of Kosovo A and Kosovo B with total installed generation capacity of 1,498 MW.

The Kosovo A power plant has 5 units. Their total installed capacity amounts to 820 MW but the actual state of these units differs considerably from their rated or design parameters. The Kosovo B power plant has two units, B1 and B2, each having a capacity of 339 MW. The units of Kosovo B are more recent than units of Kosovo A, and, therefore in a better condition. Overhauling and rehabilitation works in the power plants have been carried out in some units but is still under way in others.

Table A7.27: UNMIK - Hydro Installed Capacity

Plant Name	Installed Capacity (MW)	Average Annual Generation (GWh)
Gazivode/Ujman	35	115
Total	**35**	**115**

Table A7.28: UNMIK Thermal Installed Capacity

Plant Name	Installed Capacity (MW)	Type of Fuel	Retirement Year[1)]
Kosovo A1	65	Lignite	2006
Kosovo A2	125	Lignite	retired
Kosovo A3	200	Lignite	2010/2015
Kosovo A4	200	Lignite	2010/2015
Kosovo A5	210	Lignite	2010/2015
Kosovo B1	339	Lignite	After 2020
Kosovo B2	339	Lignite	After 2020
Total	**1,498**		

1. Appendix 8 contains a discussion regarding the rehabilitations plans for these thermal plants.

The Power supply situation was about to start improving, when two accidents happened at the power plant Kosovo B and the Bardh mine in 2002. These seriously crippled the system's ability to meet the rapidly growing demand. Now the priority is to stabilize the supply, and then, to provide for secure supply in the near and medium term period.

The present available capacity of the system is only 640 MW. By winter 2004, when both units in Kosovo B were anticipated to be in operation again, the total output was expected to increase to around 900 MW (A1, A3, A4, A5, B1 and B2). However, production will remain limited to 2B+1A units (about 650 MW) due to continued constraints in coal supply. In order to maintain a continuous power supply, imports are needed to meet the peak demand of around 800 MW.

A7.10.2 Transmission and Distribution

The total length of transmission lines (400, 220 and 110 kV) is 1,162 km. During the conflict the transmission network, especially the 400 kV portion, was partially destroyed. Most of the transmission lines are now back in operation following recent repairs, while substations are still in bad technical condition.

Figure 24 UNMIK Existing and Proposed Transmission Network

The 400 kV and 220 kV transmission networks of UNMIK is an integral part of the regional interconnected transmission system (Figure 24). The UNMIK system is part of the 2nd UCTE (Union for the Co-ordination of Transmission for Electricity) synchronous zone.

The transmission system is interconnected with all the neighboring systems at the 400 kV level except with Albania, where interconnection is at the 220 kV level only. This missing 400 kV interconnection line to Albania is considered vital for the realization of substantial power exchanges between thermal power based UNMIK system and hydropower based Albanian system in the medium to long-term future plans. A summary of the transmission network for UNMIK is presented in Table A7.29.

Table A7.29: UNMIK Transmission Network

Overhead Lines	400 kV	220 kV	110 kV	Subtotal	Below 110 kV
Length (km)	181	361	643	1,185	15,516

Substations (kV)	400/x	220/x	110/X	Subtotal	MT/LT
No. of Substations	1	4	24	29	4,193
No. of Transformers	3	9	41	53	4,370
Installed Power (MVA)	1,200	1,370	1,418	3,988	1,294