PROSPECTS FOR THE DEVELOPMENT OF A PERIPHERAL ELECTRICITY MARKET IN THE BALKAN REGION

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CORRIGENDUM

Study on "Prospects for the Development of a Regional Electricity Market in the Balkan Region"

(1) The use of the acronym 'FYROM' in this study is intended as a diminutive of the provisional designation of the country, which should be read throughout the study as being 'The former Yugoslav Republic of Macedonia'.

(2) On page 13 of the Study, the last sentence of the third paragraph should be replaced with the following:
"*The country signed a Cooperation Agreement with the European Community on April 29th 1997 which entered into force on January 1st 1998.*"

(3) The map on page 206 should be replaced with the following map:

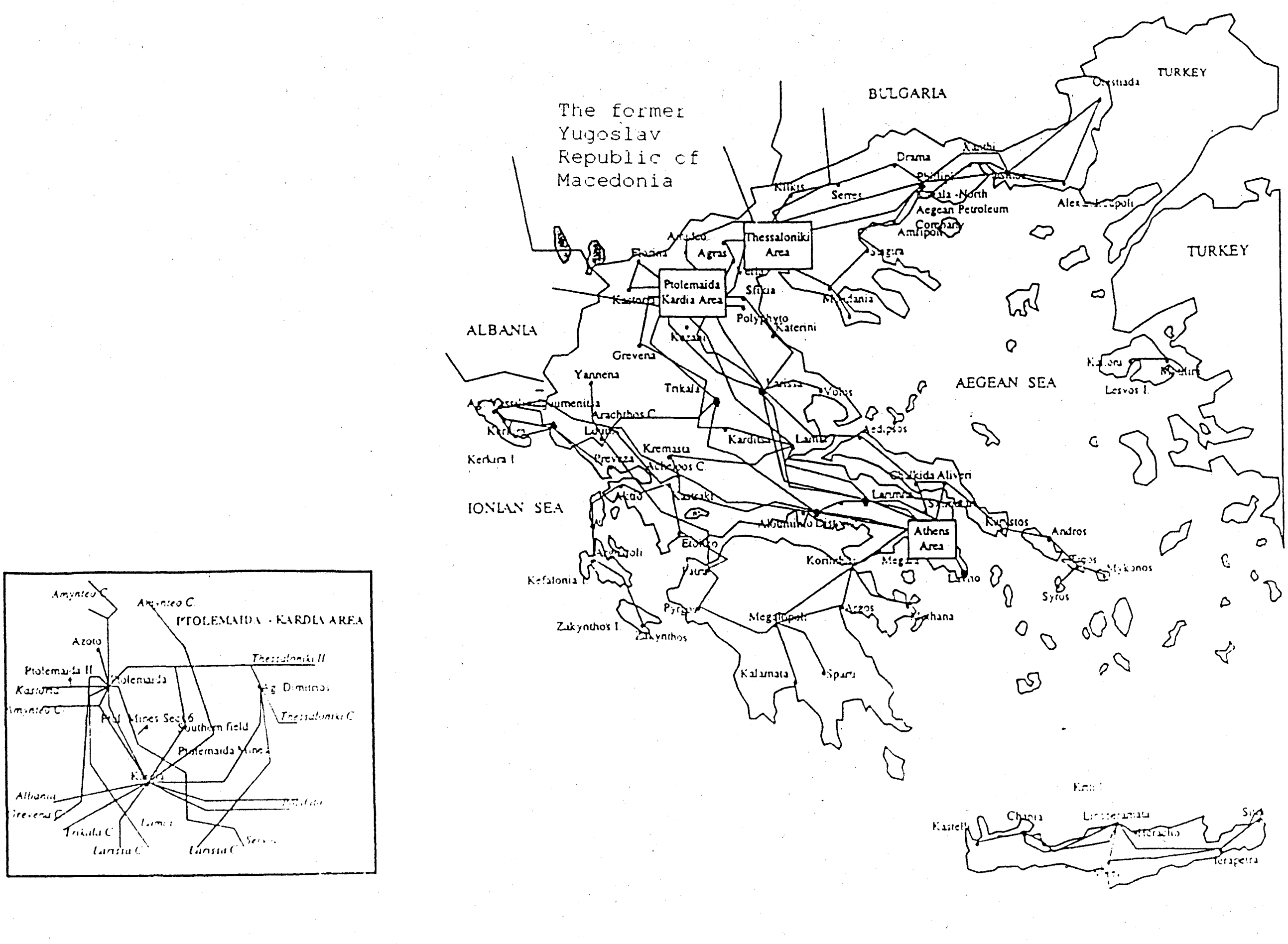

Figure 3.12 The Electric Energy System of Greece

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PROSPECTS FOR THE DEVELOPMENT OF A PERIPHERAL ELECTRICITY MARKET IN THE BALKAN REGION

December 1997

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"The overall objective of the Community's Energy Policy is to help ensure security of energy supplies for European citizens and businesses at competitive prices and in an environmental compatible way. DG XVII initiates, co-ordinates and manages energy policy actions at European level in the fields of solid fuels, oil and gas, electricity, nuclear energy, renewable energy sources and the rational use of energy. The most important actions concern the security of energy supply and international energy co-operation, the integration of energy markets, the promotion of sustainable development in the energy field and finally the promotion of energy research and technological development through demonstration projects. DG XVII manages several programmes as SYNERGY, SAVE, ALTENER and THERMIE. More information is available in DG XVII's pages on EUROPA, the Commission's server on the World Wide Web".

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Preface

This study of "Prospects for the Development of a Peripheral Electricity Market in the Balkan Region" was carried out by the Energy Policy Group of the National and Kapodistrian University of Athens at the request of European Commission (DGXVII) under the SYNERGY programme.

The study deals mainly with the existing infrastructure of power systems and networks in six Balkan countries and examines the perspectives of the formation of a Regional Electricity Market.

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Athens 17 April 1997

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TABLE OF CONTENTS

1. INTRODUCTION 9
1.1 POLITICAL PERSPECTIVES IN THE BALKANS 9
1.2 BRIEF PRESENTATION OF THE EUROPEAN UNION POLICIES IN THE AREA IN CONNECTION TO THE ELECTRICITY SECTOR 10
1.3 BRIEF REVIEW OF THE PRESENT STATE OF POLITICAL, INSTITUTIONAL AND SOCIO-ECONOMIC SITUATION IN THE BALKANS 12
1.4 SYNTHESIS OF THE FUTURE REM 15
1.5 REM DEFINITION 16
1.6 BRIEF PRESENTATION OF THE NEIGHBOURING AREAS IN CONNECTION TO THE ELECTRICITY SECTOR 18
1.7 THE E.U. DIRECTIVE FOR THE INTERNAL ELECTRICITY MARKET 21
2. REVIEW OF SYSTEMS AND MARKETS 23
2.1 EUROPE 23
2.1.1 UCPTE 23
2.1.2 IPSCIS 24
2.1.3 THE ELECTRICITY MARKET IN UK 26
2.1.4 NORDEL ELECTRICITY MARKET 29
2.2 SOUTHERN AFRICA 33
2.3 ASIA 35
2.3.1 INDIA 35
2.3.2 SOUTH EAST ASIA 37
2.3.3 CHINA 37
2.3.3.1 General features of the Electricity Sector 37
2.3.3.2 Major Contents of China's Existing Laws and Regulations on Electric Power 38
2.4 AMERICA 40
2.4.1 UNITED STATES 40
2.4.2 CENTRAL AMERICA 45
2.4.3 SOUTH AMERICA 45
2.5 CONDITIONS FOR PARTICIPATION OF NON MEMBER BALKAN COUNTRIES IN UCPTE 46
3. POWER SYSTEMS 49
3.1 ALBANIA 49
3.1.1 ORGANISATIONAL STRUCTURE OF THE ELECTRICITY SECTOR 49
3.1.2 ELECTRIC POWER GENERATING SYSTEMS 50
3.1.3 TRANSMISSION NETWORK 48
3.1.4 ENERGY BALANCE 49
3.1.5 ELECTRICITY MARKET CONSUMPTION 53
3.1.6 ELECTRIC UTILITY POWER EXCHANGES 53
3.1.7 COMMENTS ON THE ACCOUNTING TABLES AND FINANCIAL RATIOS - ALBANIA (KESH) 54
3.2 BULGARIA 55
3.2.1 ORGANISATIONAL STRUCTURE OF THE ELECTRICITY SECTOR 56
3.2.2 ELECTRIC POWER GENERATING SYSTEM 59
3.2.3 TRANSMISSION NETWORK 57
3.2.4 ENERGY BALANCE 61
3.2.5 ELECTRICITY MARKET CONSUMPTION 61
3.2.6 COMMENTS ON THE ACCOUNTING TABLES AND FINANCIAL RATIOS - BULGARIA (NEK) 62
3.3 FYROM 66
3.3.1 ORGANISATIONAL STRUCTURE OF THE ELECTRICITY SECTOR 66
3.3.2 ELECTRIC POWER GENERATING SYSTEMS 66
3.3.3 TRANSMISSION NETWORK 67
3.3.4 ENERGY BALANCE 68
3.3.5 ELECTRICITY MARKET CONSUMPTION 68
3.3.6 COMMENTS ON THE ACCOUNTING TABLES AND FINANCIAL RATIOS - FYROM (ELEKTROSTOPANSTVO NA MAKEDONJA) 69
3.4 GREECE 71
3.4.1 ORGANISATIONAL STRUCTURE OF THE ELECTRICITY SECTOR 71
3.4.2 ELECTRIC POWER GENERATING SYSTEMS 73

3.4.3 TRANSMISSION NETWORK 74
3.4.4 ENERGY BALANCE 75
3.4.5 ELECTRICITY MARKET 75
3.4.6 ELECTRIC UTILITY POWER EXCHANGE 76
3.4.7 COMMENTS ON THE ACCOUNTING TABLES AND FINANCIAL RATIOS - GREECE (PUBLIC POWER CORPORATION) 77
3.5 ROMANIA 82
3.5.1 ORGANISATIONAL STRUCTURE OF THE ELECTRICITY SECTOR 82
3.5.2 ELECTRICAL POWER GENERATING SYSTEM 83
3.5.3 TRANSMISSION NETWORK 85
3.5.4 ENERGY BALANCE 86
3.5.5 ELECTRICITY MARKET CONSUMPTION 87
3.5.6 ELECTRIC UTILITY POWER EXCHANGES 87
3.5.7 COMMENTS ON THE ACCOUNTING TABLES AND FINANCIAL RATIOS - ROMANIA (RENEL) 88
3.6 F.R YUGOSLAVIA 90
3.6.1 ORGANISATIONAL STRUCTURE OF THE ELECTRICITY SECTOR 90
3.6.2 ELECTRIC POWER GENERATING SYSTEMS 91
3.6.3 TRANSMISSION NETWORK 92
3.6.4 ENERGY BALANCE 93
3.6.5 ELECTRICITY MARKET CONSUMPTION 93
3.6.6 ELECTRIC UTILITY POWER EXCHANGES 94
3.7 COMPARATIVE ANALYSIS OF THE ELECTRIC UTILITY ECONOMIC STATUS 95
3.8 SUMMARY 99
3.9 CONCLUSIONS, COMMENTS AND PROSPECTS FOR THE FUTURE 104
4. EXPANSION PLANS 106
4.1 ALBANIA 106
4.1.1 GENERATION SYSTEM 106
4.1.2 TRANSMISSION SYSTEM 108
4.2 BULGARIA 110
4.2.1 GENERATION SYSTEM 110
4.2.2 TRANSMISSION SYSTEM 111
4.3 FYROM 112
4.3.1 GENERATION SYSTEM 112
4.3.2 CONSTRUCTION OF TRANSMISSION NETWORK SYSTEM 114
4.4 GREECE 116
4.4.1 GENERATION SYSTEM 116
4.4.2 TRANSMISSION SYSTEM 118
4.5 ROMANIA 119
4.5.1 GENERATION SYSTEM 119
4.6 F.R. YUGOSLAVIA 121
4.6.1 GENERATION SYSTEM 121
4.6.2 TRANSMISSION SYSTEM 125
5. RESTRICTIONS 127
5.1 SECURITY OF SUPPLY 127
5.2 GENERATION AND TRANSMISSION SYSTEM ANALYSIS 131
5.2.1 METHODOLOGY 131
5.2.1.1 Reliability analysis 131
5.2.1.2 Transient stability analysis 131
5.2.1.3 Short-circuit withstand, protection, defence and restoration 131
5.2.1.4 Basic hypotheses 132
5.2.2 GENERATION RESERVE CAPACITY AND IMPORT/EXPORT CAPABILITIES 134
5.2.2.1 Albania 134
5.2.2.2 Bulgaria 134
5.2.2.3 FYROM 135
5.2.2.4 Greece 135
5.2.2.5 Romania 135
5.2.2.6 F.R. Yugoslavia 136
5.2.2.7 General conclusions 136
5.2.3 NETWORK RELIABILITY BY N-1 CRITERION ASSESSMENT AND OTHER PROBABILISTIC STUDIES 138
5.2.3.1 General 138
5.2.3.2 Albania 138
5.2.3.3 Bulgaria 138

5.2.3.4 FYROM 138
5.2.3.5 Greece 139
5.2.3.6 Romania 139
5.2.3.7 F.R. Yugoslavia 139
5.2.4 TRANSIENT STABILITY 140
5.2.5 SHORT CIRCUIT WITHSTAND, PROTECTION, DEFENCE AND RESTORATION 140
5.3 ENVIRONMENTAL RESTRICTIONS 141
6. MARKET DEVELOPMENT PROBLEMS 146
6.1 SUITABILITY OF THE EXISTING ORGANISATIONAL INFRASTRUCTURES OF THE ELECTRICITY SECTOR 146
6.2 TECHNICAL LIMITATIONS AND PROBLEMS ASSOCIATED WITH THE PARALLEL AND SYNCHRONOUS OPERATION OF THE SIX BALKAN COUNTRIES POWER SYSTEMS AND UCPTE 149
6.2.1 POWER MODULATION 149
6.2.2 PRIMARY POWER - FREQUENCY AUTOMATIC CONTROL 149
6.2.3 SECONDARY POWER - FREQUENCY AUTOMATIC CONTROL, CENTRALIZED DATA TRANSMISSION AND SYSTEM CONTROL 150
6.2.4 VOLTAGE AND REACTIVE POWER CONTROL 152
6.3 EXISTING LEVEL OF ECONOMIC RESULTS TRANSPARENCY FOR THE ELECTRIC UTILITIES OPERATING IN THE BALKAN REGION 153
6.4 TRANSMISSION PRICING 155
6.4.1 INTRODUCTION 155
6.4.2 COST ALLOCATION METHODS 155
6.4.2.1 Average Cost of Methods 156
6.4.2.2 Methods Based on Incremental Costs 156
6.4.2.3 Methods Based on Marginal Costs 157
6.4.3 PRICING METHODS 157
6.4.3.1 Postage Stamp 157
6.4.3.2 Contract Path 157
6.4.3.3 Physical Path 158
6.4.3.4 Zonal 158
6.4.3.5 Investment Cost Related Pricing 158
6.4.4 PRACTICAL APPROACHES 158
6.4.5 CONCLUSION 159
6.5 ECONOMIC SITUATION AND OBSTACLES TO INVESTMENT UNDERTAKINGS IN THE BALKANS 160
6.5.1 ROMANIA 160
6.5.2 BULGARIA 162
6.5.3 F.R. YUGOSLAVIA 163
6.5.4 FYROM 164
6.5.5 ALBANIA 164
6.5.6 SOURCES 165
7. PROPOSAL FOR A COMPETITIVE ELECTRICITY MARKET 166
7.1 INTRODUCTION 166
7.2 OPERATING, DEVELOPMENT AND ELECTRICITY TRADE CRITERIA 170
7.3 CRITERIA FOR AN INTEGRATED EXPANSION PLANNING IN THE REGION 174
7.4 MARKET STRUCTURE 176
7.4.1 ORGANISATION OF THE MARKET 176
7.4.1.1 Balkan Electricity and Development Operating Center 176
7.4.2 SUPPORTING DEPARTMENT OF THE BEODC 177
7.4.2.1 Technical Department 177
7.4.2.2 Commercial Department. 178
7.4.2.3 Planning Department. 178
7.4.2.4 Legal Department 179
7.4.2.5 Administration Department 180
7.4.3 ARBITRATION 180
REFERENCES 181
APPENDIX A 183
APPENDIX B 185
APPENDIX C 202

1. INTRODUCTION

1.1 POLITICAL PERSPECTIVES IN THE BALKANS

The transition process launched in 1989 is a long and painful trajectory which involves structural changes in all spheres of public life: political , economic, social etc.

The adjustment of these countries to the new era is not easy; in most cases the Balkan countries were to be confronted with the challenge of reshaping their political, social and economic landscape.

The war in ex-Yugoslavia was a harsh reality which all Balkan states had to face, since the hostilities and the following embargo struck the economic life of the whole region.

The progress made varied from country to country. Yet, all countries, even the ex-Yugoslav Republics have put down strong foundation for the future.

The end of the hostilities open a new chapter for the region as a whole. The end of Bosnian war creates optimistic expectations for the creation of new links between Serbia (F.R. Yugoslavia) and the EU and more generally for the economic recovery of the ex-Yugoslav Republics and the reconstruction of the region, devastated by war.

All Balkan countries aspire ultimately to full integration into the western political and economic structures. The coming to effect of the Europe Agreements between the EU and Bulgaria and Romania, the closer relations between FYROM and Albania and the EU, as well as the PHARE program for technical assistance to these countries establish a new situation in the region.

However, recent events in Albania and Bulgaria witness the fact that transition is not an one way road and that western support is necessary during this critical phase.

Still much has to be done. Peace and stability can only be assured through close cooperation in all fields. Only enhanced cooperation could overcome the strained relations of the past, establishing a new kind of relationship based on the reality of interdependence of the Balkan states.

1.2 BRIEF PRESENTATION OF THE E.U. POLICIES IN THE AREA IN CONNECTION TO THE ELECTRICITY SECTOR

The EU has undertaken a series of initiatives concerning the Balkan region, in order to assist the implementation of the most urgent reforms launched by the new governments.

The Union offered its political, economic and technical assistance through specific operational programmes contributing at the gradual reapprochement of these countries with the EU. The economic decline of the first years of transition posed a threat to stability for the region and for Europe as a whole. The EU helped the Balkan countries to deal with their transitional problems in a variety of ways. Likewise, its role is most important in the current phase of reconstruction of ex-Yugoslavia after the end of hostilities and the Dayton Agreement.

The major instrument of assistance is the PHARE programme, a medium-term financial instrument, especially created for the reconstruction of the countries of central and Eastern Europe. It consists in technical assistance for the reorientation of the economy. Since the Essen summit in December 1994, PHARE has also enhanced possibilities to promote infrastructure development and intraregional cooperation, as a 25% of each country's annual PHARE allocation is reserved for infrastructure financing. Meanwhile, PHARE's crossborder cooperation facilities and multi-country programmes have been instrumental in enhancing regional cooperation (ex. electrification of railway lines, modernization of customs facilities etc.).

Energy is a priority sector for coordinated assistance. For the EU the sector of energy policy is a basic driving force as regards both the development of the Balkan area and the cooperation of the Balkan countries with the EU, the Balkans being considered as an energy corridor.

The EU's energy policy as it is presented in the European Commission White Paper for Energy has 5 main priorities:

- promotion of individual competitiveness and employment;
- security of energy supply;
- promotion of the internal energy market;
- protection of the environment, and
- strengthening of international cooperation.

The existence of two main restrictions, energy supply and the protection of the environment, underlines the need of balancing the priorities and of involving all countries. The development of interconnected energy networks is considered by PHARE as one of its main fields of activity. PHARE assists the private investors in complementing the support provided by the International Financial Institutions (EIB, EBRD, World Bank etc.). Apart from the general energy policy, the Energy Charter Treaty is a essential legal framework that provides global institutional coverage of international energy cooperation. Considering that the Black Sea Region is one of the most important energy corridors, the European Commission created the Black Sea

Regional Energy Centre, located in Sofia. This is the first region-wide initiative of the European Commission in the Black Sea region.

The European Commission supports the Centre's activities through SYNERGY (programme of international cooperation in the energy sector of the Directorate General for Energy), PHARE, TACIS and THERMIE programmes. Albania, Bulgaria and Romania participate in the Centre. Finally, the Commissioner responsible for the Energy sector, Christos Papoutsis, announced in October 1995 his intention to create a Balkan energy Interconnections Task Force, which will help to ensure the efficiency and coordination of investment initiatives in the energy sector of the region. This Task Force will operate under the aegis of the Black Sea Regional Energy Centre, and will be a common effort between the Balkan countries and the EU. The perspectives for coordination and cooperation in the field of energy are still enormous. The years to come will be crucial in creating a new landscape in the region.

1.3 BRIEF REVIEW OF THE PRESENT STATE OF POLITICAL, INSTITUTIONAL AND SOCIO-ECONOMIC SITUATION IN THE BALKANS

The encouraging developments regarding the stabilization of the political and economic system in the Balkan region after the end of the Yugoslav war, prove that the transition process is gaining momentum in all Balkan states, even if this process varies from country to country.

Albania. The general elections of May 1996 have not been able to solve the political problem in the country and public discontent against the Government is gaining momentum. The recent scandal with the collapse of the para-banking system and the series of demonstrations that followed together with the armed revolt in the South of the country, which obliged the Government to resign, are a serious test of the ability of the Albanian state and the new Government to face the general unrest and avoid chaos and anarchy. Albania has strengthened ties with western international institutions since the country was accepted into the Council of Europe and approved of the presence of NATO forces in the country. The overall output of the country improved even though the industrial production of some sectors was reduced. Yet agriculture and the expansion of small business, especially in the service sector and informal economy, will continue to serve as the main engine of growth. Remittances from Albanians working abroad (about 500,000 to 600,000) are still instrumental in fueling economic life in the country. Inflation remains under control, as the government has managed to reduce it from 85% in 1993 to 20% in 1994. In 1995 it was about 15%.It has to be noted that most of the growth is fueled by the shift to consumption. Industry will be the most important problem the Government will have to solve since most industrial plants are archaic and it is very difficult to sell them. The balance of payments deficit continues to deteriorate as in the first half of 1995 imports were nearly four times as large as exports. This disproportion can have destabilizing effects which can be reversed only by sustained investment in the country's productive base. This is unlikely to happen since hard currency is used almost exclusively for imports of consumer goods. Organized crime is a growing problem for Albanian society, focused mainly in the area of smuggling of fuel across the border with Montenegro and refugee smuggling by speedboat to Italy.

Bulgaria. The last parliamentary elections brought to power a coalition Government that was mainly formed by technocrats and its programme pledges to continue with reform. Since it came to power, new administrative structures to implement the Europe Agreement were established and priorities have been defined, among which integration into European structures were high on the list. However, the Government's decision to strengthen links with Russia has been the subject of controversy. Since the Presidential elections, mass demonstrations together with the protracted economic crisis provoked a major political crisis and the Government resigned on December 28 1996.A new non partisan government is formed in order to lead the country to elections. The main problem of the former Government lied in the economic sphere.

The Governmental team was reluctant to take the necessary measures which would lead to a market economy. However, the slow pace of privatization was partly due to foreign investors who are reluctant to invest in Bulgaria, thus favoring the appearance of powerful local entrepreneurial groups. According to the Bulgarian Privatization Agency, 60% of the privatized enterprises were bought by Bulgarians. The Government proposed a voucher scheme for the mass privatization of 1,227 enterprises out of a total 3,900. The decision to liquidate some of the least viable industrial enterprises is not yet materialized and the list is not yet final.

Bulgaria's ability to serve its external debt was largely questioned and is responsible together with the slow pace of privatization for the dramatic fall of the lev which declined by 13% against the dollar in one day (8th of May 1996). Bulgarian Government has followed a policy of equal distances regarding the western financial institutions and its traditional commercial partners. The Europe Agreement between Bulgaria and the EU was signed in March 1993 and entered into force the 1st of February 1995. For both Romania and Bulgaria, the pre-accession strategy approved by the Essen European Council is instrumental in paving the way for the integration of the two countries into the Union.

FYROM. The Former Yugoslav Republic of Macedonia has been the only Republic of ex-Yugoslavia to steer clear from the wars in the Federation. Despite the internal problems and the interethnic strife, as well as the difficult foreign relations of the country up to now, the Republic has a functioning democratic system and has undertaken serious steps towards a market economy. The suspension of UN sanctions against Serbia in November and the amelioration of the country's relations with Greece, open up good prospects for trade and economic cooperation with all the neigbouring countries. The Government still holds the keys of stability in the country. FYROM has been able to reach an agreement with the numerous Albanian minority (22%) who participates in the coalition government, presenting himself as the most important channel for resolving differences between the Slav and the Albanian community. The amelioration of relations with the neighbors will give to the economy its first real opportunity to recover. Greek investment has already started to flow in the country, notably in mining, metal processing, textiles, tobacco, timber etc. Unemployment has been one of the most important problems since independence. According to the official data, unemployment rate is not much below 50% of the workforce, with the loss in 1995 of another 20,000 jobs under a restructuring plan for 25 loss-making industrial companies and cuts in the workforce at newly privatized companies. Privatization moves ahead despite the problems. At the end of September 1995 230 enterprises have been sold since the beginning of 1995 and the Privatization Agency was planning to sell 550 more by the end of the year, leaving another 300 for 1996. The country will benefit from increased access to loans from international financial institutions and foreign governments , following the rescheduling of its debt to the Paris Club of international creditors. The country is negotiating with the EU the signing of an Agreement of Economic and Commercial Cooperation, which will bring her closer to European integration.

Greece is only indirectly affected by these developments. As the only Balkan country which is a member of NATO, EU and WEU, it does not have to face the problems which are currently common in all the other Balkan states. Even if the country has to deal with serious problems, due mainly to the convergence process in the EU, it has a stable democratic system and a viable economy.

Romania has a new President and a new Government, after the presidential and parliamentary elections of the 3rd and 17th November 1996. The new Government is committed to a more rapid pace of privatization and transition to a market economy and is expected to have strong support from the West.

Relations with Hungary have already ameliorated under the Stability Pact and the "Romanian-Hungarian historic reconciliation project". Romania was the first Eastern European country to sign the Partnership for Peace Programme. Integration into the western structures, mainly NATO and the EU are on top of the Government's agenda.

The economy is showing clear signs of recovery. Romania is the best performing country of the region as regards macroeconomic figures. The increase in the GDP accelerated in 1995. The growth is mainly due to the industrial production (electrical appliances, metallurgy etc.) which in 1995 increased by 10%. Serious steps have been undertaken by the previous Government, but still much has to be done. The slow pace of privatization, the need for structural reforms in the banking and the public sector were up to now responsible for important delays in key sectors and posed serious obstacles to foreign investment. Romania has signed a Europe Agreement with the EU on the 1st of February 1993 and the Interim Agreement was implemented in May 1993. In February 1995 the Agreement entered fully in force after being ratified by all EU members.

F.R. Yugoslavia (Serbia and Montenegro). With the end of hostilities, Serbia is bound to put emphasis on economic recovery and integration into the market economy. Still, there are many difficulties which have to be faced, both in the political as in the economic sphere. However, the series of demonstrations that followed local elections of the end of 1996, and the ongoing unrest are a major challenge to the Government's power and source of renewed western criticism on the internal situation of Serbia. Dayton peace agreement was an important step in the direction of normalizing foreign relations. Yet the F.R. of Yugoslavia, has to take on its -still undecided-share of the debt of former Yugoslavia and may have to face claims against its limited foreign financial assets which are still frozen. Still, Serbia before the war had developed an important industrial sector and there is already a substantial small and medium size private sector, which accounts- according to some estimations- for 1/3 of national income. Serbia has to cover in months the trajectory followed by other countries of Central and Eastern Europe in four or five years. With the lifting of sanctions massive restructuring of the economy is required, so that the country will be able to compete with the other states of the region.

1.4 SYNTHESIS OF THE FUTURE REM

The region is consisted of countries of various political, economic, institutional and technical origins and experiences concerning the free market operation laws.

One of them, Greece, is a European Union member, but its electrical system although operating under the UCPTE standards is disconnected from the network because of the war hostilities in ex-Yugoslavia.

FYROM and Serbia suffer the consequences of state destruction in their power systems which as parts of the ex-Yugoslavian system were interconnected to UCPTE. Both countries have expressed their intention to operate according to these standards.

Albania without being an UCPTE member has been interconnected synchronously with the Greek power system and has expressed its intention to follow UCPTE.

Bulgaria and Romania are testing their systems for synchronous operation with the aforementioned countries while they examine the possibilities of interconnection with the ex-CENTREL network which recently has been interconnected to UCPTE.

Taking into account that recent studies conclude that the parallel and synchronous operation of *Albania, Bulgaria and Romania* is technically feasible with minor scale investments, that the remaining three countries *Greece, FYROM and F.R. Yugoslavia (Serbia and Montenegro)* already operate their systems according to UCPTE standards and that the six countries are already operating in parallel and syncronously, it is obvious the necessary technical infrastructure for a possible REM already exists for these six countries. The constitution of such a peripheral electricity market and its parallel operation with the UCPTE grid will create the basis for the development of electricity trade, between the Balkans and the integrated electricity market of the EU with mutual profit to all the interconnected electrical utilities, independent power producers and power consumers.

It is also important to notice that in the outskirts of the region and beyond the existing route of interconnection with the central Europe consumption centers through ex-CENTREL network, there is a number of countries (Ukraine, Turkey) which have constructed the proper infrastructure for electricity trade with some of these Balkan countries, while other countries are expected to have analogous transactions in the future. Countries of ex-Yugoslavia (F.R. Yugoslavia, Bosnia, Croatia) when peace and stability will be well established in the near future and their interconnection lines towards Serbia will be fully restored are expected to participate in the REM as well as southern Italy when the submarine DC cable will interconnect the systems of Greece and Italy.

1.5 REM DEFINITION

Bilateral or multilateral electricity exchanges between countries in the region have been based on the installation of the appropriate interconnection lines and infrastructures. Further technical studies and improvements may allow to the national systems to operate altogether in parallel and synchronous mode. These improvements will increase the overall interconnection efficiency of the systems but electricity trade will be far more complicated involving political agreements, low costs, institutional modifications, and possible changes in the structures of electricity sector in the participating countries.

The formation of a competitive REM will depend on the way the interested parties (countries and electric utilities) will be able to create an environment where buyers and sellers (countries, electric utilities, IPPs, large customers) will be able to negotiate and execute power and energy contracts at any time, independently of their geographic position, in a safe and reliable economic environment.

Although the target group of REM is consisted of six countries, a step by step procedure with a smaller number of participants may be necessary at the beginning. The existence of the market will show off the benefits for the participants and will create the momentum to pull in the others.

Up to recent years, most of the electric utilities around the world were and several still are vertically integrated entities active simultaneously to the three basic functions of the industry, namely: generation, transmission and distribution. Most of these utilities are self-sufficient in terms of generation capacity capability within their respective geographical areas. Interconnection lines with their neighbouring countries or with adjacent compatible utility systems were decided upon and developed either to improve power system reliability and reduce the reserve capacity investments as well as benefit from the complementarily of hydroelectric generation satisfying peak loads or in some cases optimize power plant maintenance scheduling.

The recent evolution process of the electrical sector within the European Union and elsewhere, may not be overlooked by the electric utilities operating in the Balkans. The integration of CENTREL to UCPTE power networks and the successful conclusion of the peace negotiations in former Yugoslavia have created the appropriate political and technical environment for the electrical interconnection to UCPTE. It should be noted that the liberalization of the electricity sector within the European Union will alter the present electric utilities practices, creating new investment opportunities within the electricity sector.

In this framework the electric utilities operating in the Balkan region will be faced with the dilemma of either continuing the operation of their market within their geographic jurisdiction with limited power and energy exchanges, or start to become involved in regional collaboration aiming towards the development of a competitive electricity market.

Regional electricity markets may take the form of a loose or a tight power pool. In any case of competition in taking benefit from the particular advantages of each member should be the basic criterion according to which the market will progressively develop.

It should be made clear that the up to date experience on regional electricity markets shows that their development was achieved step by step such that all participating parties could benefit at maximum possible level through firm trading commitments.

A developing regional electricity market becoming increasingly formal and long term, will increasingly impose restrictions to the generators operational and system expansion freedom. The basic differences between a tight regional electricity market arrangement and a conventional loose electricity trade through on the spot agreements as well as medium and long term contracts are the following:

Regional networks require first of all compatible physical interconnections and a sound institutional arrangement and framework, transparent pricing principles, authorities responsible for electricity trade overseeing and settlements, agreements on the enforcement of technical and operational standards as well as contract enforcement.

The establishment of an electricity market through a regional network, comprising a number of interconnected electrical system may take either a tight form or, more frequently, a loose form. The main characteristics of both forms are depicted in the following table:

Table 1.1 Main Characteristics of Tight and Loose Power Market

Function	**Loose Market**	**Tight Market**
System dispatch	by utilities	centrally controlled
Dispatch cost	free bidding (1)	audited costs
Contract settlement	bilateral	by REM authority
Operating reserve	unregulated	REM mandatory requirements
Reserve capacity	unregulated	REM mandatory requirements
Maintenance scheduling	no co-ordination (2)	REM controlled
Expansion planning	by utilities	by REM and utilities
Transmission network Utilization	trade at borders, wheeling, optional 3rd party access	mandatory 3rd party access, trade at borders, wheeling

(1) *Short term or rarely, long term contracts may be established on the basis of the avoided short term or long term marginal avoided costs plus the required benefits, regularly or occasionally*

(2) *Maintenance scheduling contracts may be established, regularly or occasionally.*

1.6 BRIEF PRESENTATION OF THE NEIGHBOURING AREAS IN CONNECTION TO THE ELECTRICITY SECTOR

The countries neigbouring to the proposed future Balkan REM, i.e. Moldavia, Ukraine, Hungary, Croatia, Bosnia-Herzegovina, Italy and Turkey, present a rich variety concerning their social and economic structures, which is resulting from the historical evolution of their internal political situation. Nevertheless, this variety is not, generally, reflecting upon the situation of their electric systems, which had, up to recently, the same state owned, vertically integrated utility form, covering production, transmission and distribution.

In most of these countries, the existing structure of the electricity sector creates an important investment charge corresponding to the state-owned utilities, which has been solved, to some extent, by their integration into co-operative organizations of interconnected power networks. It is natural that the extent and the boundaries of such organizations resulted from geographical and political necessities.

These latter have been changed, radically, as concerns the countries of the Eastern Europe, after the political changes of the period 1989-1991, the access to power of democratically elected governments in these countries and the political dissolution of former USSR and Yugoslavia. The new political equilibrium in Eastern Europe has created new trends in relation to the interconnections of the power networks. On the other hand, the war in former Yugoslavia which was prolongated up to the end of 1995, resulted to an extended disconnection between several parts of the former Yugoslavian network.

The synchronous interconnection of power networks of different countries within UCPTE (Western Europe Countries) or IPS/UPS (Eastern Europe and former USSR Countries) has revealed important benefits as savings in the investment program (like in Italy), increased reliability and quality of supply, reduction of losses and opportunities for electricity trade which can be beneficial to either party.

The new trends are guiding to increased interconnections between the countries of the Eastern Europe and of the former USSR and the countries of the UCPTE. This new situation has a double significance; on the political field, the countries of the Eastern Europe are seeking their integration to the European Union and, they urge their full participation to the Trans-European Energy Networks to be established in accordance to the Maastricht Treaty; on the economical field, the countries of the UCPTE are interested in the abundant energy resources in Eastern Europe and former USSR, where a lot of already amortized investments in the energy sector have been carried out in the past, including nuclear power plants (e.g. in Ukraine), which are largely in excess to the present demand for electricity in the Eastern European and former USSR countries.

A number of interconnections through 400 kV lines and the improvement of control of the power plants have permitted to Hungary, together with the 3 other Eastern European countries participating in CENTREL (Poland, Czech and Slovakian Republics) as well as with the eastern part of Germany, to be synchronously interconnected to UCPTE, since the end of 1995.

Recently, a number of interventions have been carried out in the electric utilities of important countries neighbouring to the proposed future Balkan REM e.g. Italy, in order to implement the unbundling between energy production and energy transmission and distribution according to the principles agreed for the creation of the internal energy market of the European Union, as well as by the installation of new Independent Power Producers (1995) in Hungary and Turkey.

Moreover, the liberalization of the production has been inaugurated in the aforementioned countries, according to the European Union directive model, accompanied by privatization of power plants in Hungary or by partial privatization of the whole state owned utility (ENEL) in Italy.

Before the war in former Yugoslavia, the electrical networks of former Yugoslavia, Albania and Greece were interconnected and synchronous operating with the rest of the UCPTE members. The war conflict and the political instability have guided to the aforementioned disconnection of the Yugoslavian network and to the isolation of parts of the Former Yugoslavia, Albania and Greece, a country of the European Union, with respect to the UCPTE.

According to the study performed under the PHARE regional program, the electric systems of Romania, Bulgaria and Albania can be interconnected to the UCPTE through Hungary after carrying out a limited number of investments for re-implementing a set of 400 kV transmission lines between Romania and Hungary, for improving the substation equipment in Bulgaria, the protection and defense equipment in Romania as well as the power plant control in the three countries. The interconnection of the Romanian and the Bulgarian systems to the UCPTE shall guide to the reintegration of Greece and Albania to the UCPTE as well as to the interconnection of Turkey to the UCPTE (that may involve the splitting of the electric network of Turkey in order to meet UCPTE standards), independently of the eventual reconnection of the parts of the former Yugoslavian network.

By the end of 1995, peace has been installed in Former Yugoslavia, thus creating the possibility for putting again in operation the interconnections between the electric systems of the new states, which, before the war, were integrated into the same state-owned utility, JUGEL, and operated synchronously to the UCPTE. This evolution should create other interconnection paths for Greece and Albania to the UCPTE.

On the other hand the projected interconnection between Greece and Italy with a back-to-back 400 kV/500 MW DC link through a submarine cable, makes Italy a neigbouring country of the proposed future Balkan REM. This interconnection shall offer the possibility for direct electricity exchanges and trade between the proposal REM and Italy as well as between the REM and the other UCPTE countries, through the electric network of Italy. Moreover the interconnection shall increase the security of electricity supply in southern Italy, where a significant electricity shortage has been experienced during the last decade and it shall create various indirect economic benefits in Greece and in southern Italy.

The electric network of Turkey is already interconnected to the electric network of Bulgaria through 400 kV lines and in the future will be interconnected with Greece. The purpose of the projected interconnection between Greece and Turkey through 400 kV/1,300 MVA lines is to facilitate the transfer of the excess of electrical energy generated in the Balkan countries or in Turkey, if any, to southern Italy through the electric network of Greece. If may be noticed that the existence of said of the electrical system of Turkey to Bulgaria and to Greece does not realize parallel and syncronous operation of the Turkish system with the Balkan countries or the UCPTE, since the corresponding technical conditions and criteria are not fulfilled by this system. However parallel and synchronous operation of the European and Aegean part of this system with the Balkan countries and UCPTE may be achieved.

The other existing or projected important interconnections between the proposed future REM and the neigbouring countries are the following:

Interconnection	Technical Characteristics (Voltage etc.)
Romania - Moldavia	750kV
Romania - Moldavia	400kV
Romania - Ukraine	400kV
Romania - Hungary	400kV (scheduled to be re-implemented in the future)
Romania - Hungary	400kV (proposed to be constructed in the future)
F.R. Yugoslavia - Hungary	400kV
F.R. Yugoslavia - Croatia	400 kV (supposed to be restored)

The installed power of the countries neigbouring to the REM as well as their annual consumption is depicted in the following table:

Table 1.2. *Production and Demand characteristics of countries neighbouring to REM*

Country	Net Annual Electricity Production	Annual Energy Import	Annual Energy Export	Net Capacity	Thermal (%)	Nuclear (%)	Hydro (%)	Peak Load
	GWh			MW				
Moldavia	7450	5354	5003	2630	2564	0	60	1700
Ukraine	214100	15780	17320	41450	36740	12820	4710	31400
Hungary	31000	2955	921	6980	5090	1840	50	5550
Croatia	7960	4547	982	3590	1530	0	2060	2023
Bosnia Herzegovina	-	-	-	-	-	-	-	
Italy	43930	1096	1096	220162	0	19745	42700	38695
Turkey	73780	31	570	20860	10980	0	9865	12800

- *Source: UN Economic Commission for Europe. The Electric power situation in the ECE Region in 1994.*

1.7 THE E.U. DIRECTIVE FOR THE INTERNAL ELECTRICITY MARKET

The operation of the European Interconnected network according to UCPTE standards has provided the electricity trade between electricity undertakings, as well as power producers and big customers, with the necessary good background for its development. So, it has enhanced the tendency forwards a more liberalized direction-according E.U. principles - in the field of electric energy, in contrast to the previous centralized and monopolistic situation which existed in most countries.

The main objective of the E.U. energy policy in the last years was the implementation of the Internal Electricity Market. The most important step taken towards this direction which came after extended discussions and negotiations between member states, was the Directive 96/92 of the European Parliament and the Council concerning common rules for the internal market in electricity, which became into force on 19.2.97.

In many aspects, this Directive is a compromise among the models proposed by the member states of the E.U., aiming at the establishment of competition in the electricity sector, at least for power generators and eligible customers.

Mainly the following features are introduced:

- Equal opportunities are provided for new generating units to be constructed through authorization procedure.
- Alternatively the new generating units shall be constructed through a competitive bidding procedure, taking eventually into account the new capacity cost, where the tenders shall be evaluated by an independent organization, to be appointed for the member state. Even in this case, the independent power producers and the eligible customers may build new power units through the authorization procedure.
- Power generators and eligible customers shall be able to use the transmission and/or distribution system in order to sell and buy the contracted power; The power transmission fees shall be determined after negotiations with the corresponding system administrators of the member state or according to published tariffs.
- Alternatively, for the member state in which a single buyer model is appointed, the single buyer may be a part of a vertically integrated electricity utility, and may be identical with the transmission system administrator. The single buyer may be obliged to buy the whole amount of power sold by the electricity generators to the eligible customers minus a transmission fee according to published tariffs. If this obligation is not imposed, the access to the transmission system of the eligible customers must be guaranteed and the fees to be paid to the administrator of the transmission system, shall be determined according to published tariffs or through negotiations.
- A transmission system administrator and operator is always appointed for each member state. He must be administratively independent from any production or distribution company and his function must be non discriminatory.
- A distribution system administrator and operator is always appointed for each member state. Function must be non discriminatory also.

- An authority, independent from any production, transmission or distribution company, shall be appointed for each member state to deal with the settlement of disputes in relation to contracts or negotiations. In case of cross-border disputes, the authority of the state, where the single buyer or the transmission system operator refuses access to the transmission system, shall be responsible.
- An authority independent from any production, transmission or distribution undertaking shall be appointed to evaluate the bids for new generating units, for each member state where the bidding procedure will be selected.
- The electric energy dispatch shall be carried out through objective criteria taking into account the economic merit order of the electric energy as well as with respect to the contractual terms between electricity generators and consumers. The dispatch shall also take into account the contractual terms arising from the construction of new generating units through the bidding procedure.
- Long term planning of the power systems of the member states shall be carried out by the transmission system administrators or other appointed authorities, at every two years
- The opening of the market to the eligible customers shall be carried out by the member states, step by step, immediately as well as three and six years after the coming into force of the directive, according to the yearly electricity consumption of each consumer. The corresponding lower limits are 40 GWh, 20 GWh and 9 GWh per year. All consumers with more than 100 GWh consumption per year shall be immediately eligible customers.
- In a vertically integrated electricity utility, the production, transmission and distribution departments shall publish separate economic accounts. This obligation is defined as "unbundling".
- Provisions supporting Market Operation such as:
  - ✓ Mechanisms for regulation, control, and transparency (in order to avoid any abuse of a dominant position).
  - ✓ Public service obligations which member states are permitted to impose, being allowed not to apply some of the Directive provisions where they would obstruct the performance of these public service obligations, that must be clearly defined transparent, not discriminatory and verifiable.

2. REVIEW OF SYSTEMS AND MARKETS

2.1 EUROPE

The electric utilities in Western Europe have worked together in close collaboration for 45 years since the foundation of UCPTE in 1951. The main objectives of the interconnected networks is to ensure a safe and economical electricity production by means of maintaining stand by reserve capacity and optimizing the electricity exchanges.

The electric power systems in Europe could be separated into the following networks:

- **UCPTE**, Union for the Coordination of Production and Transmission of Electricity, including 15 West European countries, which has already to UCPTE from the end of 1995.
- **CENTREL**, a recently formed network that connects the Czech, Slovak, Polish and Hungarian electric utilities.
- **IPSCIS,** Interconnected Power System of Common Independent States, is the former UPS.
- **NORDEL**, Nordic Organization for Electric Power Cooperation, concerning four Scandinavian countries.
- **UK**, is linked to the mainland via a cable in the Cross channel between England and France concerning England & Wales, Scotland and North Ireland.
- **Ireland-Iceland**: Independent networks.

From the above mentioned interconnected systems it is worthwhile to examine the operating and structural developments of the UK and NORDEL interconnected system due to the unique electricity market that has been developed in these systems. In addition the interconnected systems of UCPTE and UPS are discussed.

2.1.1 UCPTE

The European interconnected electric network has been in existence for more than 45 years transcending national frontiers and political, social and economic barriers between involved countries and their electricity under-taking.

The framework of interconnected operation is nowadays, provided by UCPTE (Union pour la Co-ordination de la Production et du Transport de l' Electricite') which was founded in 1951.

All of the companies in UCPTE participating countries are connected to their neighbors via three-phase high voltage power lines of 220 and 380 kV. In addition to this, there are also direct current interconnections with other countries which operate their networks asynchronously with the UCPTE network, with their own frequencies.

Thus, the European interconnected electrical network has optimized the benefits of interconnecting networks between them and has achieved the main objective of the

UCPTE which has always been to make the most possible use of energy within its sphere of influence and to increase the reliability and security of supply.

Energy interchange as well as the network techniques that this requires have been duly developed. In this context it is worth noting that the exchange of electricity within the UCPTE had already been totally liberalized when all international commerce was still subject to limitations and controls.

Since today's interconnected network is very heavily meshed, the various load dispatching centres responsible for operation within their region have to be in full control of their own network and at the same time have a good knowledge of the operating situation in neigbouring networks. The operating decisions taken within each network must not cause unacceptable disruption in neigbouring networks.

This does not, however, mean that a central organization is needed to co-ordinate, manage or control operation. It merely requires the load dispatching centres to keep one another permanently informed by, for example, exchanging the values of operating parameters for their networks.

This cooperation assumes that recommendations have been jointly prepared for this purpose and that they constitute the basis of the interconnected mode of operation practiced today.

The most important prerequisites is firstly that each partner must satisfy the following conditions in his own supply zone:

- Requirements must be met at all times by its own power stations, shared power stations or supply contracts.
- Each interconnected partner must be capable of covering his own load curve at all times by use of his available resources (even in the event of a simple fault).
- Each partner must maintain a primary control reserve equivalent to at least 2,5% of its network's generating capacity; it must be possible to activate this reserve within a delay of a few seconds.
- In interconnected, partner networks must be equipped with secondary power - frequency control.

The structure of the network must be designed to ensure n-1 security in network operation under all possible operating situations (power stations and network line connections).

2.1.2 IPSCIS

The IPSCIS, actually the United Power Grid of Russia, is the world's largest power pool with centralized management. It consists of 505 power stations (5MW and more) having a total installed capacity of more than 205 GW. The electricity generated in 1994 by the power stations in the UPG of Russia amounted to 818,6 TWh.

There are seven territorial power pools in the UPG of Russia: the Central, Middle-Volga, North-West, Ural, North Caucasus, and Siberian power pools, and the power pool of the Far East that is isolated from the others in Russia. There are 72 single-area power systems in these power pools; each of them has its own power - frequency control mode; 65 of them are in the UPG of Russia.

The power systems of the Ukraine, Kazakhstan, the Transcaucasaus, Byeloroussia and Baltia operate in parallel with the UPG of Russia. The power systems of countries, which were formerly part of the power system Mire with its central dispatching office in Prague, operate in parallel with the UPG in Russia through the power systems of Byelorussia and the Ukraine. The power system of Finland, which is part of the power pool of the North European countries, (NORDEL), operates in parallel (but out of synchronism) with the UPG of Russia. This system is connected to the latter though a DC intertie. Electricity from the UPG of Russia is also exported to Norway, Mongolia and China. In 1993 exports of electricity amounted to more than 5,5 Twh.

The UPG of Russia in its boundaries of 1994 was formed mainly by 220 - 750 and 1150 kV transmission lines, specifically:

- 507 Km of 1150 kV lines;
- 2604 Km of 750 kV lines;
- 33722 Km of 400 - 500 kV lines;
- 9744 Km of 330 kV lines;
- 82700 Km of 220 kV lines.

Processes in the production, transmission, and distribution of electricity are managed by a multi-level hierarcal dispatching system and a system of automatic control for normal and emergency conditions.

The structure of dispatching control for the UPG of Russia consists of:

- a Central Dispatching Office (CDO) for the UPG of Russia;
- Dispatching offices for the Power Pools (PPDO) in the UPG of Russia;
- Central Dispatching Services (CDS) for the regional single-area power systems (AO-energo);
- control stations for the power supply subsystems;
- emergency repair teams.

In order to improve the efficiency of dispatching control, automated systems have been created that employ modern computer technology for the transmission and display of information.

The quality of the electricity is maintained by using automatic facilities for normal operating conditions, specifically:

- automatic load-frequency control;
- automatic reactive power-voltage control.

The UPG of Russia is an exceptionally reliable system. For over 45 years, no global faults have ever occurred in it that required long-term discuption of power supply to large cities. The high reliability of the UPG of Russia is due to the advanced characteristics of the system of emergency automation that is used.

2.1.3 THE ELECTRICITY MARKET IN UK

The present market for trading electricity between Generators and Suppliers was established on 31st March 1990. This market recognizes that supply and demand of electricity must be balanced within the system, even though it may not be technically possible to trace electricity from a particular Generator to a particular Supplier. Electricity generated within this system is essentially pooled to meet demand. The commercial provisions which overlay this process are accomplished via the Pool and by separate contractual arrangements.

The electricity industry in UK is separate from organizational point of view into three electric systems:

England & Wales, Scotland and Northern Ireland.
The English and Scottish systems are connected to each other and there is also a DC link between England and France.
N. Ireland's system is presently isolated.
In England and Wales the system include three main electricity producers; National Power, PowerGen and Nuclear Electric, 17 IPP's and a few smaller generating companies (municipal etc.).

The transmission is carried out by the National Grid Company (NGC) while the distribution is responsibility of 12 Regional electricity companies (REC's) operating the distribution network in its authorized area.

In Scotland there are two public Electricity Companies Scottish Power and Hydro-Electric vertically integrated operating their own generation, transmission and distribution network and the state owned Scottish Nuclear selling electricity to the two public companies.

UK's net generating capability totaled 69,3 GW in 1995, of this 93% was owned by the major power producers. Over half of generating capacity is owned by National Power (21,2 GW) and Power Gen (15,6 GW) representing 53% of the total capacity. The other major producers include Scottish Power, Hydro Electric and Scottish Nuclear with a combined capacity of 9,8 GW. Four generating companies in Northern Ireland own 2,2 GW while the new independent producers in England & Wales own 3,4 GW.

The electricity consumption in UK was 303 TWh in 1995, out of which 103 TWh and 102 TWh represent residential and industrial customers respectively. The maximum demand for electricity in UK was almost 55 GW in 1995.

Electricity producers sell electricity to suppliers through the Pool. EDF of France and the Scottish utilities are external members of the Pool.
The Pool is a trading arrangement to determine which generator will be called to supply the demand at any particular moment and to set the spot price for electricity.

To protect customers and to promote competition among the generating companies a new regulatory establishment was introduced, the Office of Electricity Regulation known as **OFFER** that monitors the operation, issues licence to the Pool members of the market and could intervene for the protection of the customers.

The Pool. Electricity is bought and sold in this market by participating Generators and Suppliers. All transactions are made according to the Pool Rules which govern both the market's operation and the calculation of payments due to and from each participant. The Pool exists solely as a mechanism to allow this trading between Generators and Suppliers within the system; it does not itself buy or sell electricity. Participation in this market is through Pool membership under the Pooling and Settlement Agreement. Pool membership is open to both Generators and Suppliers of electricity, subject to fulfillment of certain membership conditions. Generators and Suppliers outside England and Wales who are connected to the NGC transmission system, such as Scottish Power and Electricite de France, are External Pool Members (EPMs).

There are a number of other entities in the Pool, essential to its operation, who are not Pool Members. These are:

The Settlement System Administrator (SSA). The SSA administers the Settlement System. This system is used to calculate prices and to process data to calculate payments due under Pool trading arrangements. Energy Settlements & Information Services Limited (ESIS) is the SSA.

The Grid Operator (GO). The GO operates the transmission system with the objective of providing a reliable supply and maintaining voltage and frequency within the standards laid down in the Transmission Licence. Using the Generator's offer data the GO schedules and dispatches generation sets (gensets) to meet demand whilst attempting to ensure the security and integrity of the transmission system. Since the GO can only schedule offered plant he cannot ensure that sufficient capacity will always be available globally or locally; this must be done by market forces. The scheduling and dispatching functions involve instructing the use of a number of services "ancillary" to the production of energy. NGC is actually assuming the functions of the GO.

The Ancillary Services Provider (ASP). The ASP contracts for ancillary services to enable voltage and frequency control standards to be maintained, as well as other services such as black start capability. The payment for these services is recovered through the Pool via the Settlement System Administrator. NGC is actually assuming the functions of the ASP.

The Electricity Pool Funds Administrator (PFA). The PFA administers the banking and billing of payments under Pool trading arrangements. The duties of the PFA are currently carried out by "Electricity Pool Funds Administration Limited" (EPFAL), a subsidiary of NGC.

Meter Operator parties. Meter Operator Parties are responsible for the installation, operations and maintenance of the local metering systems which allow consumers with a demand of 100kW or more to purchase energy from their chosen second tier Supplier.

The Pooling process

Payments to be made by customers for electricity purchases are calculated from Generator offer data and demand forecasts.

Essentially, the Generator's offer data and the forecast demand are considered by scheduling sufficient capacity to meet that demand, based on the assumption that there are no constraints on the transmission system. This is termed the Unconstrained Schedule. The most expensive generating unit in this schedule sets the System

Marginal Price (SMP), which determines the price for all the scheduled power. A capacity element is added to this price which reflects the risk of losing load and the value to the consumer of that load. This risk is termed the Loss of Load Probability (LOLP). These factors then set the Pool Purchase Price (PPP).

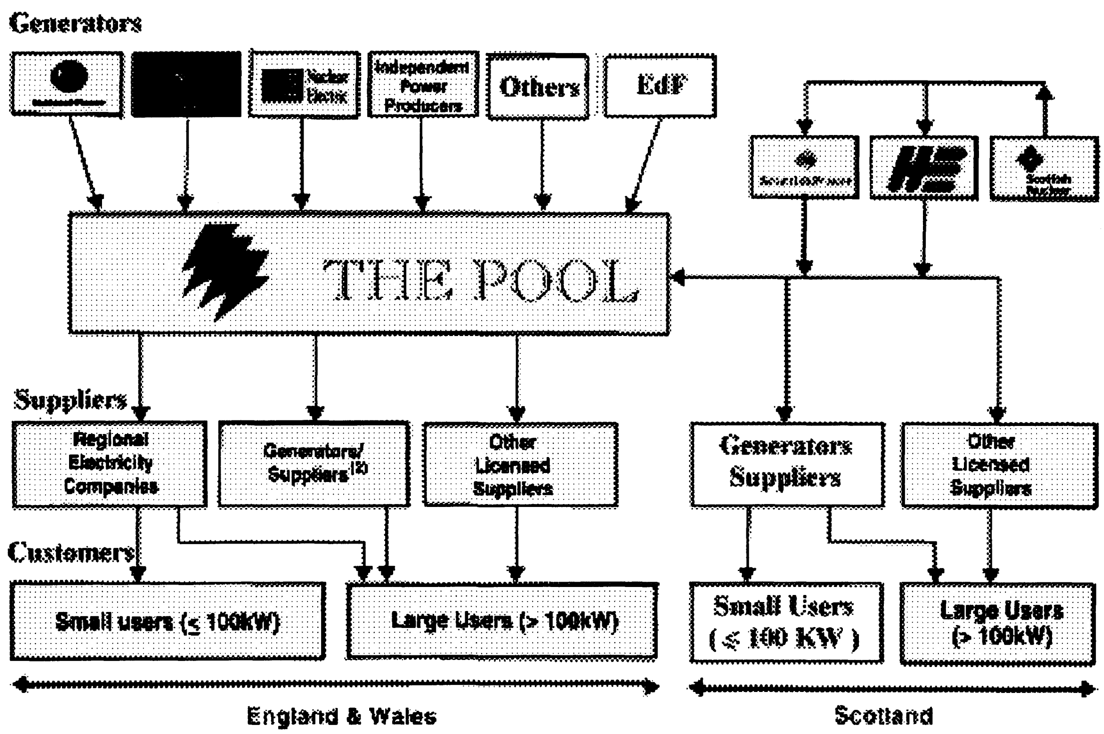


Figure 2.1. Structure of the Electricity Industry in GB

The calculation of Pool Purchase Price is completed 24 hours ahead of real time and sets the price the Generator will receive for the energy from each generating unit which appears in the Unconstrained Schedule.

Other costs that may be incurred because actual operation does not align with the generation scheduled when PPP was determined are recovered from Suppliers through an additional item added to the PPP called Uplift.

Uplift takes into account such factors as:

- operational constraints,
- the cost of ancillary services,
- compensation payments to Generators carrying reserve in the Unconstrained Schedule,
- availability payments to Generators who are not selected for the Unconstrained Schedule,
- small miscellaneous costs

The Pool Purchase Price, increased by Uplift, forms the Pool Selling Price (PSP), the price paid by Suppliers for electrical energy.

Since April 1994 large customers, with maximum demand of more than 100 kW are free to choose their Suppliers, thus more than 50% in terms of sales are opened to competition while the rest must take their electricity supply from their local REC.
From April 1998 the market is expected to be free to all customers to shop around for electricity supply.

2.1.4 NORDEL ELECTRICITY MARKET

The Scandinavian countries have cooperated in the electricity sector as early as 1915 through undersea interconnection between Sweden and Denmark. The cooperation was further formalized by the establishment of the Nordic Electric Power Co-operation (NORDEL) organization in 1963, where the other Nordic countries also participated for the optimization of production cost in the region.
Today, the initial connection of Sweden and Denmark has been enlarged several times covering all Nordic countries on the European continent, namely Denmark, Finland, Norway and Sweden. The generating system of these countries produced 362 TWh of electricity in 1995 out of which more than 55%, 207 kWh was generated by hydro power units. The maximum load reached 63 GW while the installed capacity was 88,6 GW.
The NORDEL system operates at synchronous mode with AC and DC interconnections among their networks. It is also connected to the neigbouring regions in a synchronous mode with the very large networks of UCPTE and UPS/IPS.
Electricity production among the NORDEL systems varies considerably. Norway's generating system is almost entirely hydro (99%) while Denmark's production, on the opposite side, is including almost entirely thermal generation (approximately 95%). The production systems of Finland and Sweden are dominated by thermal and hydroelectric units with significant nuclear and capacity.
Based on the above mixture of generation, the Nordic countries have presently the lowest average generating cost in Europe.
Concerning the structure of the electricity sector, in each country there are various ownership arrangements.
In general, the following composition and structures exist today:

The electricity sector in Denmark is dominated by two large vertically integrated utilities, ELSAM and ELKRAFT. Both utilities control the transmission network in their respective regions with high level of municipal ownership at the distribution level. The installed capacity in Denmark was 10342 MW in 1995 with the following type of units.

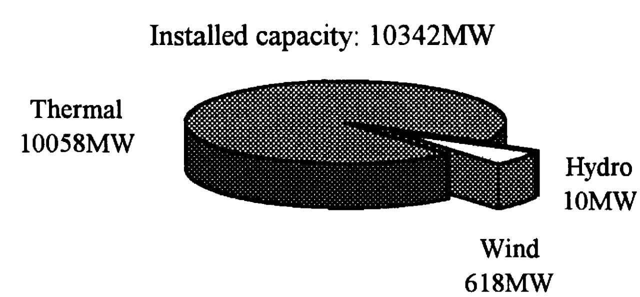


Figure 2.2. Installed Electrical Capacity in Denmark

In **Sweden,** having the largest electric industry among the NORDEL power systems, the generation is mainly dominated by the public utility Vattenfall.

Recently, the operation of the transmission national grid and the responsibility for electricity exchanges through the interconnections were separated from Vattenfall. The electricity sector is presently (January 1996) under very extensive reforms.

The installed capacity in Sweden was 34,608 MW in 1995 including the following type of generation:

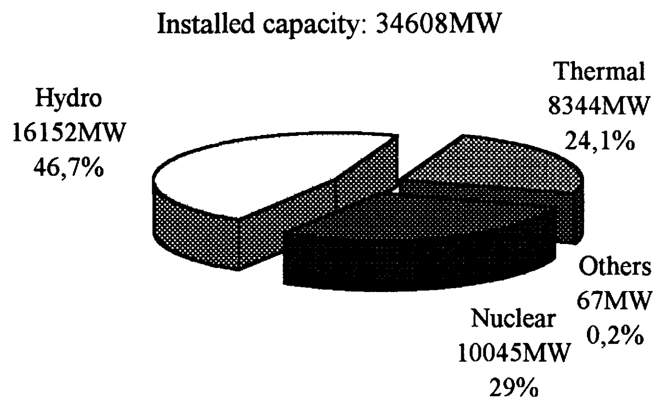


Figure 2.3. Installed Electrical Capacity in Sweden

The electricity network in **Finland** used to be dominated by the Public Utility IVO, however, the transmission grid was separated form IVO in 1992 but the utility is still responsible for the international interconnections. Deregulation towards an open market took place on June 1995 but access to the grid is only for customers of over 500 kW. From January 1997, the system will be open to everybody.

The installed capacity in Finland was 14740 MW in 1995 including the following type of generation:

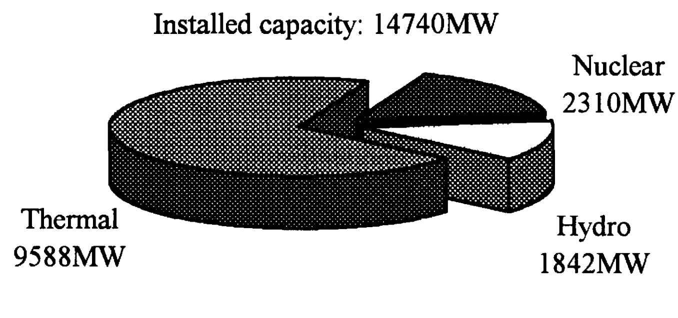


Figure 2.4. Installed Electrical Capacity in Finland

Norway, the almost entirely hydroelectric system, had recently (1991) experienced extensive deregulation towards the opening of the electricity market. There are numbers of multiple producers supplying energy under long term contracts to the pool. A public company is responsible for the national grid, the pool and the operation of most electricity interchanges. In Norway all producers have access to the market and all customers have the right to choose their supplier.

The installed capacity in Norway was 27,541 MW in 1995 almost entirely hydroelectric:

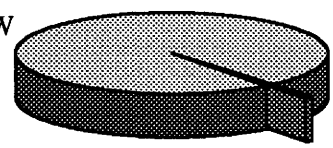


Figure 2.5. Installed Electrical Capacity in Norway

The total capacity of the interconnection links of NORDEL is approximately 18% of the installed generating capacity, while interconnection exchanges represent a considerable amount of the gross electricity production of the Nordic countries.

Almost all electricity is exchanged on a day-to-day basis and only a few long term contracts exist. Even though most of the trade is seasonal interconnection, capacity is a constraint during certain times of the year.

NORDEL provides the framework for cooperation and coordination of the electricity market but it has no formal powers. Its membership is limited to prominent members of the electricity supply industries and members do not represent the governments of their respective countries.
Trade has been conducted on the basis of bilateral, informal "gentlemen's agreements". Payment has traditionally been made through:

- sharing of information on marginal operating costs
- splitting of gains from electricity exchanges.

Following the electricity reforms in Norway in 1992, the mutual trust among the members has been demented and less trust in the cost information is provided. Trade has moved towards more commercial pricing arrangements on the basis of offer prices for bulk energy, which may not be cost-reflective.

The majority of electricity exchanges is in a short term basis. This reflects a policy by the governments of avoiding net trade, and so largely restricting trade to seasonal interchange. Consequently, trade has not been sufficient to equalize electricity marginal costs in neigbouring countries including allowance of marginal transmission costs.
In addition, to the capacity constraints, the potential to the UCPTE exporting of electricity has been limited due to existing restrictions on wheeling among the NORDEL member states.

The NORDEL electricity market is concentrated mainly on the coordination of technical standards and investment in connection capacities, to increase the reliability and security of supply and to save on reserve capacity.

All of the NORDEL members have been committed to self-sufficiency policies in the electricity sector that reduce export and import quantities of electricity which would be resulted from a free trade. However, the day-to day exchanges, involving a **Loose Pool operation**, have become considerable though the years with substantial economic and technical gains.

Nordic countries are predicting even closer links in the future. That will come through cooperation agreements, buy-outs and mergers. The idea is that of the creation of a NORDEL electricity exchanges market, similar to a money market. The new form of exchanges was operative provisionally in 1996, mostly between Sweden and Norway. It will be in full development in January by including also Finland out Denmark. However, if the Scandinavian market is to be successful it is important to ensure reciprocity principle as far as possible.

2.2 SOUTHERN AFRICA

In Africa, the most important attempts for encouraging the interconnections of the electric networks and the promotion of the power and energy exchanges are those in northern Africa between the countries of Maghreb and those in Southern Africa, between Zaire, Zambia, Botswana and the Republic of South Africa (RSA).

The case of Southern Africa is the most important exemple of step by step construction of a REM which will develop to a "loose energy pool" in the future years. The utilities involved are those of SNEL (Zaire), ZESCO (Zambia), ZESA (Zimbabwe), BPC (Botswana) and ESKOM (RSA), which are state -owned and vertically integrated. Private investments are encouraged in the production sector.

Zaire has 2,600 MW of hydro power developed for the moment and there are plans for developing further 40,000 MW. There is a 220 kV AC interconnection between Zaire and Zambia which is the prolongation of ±533 kV HVDC line in Zaire.

Zambia and Zimbabwe have an integrated 4,000 MW hydro/thermal power system. Zambia is exporting power to Zimbabwe through a 330 kV AC network. With 460MW and 2,328 GWh over the last 15 years, this trade is the largest in Africa. A 400kV AC link is planned between Zimbabwe and RSA, in order to stimulate electricity trade with this country which, actually, is carried out through Botswana.

Botswana has only 205 MW coal-fired thermal power and is interconnected to Zimbabwe through a 220 kV AC link and to RSA through 132 kV AC lines.

RSA has a big installed capacity of about 36,000 MW coal-fired thermal power; 8,000 MW are considered as surplus and can be exported to the northern countries to cover deficits of the hydroelectric power due to drought.

In 1992, ZESA, BPC and ZESCO, belonging to countries already cooperating inside the SADC regional organization, formed the Interconnection Operating and Planning Committee (IOPC) to which ESKOM is participating since 1994. IOPC is promoting the development of common planning and operation of the electric systems, is coordinating the design, installation and operation of the generation and transmission systems and is promoting wheeling through the electric networks of the four countries.

Electricity trade has the form of (i) emergency supply, (ii) surplus energy exchange under the condition that the importing country has sufficient capacity to cover the surplus and is merely taking profit from the lower short run marginal cost (SRMC) in the exporting country and (iii) firm power supply for longer periods and higher prices, close to the long run marginal cost (LRMC).

The transmission charges are generally, incorporated into the energy charges. There exist also additional wheeling charges including a fixed part as contribution to the fixed network costs as well as a constant percentage of the energy wheeled.

There is no formal regional co-ordination of the electricity market and trade is implemented through bi-lateral and rarely tri-lateral contracts, since the utilities concerned have not yet applied the principle of equal sharing of benefits. The agreements have the form of Government to Government Memorandums of Understanding, Inter-Utility Agreements, Supply Agreements for Power/Energy, System Operating Agreements, Maintenance Agreements. The important lesson taken

(3)

from the experience already gained is that tariffs must be agreed before the implementation of the projects.

In the future, the IOPC intends to undertake resource planning, load dispatch, management of the joint systems, as well as the active supervision of the cost recovery between participants and the settlements related to the contracts. This structure corresponds to a "loose pool" which shall incorporate also Zaire (SNEL).

The main technical problem is the lack of Automatic Generation Control (AGC) of the ZESCO and ZESA electric networks which impede their integration with BPC and mainly with ESCOM, as the latter have AGC. Each interconnected system is proposed to act as a Control Area, responsible for its own area balance and frequency control and shall regulate the load of the interconnections so that a predetermined error in the load flow is corresponding to a given variation of the frequency (area control error or ACE strategy). The use of Flexible AC Transmission System (FACTS) Technology is also envisaged, through the use of static VAR compensators (SVCs), controlled series compensators (CSCs) and the continuous variation of the apparent impedance of a number of transmission lines, thus forcing load to flow along "contract paths". The FACTS devices could double the present capacity of the existing AC transmission system.

Surplus energy is priced as a percentage of the SRMC of the buyer (avoided cost). A high proportion of the SRMC increases the benefits of the exporter, on the other hand a lower proportion introduces a more equitable sharing of the benefits between importer and exporter. Firm power is supplied for contract life and provide a higher benefit to the purchaser, since he can postpone generation investments. Therefore, the prices for such contracts are higher. The firm power and energy are either offered at a charge reduced proportionally in case of a capacity or availability shortage, or offered through a "take or pay" contract. In both cases, the contracts have no penalty for non-supply and the exporter or supplier is practically not obliged to ensure capacity and availability. The charges are normally paid in US$ and escalated at an a agreed rate.

The Southern Africa REM has achieved to procure benefits to its partners, which either have coal fired power plants (RSA, Botswana) or an important contribution of hydro power plants (Zaire, Zambia, Zimbabwe). The import of energy from RSA has solved enormous problems created by the drought in Zimbabwe. On the other hand, the existence of the REM has provided with additional spinning reserve the electric systems of RSA and Botswana and gave to them the possibility to cover peak load at lower costs. RSA can also import cheap energy from hydro power plants in Zaire.

However, the political mistrust between the countries participating in the REM is affecting its undisturbed evolution to a "loose power pool". The participation of the big electric network of RSA is creating an asymmetrical relationship. Another asymmetrical relationship is created between Zimbabwe and its neigbouring SADC countries, since Zimbabwe is unilaterally dependent from imported electricity. It should be noted that RSA was accepted as a member of the IOPC as a result of the drought and of the other difficulties of ZESA. The smaller countries participating to the South African REM are more or less reluctant to give up some autonomy in the energy sector and be integrated in a "power pool". Of course the political change in RSA over the last years is favorable to the increase of cooperation between the utilities of the Southern African countries.

2.3 ASIA

There are two REMS of major importance in Asia, the power system of India and the regional network of Thailand, Malaysia and Laos.

2.3.1 INDIA

The Indian power system has an installed capacity of some 72,000 MW. After allowing for poor availability and fuel quality, the system can supply a maximum demand of 49,000 MW. 28% of the capacity is hydro and the rest thermal. The supply is chronically short of the demand (estimated by some as 15 - 20%).

Over 96% of the electricity supply industry is in public ownership. The industry is dominated by vertically integrated utilities at State level, known as State Electricity Boards (SEBs). These State level utilities are grouped into five synchronously connected Regional Electricity Boards (REBs). The SEBs operate their own generation, and have contractual shares in plants owned by the central government. They also trade with other SEBs.

The Indian power sector is characterized by a high level of capacity deficiency. This constrains trade, since there are relatively few situations where there is surplus energy to trade. It also contributes to grid indiscipline; during peak periods, SEBs are reluctant to shed load to the degree required. As a result the frequency tends to fall during peak periods, sometimes to below 48 Hz.

Trade takes place between REBs. The main inter-regional links are DC. Those that are in existence or under construction, are set out in the table below.

Table 2.1. Main Inter Regional Links

Between regions	Link capacity MW
South - West	1000
North - West	500
East - South	500
North - East	500

There is a high degree of central planning, with the planning focus being the optimal development of each regional grid as a separate entity. The concept of planned exchanges of power, and the eventual development of a national grid remains a long term general objective only.

In addition, there a number of lower voltage AC links, used to arrange radial supplies. International connections are minor, although a 132 kV link with Nepal is under construction.

Although the regional grids in India are chronically short of capacity, these shortfalls do not all occur simultaneously. There are occasions when some grids may have an energy surplus whereas a neigbouring grid has an energy shortfall. In most regional grids in India, the existence of hydro electric capacity allows at least some storage of electrical energy (by holding on water in the reservoirs when excess thermal energy is available). There is also potential for reducing generation costs (primarily in off-peak periods).

In the longer term, there may be wider potential for reducing generation costs through developing hydro or other low cost generation for export to other REBs. The volume of inter-REB trade at present is very low, and less than 0.5% of gross generation in India.

In India trade is priced on a split savings basis. The agreements covering this were relatively informal, and required a high degree of trust and information sharing between utilities. They are based on a tariff set by a third party - the central Government Generation Corporations - and so they are less dependent on revealing internal cost information than in other cases.

Trade is carried out between two SEBs along an interconnection between two REBs. The trade takes because one SEB has a contractual right to capacity at a centrally owned generating plant which this last does not require. As the Regional Load Dispatch Centers (RLDCs) oversee the operation of centrally owned plant, they also oversee the trade. The cash settlement is between the SEBs on whose behalf the trade was arranged.

RLDCs identify any surplus within their region, usually due to SEBs not requiring their full contractual entitlement from a centrally owned plant. This surplus is offered to the neigbouring RLDC. Both RLDCs independently inform Power Grid (operators of the DC link) of the agreed trade. Power Grid only implements the trade if both statements agree.

Grid discipline has been a major problem within the synchronous REB networks. This has principally been due to capacity deficiency, and a reluctance of SEBs to shed load when their own generation, plus their contracted share of a centrally owned plant, is insufficient. To avoid these problems, trade between REBs has all been on a radial basis, through DC lines.

Thus, the trade is priced on the basis of the tariff for a centrally owned plant. The RLDC offering energy quotes the tariff for the centrally owned plant concerned. The RLDC importing energy quotes the tariff of its most expensive central plant. If it is in deficit, the price of the electricity imported exceeds that of the most expensive plant. Trade proceeds if there is a tariff differential, and the benefits of trade are evenly split between the two SEBs concerned, if the RLDC importing has no deficit in power.

India provides the main example of difficulties in contract enforcement. There are examples of payment for trade between SEBs being delayed for up to one year. No specific examples were quoted of difficulties in enforcing contracts between REBs. As there is no synchronous connection, it would of course be straightforward to stop trade if payment was not forthcoming. Inter-REB trade does not suffer from the same grid discipline problems as trade within REBs.

The PowerGrid Corporation has only recently been formed, and is paying contract fees for wheeling central sector generation to the SEBs. Consultants are currently looking at a more cost reflective charging system for the Power Grid. One of the aims is to encourage IPPs.

Power sector reform in India may also involve corporatisation, with increased efficiency incentives, or transfer of ownership to profit maximizing private companies (IPPs). Some Indian SEBs are looking at privatization of existing assets.

2.3.2 SOUTH EAST ASIA

South East Asia network and trade through it is of interest in having agreements for firm cross-border trade.

Thailand has a power system of 1,000 MW operated by the Electricity Generating Authority of Thailand (EGAT), with a small share of energy (8%) from hydro power. Laos has 90 MW of installed capacity for the domestic market. It also has 300 MW of hydro power dedicated to export to Thailand, and a further 1,500 MW for export is under discussion and/or development. Malaysia has a developing power sector, but a relatively weak link to Thailand.

The existing and proposed hydropower stations based in Laos for export to Thailand provide firm power. EGAT, importing to Thailand, is seeking to negotiate firm power agreements for the next 1,500 MW hydro plant. This would require the plant to provide a specified level of firm power at all times, and would price that firm power at the cost of displaced (baseload) capacity. Although EGAT itself, will be the purchaser of the energy, it is not proposing to finance the investment which means the arising of another issue.

Because the Laotian system is so small compared with EGAT and the size of the link relatively large compared with the Laotian system, Laos becomes in effect a small distributor connected to the Thai system; its operation has virtually no influence on the interconnected system. It would be difficult therefore for Thailand to perceive any operational difficulties arising from the connection to Laos, and this is indeed so.

The AC interconnection between Thailand and Malaysia failed on a number of occasions because of the difficulties of maintaining synchronism between two relatively large systems using such a weak link. Attempts to operate the synchronously interconnection have been abandoned, and it has been used for radial supplies. A 300 MW DC link is under active consideration.

Trading between Laos, Malaysia and Thailand is all on opportunistic basis, with the exception of the Nam Gun power station and the proposed new hydro projects. The contract proposed for the new developments obliges the Laotians to provide firm power, and lays down penalties for failure to do so. This approach would probably deliver lower benefits than a more flexible approach with less security of delivery under the contract.

2.3.3 CHINA

2.3.3.1 General features of the Electricity Sector

China adopted the policy of reform and opening to the outside world in 1978. Since then the country's electric power industry has developed rapidly. During the period 1990-1995, the capacity of large and medium sized generating units increased by 12 millions kilowatts annually, and the installed capacity of power generation increased by 75 million kilowatts each year, and the total increased capacity reached 210 million kilowatts, while the annual electric energy production reached 1 trillion KWh.

The electric power industry is regulated by the "Electricity Law" which was promulgated in 1995

There have been three stages concerning the regulating of the electric power industry. During the first stage (1949's - mid - 1980's), government regulations were designed to suit the system of a planned economy, with their contents covering almost all aspects of the electric power industry. In the second stage (mid 1980's - early 1990's), the traditional structure of a planned economy was reformed, and the monopoly in power generation area broke as the raising of funds was encouraged and a system of multiple tariffs was introduced. The level of laws concerning the above was upgraded. The third stage (lastly 1990's - present) introduced a plan for the utilization of foreign investment in a socialist market economy ruled by the legal system.

2.3.3.2 Major Contents of China's Existing Laws and Regulations on Electric Power

Basic Principles:

The law provides principles for maintaining the legal rights of investors and operators as well as consumer encouraging and leading economic organizations and individuals from both China and abroad to invest in power construction and establishment of power production enterprises, and the principle of "Who Invests Benefits". In the operation and management of electric power, the law provides a principle for separating the functions of government administration from those of enterprises. In the production of electric power and the management of power grids, the law stipulates principles for both the power generating and grid management companies to sign power purchase supply agreements, comply with unified dispatching, conduct management at different levels, mutually benefit, have consultations and reach consensus. In the supply and consumption of electric power the law clearly defines that every area of power consumption can have only one institution to operate the supply of electric power in a bidding procedure as well as to regulate the area divisions to consume electricity. And, in the formulation of power tariffs and collection of charges, it provides for principles of national compensation for costs, reasonable fix of percentages of grids, computation of tax in line with law provisions and definition of rates of fair payment for power consumption.

Power Consumption:

In accordance with policies defined above the raising of funds by local authorities for power construction accounts for roughly 40% of the total investment in the electric power industry and investment from foreign economic organizations and individuals took a proportion of 10% in addition to the investment from the Central Government of China. In an effort to encourage foreign economic organizations and individuals to invest in electric production enterprises, the State has established laws and regulations covering guarantee, insurance, customs affairs, contracts etc., as well as procedures for official approval of foreign investment.

Policies in the Electric Power Industry:

The state applies the policies of developing hydropower stations and thermal power plants as well as nuclear power plants and synchronously operating power grids.

Tariffs:

The state applies two part tariffs; one part is based on electric capacity and the other part is based on energy. There are general categories such as purchasing electric power by the power grid, mutually supplying electric power and tariffs on selling electricity to consumers. There is also a price control authority for approving these tariffs even in the case of an independent power plant.

Management of Power Grids:

All companies operating under a power grid are required to comply with the unified dispatching of the power grid concerned, and to assign agreements with the grid management company on the supply and purchase of electricity.

Taxation and Foreign Exchange Control Concerning Electric Power:

All companies comply with a unified regulation, in order to guarantee the smooth realization of the two fundamental changes, that of the national economic structure from a planned economy to a socialist market economy, as well as that of the economic growth from a pattern of extensive operation to that of intensive operation. The state has decided as a strategic task that "The construction of the social democracy and legal system as well as the promotion of the reform of the political system are the major guarantee for China's reform and opening to the outside world as well as for the modernization drive".

In addition to the above a further improvement of relevant regulations on the use of the foreign investment for power construction has been decided.

The present strategic policy set by China has been designed to create a favorable investment environment for international co-operation and therefore it has focused on such legislations that ensure the foreign investors' capital.

2.4 AMERICA

The electric power system of America can be devided into three major interconnected power systems. The interconnected network of North America including the electric utilities of US and Canada. The power systems of Central America from Mexico to Colombia and Venezuela and the electric networks of South America from Bolivia and Brazil to Argentina and Chile.

2.4.1 UNITED STATES

The electric power industry in United States today is a diverse mixture of investor and publicly owned utilities, government agencies, cogenerators, and independent power producers. The industry consists of more than 3,200 entities that supply electricity to more than 100 million households, commercial establishments, and industrial operations. At present, there are 203 investor-owned utility operating companies, 1,988 local publicly owned systems (including municipal, State, country and regional systems), 994 rural electric cooperatives (including 885 distribution co-ops and 59 generation and transmission co-ops), 59 public joint-action agencies, 6 Federal power agencies, and several hundred cogeneration and small power producers.

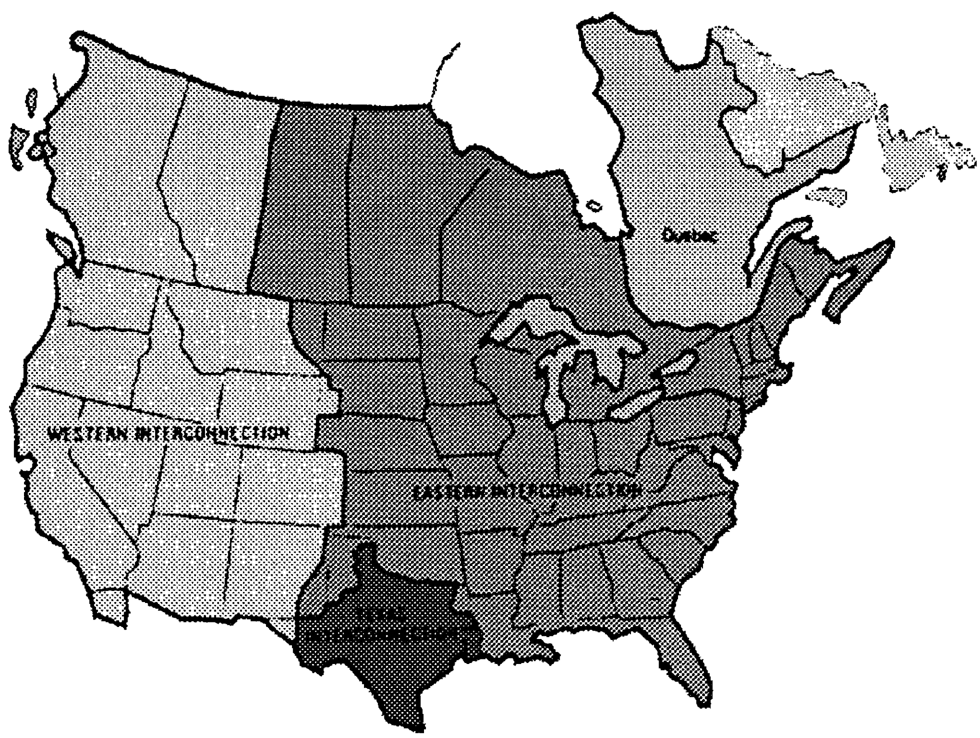


Figure 2.6. Interconnections of the North American Electric Reliability council

Investor-Owned Utilities. The 203 investor-owned utility operating companies dominate the electric power industry, generating 76% of USA's power and serving about 75% of all retail customers. These companies are an assimilation of some 2,000 private utility systems that were in existence in the 1920s. Actual control of the industry is somewhat more centralized because nearly one-quarter of the utility operating companies are subsidiaries of nine registered main electric utility holding companies regulated under the Public Utility Holding Company, Act of 1935 (PUHA).

Federal Systems. The Federal Government is primarily a whole-seller of electric power produced at federally owned hydroelectric facilities operated by the Bureau of Reclamation and the U.S. Army Corps of Engineers. Power is marketed through five Federal marketing agencies and through the independent Tennessee Valley Authority, a government corporation. Together, Federal systems had an installed generating capacity of approximately 64,000 megawatts (MW) and accounted for 8.4% of the Nation's power generation in 1987. All Federal powers systems are required under existing legislation to give preference in the sale of their output to other publicy owned systems and to rural electric cooperatives.

Local Public Systems. In addition to the Federal systems, there are 1,988 local, municipal distribution companies including giant systems like the Power Authority of the State of New York. Publicly owned systems are in operation in every State except Hawaii. Municipal systems are usually run by the local city council or an independent board elected by voters or appointed by city officials. Other public systems are typically run by public utility districts, irrigation districts or special State authorities. Together, local public power systems generated 10.2% of the Nation's power in 1987 but accounted for 14.3% of total electricity sales, reflecting the fact that many public systems are involved on in retail power distribution.

Interconnections. North America's interconnected utilities create four physically separate, synchronously operated transmission networks:

- the Eastern Interconnection (or Seven Council Interconnection):
- the Texas Interconnection;
- the Western Systems Coordinating Council (WSCC); and
- the Hydro Quebec System.

DC and AC transmission interties between the networks are limited in number and capacity, with the result that the transmission systems in the United States do not form a single national grid, but rather form three separate grids. The transmission barriers between the three grids effectively limit the market areas for electric power in the United States into separate synchronous transmission networks. However, it would be possible to construct AC-DC-AC interties to allow greater power flows between these regional networks without disrupting synchronous operations.

Power Pools. There are two types of power pool arrangements-**tight** power pools, which include holding company power pools, and **loose** power pools. The nine tight power pools are highly interconnected, centrally dispatched, and have established arrangements for joint planning on a single-system basis. Four of these tight pools consist of utility holding companies with operations in more than one State; the others are mostly multiutility pools. Together, the tight power pools account for about a quarter of the industry's total generating capacity.

In addition to the tight power pools, there are a number of loose power pools. Arrangements among utilities in loose power pools are quite varied and range from generalized agreements that coordinate generation and transmission planning to accommodate overall needs to more structured arrangements for interchanges, shared reserve capacity, and transmission services.

Existing interutility obligations and economic dispatch and transmission arrangements in interconnected and highly coordinated power pools may tend to limit opportunities for expanded competition in some areas for several reasons. Among the most significant are constraints imposed by existing long-term pooling contracts and the extent of operating economies already captured by pooling. In areas without extensive pooling agreements, increases in power pooling, coordination, and/or power brokering could offer benefits from better utilization of existing capacity that might be similar to those claimed for greater competition in bulk power purchases.

NEPOOL: One of the largest regional electricity markets in United States is the New England Power Pool (NEPOOL) consisting of 96 electric utilities that cover the six New England states, namely: New York, Massachusetts, Connecticut, New Hampshire, Main and Vermont. This market operates in the form of a tight power pool, with centralized dispatch and expansion planning. NEPOOL has nearly 26 GW of plant capacity and it services is in part most of the north-eastern United States and Canada.

The majority of NEPOOL's capacity is oil and natural gas fired while nuclear power accounts for 25% of the installed capacity and nearly 40% of the generation. NEPOOL imports a significant amount of electricity from other regions which is contracted, purchased, and co-ordinated by the pool. Also, Independent Power Producers play a significant role in the overall electricity balance of the power pool.

NEPOOL is governed under an agreement between all participating electric utilities, where its main focus is on organizational issues. The agreement establishes a management committee that oversees the overall pool management, as well as an operation and planning committee. Functionally, NEPOOL operations are the following:

- *New England Power Exchange* (NEPEX) responsible for the centralized dispatch of all power plants as well as for maintaining the power supply and network security.
- *NEPOOL Billing* monitors the energy rated and services transactions accounts.
- *New England Power Planning* (NEPLAN) is responsible for load forecasting, generation and transmission systems planning as well as for the evaluation of generation and transmission projects.

It should be mentioned that as the pool members must foresee and provide their generation system with sufficient generating capacity, either by ownership or by contract, the same holds true for the reserve capacity level. The contrary is discouraged through penal pricing.

Due to the large number of participating utilities the dispatching is carried out centrally by the pool. Also, the number and the diversity of the participants geared the attention of the pool to institutional issues. The pool dispatch is carried out in two steps: 1st for each utility separate as if there was no pool and 2nd for the pool as a whole. Utilities that generate more than they require for their own market are paid their short term marginal cost (SRMC), while those generating less pay their own SRMC. A savings fund equal to the difference in cost between pool dispatch and the sum of individual dispatches is then distributed to all members. Those utilities whose individual dispatch shows a capacity deficit pay a penalty rate for imports in order to cover capacity deficits.

The power pool benefits result from the pool's ability to provide reliable supply with limited reserve margin and therefore minimum future generation investments. It should be emphasized that NEPOOL has also benefited from trade with Hydro Quebec and other pools. Negotiations and power purchases from Hydro Quebec have been proven easier for NEPOOL than for each participating utility separate.

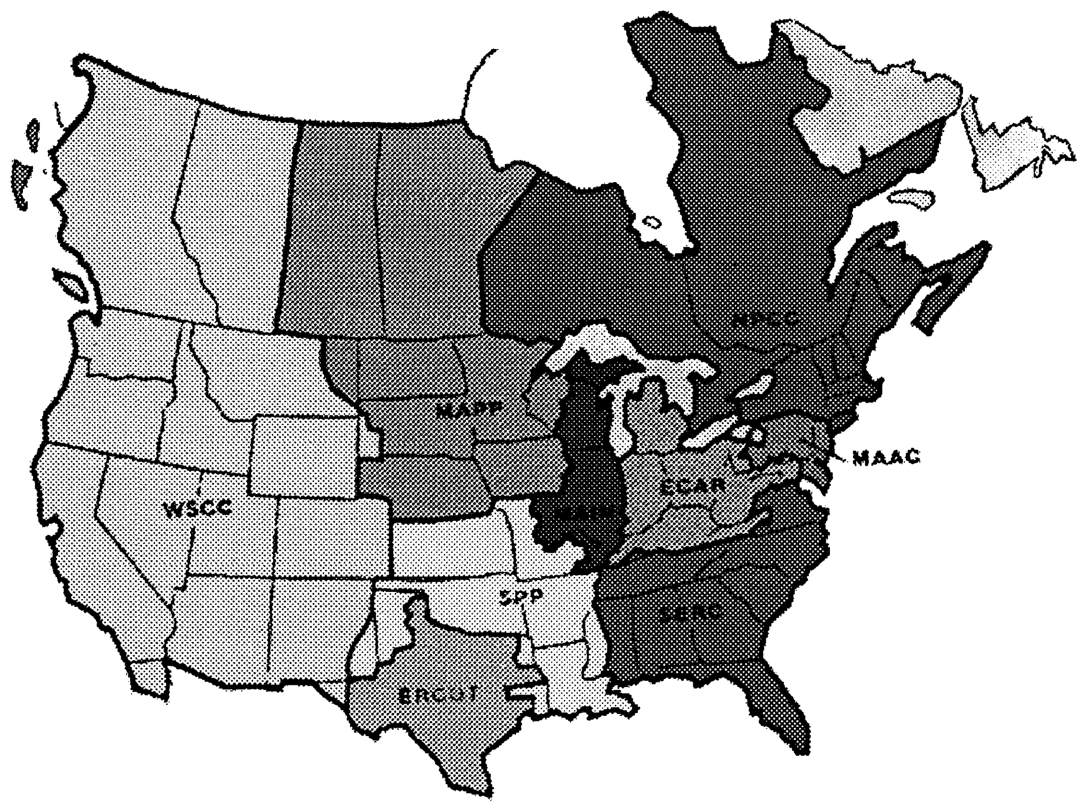


Figure 2.7. North American Electric Reliability Council

The North American Electric Reliability Council (**NERC**) contains the following power pools:

ECAR : East Central Area Reliability - Coordination Agreement;
ERCOT : Electric Reliability Council of Texas;
MAAC : Mid-Atlantic Area Council;
MAIN : Mid -America Interconnected Network;
MAPP : Mid -Continent Area Power Pool;
NPCC : Northeast Power Coordinating Council;
SERC : Southeastern Electric Reliability Council;
SPP : Southwest Power Pool;
WSCC : Western Systems Coordinating Council;

Mid-Continent Area Power Pool (MAPP): MAPP operates as a formal brokering type power pool. Its voting members are electric utilities that:

- own or lease and operate one or more generating units to meet all or part of the system load;

- they are directly interconnected with one or more participants in order to meet obligations of the MAPP Agreement;
- operate or participate in a 24-hour dispatch center with a terminal on the MAPP communication network and,
- maintain Adequate Capability during each month.

Between 1988 and 1997 installed capacity has been increase by approximately 700 MW. This increase consists primarily of a 400 MW coal-fired unit and the return of retired units to service.

Summer peak demand is expected to grow by 1.5 % annually and the winter peak by 1.6 % annually for the forecast period. MAPP utilities are actively pursuing various load management programs to reduce growth in peak demands.

Capacity margins for summer peak periods in MAPP are projected to decrease from 27.6 % in 1988 to 21.4 % in 1997. Although capacity margins will decrease during this period, NERC expects that they will meet reliability criteria and should therefore be adequate.

The Pool depends heavily on coal and nuclear power for electricity generation. Coal used, now accounts for little more than two-thirds of electricity generated, is expected to increase to 70.8 % by 1997. Nuclear share is expected to decline to 17.5%, and hydro's share will decline slightly.

Transmission. MAAP has experienced increase at the internal and interregional use of its transmission systems for economy and emergency energy transfers. For example, NERC reported that in 1986 transfer capacity between MAPP-U.S. and MAPP-Canada was utilized at 71% of maximum capacity; interregional energy transfer capacity between MAPP and WSCC was almost 87 % of the maximum capacity.

Furthermore, interregional transfers from MAPP to MAIN and SPP have been increasing annually since 1976 and are expected to continue over the next decade. According to NERC, improvements currently underway or planned should help to alleviate concerns. NERC expects the region's transmission facilities to be adequate through 1997.

Bulk Power Transactions. MAPP utilities take advantage of their significant coal-fired capacity by selling to utilities in other regions. Bulk power transactions within the region are based on **least-cost generation**. But, the region's lack of generation diversity may limit the potential for large-scale purchases and sales. The NGA survey indicated that MAPP respondents contracted to sell 1,900 MW and to plurchase 2,470 MW.

Coordination. MAPP consists of the Upper Missisippi Valley Power Pool, the Iowa Power Pool and the Nebraska Public Power Systems. Pool agreement provisions cover capacity and transmission plans and requirements as well as daily and seasonal operations. However, the pool agreement does not oblige members to provide bulk power supplies to other members over a long period of time. Individual utilities would have to independently arrange for their power needs

Control Areas. Responsibility for the operation of USA's generating facilities and transmission networks is divided among more than 140 "control areas." In an operational sense, control areas are the smallest units of the interconnected power system. A control area can consist of a single utility, or of two or more utilities tied together by contractual arrangements. The key characteristic is that all generating utilities within the control area operate and control their combined resources to meet their loads as if they were one system. If a single control area is used to dispatch the generating facilities of several utilities to minimize overall costs, the process is known as "central dispatch." Because most systems are interconnected with neigbouring utilities, each control area must assure that its load matches its own internal generation plus power exports or interchanges to other control areas, less power imports.

Because of interconnection, each control area must satisfy more stringent requirements for generation control, frequency control, and tie line flows than would be needed for an isolated system. Control areas coordinate transmission transactions among electric power systems through neighbouring control areas.

2.4.2 CENTRAL AMERICA

In Central America a project of major interest to utilities and private investors alike is the Sistema de Interconexion Electrica Centroamericana (SIEPAC) transmission project to serve as the "backbone" of a central American grid. A preliminary study was completed by Spain's state-owned utility, Endesa, in 1992 which recommend a transfer capability of 500MW. In a meeting in the summer of 1995, Central American utility planners agreed to do a follow-on study for a line with a target completion date of 2000. The first stage would be to begin building an interconnection between El Salvador and Honduras in 1997, but, ultimately the scheme would tie in to Mexico in the north and to Colombia and Venezuela in the south.

2.4.3 SOUTH AMERICA

The integration of the economies of Argentina, Brazil, Bolivia, Paraguay and Uruguay into the South American common Market, also called "Mercosur", could foster greater interconnection of national grids and higher levels of technology transfer. The plan is already being implemented; Chile is expected to join Mercosur later this year.

As in Southern Africa, numerous interconnections already exist among these countries. A 500-kV line connects Argentina with Paraguay, Bolivia and Chile. There exist also world-class transmission systems in Brazil and Venezuela. Brazil's transmission system operates on a high-voltage network of 750-, 500-, 440-, 345- and 230-kV.

Brazil's focus on sophisticated transmission technology is clearly necessary to serve the domestic market. Beyond that, if advanced ultra-high voltage (UHV) systems, being considered by Brazil, can be commercialized, they could enable construction of a tightly interconnected electricity grid across the Mercosur trade union. Brazil and Argentina are already planning a 900-MW interconnection that would feed power to whichever nation is experiencing a greater shortfall of hydro capacity.

Pacto Andino is another Latin American common market that has been under negotiation for the past 25 years and has been partially implemented. It includes the countries of Venezuela, Colombia, Equador, Peru and Bolivia. It's intentions are similar to those of Mercosur. Venezuela with a network of 765-kV transmission lines, is one of the five countries in the world with a grid at this voltage level, and has

230-kV as well as 115-kV interconnections with Colombia. Officials have discussed linking Venezuela's Guri hydroelectric plant with Manaus, Brazil, via a 1,500-Km interconnection.

2.5 CONDITIONS FOR PARTICIPATION OF NON MEMBER BALKAN COUNTRIES IN UCPTE

In the framework of UCPTE an inventory of the requirements regarding an extension of the network system to Bulgaria/Romania is presently drawn up. Specifically a study for the interconnection of Albania, Bulgaria and Romania to UCPTE under the PHARE regional program is presently completed.

The study was performed by a Consortium made up of EDF (France), ENEL (Italy), PPC (Greece) and SEP (Netherlands), with the active participation of KESH (Albania), NEK (Bulgaria) and RENEL (Romania).

The aim of this study is to estimate the feasibility of the paralleled interconnection of Romania, Bulgaria and Albania to UCPTE, to evaluate the necessary investments to ensure compliance with UCPTE requirements and to guarantee appropriate operation in the whole interconnected system.

In cooperation with the parties concerned, the technical measures required for the restoration of interconnected systems operation on the territory of ex-Yugoslavia are being prepared taking account of the links to Bulgaria and Romania.

The variants of network interconnections between the Balkan countries have been considered in the PHARE final report as follows:

Table 2.2. Variants of network interconnections of the Balkans in PHARE

TIE-LINES	VAR1	VAR2	VAR3	VAR4
"Adriatic" line in former Yugoslavia (via Mostar).	NO	NO	NO	YES Mostary Passed
"Northern" line in former Yugoslavia (via Ernestinovo).	NO	NO	NO	NO
Link via Ukraine (one node Mukachevo-West with connection of the lines coming from Vojanyn Sajoszoged and Rosiori).	YES	NO	YES	YES
750 kV line Albertirsa-Mukachevo operated at 400 kV and connected to Mukachevo West.	YES	NO	YES	NO
Line Bekescaba-Oradea between Hungary and Romania.	NO	YES	NO	NO
Hugarian line Sandorfalva-Bekescsaba.	YES	YES	YES	NO
750 kV line Isaccea-Varna operated at 400kV and connected between Romania and Bulgaria.	NO	NO	YES	NO

Moreover for 2005, the network of former Yugoslavia is considered as restored. This corresponds to a fifth scenario with the "Adriatic" and "Northern" lines in former Yugoslavia in operation and the other links in the situation described in VAR3.

Two main questions must be addressed in order to assess the feasibility of the interconnection of Albania, Bulgaria and Romania to UCPTE.
First the system must comply with the UCPTE recommendations, and notably:

- have enough generation capacity and margins to cover its load and respect its energy exchange commitments;
- fulfil the criteria of reliability, protection, defense and restoration, transient stability and short-circuit withstand, in conformity to the requirement of UCPTE;
- contribute its fair share to frequency control;
- present frequency and voltage profiles according to the requirement of UCPTE;
- be able to prevent or at the very least, keep within its borders all disruptions that could adversely affect the other partners.

Consequently, the feasibility assessment for the interconnection of the power systems of Albania, Bulgaria and Romania to the UCPTE system entails an analysis of the operating performance of each.
Secondly the network investments necessary to make this interconnection feasible, are estimated while taking into account the uncertainties about the evolution of the peace procedure in the former Yugoslavia, which has a significant influence on the interconnection.
It is remarkable to notice that actually, the power systems of Greece, Albania, F.R. Yugoslavia and part of Bosnia Herjegovina, FYROM and Romania are operating in parallel and synchronous mode since the beginning of 1995. Moreover, since the beginning of 1996, the Bulgarian electric power system is participating to this operation. Up to this moment these power systems are operating in satisfaction to the basic requirements of UCPTE for small systems, i.e. with ± 40mHz frequency variation and with ± 5% voltage variation with respect to rated voltage at the interconnection lines and with reserve regulating power for primary frequency control at least equal to 2,5% of the total rotating capacity. Moreover there exist an agreement between most of the involved power utilities for mutual assistance in case of emergencies, with the maintenance of an operating reserve by each partner, equal to 100MW to be put at the disposal of the others.
The funds required for the interconnection of the power systems of the three Balkan countries to the UCPTE network are given in the PHARE program study final report as follows:

Table 2.3. Investment Costs (million USD) in Phare Study

	Necessary for the interconnection			**Useful for the interconnection**			
	PHARE A Generation Capacity P/F control, network development protection and defense, data transmission and system control	PHARE B U/Q control, defense and restoration, data transmission and system control (1)	Total	PHARE A Generation Capacity P/F control, Network development protection and defense, data transmission and system control	PHARE B U/Q control, defense and restoration, data transmission and system control (1)	Total	Grand Total
ALBANIA	1.5	10.3	11.8	95.8 (2)	3.3 (4)	92.1 (2)(4)	110.9 (2)(4)
BULGARIA	34.6	2.3	36.9	(3)	64.6	76.6	113.5
ROMANIA	118.0	0.8	118.8	259.0	9.6 (4)	268.6 (4)	387.4 (4)
TOTAL	154.1	13.4	167.5	366.8 (2)	77.5 (2)(4)	444.3 (2)(4)	611.8 (2)(4)

(1) *1 ECU = 1.16179 USD*
(2) *55 millions USD for hydroelectric capacity refurbishment*
(3) *already financed*
(4) *maximum value*

In the framework of a new TACIS/PHARE Study, cooperation between the electricity industries of Eastern Europe and UCPTE/CENTREL is to be investigated. The wider objectives of the project are to define a strategy for developing the power exchange facilities between the extended West European power system (UCPTE with CENTREL) and its Eastern neighbour power systems.

3. POWER SYSTEMS

3.1 ALBANIA

Albania is a small country situated at the western part of the Balkan Peninsula, with an area of 28,748 Km^2 and over 3,300,000 inhabitants. Its territory is mountainous, with mean altitude of above 700 meters. Only the western costal area, almost 20% of the total, is of low altitude above the sea level. Albania has maximum extent from north to south of 340 Km and from east to west 148 Km. There are about 70 small cities and 2,800 villages. The capital city of Tirana is also the largest city with over 250,000 people. Some other 7 cities have an average population of almost 50,000 people. Of the total population of Albania only about 40% lives in urban areas. The climate of Albania is typical Mediterranean with average winter temperature of around 0-5° C and 30- 40° C in the summer.

From the economic point of view, Albania has the lowest GDP in the region of 380 US Dollars per capita in 1994. In addition, Albania presents a very low per capita energy consumption 0.66 toe/inhabitant in 1991 revealing the very low level of economic activity and comfort.

3.1.1 ORGANISATIONAL STRUCTURE OF THE ELECTRICITY SECTOR

The electric power system of Albania was created in 1957. Today, the responsibility of Production, Transmission and Distribution of electricity in the entire country belongs to the public enterprise KESH, the utility that was created in 1992. According to the establishing low, KESH is a vertically integrated public enterprise under the Ministry of Energy Mines and Resources.

The organizational structure of the utility includes the Administrative council, the Executive Director and two Vice-Executive Directors responsible of the Financial and Technical matters respectively.

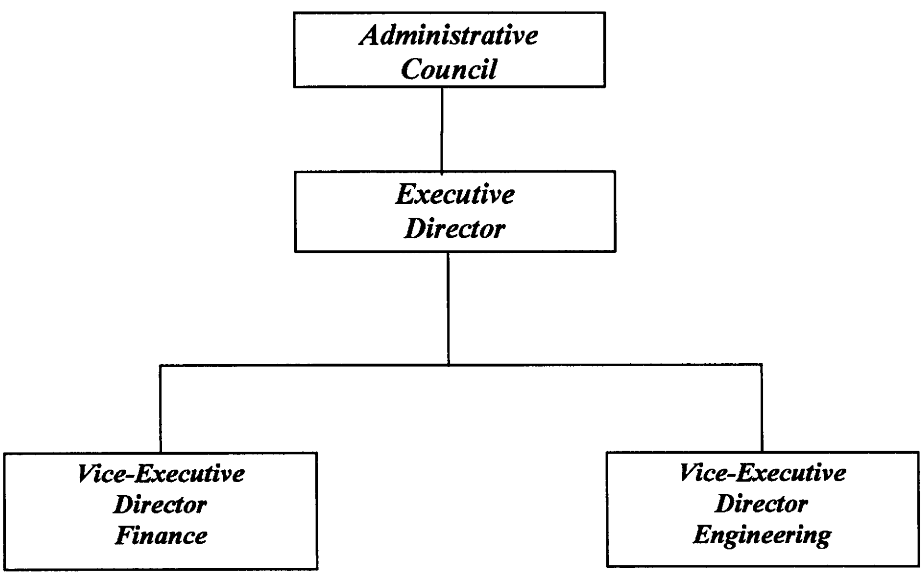


Figure 3.1. Organizational Structure of KESH

The operation of KESH is under close colaboration with the Ministry of Industry.

The Electric power system of Albania includes 47 enterprises out of which 12 are for production and transmission of electricity in the entire country, 29 for distribution and 6 for selling electricity.

In the Executive Directory of the electric utility there are about 110 employees and in the Institute of Energetic there are almost 80 employees mainly engineers. In total, in the electricity sector of Albania there are employed more than 9,000 people.

3.1.2 ELECTRIC POWER GENERATING SYSTEMS

The generating system of Albania is based mainly on hydroelectric generation with a small percentage of thermal generating plants. The generation has been steadily increasing since 1980 except for the year 1990 when it recorded a sharp drop over the previous year.

Today, there are 20 electric power plants with installed capacity of 1,659 MW. Out of them 11 are hydroelectric power stations with an installed capacity of 1,446 MW (87.2%) and 7 are thermal power plants totaling 213 MW (12.8%). The largest is the Fieri plant of 159 MW utilizing oil or natural gas. The smaller thermal power plants are for local heat supply.

The most important power plants are Vau Dejes, Komani and Fierza with 250 MW, 600 MW and 500 MW built on cascade on the Drini River representing almost 80% of the installed capacity of the Generating system.

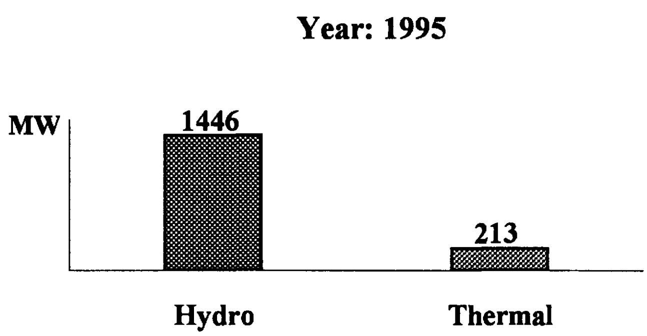


Figure 3.2. Installed electrical capacity

The electricity generation reached 3,747 GWh in 1994 out of which 3,681 GWh (98.2%) was the production of hydroelectric power plants and 130 GWh represents the production of the thermal power units. Thus, thermal power generation is very limited.

In comparison with the previous years the following production has been achieved.

Table 3.1. Production of Electricity (GWh)

Power plant	1990	1991	1992	1993	1994
Thermal	370	268	130	306	66
Hydro	2844	3518	3191	3130	3681
Total	**3214**	**3786**	**3321**	**3436**	**3747**

Under dry hydrological conditions the capacity of the hydroelectric units does not exceed 835 MW.

3.1.3 TRANSMISSION NETWORK

The Transmission network of Albania consists from electricity lines at the voltage level of 400 kV, 220 kV, 110 kV and 35 kV.

The length of the transmission lines was by the end of 1993 as follows:

Table 3.2. Transmission lines by voltage level

Voltage (kV)	length (km)
400	120
220	1100
110	1180
35	1150
Total	**3550**

The transmission lines at the voltage level of 400 kV and 220 kV are considered to be sufficient to meet the future demand until the year 2000. There are problems at the transmission level of 110 kV, and 35 kV due to over load, especially for the medium and low voltage customers because of the change that had occured in the composition of demand. In the past, the high voltage industrial consumers were representing the majority in electricity consumption, today, the low voltage residential and commercial customers consume most of the electricity.

The 220 kV transmission system connects the three large hydro plans on the Drini river (Vau Dejes, Komani, Fierza) and the thermoelectric power plant of Fierza with the country's major load centers. The 220 kV electric network includes mainly single circuit lines. In general, the 220 kV system presently it is not overloaded and operates satisfactory.

The 110 kV transmission network, connects the 110 kV level to eight 220 kV main substations and transfers electricity to all other load centers of Albania (aprox. 60 substations).

3.1.4 ENERGY BALANCE

The overall electricity production in Albania was 3,482 GWh in 1993, thus, there was an increase by 3.5% over 1992 level, even though there is a considerable reduction since 1989 where the production reached 4,154 GWh. The maximum production in Abania was in 1986 with 5,083 GWh.

Electricity demand in Albania grow by 15.6% in 1994 and in 1995 reached 4,302 GWh. The growth was mainly due to demand increase from the residential sector and small commercial enterprises. Much of the consumption was destinated for uneconomic uses, such as space heating.

The additional demand created a very skew load duration curve towards the peaking hours, thus, explaining the surge in peak load to 960 MW in December 1995 as compared to 801 MW over the same month is 1994.

The energy balance for the year 1993 is shown on the following Tables.

Table 3.3. Supply of Electricity

Incoming Electric Energy	**GWh**
Hydro production	3,130
Thermal production	306
Total	**3,436**

Table 3.4. Supply of Electricity

Consumption and Losses	**GWh**
Electricity sales	1,908
Losses	693
Net Export	166
Other	669
Total	**3,436**

By far, most of the electricity production comes from hydro power plants, thus, variation of the hydrological conditions affect significantly the overall production of electricity and the net interchange of electricity with the neighbouring power systems. Concerning the production of thermal power plants there are serious problems due to aging and availability of the units, low efficiencies and fuel shortages.

3.1.5 ELECTRICITY MARKET CONSUMPTION

The consumption of electricity in Albania reached 1,908 GWh in 1993, thus, presenting an astonishing increase of 20.6% over 1992. The increase in the consumption was mainly due to the significant increase accounted on the Residential sector (61.6%). The maximum load of demand reached 612 MW in 1992.

The consumption of electricity in Albania is presented on the following Table:

Table 3.5. Annual Electricity Consumption

	GWh		
Use	1991	1992	1993
Residential	312	479	774
Industrial	846	504	543
Agricultural	225	82	46
Other	786	588	545
Total	**2169**	**1653**	**1908**

In Albania, the Residential sector representing 40% of the total consumption is increasing lately by very high rates.

3.1.6 ELECTRIC UTILITY POWER EXCHANGES

Historically, the electricity interchanges in Albania are almost exclusively with Greece, however, recently some exchange of electricity with Bulgaria were wheeled through the electric network of PPC of Greece. The exchanges are realized exclusively from the 400 kV connecting Elbasan with Kardia. The KESH network of Albania operates in parallel with PPC of Greece and the former Yugoslavia network even though the Albania electric system is not a member of UCPTE.

The exchange of electricity over the last 3-years is presented on the following table:

Table 3.6. Electricity Exchanges (GWh)

	Import GWh			Export GWh		
	1991	1992	1993	1991	1992	1993
Greece	648	104	82	298	531	246
F.R. Yugoslavia	-	-	-	-	-	-
Total	**648**	**104**	**82**	**298**	**531**	**246**

The exports of electricity in Albania reached a record of 2,134 GWh in 1986 representing 42.6% of the net production of that year.

3.1.7 COMMENTS ON THE ACCOUNTING TABLES AND FINANCIAL RATIOS - ALBANIA (KESH)

The data were used include the accounting tables for the years 1992, 1993. These tables are presented in the Appendix B:
The accounting tables were used are expressed in constant prices 1993.
The following comments could be underlined:

Assets

For the year 1993, the total assets are estimated to 10,041 MLEK increased against 1992 by 18.6% or 1,575 MLEK. This raise is due to an increase of the total fixed Assets by 15.8% and to an increase of total current assets by 24.5%. A considerable decrease of the order of 80% could be noted, for the amount "work in progress" from 1992 to 1993. This means that the investment program may has been decreased.

Liabilities

There is an increase in the Equity of the order of 13.4% from 6,774 MLEK in 1992 to 7,680 MLEK in 1993.

The provisions have been increased by 57 MLEK or 80%.

The most considerable conclusion is that the long term debt was substantially near to zero, in the year 1992, with foreign debt equal to zero. For the year 1993 there is an increase in the foreign debt, which is amounted to 766 MLEK, while the corresponding debt in local currency was only 59 MLEK.

Revenues - Expenses

There is a very small increase of revenues for the year 1993 against 1992, due to the increases in electricity prices, in the domestic sector, as well as increases of revenues due to increases in steam prices. The total revenues were increased by 4.3%. The total expenses before taxes were increased by 71.3% and after taxes by 30.4%.

The operating income was decreased by 64.4% and amounted to 369 MLEK against 1037 MLEK for the year 1992 while the net income was decreased by 65%, from 1037 MLEK in 1992 to 369 MLEK in 1993.

The retained earnings were decreased by 63.2%, from 829 MLEK in 1993, to 305 MLEK in 1993.

A considerable remark related to the capital charges could be made, that the total cost related to this amount is <u>only</u> 7 MLEK for the year 1993 due to the long term debt mainly in foreign currency.

Sources and application of funds

(a)Internal sources: The internal sources of finance include depreciation and net income. These sources of funds were decreased by 54.4%, from 1,196 MLEK in 1992, to 545 MLEK in 1993.

(b)External sources: The total external sources have been increased by 42.8% due to an increase of Grants by 421 MLEK.

(c)Debt: The debt for the year 1993 is estimated to increase by 816 MLEK against zero (0) MLEK in 1992.

(d)Loan repayments: Finally, it must be underlined that there are non loan repayments in the contents of capital needs, due to the grace period for the loans that has been given by the World Bank.

Ratios

The following table presents the ratios that are defined in the Appendix A :

Table 3.7. Annual Variation of Ratios

Ratios	199	199	1994
R1.1(%)	-15.4	11.0	9.4
R1.2(%)	226	85	-
R1.3(GWh)	1653	1908	-
R1.4(LEK/KWh)	1.845	1.66	-
R1.5(%)	25.8	54.2	-
R1.6(%)	68	66.4	-
R1.7 (%)	80	76.5	-
R1.8 (%)	24	29	-
R1.9(%)	19	22.2	-
R1.10(%)	0	0.18	-
R1.11(%)	0.24	20.97	-
R1.12(%)	Equal to R.10 because Capital repayments equal 0		
R1.13(%)	12.2	3.9	-
R1.14(%)	100	58.4	-
R1.15	1.68	2.39	-
R1.16(%)	0	0	-

The exchange rate LK:$ is

	1992	1993	1994
Mid	110	106	100

Since 1991 LEK was depreciated dramatically against the dollar.

Comments

The following remarks could be made based on the available data:

GDP growth rate is keeping in the level of 10% after a dramatic fall in 1992.

The inflation rate was very high (226%) in the year 1992 and was decreased to 85% in 1993.

Electricity demand growth rate will follow the trend of GDP growth rate.

In 1993 the investments will grow more than the revenues.

The level of fixed assets to total assets will remain constant (R1.6).

The level of equity to total liabilities will remain in the level of 75%. (R1.7).

The ratio of Debt to equity is in satisfactory level in the order of 30% (R1.8).

The ratio of total debt to total liabilities remain under 25% for the years 1992 and 1993 (R1.9).

The expenses for financial charges to total revenues is in the order of zero (0%), for the year 1992 since the existing debt is only raised in 1993 (R.1.10).

The total debt to revenues is very small and it was raised a little only in the year 1993 (R1.11).

The earnings to total equity was decreased in 1993 to 3.9% (R1.13).

The self financial ratio is satisfactory ranged from 58% to 100% (R.1.14).
The liquidity ratio is ranged from 1.68 to 2.39 (R1.15).
The cost of capital is almost zero due to the non existing financial costs (R.1.16).

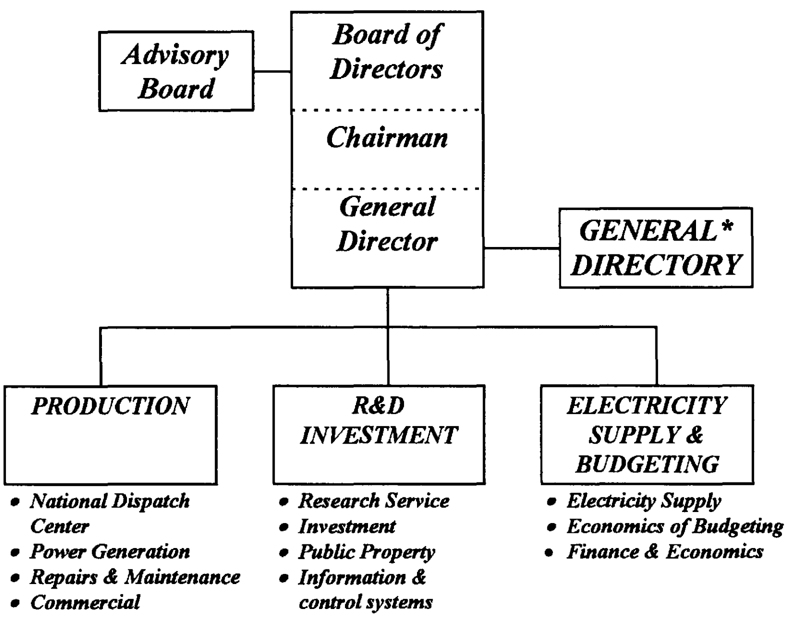
3.2 BULGARIA

Bulgaria is situated in Balkan peninsula having borders with Greece and the European part of Turkey at the south, Romania at the north, F.R. Yugoslavia and FYROM at the west side and the Black sea from the east. The area covered by the country, with mainly mountainous terrain is 110,910 km^2. The overall population is 9,000,000 inhabitants, out of which almost 120,000 people live in the capital city of Sofia. Some others cities with population more than 100,000 are Varna, Plovdiv, Pleven, Rousse, Dobrandja and Bourgas. Most of the people (68%) in Bulgaria live in urban areas.

From economic point of view Bulgaria enjoys the second highest GDP in the region after Greece with 4,230 US Dollars in 1994. In terms of per capita energy consumption, Bulgaria used to be very close to the average European Community figure, however, a rapidly drop after 1989 resulted in 2.24 toe/inhabitant in 1991. The energy dependency of the country fell quite significantly after 1989 to approximately 54% in 1991.

3.2.1 ORGANISATIONAL STRUCTURE OF THE ELECTRICITY SECTOR

The electric power system of Bulgaria is under the responsibility of the public utility NEK that owns the electric power units and controls the flow of electricity through the Transmission and Distribution system in the country which is also controlled by National Electric Utility.



***** *Legal Department, Foreign Relations, Accounting, Finance of Economics, Administration, Civil Defence, Information Support of Public Relations.***

Figure 3.4. Organizational Chart by NEK

3.2.2 ELECTRIC POWER GENERATING SYSTEM

In 1995, the installed capacity of the power plants in Bulgaria amounted 12,825 MW out of which 11,149 MW are owned by NEK and the remaining 1,676 MW belong to various industrial producers.

The conventional thermal power plants total 6,634MW representing 51.73%, the nuclear units of the Kozloduy power plant have an installed capacity of 3,760MW representing 29.32%, and the hydroelectric units total 2,431MW, accounting for 18.96%.

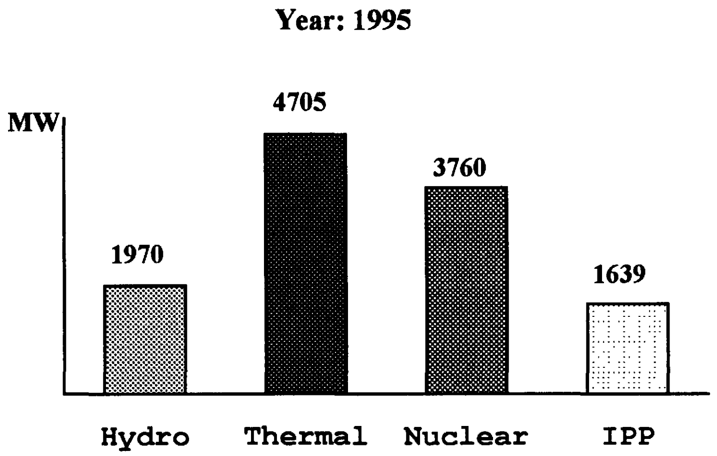


Figure 3.5. Installed Electrical Capacity

The Kozloduy nuclear power plan includes four units of the type VVER-440 reactor and two units of the VVER-1000 reactor. Repair work for the four aged units had started in 1991, however the Bulgaria government had already decided to retire due to various operational problems the units No 1 and 2.

The electricity generation in Bulgaria reached 38,2 TWh in 1994 representing an increase of 0.7% over the previous year. The production of the thermal power plant of NEK was 16,762 TWh, of the nuclear units reached 15,334 TWh while the hydroelectric power plant decrease to the lowest value of the last decade producing 1,509 TWh. The generation of the industrial-owned power units reached 4,6 TWh.

In comparison with the previous years the following production of electricity has been achieved.

Table 3.8. Annual Variation of Electricity Production

Type of Production	**Production (GWh)**			
	1991	1992	1993	1994
Thermal	17879	17263	17303	16762
Nuclear	13184	11552	13897	15334
Hydro	2441	2064	1941	1509
IPP	5330	4668	4762	4571
Total	**38834**	**35547**	**37903**	**38176**

3.2.3 TRANSMISSION NETWORK

The electric Transmission network of Bulgaria consists of lines at the voltage level of 400 kV, 220 kV and 110 kV.

A transmission line at the voltage level of 750 kV serves, since 1988 for the interconnection of the Bulgarian power system with the power system of Ukraine and Romania (Isaccea substation). The line has been mainly used for improving the reliability of the Bulgaria's electric power system having large nuclear generating units of 1,000 MW. In addition, of course, the line has been utilized also for exchanges of electricity.

The length of the Bulgaria transmission system is the following:

Table 3.9. Transmission Lines by Voltage Level

Voltage level kV	Length Km
750	85
400	1844
220	2283
110	7809
Total	**12021**

The transmission system of the Bulgaria network is connected to the electric networks of Ukraine, Romania, Serbia, Greece and Turkey by lines of 400 kV, 220 kV and 110 kV.

It is anticipated that the transmission lines of 400 kV, carrying most the electricity generation will remain the main transmission capacity level for the future.

3.2.4 ENERGY BALANCE

The electricity demand of Bulgaria reached 81,104 TWh in 1994 presenting an increase of 0.2% over the previous year. However that small increase was the second consecutive since 1988. The load demand is showing presently stabilization, even though that level of demand is only 78% of the maximum demand level that was observed in the country in 1989.

The energy balance in Bulgaria for the year 1994 is presented on the following Tables:

Table 3.10. Electricity Supply

Type	**GWh**
Hydro	1509
Thermal	16762
Nuclear	15334
IPP	4571
Total	**38176**

Table 3.11. Electricity Consumption

Consumption and Losses	**GWh**
Electricity sales	29088
Losses	4445
Next Export	72
Other (IPP, etc.)	4571
Total	**38176**

3.2.5 ELECTRICITY MARKET CONSUMPTION

The electricity consumption in Bulgaria increased by 0.1% in 1994, thus, presenting the first increase in consumption since 1988 where the maximum consumption level was observed.

However, the electricity consumption of 1994 is only 73.7% of the consumption level presented in 1988.

The increase of the overall electricity consumption is mainly due to the increase by 3.8% that was observed in the residential sector.

The sales of electricity in Bulgaria by type of use is presented on the following Table:

Table 3.12. Electricity Consumption by user type

Electricity Consumption	GWh		
Type of Use	1991	1992	1993
Residential	10037	9648	10017
Industrial	15608	15985	13623
Agricultural	866	820	796
Other	4958	4880	4568
Total	**31469**	**29333**	**29004**

3.2.6 COMMENTS ON THE ACCOUNTING TABLES AND FINANCIAL RATIOS - BULGARIA (NEK)

The tables in the Appendix B present the Balance Sheet and the Statement of Revenues and Expenses of NEK (Electricity Undertaking of Bulgaria) for the years 1994 and 1995.

Assets - Liabilities

From the balance sheet table, the following remarks could be made:

The Total Assets were increased by 14.3%, from 1994 to 1995 or 16,406,796 th BGL. Due to the inflation rate of 32.9% this change is negative in constant prices.
This increase was due to a change of current assets by 11,708,839 and a change of fixed assets by 2,848,168 th BGL.
The same change of 14.3% or 16,406,796 th BGL of liabilities is due to the change of Equity capital by 67,363 th BGL, a change of the order of zero and to the change of borrowed capital by 16,401,346 th BGL or 120%.
This small change of equity capital is due to the fact that this company doesn't have retained earnings, due to the losses for the years 1994 and 1995.

Revenues - Expenses

From the second table of revenues and expenses the following remarks could be made:

The total costs were increased by 50% or 16,727,703 th BGL. This increase is mainly due to the increase of ordinary costs by 14,058,260 th BGL and secondary to the increase of extra charges. The corresponding costs per KWh have been increased by 30.8% , at an annual inflation rate of 32.9% (Ref. 5). There is still an unfavorable trend to reducing the relative share of depreciation and overhauls in the structure of costs, which limits the funds for construction of new and rehabilitation of the existing capacities.

The following table present the relative share of costs for the years 1994 and 1995 :

Table 3.13. Relative Share and Cost of Electricity

SHARES OF COSTS	1994 Report %	1995 Report %
Purchased power	5.07	8.70
Other costs	5.53	6.95
Insurance	0.98	0.71
Depreciation	12.70	9.49
Fuels	34.35	33.67
Overhaul costs	10.67	10.17
Social benefits	0.96	0.90
Salaries	9.56	9.64
Social security costs	3.98	4.01
Retraining and unemployment fund	0.67	0.68
Financial charges	6.50	4.09
Extraordinary charges	5.59	7.17
Raw materials and feed stock	3.45	3.82

A table of Source and Application of Funds is not available.

Loans

During the reported year NEK received loans for turnover funding to the amount of BGL 6,670 million and USD 6,5 million, and has paid principals to the amount of BGL 4,730 million and USD 2,5 million, paying also BGL 1,610,761 million in interests.

The credits received from Bulgaria commercial banks and The State Savings Bank amount to BGL 3,669,698 million, and those received from Raiffeizen Bank and ING Bank amount to USD 6.5 million.

In 1995 NEK received two more loans from the Reconstruction and Development State Fund, one amounting to BGL 2 billion with repayment terms as from April 1996 to December 1998, and the other to the amount of BGL 1 billion with repayment terms as from January 1996 to December 1996. An interest of BGL 258 million has been paid for them. The payments of the credit from Reconstruction and Development State Fund were received in 1994 and amount to BGL 1,440 million the principals, and BGL 466 million the interests.

Investment Activity

Energy 1 Project was funded by a World Bank Loan to the amount of USD 93 million.

- Sums drawn from the loan account in 1995-USD 7,587,572.
- Loan expenditure with accumulation as of end 1995-USD 15,264,544.
- Loan interests and fees paid-USD 1,303,625.

Maritsa East 2 Project, Unit 8 was funded by the European Bank for Reconstruction and Development with a loan amounting to ECU 40 million.

- Sums drawn from the loan account in 1995-USD 9,963,383.
- Loan expenditure with accumulation as of end 1995-USD 12,534,050 and ECU 300,000.

- Loan interests and fees paid-USD 451,175 and ECU 622,291.

Maritsa East 2 Project, Unit 8 was financed by the European Investment Bank with a loan of ECU 45 million.

- Sums drawn from the loan account as of end 1995-USD 2,241,200.
- Loan expenditure-USD 2,241,200.
- Loan interests and fees paid-USD 257,476.

During the year reported NEK followed the tradition set up with its foundation to service all its credits and maintain a high credit rating.

Ratios

Table 3.14. Annual Variation of Ratios

Ratios	1993	1994	1995
R1.1(%)	-4.6	0.4	-
R1.2(%)	72.8	96	32.9
R1.3(TWh)	-	-	29.7
R1.4(%)	-	-	-
R1.5(%)	-	-	-
R1.6(%)	-	84	75.6
R1.7(%)	-	88	77
R1.8(%)	-	14	30
R1.9(%)	-	11.9	22.9
R1.10(%)	-	7.4	4.15
R1.11(%)	-	17.7	16.7
R1.12(%)	-	-	-
R1.13(%)	-	Losses	Losses
R1.14(%)	-	-	-
R1.15(%)	-	-	-
R1.16(%)	-	1.9	1.5

The exchange rate lev/US $ was the following: 1991/19, 1992/23.3, 1993/27.6, 1994/54.2.

Comments

GDP growth rate is almost zero for the year 1994, while in the previous year 1993 was -4.6%.

The inflation rate was very high for the years 1993 and 1994 and it has fallen in 32.9 in 1995. (Ref. 5). The figures for inflation rate are different for the references (25),(28) and (29).

The ratio of fixed assets to total assets is satisfactory (R.1.6).

The ratio of equity to total liabilities is satisfactory, in the order of 80% (R.1.7).

The ratio of debt to equity is ranged from 14% to 30% (R.1.8).

The ratio of total debt to total liabilities is ranged from 12% to 23%, due to the duplication of the total debt (R.1.9).

The ratio of financial charges to total revenues was decreased from 7.4% to 4.15% due to the increasing revenues. The financial charges remained almost constant. (R1.10).

The ratio of indebtedness to turnover is in the order of 17%, that is, considerably low (R.1.11).

The losses for the years 1994 and 1995 don't give any ratio of earnings to equity (R.1.13).

The cost of capital is very low, in the order of 1.5% in 1995.

Self financing (R.1.14) and liquidity ratios (R.1.15) are not available.

3.3 FYROM

The Former Yugoslav Republic of Macedonia (FYROM) is the smallest country in the Balkan peninsula covering an area of 25,715 Km^2. The country is situated in the middle of the Balkan states having boarders with Greece form the south, Bulgaria form the east, F.R Yugoslavia from the northern part and Albania at the west.

The population of the country is almost 2,000,000 with the capital city of Scopje of almost 600,000 inhabitants. The population is almost evenly distributed to urban (54%) and rural (46%) areas.

From the economic point, FYROM is the second poorest economy in the region and possibly in Europe, with almost 800 US Dollars per capita in 1994. Data concerning the economy and the energy sector in total are not readily available as yet, however it is well known that FYROM is a net importer in energy terms.

3.3.1 ORGANISATIONAL STRUCTURE OF THE ELECTRICITY SECTOR

The electric power system of the Former Yugoslavian Rebublic of Macedonia (FYROM) was part of the federal state owned electric utility JUGEL of F.R Yugoslavia.

Today, the electricity power sector of FYROM is dominated by the state owned ESM (Electric Power Company of Macedonia).

The electric utility is a vertically integrated company responsible for Generation, Transmission and Distribution of electricity in the country. Mining of Lignite, the main source of the produce electricity belong also to ESM.

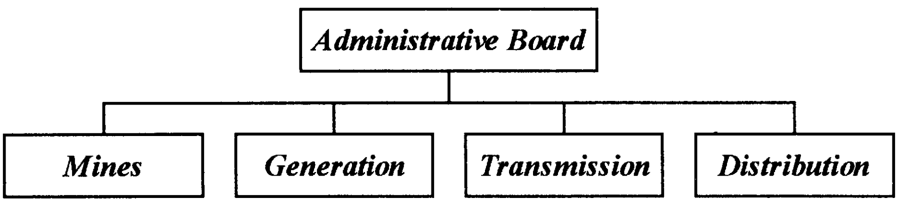


Figure 3.7. Organisational chart of ESM

3.3.2 ELECTRIC POWER GENERATING SYSTEMS

The electric generating system of ESM in FYROM is a mixed hydrothermal with very significant production close to 85% from lignite generating units (the highest proportion in Europe).

Today, there are three thermal power plants, out of which 800 MW (57%) are lignite generating units and 210 MW (15%) represent fuel oil units. The hydroelectric generating units representing 28% of the installed electric capacity in FYROM constitute six power plants where the largest power plant, "Vrutok" of 150 MW represents more than 40% of the total hydroelectric capacity.

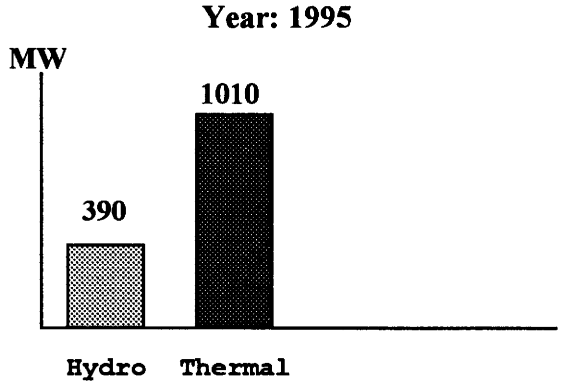


Figure 3.8. Installed Electrical Capacity

The net electricity generation reached 5,685 GWh in 1995 out of which 4,888 GWh was the production of thermal power units and 797 GWh were produced by hydroelectric units.

In comparison with the previous years the following production has been achieved.

Table 3.14. Annual Variation of Electricity Production

Type	**Production (GWh)**			
	1992	1993	1994	1995
Thermal	4817	4621	4795	4888
Hydro	823	520	696	797
Total	**5640**	**5141**	**5491**	**5685**

3.3.3 TRANSMISSION NETWORK

The Transmission network of FYROM exceeds 2,000 Km and consists from electricity lines at the voltage level of 400 kV, 220 kV, 150 kV and 110 kV.

The length of the transmission lines is presented on the following table:

Table 3.15. Transmission System by Voltage Level

Voltage level kV	**Length Km**
400	256,5
220	165,3
150	22,5
110*	1,565,3
Total	**2,009,6**

**Including 90.3 Km of double line circuits*

3.3.4 ENERGY BALANCE

The electricity demand in FYROM reached 4,931GWh in 1994 presenting a small decrease of less than 3% over the previous year. That was the second decrease since 1992 where the maximum demand of the country (5,165 GWh) was observed. Today's consumption of electricity is about 5% higher than the consumption of 1990 that was the first year of collecting data for ESM.

The energy balance in FYROM for the year 1994 is presented on the following Tables:

Table 3.16. Electricity Supply

Type	GWh
Hydro	696,3
Lignite	4,794,6
Oil	0,0
Import	67,8
Total	**5,558,7**

Table 3.17. Electricity Consumption

Consumption	GWh
High Voltage consumers (110 kV)	1502.4
Industrial consumers (35 & 10 kV)	790.5
Distribution	2230.8
Consumers on 0.4 kV	406.9
Losses	628.1
Total	**5558.7**

3.3.5 ELECTRICITY MARKET CONSUMPTION

The sales of electricity by type of use for the years 1994 and 1995 are presented on the following table:

Table 3.18. Electricity Sales by Use

TYPE OF USE	GWh	
	1994	1995
Residential	2224	2382
Commercial	403	461
Industrial	2307	2273
Other	0	0
Total	**4938**	**5116**

3.3.6 COMMENTS ON THE ACCOUNTING TABLES AND FINANCIAL RATIOS - FYROM (ELEKTROSTOPANSTVO NA MAKEDONJA)

The tables in the Appendix B present the Balance Sheets for the years 1993, 1994 and 1995 and the Profit and Loss Account for the year 1995. The balance sheets for 1993 and 1994 are inflation adjusted as at 31st December 1994.

Assets - Liabilities

From the tables of Assets and Liabilities for the year 1995 the following remarks could be pointed out:
The Total Assets and Liabilities amounted to 41,718,118 th Denars.
The Total Assets basically consist of 36,391,685 th Denars of fixed Assets and investments, or 87% of Total Assets, and 4,871,716 th Denars of Total Current Assets or 11.7% of Total Assets.
The Total Liabilities basically consist of 36,084,864 th Denars Total Capital and Reserves (Equity) or 86.5% of Total Liabilities, 1,399,197 th Denars Long Term Debt or 3.4% of Total Liabilities, and 2,513,747 th Denars current Liabilities or 6% of Total Liabilities. It is considerable that only 9.4% of Total Liabilities is the Total Debt (Long Term Debt plus current Liabilities).

Profit and loss account

From the table of Profit and Loss Account it is considerable that either the operating result (-1,274,112 th Denars) or total result (-423,584 th Denars) are losses due to the applied tariff policy of low prices. This tariff policy could create problems in the formation of capital for self financing of the total capital needs (non capital formation from retained earnings) due to the negative results (losses), as well as energy problems (wasting of electricity and energy, environmental problems). The former could deteriorate the capital structure of the company. A table of Source and Application of Funds is not available.

From the total operating expenses on 31st of December 1995 the relative share of electricity costs is depicted below:

Table 3.19. Relative share of Electric Costs

	th.Denars.	%
Depreciation	2,778,996	27.07
Revaluation of Depreciation	45,256	0.44
Salaries and Wages	2,204,811	21.48
Mining expenses	814,868	7.94
Capital formation for Development	799,262	7.79
Maintenance	801,747	7.81
Material expenses	669,878	6.53
Insurance	638,561	6.22
Spare Parts	493,624	4.81
Services	320,181	3.12
Electricity Purchases	154,015	1.5
Cost of Commodities Sold	125,288	1.22
Fuel	30,326	0.3
Other	387,131	3.77
Total	**10,263,944**	**100.00**

Ratios

Table 3.20. Annual Variation of Ratios

Ratios	1993	1994	1995
R1.1 (%)	-	-	-
R1.2(%)	230	58	-
R1.3(GWh)	-	4938	5116
R1.4	-	-	-
R1.5	-	-	-
R1.6(%)	92.6	89.7	87
R1.7(%)	87	89	86.5
R1.8 (%)	-		10.8
R1.9(%)	12.4	8.8	9.4
R1.10(%)	-	-	2.6
R1.11(%)	-	-	37.9
R1.12	-	-	-
R1.13	-	-	(Losses)
R1.14	-	-	-
R1.15	-	-	1.94
R1.16(%)	-	-	0.8

The currency was created in 1993 and the exchange rate for 1993 is 1 DM : Den 14
For 1994 the exchange rate is, 1 DM : Den 24

Comments

The inflation rate is starting from 230% in 1993 and decreases to 58% in 1994.

The electricity demand sales were increased by 3.6% from 1994 to 1995.

The ratio of fixed assets to the total assets is in the order of 87% to 93% (R.1.6). The ratio of equity to total liabilities is very high in the order of 85% to 89% (R.1.7). The ratio of debt to equity is very low in the order of 11% (R.18).

The ratio of total debt to total liabilities is relatively low, in the order of 9% for the years 1994, 1995 (R.1.9).

The ratio of financial charges to turnover is very low, only 2.6% (R.1.10)

The ratio of indebtedness to turnover is satisfactory and amounted to 38% (R.1.11).

The ratio of earnings to equity doesn't exist due to the losses (R.1.13).

The liquidity ratio is 1.94 (R.1.15).

The cost of capital is near to 0%, due to the very low financial expenses (R.1.16).

3.4 GREECE

Greece is the second largest among the Balkan countries covering an area of 131900 km^2. It is situated at the southern part of the Balkan peninsula and is surrounded by the Agean, Ionian and the sea of Crete at the far south. In Greece, there are numerous of islands, while the continental part is highly mountainous by almost 60%. The population exceeds 10.4 millions with density of 79 people per square kilometer out of them 62% lives in urban areas. At the capital city of Athens and the surrounding area live more than 4,5 million people while at the second largest city of Salonica there are almost 1,5 million people. Other large cities with population of approximately 100,000 include, Patra, Volos, Larissa and Irakleio on the island of Crete.

From the economic point of view, Greece represents the best economy in the region with annual GDP of almost 12,000 USD in 1995. In Greece, the per capita energy consumption was 2,13 toe/inhabitant in 1991 revealing one of the highest consumption in the region while the dependency on imported fuel in the energy sector was 66% the same year.

3.4.1 ORGANISATIONAL STRUCTURE OF THE ELECTRICITY SECTOR

The Electricity Supply Industry in Greece is dominated by a vertically integrated, state-owned company, the Public Power Corporation (PPC). The electric utility PPC is responsible for most lignite mining in Greece (approx. 95%) as well as for the electricity ***generation***, ***transmission*** and ***distribution*** in the whole country.

PPC is supervised by the Ministry of Development which ensures that tariff policies and rate structures are in line with the Government's macroeconomic policy, approves the PPC's development plans and corresponding investment and borrowing programs. The Ministry of National Economy approves also the PPC's budgets.

The PPC's mandate requires to meet the country's electricity needs at the lowest possible cost with a high degree of reliability by using indigenous resources. These goals might be in conflict, depending on the costs of domestic lignite. Tight government control and the absence of competition have provided the basis for development of indigenous energy resources, in particular lignite, but this development must be placed on a sound economic basis. The government with a recently passed law (2244/94) has promoted dispersed and small-scale sources of electricity production, including renewable-based power, essentially on the islands. Action to promote electricity end-use efficiency has been limited.

The Government has been closely involved in the PPC's management and operations. Its influence remains strong in areas such as borrowing and employment practices, and further relaxation would be beneficial.

The Public Power Corporation ***(PPC)*** was established in 1950, as a State owned public utility. According to its founding legislative act 1468/50 the ***Corporation*** had the exclusive right to produce electric energy from any source, as well as to transmit and distribute it in the entire country. A few years later the exclusive right of distribution was given also to PPC.

Since 1950, several amendments and supplements have been effected and in addition to the establishing law a number of other laws, presidential degrees and ministerial decisions have been issued relating to the structure, management and operation of PPC.

PPC today is the largest enterprise in Greece having facilities all over the mainland and the Greek islands.

Presently the utility retains its dominant role in the area of production of electricity and its monopoly in transmission and distribution of electric energy over the mainland and islands of Greece.

The Management of **PPC** is exercised by the Chairman and the 10 members of the **Board of Directors**. The 10 members consist of the General Manager, 6 members appointed to represent various social entities and 3 elected representatives of the utility personnel.

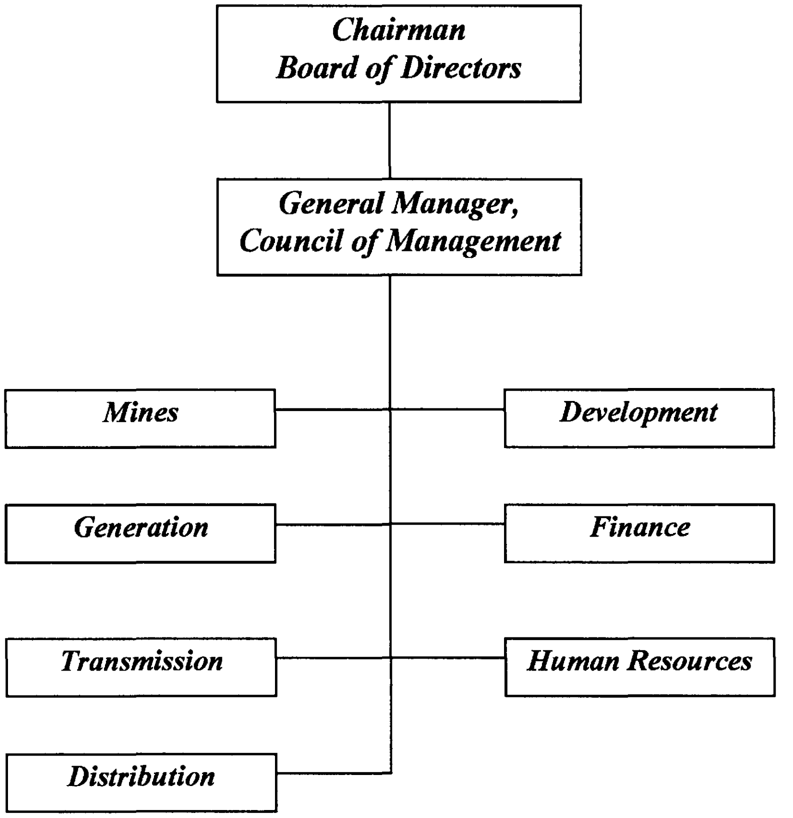


Figure 3.10.Organizational Chart by PPC.

Responsible for the day-to-day running of the utility is the General Manager and the **Council of Management,** which consists of the 7 Assistants to the General Manager in charge of the respective Divisions of **PPC**.

The Social control of **PPC**, according to the presidential order, 57/85 is exercised by the Representative Assembly of Social Control (**RASC**), consisting from 27 members out of which, 9 members represent the State, 9 are elected from **PPC** personnel, 1 member represents the local government and 8 members are representatives of various Social entities and organizations.

In 1995, there were almost 35,000 people employed by PPC, out of them almost 20% were at the Generating plants, 7% at the Transmission and 40% at the Distribution Division.

3.4.2 ELECTRIC POWER GENERATING SYSTEMS

The electric energy generation system of Greece consists of thermal and hydroelectric units and a small percentage of renewables. The generating capacity belongs to PPC at almost 98% and the remaining represents independent autoproducers.

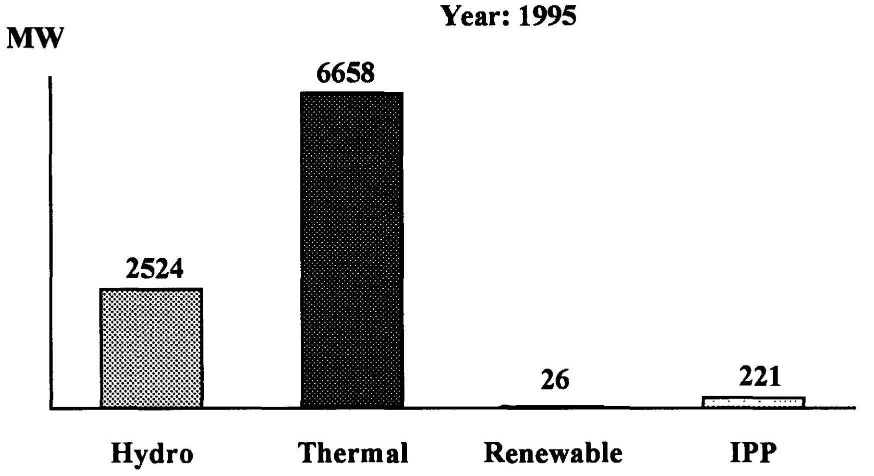


Figure 3.11. Installed Electrical Capacity

The installed capacity of **PPC's** generating system at the end of 1995 was 9198 MW broken down as follows:

Table 3.21. Capacity By Generation Type

TYPE	MW	%
Lignite - fired	4,533	49.2
Oil - fired	2,114	23.1
Hydroelectric	2,525	27.4
Renewables	26	0.3
Total	**9,198**	**100.0**

In addition to the above installed capacity, there are presently in operation 221 MW of "self-producers", out of which, 130,7 MW (60.1%) are oil-fired units, 39,5 MW (18.2%) are natural gas units and 47,3 MW (21.7%) use other fuels.

The generating system of **PPC** consists of the following independent electrical Power systems:

Table 3.22. Electrical Power Systems

	MW	%
Mainland	8,242	89.5
Crete	410	4.7
Rhodes	147	1.6
Other islands	399	4.2
Total	**9,198**	**100.0**

3.4.3 TRANSMISSION NETWORK

The transmission system in Greece (1995), consists of lines at the **high** voltage level of **66 kV, 150 kV** and **400 kV**.

The 400 kV transmission lines constitutes the backbone of the electric energy transmission in the continental Greece, since most of the electric energy generation (70-75%) takes place in Northern Greece, whereas 65-70% of the electricity sales are realized in South and Central Greece.

Table 3.23. Transmission Lines by Voltage Level and Type

	Lines			Km
	400kV	150kV	60kV	Total
Overhead	1,936.7	7,696.1	230.7	9,862.3
Underground	-	24.4	-	24.4
Submarine	-	84.8	-	84.8
Total	**1,936.7**	**7,805.6**	**229.5**	**9,971.5**

By the end of 1995 there were 23 high voltage industrial consumers supplied directly by the transmission system at the 150 kV voltage level, representing almost 50% of the total industrial sales of electricity.

3.4.4 ENERGY BALANCE

The total demand of electricity by PPC in 1995 reached 38349 GWh including the demand of the islands. Thus these was an increase of 3.7% over the previous year.

The energy balance for the year 1995 is presented on the following Tables.

Table 3.24. Electricity Supply

Incoming Electric Energy	GWh
Hydro production	3,765
Thermal production	33,757
Net Imports	797
Renewables	30
Total	**38,349**

Table 3.25. Electricity Consumption

Consumption and Losses	GWh
Electricity sales	33915
Losses	3208
Mine consumption	864
Pumping	362
Total	**38349**

Almost 93% of the total consumption of electricity in Greece is realized on the mainland part of the country.

3.4.5 ELECTRICITY MARKET

The **sales** of electric energy by **PPC** grew up to 33,9 TWh in 1995 while the per capita consumption of electricity in Greece reached 3,400 KWh. The percentage by type of using electricity is the following:

Table 3.26. Electricity Consumption by User Type

TYPE OF USE	TWh	%
Residential	11.5	33.9
Agricultural	2.0	5.9
Commercial	6.8	20.0
Industrial	12.0	35.4
Other	1.6	4.7
Total	**33.9**	**100.0**

Electricity consumption of **PPC's** lignite mines was 864 GWh in 1995.

The peak load for the interconnected system on the mainland reached 6063 MW in 1995. During the summer of 1996 the peak load exceeded 6500 MW presenting an increase of 7.3%.

3.4.6 ELECTRIC UTILITY POWER EXCHANGE

PPC's electric energy transmission system is connected already with the networks of Albania, ex - Yugoslavia (power systems formerly connected to UCPTE) and Bulgaria through transmission lines of 150 kV and 400 kV. The maximum potential of annual electric energy exchanges exceeds 5 TWh.

Table 3.27. Electricity Interconnections

	ALBANIA		EX. YUGOSLAVIA		BULGARIA
LINES	I	II	I	II	I
Voltage (kV)	150	400	150	400	400
Capacity (MVA)	138	1400	138	1400	1400
Energy (GWh)	140	2000	500	2500	1200

Beside improving the reliability of the system the electric energy exchanges of **PPC** are exclusively of the following type:

- economy interchanges
- maintaining hydraulic reserves

The electricity exchanges through the tie-line connections with the neigbouring systems in 1995 were the following:

Table 3.28. Electricity Exchanges

Tie - line	Import GWh	Export GWh
Albania	121	391
FYROM	540	193
Bulgaria	652	9
TOTAL	1,389	593

PPC in cooperation with ENEL is presently constructing the interconnection of the electric networks of Greece and Italy through submarine direct current cables of 500 MW, 400 kV. With the submarine cables, Greece will be connected directly with the networks of the countries of the European Union (EU).

3.4.7 COMMENTS ON THE ACCOUNTING TABLES AND FINANCIAL RATIOS - GREECE (PUBLIC POWER CORPORATION)

The tables in the Appendix B present the Balance Sheet, the Income Statement and the Sources and Applications of funds for the year 1995 on the 31st of December.

The Balance Sheet changes between the years 1995 and 1994 are depicted below in primary accounts table:

Table 3.29. Balance Sheet between 1994 and 1995

Assets (in million Drs.)	**%**	**Drs.**	**Liabilities (in million Drs.)**	**%**	**Drs.**
Installation Expenses	(22.23)	(45,949)	Capital	11.92	64,530
Fixed Assets	8.91	108,790	Provisions	59.85	13,899
Current Assets	10.99	44,498	Debt	3.00	39,221
Deferred Debit Acc.	21.96	13,040	Deferred Credit Acc.	13.23	2,729
Total Assets	**6.36**	**120,379**	**Total Liabilities**	**6.36**	**120,379**

In the Balance sheet, Income Statement and Sources and Application of Funds for the year 1995, the following analysis could be presented:

Assets

Total Assets on 31.12.95, excluding contra accounts, amounted to Drs. 2,012,591 million as against Drs. 1,892,211 million in the fiscal year 1994, posting an increase of Drs. 120,379 million or 6.36%. The corresponding percentage increase in 1994 over 1993, was 4.02%.
The main reasons for this increase are attributed to the following changes :

- **Installation Expenses**

In 1995, the balance of «Installation Expenses», before depreciation, marked a decrease of Drs. 29,846 million or 11.08%.

The above decrease is mainly due to the decrease of Drs. 53,153 million or 36.99% on the «Deferred Exchange Parity Differences» account because of favorable developments in the drachma exchange rates during the year.

- **Fixed Assets**

The value of «Fixed Assets» in 1995 marked an increase, before depreciation, of Drs. 177,856 million as compared to that in 1994, which is due to:
A considerable increase of Drs. 108,060 million or 8.92% on the «Machinery & Plant Equipment» account.
An increase of Drs. 56,808 million or 16.19% on «Construction in Progress & Prepayments».

Total reserves for depreciation of «Installation Expenses» and «Fixed Assets» increased from Drs. 747,781 million in 1994 to Drs. 832,949 million in 1995 marking an increase of 11.39% versus last year.

- **Current Assets**

In 1995 the balance of «Current Assets», amounting to Drs. 449,554 million showed an increase of Drs. 44,498 million or 10.99% as compared to the respective balance in 1994.

This growth is due to:

- An increase in «Stores» by Drs. 13,749 million or 9.77%, mainly attributed to a rise in raw materials (Drs. 11,001 million).
- An increase in «Securities» by Drs. 10,370 million or 26.38% during 1995.
- An increase of 15.86% of the sum of various receivables.

Liabilities

- **Capital**

Corporation's Capital grew by 11.92% or Drs. 64,530 million compared to last year. This increase is attributed to :

- An increase on Retained Earnings by Drs. 38,690 million due to the considerable profit in 1995.
- An increase on contributions, by 10,49% or 25.834 th. Drs.

- **Debt**

Total Debt at the amount of Drs. 1,346,386 million during 1995 registers an increase of 3% or Drs. 39,221 million compared with last year's figure, while «Total Debt from Loans and Credits» amounted at 31.12.95 to Drs. 1,131,352 million instead of Drs. 1,159,409 million of 1994, showing a decrease of 2.42%.

Income Statement

- **Operating Results**

The increase in turnover by 13.22% or Drs. 80,075 million is basically due to :

- An increase in sales of electricity by 4%.
- An increase in tariffs, effective from 1st of July 1995.

Respectively the «Cost of Sales» increased by 10.50% or Drs. 29,550 million, as it can be seen in the table below.

Table 3.30. Cost of Sales Variation

Cost of Sales (in million Drs.)	1995	1994	%
Salaries and Wages	99,917	83,714	19.36
Third Party Expenses	155	324	(52.16)
Third Party Allowances	24,750	22,056	12.21
Taxes	154	152	1.32
Depreciation of Fixed Assets	50,351	47,709	5.54
Consumption of Inventories	103,824	91,977	12.88
Other Expenses	31,723	35,392	(10.37)
TOTAL	**310,874**	**281,324**	**10.50**

The revenue from electricity sales by type of customer is presented below:

Table 3.31. Electricity Sales by User Type

Medium & Low Voltage Customers	1995	1994
	(in million Drs.)	
Residential	255,727	224,603
Agricultural	20,654	19,836
Commercial	190,970	166,997
Industrial	111,441	104,600
Other	36,877	32,609
High Voltage Customers	67,512	54,895
Total Revenue	**683,181**	**603,540**

Source and application of funds

In this table, the needs for financing is amounted to 401,430 mil. Drs. The amount of 196,317 million drs or 48.9 % of total needs is used for investments and the amount of 191,705 million drs or 47.8% of total needs is used for loan repayments.

From the Sources of Funds, the self Financing amount from company sources is 216,732 millions Drs. consisted of depreciation, total profit before tax, customers contributions and advances or 54% of the Total Capital needs.

The total borrowing is amounted to 172,685 millions or 43% of the total needs. The net annual borrowing (total Borrowing less loan repayments) is negative due to the satisfactory level of self financing for both the years 1994 and 1995.

From the total expenses which are 681,057 million drs the share of each one in the total cost is presented below:

Table 3.32. Expences by Type

Total Expenses	1995 (Million drs.)	(%)
Fuel cost	179,253	26.32
Salaries and wages	157,182	23.08
Interest expenses	94,822	13.92
Insurances	29,227	4.29
Materials - Spare parts	16,860	2.48
Contractors and services	22,773	3.34
Depreciations	133,330	19.58
Others	47,610	6.99
Total	**681,057**	**100.00**

Ratios

Table 3.33. Annual Variation of Ratios

Ratios	1993	1994	1995
R.1.1(%)	0.5	2.2	2.0
R.1.2(%)	14.14	10.92	9.28
R.1.3(GWH)	31,819	33,464	34,815
R.1.4(drs/Kwh)	17.640	18.207	19.62
R.1.5(%)	29.4	27.2	26.5
R.1.6(%)	61.9	64.5	66
R.1.7(%)	27.8	28.6	30
R.1.8(%)	250	240	220
R.1.9(%)	69.7	69.1	66.9
R.1.10(%)	14.3	12.7	12.8
R.1.11	2.1	2.05	1.8
R.1.12(%)	32	37.3	38.7
R.1.13(%)	(losses)	1.7	9.76
R.1.14(%)	61.5	59.8	57
R.1.15	1.38	1.14	1.31
R.1.16(%)	5.5	4.98	5.48

The exchange rate of drs. to US $ is: 229.2 for 1993, 242.6 for 1994, 231.3 for 1995.

Comments

GDP growth rate was positive and it is expected to raise more than 2% after 1995 (Ref. 1.1). The inflation rate is continuously decreasing terminated at the end of 1996 at 7.5%. The demand rate is expected to raise at the level of 4% till the year 2000.

The average price of electricity is falling down in constant prices.

The ratio of investments to its turnover is ranged from 26% to 30% (R.1.5).

The ratio of fixed assets to total assets is increasing to 66% at the end of 1995 (R.1.6).

The ratio of equity to total liabilities is around 30% due to the low prices and intensive investment programs (R.1.7).

The ratio of debt to equity is progressively decreasing from 250% to 220%, basically, due to increasing profits and negative net annual borrowing (Total borrowing less sinking funds) (R.1.8).

The same remarks as above could be written for total debt to total liabilities (R.1.9).

The ratio of financial charges to turnover is about 13% in 1995 (R.1.10).

The ratio of indebtedness to turnover is decreasing from 2.1 to 1.8 (R.1.11).

The ratio of debt servicing (interests, repayments) to turnover is increasing from 32% in 1993 to 38.7% in 1995 (R.1.12).

The ratio of financial profitability is increasing and is amounted to the order of 10% in 1995 (R.1.13).

The self financing ratio of the total capital needs is about 60% (R.1.14).

The liquidity ratio is amounted to 1.3 in 1995 (R.1.15).

The cost of capital is in the order of 5.5 in 1995 (R1.16).

3.5 ROMANIA

Romania is the largest of the Balkan countries, situated at the northeastern part of the Balkans covering a land area of 238,000 km^2. The population is almost 23 million inhabitants with density 96 people per square kilometer; out of them 54% lives in urban areas. The capital city of the country is Bucharest with 2.1 million. Other large cities with population more then 300,000 are Constanza at the Black Sea, Timisoara, Galazi, Graiova and Brasov.

The country is been divided to geographically into three parts, the Transylvania which is highly mountainous and the plains to the south and east of the Carpathian mountains leading to Danube and Prut rivers and the Black sea to the west.

From the economic point of view the GDP of the country reached 2,920 USD per capita in 1994. In terms of energy consumption, Romania has quite lower value than that of the average European Community reaching 2.16 toe/inhabitant in 1991.

3.5.1 ORGANISATIONAL STRUCTURE OF THE ELECTRICITY SECTOR

Policy and operational functions, previously combined within the Ministry of Electricity were separated, by governmental act in 1990 through a reorganization procedure that gave policy responsibilities to Ministry of Industry and for operation of the electric sector to RENEL. The Romanian Electricity Authority was established as a state owned public utility to include also activities outside its main line of business.

Since 1990, several activities were separated from the Authority into subsidiary commercial companies with a view to be privatized (construction power plants etc.).

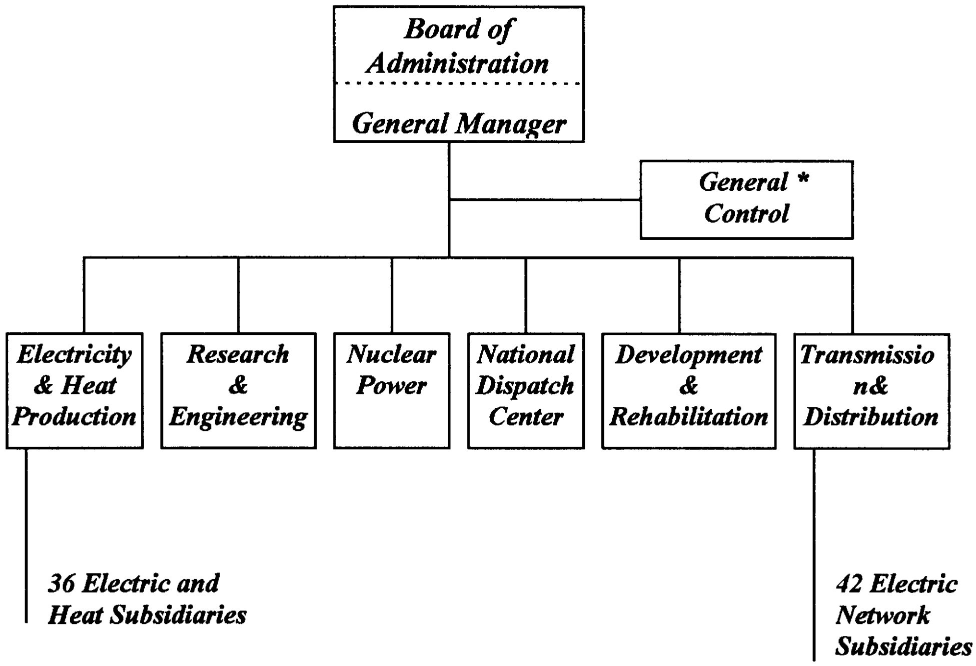
RENEL's main tasks cover the monopoly in transmission, distribution, import, export and sales of electricity. The generating plants of the utility supplies almost 98% of the electricity requirements in the country.

RENEL is charged with the optimal operation of the electricity system, the repair and maintenance of power units. It undertakes planning, research, technical studies, training and fuel oil imports in order to provide, at minimum operating costs the sufficient supply of electricity within predetermined quality standards to balance the economic growth of the country.

RENEL also supplies about 60% of district heat generated in Romania. Its responsibilities for heat supply vary in different towns. The remaining quantities are covered from self-producers of electricity and from municipal utilities for district heat.

In 1995, there were almost 99,000 people employed by RENEL; out of them, more than 50,000 employees are working at the generating plants.

The organizational structure of RENEL is presented in the following chart:



Including the following Departments:
Strategy & Planning, International Affairs, Legal Department, Administration,Office of G.M, Management of Human Resources, Inspection, Finance.

Figure 3.13. Organizational Structure of RENEL

3.5.2 ELECTRICAL POWER GENERATING SYSTEM

The Romanian power system produces electricity from a mix of fuels; thermal plants utilize oil, gas, lignite and hard coal while the hydroelectric plants generate electricity from run of the river plant on the Danube and long cascades on rivers in the Carpathian mountains.

In 1995, the installed capacity of power plants in Romania was 19,413 MW and the net electricity production 52,677 GWh. Power plants owned by RENEL hold about 92% of the installed capacity of the country, these plants, generate almost 96% of the total electricity output in 1991.

In April 1996, the first CANDU nuclear unit of 700 MW reached the critical point of operation, thus, expecting to contribute significantly to the generation of RENEL.

The installed electric capacity in Romania at the end of 1995 is presented on the following figure:

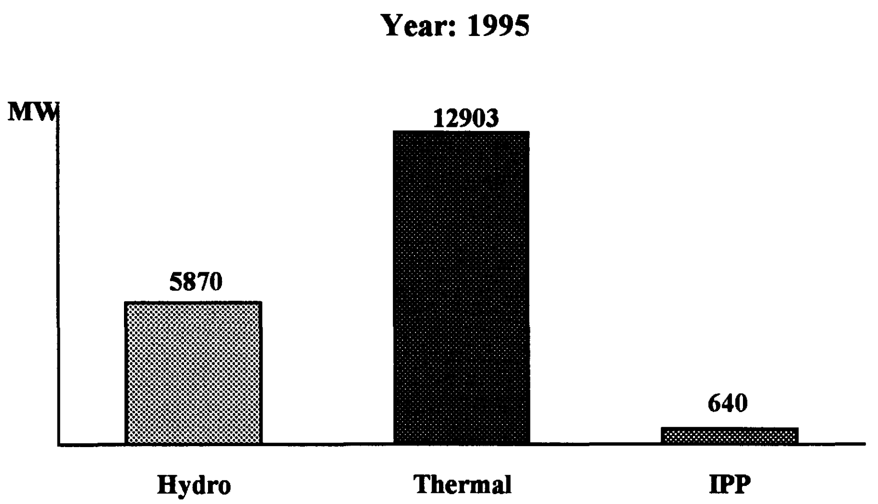


Figure 3.14. Installed Electricity Capacity

An important future of the Romanian production system is the presence of a significant amount of cogeneration power plants. The capacity of these plants is almost 6,200MW representing approximately 35% of the total capacity.

The power plants that belong to RENEL are the following:

Table 3.34. RENEL Generating Capacity

Type	MW	%
Hydro	5,658	26.6
Coal	8,666	40.74
Oil & Gas	6,247	29.37
Nuclear	700	3.29
Total	21,271	100

The Autoproduction in ROMANIA has an installed capacity of 1600 MW representing almost exclusively cogeneration units.

3.5.3 TRANSMISSION NETWORK

The transmission network in Romania consists of lines at the voltage level of 400 kV, 220 kV and 110 kV. A transmission line at the voltage level of 750 kV is crossing the country connecting the Bulgaria network with Ukraine's major power stations.

The length of the transmission lines is presented on the following table.

Table 3.35. Transmission Lines by Voltage Level

Voltage kV	Length km
750	145
400	3506
220	4425
110	17663
Total	**25748**

The transmission network of Romania is strongly connected with the neighbouring power systems of Bulgaria, Serbia, and Ukraine. There are also weaker links with Hungary and Moldova; the tie lines mainly are at the voltage level of 400 kV.

The state of the transmission network is generally good and it seems to be well adapted to the location and size of the existing supply and demand levels even though some strengthening to improve service at the northwest would be desirable. At higher level of demand probably the capacity of the 400 kV transformers connections are biased towards the East which is now under-utilized. Because Romania wishes to join the UCPTE network agreement, it has already been reached to strengthen the Yugoslavian (to be used when political conditions are permitting) and Hungarian 400 kV connections.

The various possibilities for interconnecting Romania with UCPTE are the subject of the detailed study PHARE.

The operation of the Romanian 400 kV network is controlled by the national dispatch center in Bucharest. Five dispatching centers control the 220 kV network. Today upgrading and modernization of these centers is strongly recommended..

3.5.4 ENERGY BALANCE

The electricity production in Romania reached 52,677 GWh in 1995 presenting for the first time since 1989 and increase of almost 2.5%. The increased production came from the thermal power units since there was almost the same production of the hydroelectric units.

In Romania, 68 cities have got centralized system of heat supply. Out of them 32 have as main heat source RENEL's power plants. The supply of heat is produced mainly in co-generation units so that 36% of the utilities production capacity is installed in thermal power plants.

In 1995 RENEL imported 60.7% of the consumed fuel oil and 33.5% of the natural gas used in the country.

The electric power balance in 1995 for Romania was the following:

Table 3.36. Supply of Electricity

Incoming Electric Energy		
	GWh	%
Thermal	36067	68.1
Hydro	16610	31.4
Net Imports	296	0.5
Total	**52973**	**100.0**

Table 3.37. Supply of Electricity Electricity Consumption and Losses

	GWh	%
Consumption	46,017	86.9
Losses	6,600	12.5
Other	356	0.6
Total	**52,973**	**100.0**

Romania presently is going through a transition period from the centrally planned economy to the market economy. Against this background, energy prices and the structure of the energy demand and supply are dramatically changing. In addition, during many years, Romanian's economy was mainly directed to high energy intensive products using inefficient technologies, which at the same time were also using relatively high polluting fuels.

3.5.5 ELECTRICITY MARKET CONSUMPTION

The consumption of electricity in Romania increased by 2.5% in 1995 in comparison to 1994, thus, exceeding 53,000 GWh.

The increase in the electricity consumption came from the industrial and residential sectors, where the household consumption was 6.3% higher than the consumption of the previous year.

The consumption of electricity in Romania by users for the last 3-years is shown on the following Table:

Table 3.38. Electricity Consumption by User Type

	GWh		
Use	1993	1994	1995
Residential	7023	6646	7066
Industrial	31743	34583	41966
Commercial	4641	3841	4179
Other	-	-	-
Total	**43407**	**45070**	**53211**

The main trend in consumption comprises of a rapid rise between 1975 to 1989 followed by a sharp decline from 1989 to 1994. Two things are worth noting: first, that residential consumption has increased substantially in the past few years, in contrast to use in the productive sectors of the economy and second, the share of the industrial consumption is disproportional high. The first tendency arises from a recent shift in political priorities. The decline in electricity use by the industrial sector is only an approximate reflection of demand.

In the recent past, because demand of electricity outstripped supply, power allocated by the Ministy of Industry was given preference to residential sector, to certain key sectors including the army and then to industry.

3.5.6 ELECTRIC UTILITY POWER EXCHANGES

The electricity exchanges with the neigbouring power systems has been decreased considerably the last 5-years until 1979 Romania was a net exporter of electricity with a maximum export of almost 3,800 GWh in 1972. After 1979, is became a net importer reaching a maximum import of 9,500GWh in 1990. Since that year, there is a continuous decrease on the amount of the net importing energy.

For the last 2-year the Romania power system operates in parallel with the networks of Bulgaria, Greece, F.R. Yugoslavia and Albania on a trial basis before joining the UCPTE system.

Taking into account that Romania wishes to extent its cooparation with UCPTE, enhancement of the connection with the Western Countries and implicitly improvement of the Arad-Szeged interconnection to Hungary at the first stage are aimed. In addition, a new 400 kV connecting line between Romania and Hungary is strongly recommended.

The electricity exchanges over the last 5-years are presented on the following table:

Table 3.39. Electricity Exchanges

	GWh					
	Import			Export		
Country	1993	1994	1995	1993	1994	1995
Hungary	-	-	67.9	-	-	282.6
Ukraine	-	-	1599.4	-	-	0
Moldavia	-	-	127.2	-	-	0
Bulgaria	-	-	75.5	-	-	1483.7
Serbia	-	-	454.8	-	-	263.1
Total	**2991**	**1790**	**2325**	**1118**	**1065**	**2029.4**

3.5.7 COMMENTS ON THE ACCOUNTING TABLES AND FINANCIAL RATIOS - ROMANIA (RENEL)

The data were used include two accounting tables for the year 1995. These tables which are showed in the Appendix B: are the Profit and Loss Account on the 31st of December 1995 and the Balance Sheet for the same period.

Assets - Liabilities

From the Total Assets which are amounted to 30,509,797 m Lei, the total fixed Assets are 26,682,801 or 87.5% of Total Assets and the current assets are 2,765,532 m lei or 9.1 % of Total Assets.
From the Total Liabilities which amounted to 30,509,597 the equity or total own capital is 26,434,197 m lei or 86.6% and the total current liabilities 4,070,907 m lei or 13.3 % of Total Liabilities

Profit and loss account

The total revenues are 5,187,306 m lei and the total expenses are 5,183,593 m lei.
The total revenues consist of total operating revenues which are 5,157,868 m lei, total financial revenues which are 15,020 m lei and exceptional revenues which are 14,418 m lei.
The total expenses are 5,183,593 m lei and consist of total operating expenses which are 5,074,041 m lei, total financial expenses which are 79,130 m lei and exceptional expenses which are 30,422 m lei.
The total profit is 3,713 m lei and the operating profit is 83,827 m lei.
The profit is near to break-even and this is a result of the applied tariff policy.
There is not available table for the Sources and Application of Funds.

Ratios

Table 3.40. Annual Variation of Ratios

Ratios	1993	1994	1995
R.1.1(%)	1.5	3.9	6.9
R.1.2(%)	290.3	136.8	32.3
R.1.3(Twh)	-	42,5	45
R.1.4	-	-	-
R.1.5	-	-	-
R.1.6(%)	-	-	87.5
R.1.7(%)	-	-	86.6
R.1.8(%)	-	-	15.4
R.1.9(%)	-	-	13.3
R.1.10(%)	-	-	1.5
R.1.11(%)	-	-	34.3
R.1.12	Capital repayments not available		
R.1.13(%)	-	-	~0
R.1.14	-	-	-
R.1.15✧	-	-	0.679
R.1.16(%)	-	-	0.3

✧ *If the loans in the balance sheet are considered as not corresponding to current liabilities then the ratio R.1.15 from 0.679 becomes 1.21.*

The commercial exchange rate Lei: $ is: for 1993: 760.1, for 1994: 1,655.1 and for 1995: 2,033.3

Comments

GDP growth rate is increasing from 1.5% in 1993 to 6.9% in 1995 (Ref. 8).
Inflation rate is very high (290.3%) in 1993 and falls (32.3%) in 1995 (Ref. 8).
The electricity demand has increased by 5.9% from 1994 to 1995 following the trend of GDP growth rate.
The ratio of fixed assets to the total fixed assets is 87.5% (R.1.6).
The ratio of equity to total liabilities is amounted to 86.6% (R.1.7).
The ratio of debt to equity is very low, at the order of 15% (R.1.8).
The ratio of total debt to total liabilities is very low and amounted to 13.3% (R.1.9).
The ratio of financial charges to turnover is very low, only 1.5% (R.1.10).
The ratio of debt to turnover is about 34.3% (R.1.11).
The ratio of earning to equity is in the order of 0%, not satisfactory (R.1.13).
The liquidity ratio is 0.679, that is, not satisfactory, this ratio should be much greater than one (R.1.15).
The cost of capital is in the order of 0% (R.1.16).

3.6 F.R YUGOSLAVIA

The new federal republic of Yugoslavia is constituted from the republics of Serbia and Montenegro. The country side is highly mountainous and it is situated at the Northwest part of the Balkan peninsula. The area is 90,000 km^2 and the population almost 10.4 million people. The capital city is Beograd with almost 1,700,000 people. The population is almost evenly split in the urban and rural area where 47% and 53% of the inhabitant live respectively.

From the economic point of view, F.R. Yugoslavia is presently through a period of turmoil. The former Yugoslavia use to be a net importer of energy. The GDP of the country is estimated to be presently in the order of 2,500 US Dollars per capita. The energy consumption of the country before the war, used to be quite lower than the Community average in 1991, reaching 1.6 toe/inhabitant.

3.6.1 ORGANISATIONAL STRUCTURE OF THE ELECTRICITY SECTOR

The Electricity industry is dominated by the Public Enterprise of Electric Power Industry of Serbia (EPS) which operates as a public utility with assets and capital owned by the government. The activities of EPS include the production of electricity and heat from hydro and thermoelectric generating units and the Transmission and Distribution of electricity in the country. The production and the process of coal is also under the responsibility of EPS.

The Managing Board of EPS is responsible for the strategic targets of the enterprise in connection with the energy policy of the Republic of Serbia.

The organizational structure of the utility consisting from the following major divisions as well as the head departments and centers operating under the General Manager are shown below:

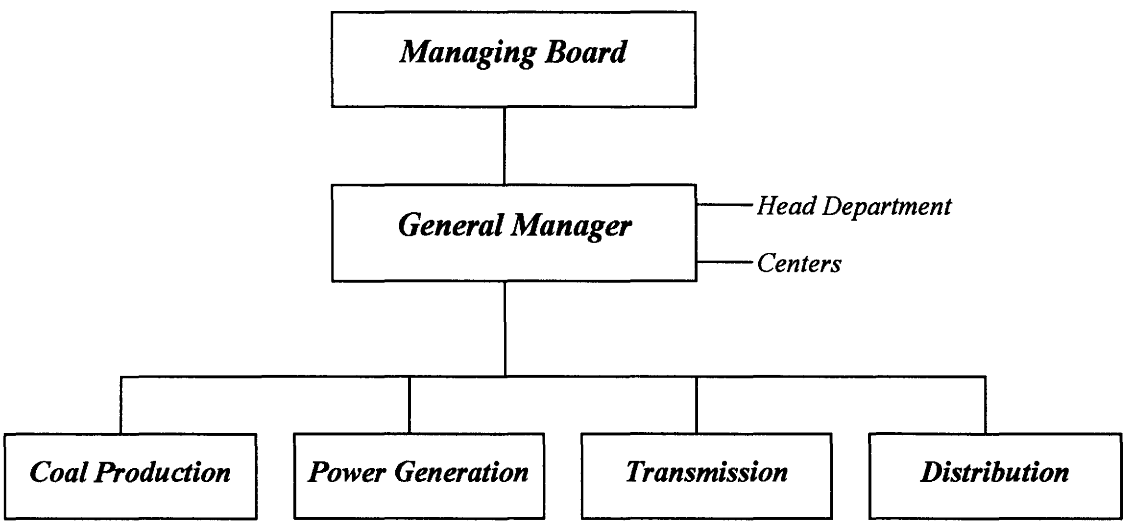


Figure 3.16. Organizational Chart of EPS

Head departments	**Centers**
1. Power Generation and Transmission	Information system
2. Coal production (4 centers)	Supervision
3. EPS management and Marketing	
4. Distribution (11 divisions)	
5. Development	
6. Investments	
7. Finances	
8. Legal Affairs	

In 1995, these were almost 65000 people working at EPS, out of them almost 52.2% are employees of the coal mining of the utility

3.6.2 ELECTRIC POWER GENERATING SYSTEMS

The generating system of Serbia is a mixed hydrothermal system with an installed capacity of 8,293 MW at the end of 1995, out of which 5,524 MW (%) are thermal power units and 2,769 MW (%) represent hydro-power plants. In addition, there three hydro-power plant totaling 461 MW within the operating responsibility of EPS.

Presently, in Serbia there are eight thermal power plants generating electricity (5,171MW) and three power plants producing electricity and heat (353 MW).

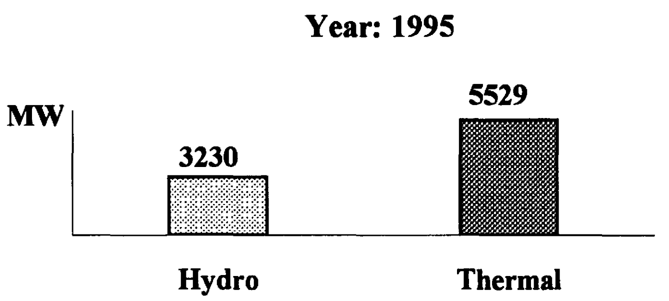


Figure 3.17. Installed Electricity Capacity

The electricity generation reached 32,946 GWh in 1995, out of which 22,286 GWh (67.6%) was the production of thermal power plants and 10,660 GWh (32.4%) represents the production of hydroelectric generation units. The generation of thermal power plants was almost exclusively from coal fired units (22,265 GWh)while the generation of conventional hydro reached 30.1% and 2.2% (758 GWh) was the generation of the hydraulic pumping storage units.

In comparison with the previous years there was the following changes in the production of the power units

Table 3.41. Variation of Electricity Annual Production

Type	(GWh) 1993	1994	1995
Thermal	21101	21182	22286
Hydro	8836	9549	10660
Total	**29937**	**30731**	**32946**

To generate electricity there was the following production of coal over the same year.

Table 3.42. Annual Variation of the coal Production

Coal Production	Mil. Tons		
	1993	1994	1995
Open-cast mines	35.10	36.50	39.08
Underground mines	0.69	0.69	0.66
Total	**35.79**	**37.19**	**39.75**

The availability of the coal-fired power plants is approximately 70% over the last 3-years where the equivalent operating hours of the units exceeds 4500 hours annually. However, the average age of the production facilities is more than 20 years.

3.6.3 TRANSMISSION NETWORK

The Transmission network of F.R. Yugoslavia consists from lines at the voltage level of 400 kV, 220 kV and 110 kV. The length of the transmission lines is approximately 1500 Km for the 400 kV, 2200 km for the 220 kV lines and almost 6450 km for the 110 kV lines while the capacities of the respective transformers are 6500 MVA, 7000 MVA and 11000 MVA respectively.

Table 3.43. Transmission Lines by Voltage Type

Voltage level kV	Length Km
400	1500
220	2200
110	6450
Total	10150

The Transmission network of EPS is connected with the power systems of Hungary, Romania, Bulgaria, Greece through the republic of FYROM, Albania. Connection also existsted with the former republics of Yugoslavia, however the present operating condition of the "Adriatic" and "Northern" Lines it is not known.

3.6.4 ENERGY BALANCE

The overall electricity production in Serbia increased by 7.2% in 1995 over the production of 1994.

The increase of the net generation of the thermal power units was 5.2% while the respecting production of the hydroelectric power plants was almost 12%.

The electric power balance in 1995 was the following:

Table 3.44. Electricity Supply

Incoming Electric Energy	GWh	
Thermo-electric Production	22286	63.9%
Hydro-electric	10660	30.6%
Other power plants of EPS	1031	3.0%
Purchases of electricity	898	2.5%
Total	**34875**	**100.0**

Table 3.45. Electricity Supply

Consumption and Losses	GWh	
Sales of Electricity	25494	73.1%
Transmission Losses	1309	3.7%
Distribution	3573	10.2%
Other sales	3297	9.5%
Water Pumping	1202	3.5%
Total	34875	100.0%

3.6.5 ELECTRICITY MARKET CONSUMPTION

The consumption of electricity in F.R. Yugoslavia increased by 5% in 1995 reaching 25,5 TWh mainly due to lack of alternative fuels (oil, gas) and in connection with the relative low prices of electricity especially for residential heating. The maximum demand of electricity reached 6,410 MW, thus presenting an increase of 4.9% over the peak load of 1994.

The consumption of electricity in F.R. Yugoslavia for the last 3 years is shown on the following table:

Table 3.46. Variation in Electricity Consumption

Electricity Consumption	GWh		
Use	1993	1994	1995
Residential	14388	15381	15853
Industrial	4826	4910	5296
Public lighting	266	245	253
Others	3729	3769	4092
Total	**23209**	**24305**	**25494**

From the above it is obvious that a significant amount of electricity exceeding 60% in consumed in the residential sector.

3.6.6 ELECTRIC UTILITY POWER EXCHANGES

The electricity exchanges with the neigbouring power systems is yet very limited since they were affected by the UN sanctions. In addition, in 1995 EPS was not in parallel operation with UCPTE.

The electricity exchanges over the last 3 year are shown on the following table:

Table 3.47. Electricity Exchanges

Country	**Import**			**Export**		
	(GWh)					
	1993	**1994**	**1995**	**1993**	**1994**	**1995**
Hungary	15	-	110	437	-	68
Romania	91	-	191	343	-	95
Bulgaria	369	-	172	53	-	56
Greece	59	-	134	54	-	218
Albania	-	-	12	-	-	28
Other Republics	973	-	279	1538	-	707
Total	**1507**	**704**	**898**	**2428**	**1562**	**1172**

3.7 COMPARATIVE ANALYSIS OF THE ELECTRIC UTILITY ECONOMIC STATUS

In this section, a comparative analysis will be presented, concerning the several economic and financial ratios either of the Balkan or E.U. countries. The order of presentation will be based on the former paragraphs where these ratios were estimated and analyzed for each utility.

GDP growth rate is increasing for all Balkan countries except FYROM. The corresponding figures for E.U. are much lower, and the average growth rate for the period 1995 to 2000 is predicted about 2.5%.

The inflation rate is decreasing for all Balkan countries, starting from high values. Greece is achieving much better results getting close to 9% in 1995 and 7.5% in 1996. The corresponding figures for E.U. are much lower and are predicted in the order of 2.4% for the period 1995-2000.
The average electricity demand growth rate for E.U. has presented positive figures, even higher than those corresponding to GDP growth, during the first part of the nineties.

The electricity prices, in real terms, have fallen in almost all E.U. countries for the period 1989-1993. The same has happened for the Balkan countries. Although the reasons for this fall were different.
Such reasons could be social or antinflationary. All the Balkan utilities operated near the breakeven point with some better results for Greece, in 1995.
The evolution of borrowing is affected by the evolution of the investment program and the internal financial capacity.

If the Balkan countries take over an optimistic investment program they have to increase the prices of electricity. Otherwise, the utilities should get loans from international market as PPC has already done.

The analysis of capital structures for the Balkan utilities and the corresponding analysis of E.U. utilities, showed the following results for the ratio of debt to equity (R.1.8), taking into account that the capital structure is affected by the investment commitments, the financial debt and the capacity to generate funds internally.

Referring to this ratio (R.1.8.), all the Balkan utilities except PPC, present a very low ratio (R.1.8) between 0.11 to 0.30. The figures for PPC are in the order of 2.3.
The E.U. utilities have presented an average ratio of 1.1 for the period 1989-1992 with high values of this ratio for the countries Italy, Holland and at a lesser degree Spain.

The electricity industries of these countries can't cover their financial requirements by their respective stock markets, since the institutional structure of the electricity industry doesn't permit financing through share issues and because the tariff policies enacted have not taken these financial needs into consideration.

The same conclusions could be made for Greece.

The following table presents the ratio R.1.8 for the utilities of several of E.U. countries and some others for the period 1989-1993.

Table 3.48. DEBT/EQUITY Ratio

Countries	1989	1990	1991	1992
AUSTRIA	1.2	1.1	1.0	1.0
BELGIUM	0.6	0.5	0.5	0.4
DENMARK	0.3	0.3	0.3	0.3
SPAIN	1.6	1.5	1.6	1.6
FRANCE	1.3	1.2	1.0	0.9
GERMANY	0.5	0.5	0.6	0.6
HOLLAND	2.2	2.0	2.7	2.9
IRELAND	1.6	1.5	1.3	1.1
ICELAND	0.7	0.7	0.7	0.7
ISRAEL	0.6	0.7	0.9	1.0
ITALY	2.5	2.6	2.7	2.7
LUXEMBOURG	0.6	0.6	0.5	0.4
NORWAY	1.2	1.1	1.0	1.2
PORTUGAL	2.1	1.2	1.2	0.8
SWITZERLAND		1.1	1.0	1.1
MAROCCO	1.7	1.6	2.0	1.5
AVERAGE	**1.2**	**1.1**	**1.2**	**1.1**

The corresponding table for the Balkan Utilities and for the period 1993-1995 is presented below:

Table 3.49. Annual Variations of Ratios

Ratio1.8	1993	1994	1995
ALBANIA	0.24	-	-
BULGARIA	-	0.14	0.30
FYROM	-	-	0.11
GREECE	2.50	2.40	2.2
ROMANIA	-	-	0.15

The analysis for the ratio "earnings after taxes to equity" (or "financial profitability ratio" R.1.13) showed that all these companies have losses or operate near the breakeven point, with some exception for Greece in 1995, where this ratio was 9.76%.

The corresponding ratios for EU countries and some other countries for the year 1992 are presented below:

Table 3.50. 1992 Financial Profitability after Taxes

Country	(%)
AUSTRIA	2.0
BELGIUM	7.6
DENMARK	1.5
SPAIN	7.7
FRANCE	0.5
GERMANY	3.0
HOLLAND	4.0
IRELAND	6.5
ICELAND	-2.4
ISRAEL	2.4
ITALY	1.2
LUXEMBOURG	3.6
NORWAY	4.6
PORTUGAL	1.4
SWITZERLAND	3.1
SWEDEN	9.8
MAROCCO	-0.4

The cost of capital ratio (R.1.16) is very low for all the Balkan countries except Greece, which has borrowed from international market and in local currency. For Greece this ratio is in the order of 5-5.5%. For the rest of Balkan countries, due to the low level of borrowing, the financial charges are very low as well as the cost of capital employed.

(7)

For the E.U. countries and some others, for the period 1989-1992, this cost of capital is presented below:

Table 3.51. Cost of Capital Employed

COUNTRY	1989	1990	1991	1992
AUSTRIA	3.4	3.4	3.5	3.2
BELGIUM	8.1	8.9	9.4	9.1
DENMARK	0.9	0.9	0.6	0.6
SPAIN	9.6	10.3	9.9	9.9
FRANCE	5.6	5.3	5.0	4.6
GERMANY	4.5	3.8	4.3	5.3
HOLLAND	2.3	1.8	2.1	4.0
IRELAND	5.6	5.1	4.9	4.5
ICELAND	2.3	0.7	1.4	3.6
ISRAEL	5.2	0.9	1.5	1.7
ITALY	5.6	5.8	7.1	9.0
LUXEMBOURG	7.5	7.1	8.1	7.9
NORWAY	10.3	10.2	10.2	9.1
PORTUGAL	10.3	8.9	11.3	8.1
SWITZERLAND		7.0	7.6	7.8
MAROCCO	4.3	3.2	3.5	2.8
AVERAGE	**5.7**	**5.2**	**5.7**	**5.7**

3.8 SUMMARY

The installed capacity of the generating system of the Balkan countries (Albania, Bulgaria, FYROM, Greece, F.R. Yugoslavia and Romania) reached 53 GW in 1995. Out of them, almost 75% represents thermal generating units, including the nuclear power plant of Kozloduy in Bulgaria (not considering the Cernavoda nuclear power plant in Romania with one 700 MW CANDU 6 type nuclear reactor scheduled to operate in 1996). The other 25% is the capacity of hydropower units.

The overall electricity demand of the six Balkan countries exceeded 170 TWh in 1995 where the production of the thermal generating units approached 80%. Concerning the peak load of electricity demand, there is a variation from almost 1,000 MW to approximately 10,000 MW to Albania and Romania power systems respectively. In addition, the peaking demand occurs during the summer months in Greece, due to air-conditioning, while for the other Balkan Power systems the peak load occurs during the winter months (heating loads).

The year 1995, can be considered as a turning point for the power systems of the Balkan countries because, from that year, the reduction in the electricity consumption of these countries that had being observed from 1989-90 (except Greece) has eventually stopped. After that year a small but steady growth of the electricity consumption is expected to continue for the coming years. Moreover the demand of electricity in the power systems of Romania, Bulgaria, and possibly of F.R.Yugoslavia will reach the demand level of 1989-90 not before the year 2003-06.

Presently, there is a considerable amount of reserve capacity among the Balkan countries varying from almost 100% in Romania to about 35% in Greece and F.R. Yugoslavia. However, care should be given since a considerable amount of capacity represents old thermal units with low availability and efficiency while a significant amount of hydro plants are seasonally energy limiting units. In addition, there are fuel supplying problems for several thermal units, to almost every country except Greece, especially those utilizing imported fuels.

From, the operating point of view, it is considered very important that Greece, F.R. Yugoslavia and FYROM are already members of UCPTE while the other countries, Romania, Bulgaria and Albania are expected to become soon members of the UCPTE network.

The creation of a regional electricity market can be considered reasonable for further investigation since in addition to the well known benefits that will arrive to every interconnected power system namely:

- Emergency support
- Best utilization of the most economic power units
- Load diversities
- Savings from delaying new expansion programs
- Reliability improvements

Considerable reduction of the new investments for power units is expected since all power systems in the region still aim at self-sufficiency in their territories and so are committed to a certain level of investment expenditures.

Presently, the exchanges of electricity among the Balkan countries and the surrounding networks can be considered to be very limited. Even with the existing tie-lines among the Balkan countries there is significant room for increasing the amount of transferred electricity.

From the following Tables and Figures the above conclusions are quite obvious.

It was observed that the expansion plans for most of the Balkan power systems, following the self sufficiency pattern also requiring significant amounts at new investment, exceeding possible the economic means of the countries. Savings on investments will be very beneficial for the countries, since considerable amounts of money can be allocated to other hardly needing areas.

Table 3.52. Population, Economy, Electricity, and Energy Indicators

	Population Millions	GDP Usd/Capita	Electricity Consumption KWh/Capita	Energy Intensity Toe/Capita	Energy Self Dependency %
Albania	3.3	380	780	0.66	95
Bulgaria	9.0	4230	3250	2.24	46
FYROM	2.0	790	2470	1.6	-
Greece	10.45	11580	3400	2.13	34
Romaia	23.0	2920	2000	2.16	32
F.R. Yugoslavia	10.4	2500	24.50	1.6	48

Table 3.53. Electricity Exchanges of the Balkan Countries in the year 1995

	GWh		
COUNTRIES	**IMPORTS**	**EXPORTS**	**NET**
Albania	319	115	-276
Bulgaria	1961	2121	160
FYROM	189	72	-117
Greece	1390	593	-797
Romania	2325	2029	-296
F.R. Yugoslavia	898	1172	374
TOTAL	**7154**	**6102**	**-1026**

Table 3.54. Demand of Electricity of the Balkan Countries in the year 1995

	Demand GWh	Max. Load MW	Reserve Capacity %
Albania	4302	960	72.8
Bulgaria	41843	7522	60.5
FYROM	5685	-	-
Greece	38349	6063	34.0
Romania	52973	9645	101.3
F.R. Yugoslavia	32946	6410	36.6
TOTAL	**176098**		

Table 3.55. Electricity Capacity of the Balkan Countries

	MW					
YEAR : 1995	Hydro	Conventional Thermal	Nuclear	Reniwables	IPP	TOTAL
Albania	213	1446	-	-	-	1659
Bulgaria	1970	4707	3760	-	1639	12076
FYROM	390	1010	-	-	-	1400
Greece	2525	6658	-	46	221	9450
Romania	5870	12903	-	-	640	19413
F.R. Yugoslavia	3230	5529	-	-	-	8759
TOTAL	**14198**	**32253**	**3760**	**46**	**2500**	**52757**

Table 3.56. Electricity Production of the Balkan Countries

	GWh					
YEAR : 1995	Hydro	Conventional Thermal	Nuclear	Renewables	IPP	TOTAL
Albania	3960	342	-	-	-	4302
Bulgaria	2468	15678	15993	-	1470	35609
FYROM	797	4888	-	-	-	5685
Greece	3764	34582	-	33	867	39246
Romania	16610	36067	-	-	-	52677
F.R. Yugoslavia	10660	22286	-	-	-	32946(1)
TOTAL	**38259**	**113843**	**15993**	**33**	**2337**	**170465**

(1) The production of other plants of EPS equal to 1031 MW is omitted.

CAPACITY 1995

52.8 GW

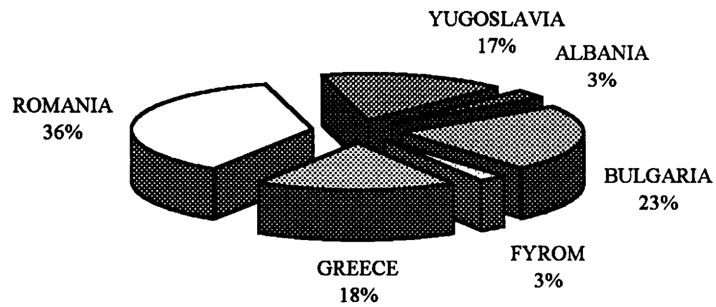


Figure 3.19. Installed Capacity Composition by Country

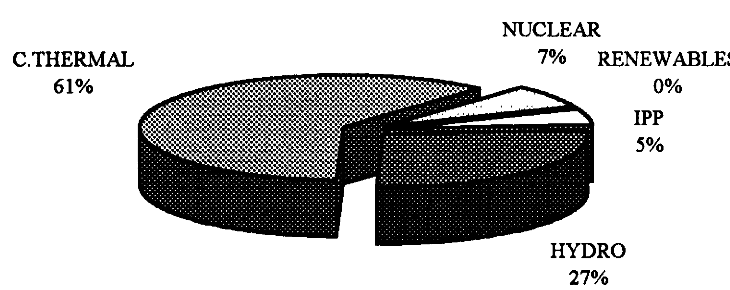


Figure 3.20. Installed Capacity Composition by Type

PRODUCTION 1995
170.5 TWh

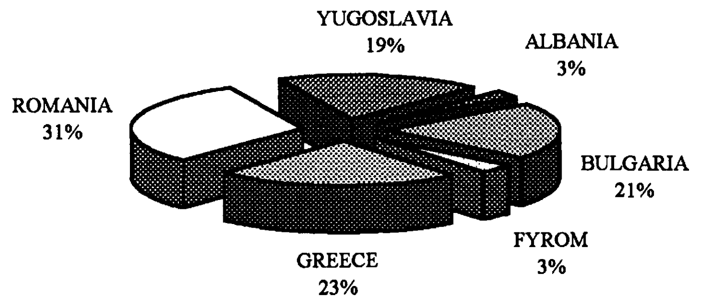


Figure 3.21. Electricity Production Composition by Country

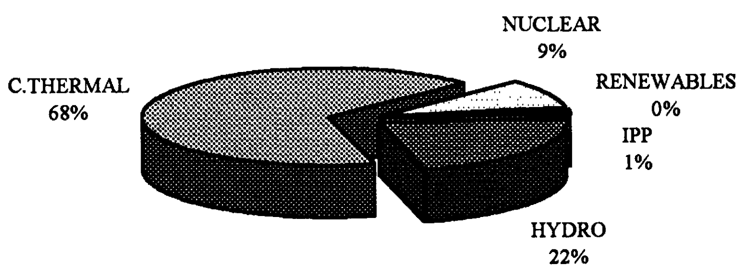


Figure 3.22. Electricity Production Composition by Type

3.9 CONCLUSIONS, COMMENTS AND PROSPECTS FOR THE FUTURE

The above presentation shows the basic accounting tables for all Balkan countries except F.R. Yugoslavia.

The comparisons of the economic status of the electricity Utilities took place through the presentation of several economic ratios not only among the Balkan Utilities, but among other countries, most of them belonging to E.U.

The above comparative analysis doesn't always direct to the correct conclusions since there are some factors which hinder the comparison of the results of the ratios obtained, specially the ratios of profitability and of the cost of capital. These factors are:

i. The diversity of the accounting practices and rules (revaluations, definitions, depreciations, allowances for asset replacements e.t.c.).

ii. Different institutional frameworks in which the utilities operate; paying dividents, private owned companies must compete on the stock markets with other parties requiring financial resources.

iii. Different economic conditions of the countries. For example the rate of inflation affects the return on investment. The interest rates and exchange rates affect the financial expenses, the amortizations and the total debt.

The comparisons could give some conclusions for these Balkan utilities with some reservations.

The first conclusion is that these utilities are not independent. They operate under a close control of the State where they belong. The State determines the tariff policy and the Revenues, the investment programs, the borrowing e.t.c.
As result of that, these utilities operate with tariffs which don't always reflect the cost, but these tariffs are designed taking into account social, development and antinflationery policies. They operate close to breakeven point with losses or very low profits. These tariff policies don't give the correct signals to the consumers and cause waste of electricity and energy.

The inflation rates and GDP growths directly affect the demand rate of electricity, the interest rates, the investment programs, the debt and generally the whole economic environment of the utilities.

The development of these utilities could be positive affected by the following:

- The prospects of network connections with other countries and between them.
- The independent operation of these utilities through the signing of contracts with the States.
- The deregulation or the liberazation of the market and the possible implementation of some measures aiming at achieving a single electricity market among the Balkan countries.
- The privatisation, partially or wholly, through several schemes (e.x. stock market).

- The designing of such a tariff policy that could reflect the cost and give some returns of capital.
- The stabilization and development of the economy.
- The prospects of peace in the region and the development of Democracy.

The economic growth and the fall of the inflation rates are expected to be improved and to affect directly the electricity demand, the interest rates and the exchange rates of the local currencies, creating the necessary conditions, for further development of the utilities. The electricity prices are expected to be raised, in real terms, to reflect the costs.

The borrowing is expected to be raised for all the utilities, except PPC, in order to finance the optimistic investment programs of these utilities.

The status and the regulatory framework for the electric utilities is expected to change for all countries.

Already PPC is obliged to adopt all the necessary changes that are initialized and proposed by the common position (EU. Directive) adapted on 16th of July 1996 for the Internal Market in Electricity.

4. EXPANSION PLANS

4.1 ALBANIA

The Development Plan of the Electrical System of Albania is prepared based on studies carried out by International Institutions and financed by the World Bank and the European Bank for Reconstruction and Development. The expansion plan strategy is focused on the following issues:

- Fulfillment of the domestic electricity demand by minimizing the interruption of supply to the customers at the highest possible quality and the lowest cost.
- Export excess production of electricity
- Rehabilitation of existing hydro and thermoelectric plants
- Development of new hydropotential sites of the country
- Development of new thermoelectric generating units based on imported natural gas
- Decrease of the non-technical losses of the system
- Reorganization of KESH for achieving efficient operation of the utility and improving its financial status.
- Welcome foreign capital investments for the development of new projects.

4.1.1 GENERATION SYSTEM

A. Rehabilitation of existing units

a) Hydropower units

With the exclusion of Komani hydropower station the others need technological renovation. For this reason it is provided the rehabilitation of two hydropower stations, Vau Dejes' and Fierza's as well as of three smaller ones, Ulza's, Shkopeti's, Selita's.
Such rehabilitation consist of the replacement of:

- Mechanical equipments
- Electrical equipments
- Commanding and regulating system
- Civil works

Such a rehabilitation project would enable the modernization of electromechanical devices of the main hydropower stations bringing the following effects:

- Increase of electricity output as well as of the efficiency of water utilization.
- Increase of equipments and buildings longevity.
- Increase of generated electricity quality generated due to the high level of the automatisation and control.
- Improvement of the security and the stability of dams.

The preliminary project cost is **46,1** million USD.

In addition, there are 85 small power plants included in the electrical system, of an annual production of 50 million kWh. These hydropower stations are of outdated technology and equipment. Their rehabilitation is necessary, and is expected to bring:

- Increase of the electricity output from 50 to 80 GWh/year (60% increase).
- Cost reduction.
- Quality improvements of electricity

To this aim the European Bank is approached to finance a feasibility study on these hydropower plants. The study cost is estimated at **80,000** USD.

b) Thermal units

Based on the old equipments and the bad shape of a great number of facilities due to lack of funds for their repairment, their rehabilitation is necessary. In this programme is envisaged the rehabilitation of two main thermoelectric plants such as Fieri's and Ballshi's, which requires a financial support or a feasibility study to this aim.

The preliminary cost is estimated at **250,000** USD.

B. New Generating units

As mentioned above, in KESH construction strategy of new energy resources the construction problems that have a substantial place include:

a) The construction of Bushati Hydropower Plant

This hydropower plant will be constructed on Drini river and is the last of the existing cascade plants made up of Fierza, Komani and Vau Dejes hydroelectric plants.

Its characteristic difference when compared to the existing plants is its low fall.

The main characteristics of the project are:

- Installed power 2 x 40 MW
- Average annual output 330 GWh.

The preliminary cost for project implementation is estimated at about **145 million USD.**

b) The financement of the Banja hydropower plant feasibility study.

The construction of this Hydropower plant started in the year 1986 and right now 40% of its civil works have been carried out. Further works are interrupted due to the lack of financing. Main characteristics of this hydropower plant are:

- Installed power 2 x 30 MW
- Average annual output 250 GWh.

The main investment cost for the optimal variant is **300,000 USD.**

c) The financement for feasibility study for a gas 200 MW thermopower plant in the area of Korca.

The preliminary estimated cost is **300,000 USD.**

In addition, the following hydroelectric power plans have been considered for future development:

- HP Bushat on the Drini river of 80 MW and expected generation of 330 GWh/year.
- HP Banje on the Devoli river of 60 MW and 250 GWh/year
- HP Kalivac on the Vjosa river of 120 MW and 300 GWh/year.

The financing of the above projects is being searched abroad.

A possible development of these projects through a BOOT scheme is the most probable.

4.1.2 TRANSMISSION SYSTEM

An investment expenditure program was prepared by KESH as a part of "The strategy for the Development of the Albanian Power System for the period 1995-2000" on the base of some technical strategies, such as:

- Increasing of 220/110 kV transformation capability in load areas;
- Construction of new 220 kV lines;
- Upgrading and the reinforcement of 110 kV system;
- Construction of new 110 kV lines.

Analytically the investment program from the transmission network until the year 2000 contains the following projects:

- New autotransformer 60 MVA, 220/110/10 kV in Vau Dejes HPP and installation of the existing one in the new part. Exp. Cost: 2.5 millions USD.
- New 110 kV line Vau Dejes - Bushat - Shkodra 15 km, AC 240 mm2. Exp. Cost: 1,5 millions USD.
- The installation of the existing 30 MVA autotransformer in Fierza HPP. Exp. Cost: 1,0 millions USD.
- New 220/110 (20) kV, 2 x 90 MVA substation in Durres and its connection with the power system. Exp. Cost: 7,0 millions USD.
- Reinforcement of the 110 kV line Tirana - Selita - Traktoraring. Exp. Cost: 6,5 millions USD.
- New 220 kV line Elbasanl - Elbasan2 (4 km, AC 500 mm2). Exp. Cost: 1,7 millions USD.
- New autotransformer 300 MVA, 220/110/(30) kV in Elbasan2. Exp. Cost: 5,0 millions USD.
- New 110 kV line Cerric - Korca (95 km, AC 240 mm2). Exp. Cost: 7,7 millions USD.
- Reinforcement of the 110 kV line Elbasan - Ibe - Traktora. Exp. Cost: 1,0 millions USD.
- Doubling the 110 kV line Elbasan - Cerrik. Exp. Cost: 2,5 millions USD.
- New 220 kV line Fieri - Vlora (30 km, AC 300 mm2). Exp. Cost: 3,5 millions USD.
- New 220/110/35 kV, 2 x 90 MVA substation in Vlora. Exp. Cost: 7,0 millions USD.

New Dispatching Center

The operation of the electrical system is a complex problem made up of automatic and manual actions of the operators at the power plants and at the transmission system, which at the present time are carried out through the Dispatching System.

Upgrading and enhancement of the electrical and of the existing system dispatching does not meet the present requirement. Such a system can not provide a secure, qualitative and optimal operation, particularly at the present time when the system is linked with the bordering countries network.

The study carried out by the World Bank shows the necessity of the construction of a modern dispatching system. Complete implementation of such a system will require a **9,5 mil USD** investment.

4.2 BULGARIA

4.2.1 GENERATION SYSTEM

The construction of new generating units in the future should be carried out only after comparative analysis with alternative decisions and providing the efficiency and the self -financing abilities of each particular project. The technological decisions, the choice of main pieces of equipment, the unit capacities, etc., should be determined.

Studies, in the short-term period till the year 2000, are performed on the following sites:

Belene Nuclear Power Plant - a general study covering:

- evaluation of the condition of the delivered equipment and the additional investments needed for securing its operation while observing the safety requirements:
- reestimation of the funds spent so far on studies and design work, construction, installation, delivery or equipment, conservation costs, expertise, etc.:
- studying the possibilities for construction of Belene TPP depending on putting units 1 and 2 of Kozloduy NPP out of operation and construction of replacing capacities in the Maritsa East Complex as to satisfy the energy demand in the country;
- studying the possible ways and conditions for financing the site.
- studies for choosing the most appropriate technologies and unit capacities in the Maritsa East Complex, sites and construction terms, needed investment by stages, financing conditions etc.
- studying the possibilities and expediency of modernization of district heating thermal thermal plants and heating stations by means of installation of gas turbine modules. Determining the efficient sites, the construction terms, the choice of equipment and the investment policy.

Because of the relatively low specific capital investments (950 dollars/kWh) and the complex character of utilization (irrigation and water supply), it is expedient during the period 2001-2005 to construct the cascade "Streden Iskar" with total capacity of 44 MW and during the period 2006-2010 the cascades "Sredna Vacha" (120 MW) and "Corna Arda" (156 MW). The construction of the cascade "Mesta" and of an hydro complex on the Danube River are proven necessary after 2015, and therefore the issues concerning their construction might be considered at a later stage.

As regards Belene NPP, it has been proven that it is without alternative during the period after 2010. If its construction is necessary at that time, it is quite possible reactors of a new generation, with inherent safety, increased flexibility and capacity in the neighborhood of 600 MW to be used.

If from the viewpoint of the condition of their pressure vessels and of the safety and security requirements, it is necessary to take units 1 and 2 of Kozloduy NPP out of operation, around the year 2000, their replacing in shorter terms may be done by unit 1 of Belene NPP. Because of difficulties of regime character, with the introduction of the condition of the delivered pieces of equipment, the proposed study on Belene NPP should be carried out in very short terms, along with the possibilities for export of electric power to neigbouring countries.

4.2.2 TRANSMISSION SYSTEM

The power transmission network after a considerable improvement and rehabilitation is in a condition during the period till 2010 to service a power demand of 55 billion KWh.

The necessary investments for improvements and rehabilitation as well as for development of the intersystem connections amount to 50 million dollars till the year 2000, 40 million dollars for the period 2001-2005 and 110 million dollars for the period 2006-2010. The costs for connection of the replacing capacities and of the new generating capacities to the power transmission network pertain to the respective sites.

4.3 FYROM

4.3.1 GENERATION SYSTEM

The state-owned utility of FYROM, ESM has an approved expansion plan for the period 1996-2000 which is defined as the «Program on Construction, Reconstruction and Rehabilitation of Electric Power Facilities».

This Program is based on an annual increase of the power demand equal to 3,1% as well as on further analyses concerning the various operational parameters of the existing power system and their improvement.

It comprises construction and rehabilitation of Hydro Power Stations, development of a new lignite open cast mine, as well as construction and rehabilitation of the transmission power network.

The Hydro Power Station of Chebren, with a total cost of US $ 326,337,000 is offered to be constructed by concession to an Independent Power Producer.

The rehabilitation of the existing Hydro Power Plants, with a total cost of US $ 8,165,000 shall be partly financed by the world Bank. Moreover the 400 kV line Bitola-Skopje, with a total cost of US $ 16,789,000 shall be financed by the European Bank Regional Development funds (EBRD).
The projects under construction in the period 1996-2000 are shown in the following table:

Table 4.1. Projects Under Construction

	Projects	Project Data	Costs (Million US $)		
			1991 - 1995	1996 - 2000	2001 - 2005
1.	Construction of Hydro Power Plants				
	Kozjak	82.5 MW 156 GWh/year	-	104.0	-
	Chebren	253.8 MW 313 GWh/year	-	326.2	-
	Gradec	54.6 MW 253 GWh/year	-	39.4 (2)	117.4
2.	Hydro Power Plant Rehabilitation		-	8.2	-
3.	Development of lignite open-cast mines Oslomej-West		-	18.9	-

(1) *The costs mentioned in the periods 1991-1995 and 2001-2005 are related only to these Projects which shall be under construction in the period 1996-2000.*

(2) *The analysis is given on the basis of equal funding per year of construction, according to the information on the time schedule given by ESM.*

Hydro Power Station Constructions

During the period to 2000, construction or only the beginning of construction are planned for the following power stations:

Kozjak (82.5 MW, 156 GWh)

Kozjak is located on the Treska river near Skopje and constitutes a part of the multi-purpose project in the Skopje field. The Hydro Power Station Kozjak provides for the construction of a rockfill dam which shall create a storage space for 550 million m3, 190 million m3 out of which shall be used as an retention space to protect the city of Skopje from floods caused by Treska river. This storage lake shall also present a compensation basin for the downstream Matka II storage lake which is used for the purpose to irrigate 20,000 ha in the Skopje field and to supply Skopje city with water. It has been under construction since 1994 and is planned to be completed in 1999. The cost estimate of this project is US$ 104,000,000.

Chebren (253.8 MW, 313 GWh)

Chebren is up-stream the Orna Keka river. The construction of this Hydro Power Station provides for building a concrete dam which shall create a storage space of 915 million m3. It was scheduled to be underway with construction from 1995-2000 but it has not started yet. This project is offered to be constructed be concession; the cost estimate of the project is US$ 326,337,000.

Gradec (54.6 MW, 253 GWh)

Gradec is downstream the Vardar river. The construction of this Hydro Power Station shall create a storage lake of 108 million m3 which in addition to power generation shall enable irrigation to 9,000 ha in the region. Building this storage lake at a distance of 22 km of the existing railway lines Skopje - Thessalonici shall be flooded. The construction of this plant along with the shift of the railway lines is scheduled to commence in 1999. The cost estimate of this project amounts US$ 156,780,000.

Existing Hydro Power Station Rehabilitation

The existing Hydro Power Station with their generation capabilities constitute a substantial electric power potential. However considering their age (30 - 40 years), rehabilitation is being planned in the present period, on the fundamental equipment. Due to the development of the equipment technology and construction the rehabilitation shall also contribute to the increase in efficiency of the hydraulic power resources available. The investment funds required for this purpose amount US$ 8,165,000 to the year 2000 a portion of which is agreed to be provided by the World Bank.

Development of Oslomej-West lignite open cast mine

The Thermal Power Plant of Oslomej (120 MW) uses lignite as driving fuel which is supplied by Oslomej-West open cast mine located immediately near the plant. By the year 2000, the coal reserves of this open cast mine shall be run out due to which the opening of the west mining district is in process to supply coal for the needs of the thermal power plant in the future 14 years. The cost estimate amounts US$ 18,900,000.

4.3.2 CONSTRUCTION OF TRANSMISSION NETWORK SYSTEM

During the period to 2000 the scope of transmission network is planned as follows:

- 400 kV transmission lines 243.5 km long;
- sub-stations at 400/110 kV, 1 x 300 MVA and 2 x 300 MVA;
- 220 kV transmission lines 45 km long;
- 110 kV transmission lines 160 km long

Table 4.2. Transmission Line Projects

	Projects	Project Dat	Costs (Million US $)		
			1991 - 1995	1996 - 2000	2001 - 2005
4.	Construction of Transmission Lines				
	•Bitola-Skopje	400 kV 113.5 Km	14.0	2.8	-
	•Veles-Shtip	400 kV 30 Km x 2	-	12.0	-
	•Shtip-Blagoevgrad (Bulgaria)	400 kV 70 Km	-	3.5	10.5
	•Vrutok-Buveli (Albania)	220 kV 45 Km	-	10.3	-
	•Other lines	110 kV 160 Km	-	10.3	-
5.	Transmission Substations				
	•Shtip	400/110 kV 300 MVA	-	10.0	-
	•Mariovo	400/110 kV 600 MVA	-	-	15.0
	TOTAL		**14.0 (1)**	**537.1**	**142.9**

The planned construction of transmission lines shall realise a loop of the 400 kV electric power transmission system, increase in the interconnections with the neigbouring electric power systems and extend of the 110 kV transmission network.

The following transmission electric power facilities are planned to be constructed :

- 400 kV Bitola-Skopje Overhead transmission line, 113,5 km long for which the construction is coming to an end (November 1996); The project is financed by EBRD, costing US$ 16,789,000;

- 400 kV Veles-Shtip transmission line, double circuit, 30 km long. The construction is scheduled to start in 1998 and the project cost estimate is US$ 12,000,000;

- 400 kV Shtip-Blagoengrad transmission line to Bulgaria; The length of this interconnection line on the FYROM side of the border is 70 km, and the construction is scheduled to start in 1999. The cost estimate amounts US$ 14,000,000 ;

- 400/110 kV Shtip substation having an installed capacity of 300 MVA. The construction is scheduled to start in 1998, while the investment funds required an amount of US$ 10,000,000;

- 400/110 kV Mariovo substation with an installed capacity of 600 MVA. The construction is scheduled to be underway in the year 2000 and will cost US$ 15,000,000 ;

- 220 kV Vrutok-Bureli transmission line to Albania. The length of this interconnection line is 45 km and its construction is scheduled in 1997 with the estimate cost of US$ 10,280,000 ;

- several 110 k V transmission lines shall be constructed which will strengthen certain transmission connections. They will cost US$ 1,760,000.

Based on the forecast time schedule related to the construction of the planned power generation and transmission facilities, the funds required rise to the amount of US$ 551,079,000 until the year 2000.

It is to be noted that the funds required for the expansion plan of FYROM prove a rather realistic approach of the problem of the increase of power demand. It should be also taken into account that the annual increase of the demand equal to 3,1 % corresponds to the upper limit of growth of the country's economy, which probably shall not be reached within the period 1996-2000.

It should be also noted that there exist also an offer for partial financing of this Program, through concession to an IPP, which may be looked as an effort to make the funding of the expansion plan even more realistic.

4.4 GREECE

4.4.1 GENERATION SYSTEM

The most important characteristic of the new 10-year generation expansion plan of PPC is the introduction of imported natural gas for production of electricity.

In the mainland system PPC has signed an agreement with the government for the limited operation of Ag. Georgios power plant in Keratsini (installed capacity 350 MW). The plant will be ready to start its operation in 1997 burning natural gas until the year 2002.

At the same time, a new combined - cycle unit, presently under construction in Lavrio (installed capacity 560 MW), will start its commercial operation at the end of 1998 using natural gas.

The new lignite unit Ag. Dimitrios No 5 (366.5 MW including district heating) is under construction and its commercial operation will be during the summer of 1997.

For the period 2001-2003, two new lignite units have been planned to start operating in Florina (2 x 330 MW including district heating) and one new combined-cycle power plant burning natural gas is scheduled to operate at the area of Komotini (installed capacity 370-480 MW).

The development plan of hydroelectric projects includes 6 new power plants, presently under construction offering an additional capacity of 625 MW to the generating system. These power plants are expected to be commissioned during the period 1997 - 2000.

At the generating system of Crete, two new gas turbine units of installed capacity 59 MW each are expected to operate in 1997 at the station of Chania. In the mean time a new thermal power station will be developed in the Atherinolakos region to cover the future demand of electricity on the island.

At the generating system of Rhodes, a new gas turbine of 21,3 MW will operate soon. Two new Diesel units of 23,4 MW each will start to operate in 1997, and one more diesel unit of the same type will start in commercial operation in 1999.

On the other smaller islands, new independent power stations will be installed during the next years.

For reducing the dependency of PPC's electricity generation balance on oil and to further reduce emissions, the utility plans the best utilization of the wind potential on the islands.

Geothermal potential is very promising for the country, the geothermal station in Milos, of 2 MW, will be scheduled to operate again and a new plant will be developed in Nisiros with installed capacity of 10 MW.

There are also plans to connect all the islands of Cyclades to the interconnected system of the mainland Greece.

The following table includes the new projects presently under construction or scheduled to be developed in accordance with the 10-year expansion plan for the mainland power system.

Table 4 .3. Power Plant or Units under construction or planned to be commissioned

PLANT/UNIT	FUEL TYPE	RATED CAPACITY MW	COMMISSIONING YEAR
Ag. DIMITRIOS 5	LIGNITE	366	1997
THISAVROS	HYDRO (P.S)	300	1997
POURNARI II	HYDRO	31.5	1997
SMOKOVO	HYDRO	10.5	1997
CC LAVRIO	NAT. GAS	560	1998
PLATANOVRISI	HYDRO	100	1998
MESCHORA	HYDRO	162	1998
TEMENOS	HYDRO	16.5	1999
FLORINA 1	LIGNITE	330	1999
CC KOMOTINI	NAT. GAS	370-480	2000
SIKIA-PEFKOFITO	HYDRO	(1)	2000
FLORINA 2	LIGNITE	330	2003

(1) The unit size has not been decided yet.

Until the year 2000 the following investments have been allocated for new thermal and hydroelectric generating units:

Table 4.4. Production Investments

Type	1996-2000 (Bil. DRS)
Thermal	501
Hydro	163
Other expenses	36
Total	700

4.4.2 TRANSMISSION SYSTEM

During the period 1996 - 2000 47 bil.drs are expected to be invested for upgrading (new lines and reeforcement of the existing grid) the transmission system.

A transmission line of 400kV between Thessaloniki and Phillipi will be ready for operation in 1998. That line will serve in the future for further development of the interconnections between Greece and Bulgaria (second line) by connecting the Phillipi substation in Greece with the Plovdiv or Maritsa substation in Bulgaria. In addition, an extension of the Thessaloniki - Phillipi line to the boarders with Turkey will allow electric power exchanges between the two countries.

4.5 ROMANIA

RENEL has developed an expansion strategy in the face of highly uncertain future demand and in conditions in which many investment projects have begun but there exist no funds to complete them.

Many major power plants perform poorly and need rehabilitation and the development of local fuel resources is of doubtful economic value.

Several co-operation projects are relevant to this process. Arrangements have been made with private Western industry to rehabilitate some units; a least cost capacity development study has been undertaken with EC funding. A technical inspection of eleven characteristic thermal units has been completed with World Bank finance preliminary to a substantial loan for the power sector.

4.5.1 GENERATION SYSTEM

Arrangements with private Western suppliers pertain to the large lignite fired plants at Rovinari and Turceni. These plants are crucial, as the viability of all past investment in lignite mining and the lignite industry's future depends on them, but today they perform very poorly. An arrangement for the rehabilitation of units 4 and 5 at Turceni has been agreed with Asea Brown Boveri (ABB). It is estimated that the units can be made to operate at 270 to 280 MW at an availability of 70%. On this basis a loan of about US$ 94 million was prepared. The total cost of the rehabilitation is estimated at US 490 million per unit. A similar programme to the ABB project at Turceni, for the reconstruction of units 5 and 6 at Rovinari, is underway with assistance from the World Bank and EIB and with RENEL as project manager in co-operation with foreign consultants.

Systematic technical inspection of characteristic units and feasibility studies of the possibilities for rehabilitation have now been completed, and the World Bank has proposed a Power Subsector Rehabilitation and Modernization Project, which would aim to restore about 3,500 MW of effective thermal capacity by 1998/2000. The project is estimated to cost about $735 million. The project also proposes repowering of a number of oil and gas fired units and the retirement of about 2800 MW of old, inefficient units by 1998/99.

Before firm recommendations can be made about the desirability of future investment in the electricity supply industry beyond that envisaged in the rehabilitation project, a revised least cost expansion study is necessary.

Few of the unfinished hydro and co-generation plants appear to be necessary, although a firm conclusion should await study results. RENEL has concluded from its system expansion studies that the optimal solutions depend on increasing use of natural gas, both for the environmental advantage and because of the expected lower cost of plan rehabilitation. Such a strategy assumes Romania will be able to increase its access to natural gas, which is uncertain.

RENEL is in some financial difficulty: its revenue is insufficient to make adequate provision for investment. In the past, investments were funded from the government budget. Now RENEL has to generate its own investment finance, except for the nuclear programme, which is still funded by direct allocation from the state budget. According to the company, a general indication of the expected annual magnitude of revenue is lei 16 billion from depreciation and between lei 15 billion and lei 70 billion from the development fund, according to whether the average price of electricity can be raised in real terms. This compares with RENEL's indicative estimate of its investment needs as lei 200 billion per year to complete the 1,420 MW of hydro and 1,400 MW of thermal plant still in construction. As a consequence RENEL now intends to complete only about 364 MW of hydro and 630 MW of thermal capacity and offer the remainder of these unfinished plants to private investors which shall act as Independent Power Producers. The cost to RENEL of its reduced investment programme is estimated at US $ 2.2 billion from 1993 to 2000.

The largest investment programme in the electricity sector is the nuclear programme. The programme initially envisaged construction of five plants of 700 MW on the Danube Canal at Cernavoda, near Constanza. These are now in various stages of completion. On unit 2 the civil engineering work is near completion and electrical and mechanical equipment is stored in the containment building, but work has been suspended. Civil engineering has progressed quite far on units 3 to 5, but all work has now stopped.

4.6 F.R. YUGOSLAVIA

4.6.1 GENERATION SYSTEM

The war conditions in the territory of the Former Yugoslavia had a direct influence on the development of the Electric Power Industry of Serbia-EPS expansion planning. This influence was manifested in two directions:

- The realization of the foreign credits (e.g. of the International Bank Regional Development Credits) was suspended or postponed
- The delivery of the necessary equipment become impossible or problematic.

Therefore, the Projects already under construction have been seriously delayed and the construction of many other already planned Projects has not yet started.

Nowadays, the expansion planning of EPS, in the field of power generation and mines includes the following:

- completion of Kolubora B Lignite Fired power plant and of the open-cast lignite mine of Tamnava - Zapad,
- the rehabilitation of the Lignite Fired Power Plant of Kosovo A
- the construction of the Lignite Fired Power Plants of Kosovo B and C,
- the development of the open-cast lignite mines and the construction of Sibdvac and Juno Kosovo.

The expansion planning in the field of a 400 kV transmission line from Nis to the border of FYROM, which will reinforce the interconnection to the southern countries FYROM and Greece.

The power generation system and open-cast lignite mines expansion Projects are shown in the following table, which also includes the necessary capital investments, through three periods of progress of the construction of the aforementioned Projects, as they are scheduled today for the future years.

Table 4.5. New Projects of EPS

No	Projects	Technical data (Capacity, etc.)	Investment (million USD)				
			Total	Years			
				up to 1995	1996-2000	2001-2005	after 2005
A	Lignite Fired Power tations						
A1	Kolubara B	2x350MW 3840GWh/Y	755	295	165	296	0
A2	Kosovo A Rehabilitation	(810 MW) 1900GWh/Y	308	0	308	0	0
A3	Kosovo B	4x350MW 7560GWh/Y	1331	0	333	998	0
A4	Kosovo C	7x350MW 13230GWh/Y	2625	0	150	300	2175
A5	Other Rehabilitations		126	0	100	26	0
B	Open Pit Lignite Mines						
B1	Tamnava Zapad	9 mil.t	444	115	214	115	
B2	Sibdvac	12 mil.t	354	0	71	283	0
B3	Juno Kosovo	24 mil.t	987	0	197	296	494

From the aforementioned data it is obvious that EPS's ambitious expansion plans, i.e. 4,550 MW and 26,530 GWh/year in new power generation with Lignite Fired Power Stations, 45 million tons per year form new open - cast lignite mines and a high capacity 400 kV transmission line to FYROM, will need high level financing, equal to 1,569 - 2,669 million USD every five (5) years. The height of the expected foreign investment contribution is 20% - 40 %.

The following detailed description has been furnished by EPS, as concerns three of the aforementioned Lignite Fired Power Plants.

Kolubara Lignite Plant

Kolubara-B 1& 2 (Stage I), with a power capacity of 2 x 350 MW and a heat capacity of 2 x 380 MJ/s for long-distance heating of Belgrade, is about 40 km southwest from Belgrade, right next to the Tamnava-Zapadno Potje open cast lignite mine, which will supply it with fuel. The construction of the main power plant began in 1988, but was stopped due to a delay in financing and to the political developments in the territory of the former Yugoslavia. Equipment for the boiler plant and the powerhouse was contracted with foreign and local suppliers (Combustion Engineering, ABB, Minel, MIN etc.) and was partly delivered. The distingegration of the former Yugoslavia opened the problem of delivery of the turbo-generator set. Part of the equipment for various auxiliary systems was also contracted.

The total investment value of this power plant is 755 million US dollars. The overall programme realization degree by financial parameters is 39 per cent. For Block I to go in operation, it will take three years from the moment the work is resumed, i.e. from consolidation of the contract on the turbo-generator set.

The Tamnava-Zapadno Potje open -cast mine will start production under a new technology early in 1996, temporarily for the requirements of other thermal power plants.
In 1991 EBRD granted a credit of 300 million US dollars for Kolubara-B with the Tamnava-Zapadno Potje mine, but its realization was shelved.

Table 4.6. Technical and Financial Data

Capacity	
- Electric Capacity	2 x 350 MWe
- Heating Capacity	2 x 380 MWth
Production of electricity	3840 GWh/Year
Location	40 km south-west from Belgrade
Fuel	lignite, 6700 kJ/kg, from Tamnava-Zapad open-cast mine, close to the Plant
Year of beginning of construction	1988.
Total estimated value	755 mil. USD
Invested up to now	295 mil. USD
Foreign equipment	47%
Expected foreign investment	236 mil. USD
Year of possible completion of the project	2000.

Kosovo A (Rehabilitation)

The Kosovo A Lignite Fired Power Plant, with five blocks and installed power of 800 MW, is one of EPS's oldest power plants. The blocks went into operation between 1962 and 1975 and, except of Block 5, they have been running for more than 100,000 hours.

The main objectives of the rehabilitation and modernization programme are to upgrade the technical, economic and ecological parameters to the required level. The main activities planned are revitalization and reconstruction of boilers, modernization of the measuring / regulation equipment, reconstruction or substitution of the electrostatic precipitators, reconstruction of the auxiliary systems etc.

A permissibility study for rehabilitation and reconstruction of the power plant (as a whole) has been prepared for this project. An investment programme and tender documentation have been prepared for Block 3, the first one to be reconstructed. Reconstruction of the rest of the blocks should be carried out successively by the year 2000. The total expected value of works for the entire power plant is about 308 million US dollars.

Table 4.7. Rehabilitation Time Schedule

	Installed capacity MW	**Year of commissioning**
Unit 1	65	1962
Unit 2	125	1964
Unit 3	200	1970
Unit 4	210	1971
Unit 5	210	1975
Total	**810**	

Table 4.8. Technical and Financial Data

Production - before	**1700 GWh/Year**
Production - after	3600 GWh/Year
Fuel	lignite
Life extension goals	upgrading technical, economic and ecological parameters
Main planned activities	rehabilitation and reconstruction of boilers, modernizing of control and instrumentation, reconstruction or replacement of precipitators, reconstruction of the auxiliaries
Prepared documentation	Permissibility study. Investment programme & Tender documentation for Unit 3
Total estimated value	308 mil. USD
Invested up to now	3 mil. USD
Foreign equipment	41 %
Expected foreign investment	65 mil. USD
Year of possible completion of the project	**2000**

Kosovo B

The Lignite Fire Power Plant Kosovo B project is the continuation of works on the same location where presently exists two units of 339 MW. On this location it is possible to erect four new units and this location has priority to the Lignite fired Power Plant Kosovo C in view of the present contracts for works and the existing infrastructure. The contracts for works are agreed with other partners combined with the demand of EPS after the year 2000. The investments are estimated on US $ 1,330mil.

During the works on the Lignite Fired Power Plant the open-cast mine Sibdvac with a capacity of 12 mil. t per year of lignite shall be also constructed.

The investments are estimated on US $ 354 mil.

Table 4.1. Technical and Financial Data

Capacity	**4 x 350 MW**
Production of electricity	7560 GWh/Year
Location	7 km nord from Pristina
Fuel	Lignite, 6700 kJ/kg from Sibdvac open-cast mine, close to the plant
Year of beginning of construction	1998.
Total estimated value	1330 mil. USD
Investment up to now	0
Foreign equipment	40%
Expected foreign Investment	532 mil. USD
Year of possible completion of the project	2006.

4.6.2 TRANSMISSION SYSTEM

Until the year 2000 it is expected to have the following network installations :

- TS Beograd 20, 400/110 kV, 300 MVA
- Line 400 kV, Subotica-Sombor, 55 Km
- Line 110 kV, 150 Km

The expansion planning is expanded in the field of a 400 kV transmission line from Nis to the border of FYROM, which will reinforce electricity exchanges with the Southern countries, FYROM and Greece.

The scheduling of the construction of the before mentioned Projects is the following:

Table 4.10 New Projects of EPS (Generation and Transmission)

			Investment (million USD)				
					Year		
No	Projects	Technical data (Capacity, etc.)	Total	up to 1995	1996-2000	2001-2005	after 2005
C	Transmission lines						
	Nis- Border FYROM	400 kV	44	0	31	13	0
	Total investment scheduling		6930	410	1538	2313	2669

5. RESTRICTIONS

5.1 SECURITY OF SUPPLY

Security of supply in the energy sector according to the definition given by the European Union means the ability to ensure that future essential energy needs can be met, both by means of adequate domestic resources, worked under economically acceptable conditions or maintained as strategic reserves and by calling upon accessible and stable external sources supplemented where appropriate by strategic stocks.

In the electricity sector the security of supply can be considered from two distinct points:

- one dealing with availability of the "primary fuel" required for the production of electricity by the power plants and the
- second with the ability of the power system in general (Generation, Transmission, Distribution) to operate reliably and within the predetermined standards of operation (voltage level, interruptions, etc.) when various components of the system fail from either wear, age, etc. or extreme weather conditions.

Security of fuel supply remains a primary goal for all countries around the world, however, its definition and scope may vary in response to broader economic technological and environmental conditions prevailing in each region or country. Today, the security issue is even more important because there is a growing interdependence of fuels like oil, gas and coal as well as the international interchanges of electricity. In addition, the opening of the energy market drives to a globalisation of the energy sector.

The main purpose of identifying the electricity security of supply is to minimise the risk of disruptions in supply or to reduce to an acceptable level the risks and potential consequences of a disruption, or non-availability of the supply of electricity.

Security risks fall into two broad categories:

Long term risks that new supplies cannot be brought on stream to meet growing electricity demand for reasons either economic and technical or ever political.

Short term risk of disruptions to existing supplies such as components failures, accidents or even extreme weather conditions.

No Electric Power System is entirely risk - free. Thus, electricity security can be best seen in terms of risk management, that is reducing to an acceptable level the risk and consequently minimize the disruption of electricity supply.

In that sense the security of supply in the electricity sector of the Balkan countries should include:

- fuel security
- technical limitations or constraints for the generation,
- transmission and distribution of electricity.

Fuel Security: The first category in the most wide area covering the supply of solid, liquid and gas fuels to the power plants for the production of electricity.

In general, with the only exception of Albania, the energy sector of the Balkan countries depends considerably on imported fuels. However, the general foreign dependency does not really includes the electricity sector. Presently, the production of electricity to a very significant percentage is covered from the utilisation of indigenous resources like lignite and water.

The following Table presents the dependency on imported fuels for the generation of electricity in the Balkan countries in 1995.

Table 5.1. Dependency on Imporeted Fuels

	Foreign Dependency as Percentage of Total Production	Imports of Electricity as Percentage of Total Demand
Albania	0.0%	6.3%
Bulgaria	51.8%[1]	-0.4%
FYROM	0.0%	2.1%
Greece	19.5%[2]	2.1%
Romania	10.0%	0.6%
F.R. Yugoslavia	0.0%	0.0%

1. Including the generation of the Kozloduy N.P. utilising imported fuel.

2. Including the production of the islands, (mainland system only 10.8%).

In the Balkan region there are significant reserves of lignite. Greece (70%) and FYROM (85%) representing the highest share of electricity generation in Europe from burning lignite. Significant amount of electricity is also generated from indigenous lignite in Bulgaria (40%), Romania (45%) and F.R. Yugoslavia (42%).

The economically recoverable reserves of lignite and the years until depletion of the existing reserves utilised at today consumption rate are presented in the following Table.

Table 5.2. Lignite Reserves on the Balkan Region

	Reserves (Mil. Ton)	Years Until Depletion
Albania	700	>100
Bulgaria	2300	75
FYROM	600	80
Greece	4000	70
Romania	2000	55
F.R. Yugoslavia	14900	>100

** Including the reserves of the former Yugoslavia except FYROM*

Hydroelectric potential is the other significant indigenous resource in the Balkan region. In addition to lignite significant quantities of natural gas and oil exist in Romania. The economical recoverable natural gas quantities in 1994 were 300 billion

m^3 while the oil reserves amount 1.6 billions barrels. However, in 1995, 33.5% of the natural gas utilized in the electricity sector was imported from Russia.

Enhanced exploitation of indigenous energy sources depending on local circumstances, can provide economic social and energy security benefits. Technological diversity and improvement as well as increased use of new and renewable energy sources can also enhance energy security.

Network security. Electric power systems install equipments to allow operation personnel to control the system in a reliable manner in order to avoid supply interruptions or even the complete collapse of the system (black out). Thus, for the safe and reliable operation of the system there are three major functions carried out at the operating control centers, namely:

- system monitoring
- contingency analysis
- corrective action analysis.

In that respect, the electric power systems of the Balkan countries have today the following major National Dispatching Centers (NDC):

Bulgaria: The NDC in Sofia having automated supervisory control and dispatching system (SCADA) which provides remote data from all substations and the power plants. SCADA provides also possibilities for remote switching and for automatic adjustments of the operation mode of the generating units. The NDC in Sofia performs its functions along with four regional dispatching centers (RDC):in Varna (East), in Sofia (West), in Pleven (North) and in Plovdiv (South) and 28 district dispatching centers (DDC).

F.R. Yugoslavia: The electric power system is operated through the Energy Management System (EMS) located in Beograd. The modern EMS project in Yugoslavia operates in close connection to the regional dispatch centers and it is connected to every power plant and substation of the electric network.

The state-of-the art EMS in F.R. Yugoslavia plays an important role for the security of supply in Yugoslavia.

Greece: The new Energy Management System (EMS) of the Greek electric system is a state-of-the art EMS consisting of the National Control Center (NCC) in Athens and two Regional Control Centers (RCC). The northern RCC is located in the Ptolemaida area and the Southern RCC is located in Athens. Each Regional control center retrieves field data from the remote terminal units installed at various stations and substations. The economic operation and the reliable electricity transfer throughout out the electric network has been secured from the EMS system of PPC that started to operate fully in 1996.

Romania: The Romanian electric system used to be controlled by the central dispatch station in Prague when the system was part of the IPS. Today, the operation of the generation and the 400 kV system is assured by the national dispatch centers at Badau, Craiova, Timisoara, Cluj and Bucharest that control the 220 kV network. The NDC maintains system stability in frequency and voltage as well the national power balance. However, the equipment at the NDC are outdated and it needs to be replaced.

9)

Upgrading of the center and provision of modern systems control and data acquisition (SCADA) facilities are required.

FYROM: The control in the operation of the power system of FYROM is being accomplished though the regional Dispatching Center of the power system of Former Yugoslavian Republic of Macedonia that was connected to the EMS in Beograd. There is no information concerning the development of a new Dispatching center in Skopja, presently.

Albania:The Dispatching center of the Albania electric network performs the basic requirements for the operation of the system. A new modern center has been proposed to be developed in order to provide secure and optimal operation of the system.

5.2 GENERATION AND TRANSMISSION SYSTEM ANALYSIS

5.2.1 METHODOLOGY

5.2.1.1 Reliability analysis

The reliability assessment of the present study was based on the investigation of the most usual deterministic criteria applied for the interconnected power systems of the countries that will participate in the proposed REM. The use of these criteria is considered as necessary but not sufficient for estimating the overall reliability resulting by the interconnection of these systems into one block.

The interconnected block of the six Balkan countries was examined on the basis of:

- capacity reserve margin.
- criterion considering the loss of a network component or of a generating unit and calculating voltage collapse margins at all busses as well as power transfer margins at all links.

Moreover the results of the reliability assessment using probabilistic analysis carried out by the study of the PHARE regional program as well as of some other similar studies carried out in Greece and Former Yugoslavia were considered.

5.2.1.2 Transient stability analysis

Transient oscillations have been examined for a number of critical cases, close to the generating units, including:

- Three-phase short-circuits with successful and unsuccessful reclosing.
- Loss of a generating unit.
- Loss of a big load centre.

The purpose of the examination is to determine the capacity of the interconnected network of the proposed REM to survive after such events.

The assessment is based on the Critical Clearing Time (CCT) of the circuit breakers computed for the most important generators and load centres, in PHARE study as well as in other similar studies carried out for each Balkan country.

The transient stability margin defined by the CCT must be combined with the protection and defence equipment installed at the power stations and big substations, i.e. with the clearing time of the circuit breakers and protection relays, with the existence of back-up protection systems etc.

5.2.1.3 Short-circuit withstand, protection, defence and restoration

The rating of the installed equipment has been examined as concerns its withstand and breaking capacity for the maximum short-circuit currents encountered throughout the network.

This withstand must be combined with the protection and defence equipment installed at the power stations and substations: rating of circuit breakers, protection relays, settings, rating of shunt reactors etc.

The overall defence scheme of the interconnected networks has been examined on the basis of extreme disturbances very far the normal operating conditions, i.e. multiple outages of transmission lines, failures of the protection system and clearing times higher than the corresponding critical values. The applied defence criteria are the protection of the network interconnection lines, the possibilities of the power plants for load rejection, the maintenance of synchronism after isolation of the faulted areas and the post - fault frequency and voltage profiles, according to the PHARE study.

Moreover the restoration plan of the interconnected network in total or partial black - out has been examined. The applied criteria are related to the safety of the power plants and of the transmission substations under black - out conditions, to the telecommunication and control facilities during such conditions as well as to the possibilities for black start of the power plants.

5.2.1.4 Basic hypotheses

The above analyses were carried out for the years 1995 and 2005, taking into account the following assumptions:

Table 5.3. Assumptions for Power Systems Requirements

Country	**Installed Power (MW)**	**Energy Demand (GWh)[1] Peak Load (MW) and Capacity Reserve Margin (%)**		**Losses (%)**	**Additional Required Capacity (MW)[4]**
	1995	1995	2005 (forecast)	1995	2005 (forecast)
Albania	1659 (1045)[2]	4302 960 73 (9)	8800 1300 28 (-20)	20.2	30 (650)[2]
Bulgaria	12076 (11518)[2]	35449 7522 61 (53)	55460 8590 41 (34)	11.6	0 (0)[2]
FYROM	1400 (1234)[2]	5802 1078 30 (14)	7870 1230 14 (0)	11.2	200 (369)[2]
Greece	8242[3] (7169)[2]	39177[3] 6063 36 (18)	55260[3] 7280 13 (-2)	8.4	1240 (2330)[2]
Romania	19413 (18166)[2]	55346 9645 101 (88)	95800 14890 30 (22)	11.9	0 (1191)[2]
F.R. Yug.	8759 (7983)[2]	33304 6410 37 (25)	46970 7310 20 (9)	14.7	730 (1535)[2]
Interconnected system	51431 (44991)[2]	173380 29640 74	270160 38310 34 (17)	119	0 (4980)[2]

1. *including transmission and distribution losses.*
2. *under dry hydrological conditions*
3. *mainland system*
4. *for maintaining a capacity reserve margin equal to 30%.*

The energy consumption forecast, without losses, for Albania and Bulgaria, at the year 2005, were taken from PHARE study A, considering that the corresponding data of 1995 were in line with the previsions of this study. Nevertheless, the peak Load for Albania was corrected taking into account the increased peak load at the year 1995. Furthermore, the energy consumption and peak load forecasts for Romania were corrected according to the «middle» scenario of RENEL, considering the increased consumption and peak load of 1995. The energy consumption forecast in Greece was based on the assumption of an increase of the demand equal to 4% per year up to 2000 and equal to 3% per year after 2000. The energy consumption forecast in F.R. Yugoslavia was based on the assumption of an annual increase of the demand equal to 3,5%. The increase of the peak load has been assessed by extrapolating the increase registered the recent years.

All the interconnection scenarios considered in PHARE study A and final report, have been taken into account, i.e., with the Northern and/or Southern interconnection links between F.R. Yugoslavia and Croatia open or closed and the interconnection link between Romania and Hungary/Slovakia through Mukachevo substation in Ukraine open or closed. The interconnection link between Bulgaria and Turkey is also supposed to be open.

In the present assessment, the interconnections between Ukraine and Romania, through Mukachevo and through the existing southern links as well as between Bulgaria and Turkey through the existing link were supposed to be open, as in PHARE study A and final report. The installation of back-to-back DC links between the aforementioned systems as well as the construction of a future DC link between Greece and Turkey and of a future AC link, through a submarine cable, between Greece and Italy will not affect the overall reliability and stability of the six-countries interconnected power system in a negative sense. In these cases, additional defence and protection measures must be taken at the substations neighbouring to said links in order to limit any undesirable increases of the maximum short-circuit current levels or transients.

The maximum power exchange capabilities of Bulgaria, Romania and F.R. Yugoslavia with UCPTE for the year 1995 have been taken into account according to PHARE study A, i.e. with n-1 criterion applied to the interconnected system of each country and at the interconnection lines in a first case, as well as with n-1 criterion applied also at the neighbouring countries in a more restrictive second case. Nevertheless, the hypotheses of PHARE study, in both cases, are considered as restrictive and on the safe side, since they consider the connection of Romania to Hungary and Slovakia, through Mukachevo substation in Ukraine, as open.

5.2.2 GENERATION RESERVE CAPACITY AND IMPORT/EXPORT CAPABILITIES

5.2.2.1 Albania

Under normal hydrological conditions, there exist no major problem in Albania up to 2005. However, in the case of dry hydrologically periods, the production system of Albania will suffer major problems.

On this purpose the rehabilitation of the existing hydropower plants as well as the construction of the new power plants included in the expansion plans of KESH (cf. chapter 4, para. 4.1.1) of a total capacity of 200 MW in thermoelectric production and 400 MW in hydroelectric production, which may be reduced to 230 MW under dry hydrological conditions, seems to be necessary, but not sufficient in order to cover the increase of the peak load with a sufficient margin, in the case of dry hydrological conditions; in such conditions, the capacity of the hydropower stations in Albania does not exceed 58% of their rated capacity.

However, from the PHARE study it is obvious that Albania can import from the other countries of the proposed REM at least 520-560 MW under the present status of the interconnection network. This means that the commissioning of the natural gas thermal power unit rated 200 MW at the area of Korca is absolutely necessary till 2005 and the other plants may be partly or totally postponed after 2005 since the rest of the necessary power, during the dry hydrological periods, may be imported from F.R. Yugoslavia and Romania (through F.R. Yugoslavia, F.R. Yugoslavia-FYROM and/or Bulgaria-Greece).

5.2.2.2 Bulgaria

The main problem arising in Bulgaria is the putting of units I and II of Kozloduy NPP out of operation about 2000. Therefore it seems to be necessary to transfer elsewhere the missing capacity of 880 MW resulting from the loss of Kozloduy units I and II minus the excess capacity of 340 MW resulting from the limited increase of the peak load, i.e. 540 MW in total. This transfer is more adequate to be implemented at Maritsa East Lignite Power Station, by constructing new unit(s) of adequate capacity, as well as at the new projected NPP in Belene (600 MW), where reactors of new generation are proposed by NEK (cf. Chapter 4, para. 4.2.1.).

However, considering that according to PHARE study, Bulgaria can import from the other countries of the proposed REM at least 570-1300 MW, it is obvious that said projects may be partly postponed for after 2005.

Priority must be given to the commissioning of new lignite unit(s) in Maritsa East complex. For reasons of self sufficiency of the future REM, only 280 MW,at least, are necessary to be commissioned.

However, it is obvious that after 2010, when the Units III and IV of Kozloduy NPP will be de-commissioned, the commissioning of Belene NPP is the only alternative.

5.2.2.3 FYROM

The expansion plan of ESM including the commissioning of hydropower units of total capacity equal to 391 MW, seem to be justified by the present and future values of the peak load up to 2005 (c.f. chapter 4, para. 4.3.1.). However, under dry hydrological conditions, this power is supposed to be reduced to 225 MW approximately, which means that a power equal to 144 MW should be imported.

On the other hand, it is quite obvious that, according to an assessment based on PHARE study, FYROM can import from the other countries of the proposed REM 400 MW which can help it to postpone partly the commissioning of the projected units for after 2005. However, taking into account the needs of the city of Skopje as well as the requirement for self-sufficiency of the proposed REM, it may be proposed to continue the construction of the hydropower plants.

Moreover, since the projected units are all hydropower, it would be more preferable to postpone the commissioning of the biggest one (Chebren) for after 2005 and replace it with the commissioning of a TPP (e.g. of a natural gas plant) up to 2005.

5.2.2.4 Greece

The overall expansion plan of Greece, includes the commissioning of units of total capacity equal to more than 2,630 MW up to the year 2005, (c.f. chapter 4, para. 4.4.1). However, under dry hydrological conditions, only 2,370 MW will be available. Approximately all this capacity is necessary for maintaining a reserve capacity margin of at least to 30%.

Moreover, considering that Greece can import at least 600 MW from the other countries of the proposed REM in accordance to PHARE study, it seems possible to postpone, partly the commissioning of this power after 2005.

However, PPC has signed a contract with DEPA, the Public Natural Gas Company of Greece, to absorb minimum natural gas quantities at the TPPs of Ag. Georgios, Lavrio and Komotini, which have a total capacity of 1335 MW at least. After the de-commissioning of Ag. Georgios natural gas thermal plant of 350 MW in year 2002, the Florina I lignite fired thermal plant of 330 MW shall replace it.

5.2.2.5 Romania

If we consider the two first Nuclear Power plants at Cernavoda, with a total capacity of 1,400 MW, no special problem appears to exist for Romania up to the year 2005, since the existing production system ensures a reserve capacity of more than 30% at this year.

In this sense, the expansion plan of RENEL (cf. Chapter 4, para. 4.5.1) can be partly postponed after 2005. However, for reasons of self sufficiency of the proposed REM, it may be proven necessary to commission additionally 400 MW in thermal power plants for Romania.

5.2.2.6 F.R. Yugoslavia

The overall expansion plan of F.R. Yugoslavia includes the commissioning of lignite units of a total capacity of 2,100 MW up to the year 2005.

From this power, only 15,35 MW are necessary for maintaining a reserve margin of 30%. It is obvious that the commissioning of the remaining 565 MW may be totally or partly postponed for after 2005.

Moreover, if we consider that, according to an assessment based on PHARE study, F.R. Yugoslavia can import from the other countries of the proposed REM, at least 1,050 MW, all the units of its expansion plan may be partly or totally postponed for after 2005. However, for reasons of self sufficiency of the proposed REM it may be proven necessary to commission 5 x 350 = 1,750 MW before the year 2005, that is two (2) lignite thermal units in Kolubara B and three (3) lignite thermal units in Kossovo B.

5.2.2.7 General conclusions

According to the aforementioned analysis which corresponds to one possible solution for operation under peak load, the necessary or already contracted commissionings of power plants in the six countries of the proposed REM up to 2005, are the following:

- Albania: a natural gas fired power plant of at least 200 MW.
- Bulgaria: lignite fired of at least 280 MW.
- FYROM: hydropower plants of at least 390 MW.
- Greece: natural gas, lignite fired and hydropower plants of at least 2,630 MW
- Romania: nuclear power plants of at least 1,400 MW and thermal power plants of at least 400 MW.
- F.R. Yugoslavia: lignite fired power plants of at least 1,750 MW.

On the basis of the aforementioned assumptions, the following possible scenario corresponding to the peak load may be constructed for the year 2005, considering the worst case of dry hydrological conditions.

It is to be noted that by constructing a second 400 kV line between Greece and Bulgaria, with the same capacity as the existing between Thessaloniki and Blagoevgrad and adding a second 400/220 kV auto-transformer at Elbasan substation (Albania) which is connected to Kardia (Greece) through a 400 kV line, it is possible to double the export from Romania and Bulgaria to Greece and Albania under n-1 contingencies.

Table 5.4. Power System Capacity Reserves Characteristics

Country	Reserve capacity over 30% margin (MW)	Power that may be exported (MW)	Capacity deficiency under 30% margin (MW)	Power that may be imported (MW)
Albania	_	_	450	Romania 260 (through F.R. Yug.-FYROM and / or Bulgaria - Creece) F.R.Yug.190
Bulgaria			260	Romania 260
FYROM	_	_	144	Romania 89 (through F.R.Yug.) F.R.Yug. 25 Greece 30
Greece	30	Albania 260 FYROM 300	_	_
Romania	609	Bulgaria570	_	_
F.R.Yug.	215	Albania 190	_	_

On the other hand, if further units are commissioned in Romania, Bulgaria, F.R.Yugoslavia and FYROM these units can be used for exporting electricity to UCPTE. In order to increase the possibilities for such an export, it is proposed to operate at 400 kV instead of 220 kV the already existing 400 kV transmission line between Romania and Hungary, to connect the network of Romania to Hungary and Slovakia through the substation of Mukachevo in Ukraine. If such an agreement can not be reached between the involved electric utilities, a new transmission line between Romania and Hungary must be constructed between Oradea and Bekescaba or between Oradea and Debrecen. Moreover, the restoration of the northern and southern transmission lines between F.R. Yugoslavia and Croatia is considered of first priority for realizing the interconnection between the proposed REM of the six Balkan countries and the UCPTE network, in a more efficient and reliable configuration. All these conclusions are already included in PHARE study.

5.2.3 NETWORK RELIABILITY BY N-1 CRITERION ASSESSMENT AND OTHER PROBABILISTIC STUDIES

5.2.3.1 General

In order to ensure the power transfer capabilities described in the above paragraph, the results of a number of studies, including PHARE study A and similar studies for the networks of Greece and former Yugoslavia were examined ; the general conclusion is that the interconnected network of the six countries is already sufficiently reliable and only a few interventions shall be necessary in order to ameliorate the overall reliability aspect.

5.2.3.2 Albania

The following recommendations are valid for Albania:

- Commissioning of a 220/110 kV, 60 MVA transformer at Vau I Dejes substation or another temporary solution to be proposed by KESH.
- Commissioning of a new 220/110 kV substation at Durres with 2 x 90 MVA transformers.
- Commissioning of Viore 220/110 kV substation and of Fier-Viore 220 kV line.
- Commissioning of a 220/110 kV transformer at Lushnje substation.
- Reinforcement of the 220/110 kV transformers at Tirana and Elbasan substations.
- Development of the internal 110 kV network, with the construction of the 110 kV line Elbasan-Cerrik.
- Commissioning of a second 400/220 kV, 300 MVA transformer at Elbasan substation.
- Construction of a new 220 kV line connecting Albania and FYROM between Bureli and Vrutok substations, which is useful not only for improving the overall reliability of the interconnected system, but also for promoting contract power exchanges.

5.2.3.3 Bulgaria

The following recommendation is valid for Bulgaria :

- Construction of a second 400 kV line between Bulgaria and Greece between Plovdiv or Maritsa and Phillippi substations.

5.2.3.4 FYROM

The following recommendations are valid for FYROM :

- Construction of a new 400 kV line interconnecting FYROM and Bulgaria, between Shtip and Blagoevgrad substations. This line is not only useful for improving the overall reliability of the interconnected network, but also for promoting contract power exchangers.

- Addition of a 400/110 kV 300 MVA transformer at the Shtip substation.

5.2.3.5 Greece

The following recommendations are valid for Greece:

- Construction of a transmission line of 400 kV between Thessaloniki and Philippi substations. The substation of Philippi shall be interconnected to the substation of Plovdiv or Maritsa in Bulgaria through a new 400 kV line.
- Extension of the Thessaloniki-Philippi 400 kV line to the border with Turkey, a project which shall not only improve the network reliability in the north-east of Greece, but it shall also allow power exchanges between the two countries.

5.2.3.6 Romania

The following recommendations are valid for Romania:

- Construction of the Arad-Oradea line, 400 kV, operated at 220 kV.
- Commissioning of a second 400/220 kV transformer in the Rosiori substation.
- Operation of the set of lines Sibia-Mintia-Arad-Hungary at 400 kV. These lines were originally constructed as 400 kV lines, but now operate at 220 kV (c.f. also para. 5.1.7).
- A new interconnection line between Romania and Hungary either through Mukachevo substation in Ukraine, or through a new 400 kV line between Oradea and Debrecen. In the case of a new line through Oradea, the lines Rosiori-Oradea-Arad must be operated at 400 kV. These lines were originally constructed as 400 kV lines but now operate at 220 kV.
- Reinforcement of Cetate-Craiova 220 kV line and of the Cetate 220/110 kV substation.
- Reinforcement of the Mintia-Cluj 400 kV line.
- Reinforcement of the 400/110 kV substations in Smiriden and Bucuresti.
- Installation of shunt reactors in Brasov, Rosiori and Smiriden substations.

5.2.3.7 F.R. Yugoslavia

The following recommendations are valid for F.R. Yugoslavia :

- Commissioning of a new 400/110 kV, 300 MVA transformer at Beograd 20 substation.
- Installation of a new 400 kV line between Subotica and Sombar substations.
- Installation of a number of 110 kV lines

- Installation of a 400 kV transmission line from Nis to FYROM. This line shall improve the reliability of the network in southern F.R. Yugoslavia and FYROM, which present low voltage conditions, and shall promote contractual power exchanges between the two countries.

5.2.4 TRANSIENT STABILITY

The stability margin and the critical clearing time (CCT) remain sufficient for the whole network with the following exceptions, already noticed in PHARE study A:

- In Bulgaria, at Chaira hydropower station where problems and loss of synchronism will occur in case of a circuit breaker failure. The protection devices must be provided with back-up systems in this case.
- In Romania at Portile de Fier hydropower station, at Rovinari and Mintia thermal power stations and at Tintoreni and Urechesti substations. New protection devices must be provided for Portile de Fier, Tintoreni and Urechesti. Back up protection must be provided and a special defence plan must be established, co-ordinating the action of all protection devices, in all the aforementional cases.

5.2.5 SHORT CIRCUIT WITHSTAND, PROTECTION, DEFENCE AND RESTORATION

The following measures have been recommended by PHARE study:

- In Albania, the replacement of the old and non reliable protection devices of the 220 kV network must be completed. Moreover out of step relays must be installed in some Generators and Diesel generators are necessary in many substations as back - up sources. The addition of inverse time protection relays on some tie lines will be also useful. Last, it's useful to modify the frequency control for island operation in three hydro power plants.
- In Bulgaria, the installation of out of step relays at two tie lines will be necassary (Sofia - Nis and Blagoevgrad - Thessaloniki), and to replace the old out of step relays at the most important Generators. Moreover in Kozloduy it will be useful to install an 140 MW gas turbine with black start capacity as back - up supply source. Furthermore, it is recommended to install diesel generators at the most important substations and to modify the frequency control for island operation in seven units.
- The only problems concerning short-circuit withstand exist at the following cases, in Romania.
    - at Tintoreni substation, where new 400 kV circuit breakers with sufficient breaking capacity (39 KA) must be installed.
    - at Brasov, Rosiori and Smiriden substations, shunt reactors must be installed.
    - the substations of Brasov and Bradu must be renovated.
- Furthermore, in Romania it is recommended to replace the old out of step relays in the tie lines to Hungary and Bulgaria and to modify the frequency control for island operation in 19 hydro power plants.

5.3 ENVIRONMENTAL RESTRICTIONS

The majority of the countries (154) have made a commitment in Rio in June 1992 under the United Nations Framework Convention on Climate Change (FCCC) to take action to reduce gas emissions.

If the current patterns of economic activity and population growth continue and currently available technologies are utilized, the levels of emissions of all greenhouse gases are expected to increase, particularly carbon dioxide, (CO_2), methane (CH_4) and nitrous oxide (N_2O).

From the Balkan countries Greece, Bulgaria and Romania belong to the industrialized countries listed in Annex I, of the United Nations FCCC. Therefore, they have to adopt policies and take corresponding measures to reduce greenhouse gas emissions to enhance sinks and to report on the results of these policies and measures, with emissions projections to the end of the decade (2000) using methodologies agreed by the COP.

In additon Greece, is listed on Annex II of member countries including the donor-countries to provide financial and technical support to developing countries concerning the climate change issue.

Table 5.5. Energy and CO_2 Emissions Data of the Balkan countries in 1990

	TPES (Mtoe)	TPES/ Capita (toe/person)	Energy CO_2 Emissions (Mt CO_2)	CO_2/Capita (t CO_2/ person)	CO_2/GDP (t CO_2/US$ 1000)
ALBANIA	-	-	-	-	-
BULGARIA	26.77	3.1	71.8	8.31	1.95
FYROM	-	-	-	-	-
GREECE	22.10	2.2	72.8	7.18	1.41
ROMANIA	59.37	2.6	165.1	7.12	2.06
F.R. YUGOSL.	-	-	-	-	-
EU	1215.4	3.5	3056.6	8.88	0.71
WORLD	7925.64	1.5	21428.8	4.07	0.79

Greece: For the protection of environment Greece has decreed laws, ministry decisions and rules. The general laws enacted include law 1360/1976 "About Site Arrangements and Environment", the presidential executive order 1180/1981 and law 1650/1986 about the "Environmental Protection", which form the basis of the active legislation frame. For the harmonization with the European Union order 88/609/EEC concerning emission limitations Greece executed the Minister decision 58751/2370/1993 which includes limits of the main pollutants from electric power units and other fossil fue fired plants. The decision distinguishes between existing and new installations. Installations operating before 1987 are considered as old and should not totally exceed 320,000 tons/a and 70,000 tons/a of SO_2 and NO_x emissions respectively. It is required from each plant to decrease gradually its pollutants emissions according to a plan yearly submitted and approved by the Greek State authorities.

The limits set by this decision referring to new plants using solid fuels are concentrated in the following Table. The same decision takes exceptionally into consideration the particularities of the indigenous lignite (high sulphur content) by regulating in a less strict way its SO_2 emissions. According to this exception the best available technology for the reduction of SO_2 from indigenous lignite should be used, provided that the required costs will not be extremely high.

Table 5.6. Limits for the emission of pollutants in Greece

Plants	**SO_2** [mg/m$_N^3$]	**NO_x** [mg/m$_N^3$]	**Dust** [mg/m$_N^3$]
$P_{th} > 500\ MW_{th}$	< 400	650	50
$100\ MW_{th} < P_{th} < 500\ MW_{th}$	2400 - 4* P_{th}	650	100
for fuels with less than 10% volatiles	-	1300	-

Having co-assessed all of the existing data, the Greek government considers that a realistic objective for its national programme would consist in restricting the total increase in CO_2 emissions - during the 1990-2000 period - to 15% (or 12.4 Mt). Discrepancies of +/-3% have been allowed for, due to unpredictable internal and international parameters and to possible revisions of the European Union's relevant policy. In comparison with the "spontaneous evolution scenario" (i.e. in the absence of abatement measures), the specific objective adopted in the programme implies that a decrease in emissions in the order 9.6 million tonnes CO_2 is expected to be achieved by the year 2000.

The abatement of CO_2 and other greenhouse gas emissions is to be achieved with the implementation of: (a) a drastic energy conservation policy in all sectors of final consumption (domestic-commercial-secvices, industries, transports) aimed at rationalising energy consumptions without affecting the population's standard of living and (b) a bold investment policy in order to promote new energy generation means (involving Natural Gas at an initial stage and Renewable Energy Sources in the longer term) in an aim to substitute for conventional fuels without altering the basic characteristics of the energy system (safety, stability and reasonable operating costs).

More than 50% of Greece's CO_2 emissions are caused by the production of electrical energy, since the national power generation system is based on the combustion of a thermally poor lignite. Consequently, the success of any policy for the abatement of CO_2 emissions will largely depend upon decisions affecting the power generation sector.

The modernisation of the existing system - so as to improve the efficiency of the lignite-fired stations, to reduce the losses in the transmission and distribution system, and to introduce new and "cleaner" lignite combustion technologies (Liquified Bed Units, Intergrated Gasification Combined Cycle) - will have very favourable impact.

As lignite plays an important role for the economy of the country, Greece does not suggest or support any CO_2 taxation, but should take in the near future the necessary measures (installation of FGD technology, e.t.c.) in order to meet the SO_2 emission limits set by the EU directives.

Albania: The environmental issue in this country specifically for the electricity sector is not presently of high priority due to the large proportion of the hydroelectric generation (exceeding 90%). The environmental concern from the operation of the thermal power plants it is not important due the small size of the power units and their desperce over the country.

However, in the near future emission controls and restrictions analogous to those impose by the member states of EU have to be adopted.

F.R. Yugoslavia: In general, the environmental issue on this country, coming out of the recently turmoil of the war in the area, does not yet has been high on the priority list of actions. The generating system of Yugoslavia has a very significant proportion of thermal generation, mainly lignite, therefore restrictions according to the EU members states are expected to be adopted, soon.

FYROM: There is not a valid monitoring system for the pollutants from thermal plants. Furthermore, there is not any authorised department neither from the government nor of the electric company (ESM) to support a monitoring campaign.

The low content of sulphur of the domestic fuel, results to the small significance of SO_2 emissions from the operation of the plants. According to the electric company, there is no urgent need of imperative measures for SO_2 emissions reduction.

A study for the utilization of the ash in the construction materials industry has been carried out but the results concerning the final products strength discourage the use of the ash.

All the thermal power plants are equipped with electrostatic precipitators, which have been installed by a Swedish company. No De - NO_x or De - SO_x units are installed in the plants.

Bulgaria: The Bulgarian state signed the Convention at UNCED in Rio in June 1992. The Council of Ministers approved the Convention in August 1994 and the Parliament, ratified the Convention in March 1995.

The Minstry of Environment of Bulgaria is responsible for the implementation of commitments under the Convention. The Committee of Energy and the Ministry of Transport are responsible for the energy and transport sectors respectively.

The Government considers that countries with economies in transition, due to their severe economic problems, cannot participate on an equal basis with the development countries listed in Annex II to the Convention in fulfilling the commitments under the Convention . It is felt that it is absolutely necessary that countries with economies in transition receive financial, technical and other assistance by Annex II countries, and that without such assistance, the countries with economies in transition listed in Annex I will not succeed in carrying out effective measures to reduce greenhouse gas emissions. Bulgaria, is in favour of activities imlemented jointly under the Convention. The Government feels that such atctivities should be long - term programmes, involving joint action, co-operation and assistance both for post-2000 commitments and for the coming years. Bulgaria is willing to participate in joint activities financed by Annex II countries at all stages in all sectors including the energy sector.

Bulgaria recently declared the target of stabilising gross anthropogenic emissions of CO_2, CH_4 and N_2O at their 1988 level by the year 2000.

A new environmental legislation has been validated from 1995 and the distincion between old and new plants is one of its main characteristics. From 1/1/1996, the environmental performance of all old units had to be in accordance with the new relative limits. In order to be achieved a significant reduction of environmental impacts, unrealistic low emissions limits have been adapted. Furthermore, the absence of provision of the additional costs have to be mentioned.

The following specifications are the basics when designing a plant.

Table 5.7. Emission Limits

Plant annual capacity factor	%	70
Min. Load	%	50
Flue gas standards (6% O_2, Dry base)	SO_2	Max. 650 mg/m_N^3 (227 ppm) according to Bulgarian Standard or min. 90% desulphurisation efficiency according to EU Standards (when using high sulphur coal).
	NO_x	Max. 600 mg/m_N^3 (292 ppm) accoring to the Bulgarian Standards
	Dust	Max. 100 mg/m_N^3 according to Bulgarian Standards
	CO	Max. 250 mg/m_N^3 (200 ppm)
Wastewater standards	Follow Classification III of "Group A, General Physics and Inorganic Chemistry indicators" of the Bulgarian Standards "Indicators and Standards applied to the Surface Water Quality Assessment" (State Gazette Issue No. 96 by the Environmental Protection Committee, Ministry of Health and the Urban Planning Committee).	

SOURCE: Energy centre - Sofia

Romania: The Romanian state attended UNCED in Rio in June 1992. In his speech to UNCED, which was the country's first official statement on global environmental problems, the President of Romania noted that dealing with environmental problems has a high priority in Romania. The Minister of Environment of Romania announced at UNCED that Romania expected that CO_2 emissions would in the year 2000 be below those of 1989. Romania signed the Convention during UNCED and ratified it in June 1994.

The Romanian Government has not yet adopted a target to stabilise or reduce emissions of CO_2 and/or other greenhouse gases. It may do so after the completion of a greenhouse gas emissions inventory for Romania. It is expected that an inventory using the European Commissions's CORINAIR methodology has been completed and an inventory using IPPC/OECD/IEA recommended methodology and default emission factors is likely to be completed in 1996. Romania views the idea of activities implemented jointly under the Convention positively, and hopes to participate in such activities.

The environmental legislation in Romania for the operation of the thermal plants is rather old. In the previous years, few changes had been made by Government Orders, for the updating of the existing limits and processes. The current limits are unrealistically strict and there is not a valid monitoring system for the environmental impacts from the power plants. The absence of reliable measurements of air and water quality and of a feedback process for the determination of the correcting actions are the most significant problems for an appropriate control of emissions and solid/liquid wastes. Furthermore the environmental department of RENEL is in a very low position in the company's hierarchy and occupies less than the minimum personnel.

The emissions are calculated by algorithms using questionable combustion factors.

Romania emission standards for **existing** lignite fired power plants.

Table 5.8. Emission Limits of Existing Lignite Units

Heat Input Mwel	Concentration (mg/m_N^3)*		
	SO_2	NO_x	Particles
150-500	50% FDG	800	150
>500	50% FDG	800	150

Romania emission standards for **new** and **retrofit** lignite fired power plants.

Table 5.9. Emission Limits of New Projects

Heat Input Mwel	Concentration (mg/m_N^3)*		
	SO_2	No_x	Particles
< 100	2000	500	100
100-500	2000-400	400	100
>500	400	400	100

* *in dry flue gas, 6% O_2*

0)

6. MARKET DEVELOPMENT PROBLEMS

6.1 SUITABILITY OF THE EXISTING ORGANISATIONAL INFRASTRUCTURES OF THE ELECTRICITY SECTOR

A common characteristic of the electricity supply industry of the Balkan countries is the dominant role of large State - owned verticalle integrated enterprises. The public utilities in the region cover all electricity activities from generation to transmission and distribution as well as the selling of electricity to the final consumers.

Within the public utilities in the region the organisational relations between the various functional departments are in the form of intra-organisational commands rather than market driven relation between different public companies.

The structure and the ownership of the electricity sector of the Balkan countries is presented in the following Table.

Table 6.1. Ownership structure of the Electricity Sector (year 1993)

Countries	Public Utilities				IPP's or Autoproducers
	No. of companies			Share of National Production	Share of National Production
	G.	T.	D.		
Albania	1	1	1	100%	0.0%
Bulgaria	1	1	1	91.8%	8.2%
FYROM	1	1	1	100%	0.0%
Greece	1	1	1	97.8%	2.2%
F.R. Yugosl.	1	1	1	98.4%	1.6%
Romania	1	1	1	97.2%	2.8%

G. = Generation, T. = Transmission, D. = Distribution
Source: UN/ECE, Electric Energy Statistics, Vol. XXXIX, 1995.

The electricity industry of the Balkan countries is dominated by the following vertically integrated state-owned enterprises:

KESH : Electroenergetical System (Albania)
NEK : National Electric Company (Bulgaria)
ESM : Elecric Power Company of Macedonia (FYROM)
PPC : Public Power Corporation (Greece)
EPS : Electric Power Industry of Serbia (F.R. Yugoslavia)
RENEL : Romanian Electricity Authority (Romania)

The above companies have also, at the present, the exclusive responsibilities for exporting and or importing of electricity in the country from the neighbouring electrical systems.

In addition to the primary function of production, transmission, distribution and selling of electricity the public utilities in the region, like PPC of Greece, EPS of New

Yugoslavia and ESM of FYROM are also involved in the mining industry for supplying fuel (mainly lignite) to their power stations. In 1995 approximately 85% of the electricity production in FYROM and 70% in Greece was generated from indigenous lignite.

In Romania, the electric utility RENEL is also responsible for most of the district heat generated in the country, representing more than 60% of the produced steam for space heating in 1995. In Bulgaria the electricity company NEK is also involved in significant production of steam for district heating, generated mainly from the Maritsa lignite power station.

Even though the electricity supply industry world - wide over the last decade has been subject to reform and changes, in the region electricity, like water, telephone services and natural gas have been perceived still as public good and as such it has been supplied exclusively by public utilities. Thus, the electricity supply industry of the Balkan Countries is controlled by state-owned monopolies and enjoys special rights and privileges in exchange for the obligation to provide a guaranteed supply of electric energy.

Presenty, the private production in the region exists only in the form of private generators, some of them owned by municipalities or autoproducers who sell their excess production to the main electricity supplier of the country (Public Utility) and whose contribution to the overall electricity production is very limited as it was shown on the previous Table of Ownership of the electricity sector in the region.

In the past, strategies in the electricity sector as well as of the overall energy sector of the region were driven mainly by the need to supply electricity to the largest physical rather economic optimal extent by reliance mainly on domestic resources like water, lignite, e.t.c..

A common characteristic in the electric Enterprises of the region, mainly of the former centrally planned economies was, and to a very large extent are still, the following:

Institutional rigidities, due to lack of experience at the policy level, investment priorities and decisions based on weak analysis biased toward large projects to meet overstimulated inefficient users and demand.

Inadequate electricity/energy demand managements, as electricity prices have been for very long below their economic costs giving highly distorted signals to the final consumers. Increases of the uniform national prices generally lagged behind inflation and the increase of costs of the imported fuels utilized for the generation of electricity. The lack of meaningful cost accounting has made it impossible to calculate the economic cost of electricity, while inadequate prices have led to resource misallocation and energy subsidies are causing a growing burden on the economies of the region.

In addition, all Balkan countries have been, at least so far, commited to policies of self-sufficiency in electricity. These policies have reduced considerably export and import volumes of electricity well below levels that may maximize economic benefits of the interconnected power systems.

It is well known that the Goverments of Albania, Bulgaria and Romania have shown intention to introduce competition into power generation through new electricity laws in their respecting countries following specific recommendetions from large financial institutions like World Bank etc. It is understandable that the new electricity laws will include provision for third party access into their respective networks.

Finally the recenty decisions of the Community for opening the electricity market is expected to initiate actions concerning the electricity sector in Greece.

6.2 TECHNICAL LIMITATIONS AND PROBLEMS ASSOCIATED WITH THE PARALLEL AND SYNCHRONOUS OPERATION OF THE SIX BALKAN COUNTRIES POWER SYSTEMS AND UCPTE

6.2.1 POWER MODULATION

The power output of each generation unit must be able to follow the variations of the power required by the interconnected systems of the six Balkan countries and UCPTE by maintaining the frequency within specified limits, at least through manual control.

For the power systems of FYROM, Greece and New Yugoslavia, which have been interconnected to each other and to UCPTE in the past, as well as for the mainly hydroelectric system of Albania, there exist no practical problems on this item.

The problem is rather difficult for the power system of Bulgaria, where the nuclear power plants can not be modulated and there exist not enough modulation margins at the thermal power plants. The load modulation is carried out mainly by the hydropower plants.

In Romania, load modulation is carried out exclusively by the hydropower plants. Most of the thermal power units can not be modulated.

6.2.2 PRIMARY POWER - FREQUENCY AUTOMATIC CONTROL

As primary power-frequency control is designated the power and frequency automatic regulation, otherwise called Automatic Generation Control (AGC), which is carried out in each generation unit individually, without taking account of any corrective command signals issued by a central power/frequency controller of the whole Control Area. As Power-Frequency Control Area (PFCA) it is convenient to suppose the interconnected power system of each individual Balkan country, since it may be considered as a system with uniform frequency variation at any moment.

The parellel interconnection of these Control Areas one to the other and with UCPTE network requires effective primary frequency control, i.e. low insensitivity (dead band) to frequency variations. $\leq$ 20 mHz for most of the Control Area units.

Effective primary power-frequency automatic control exists at most of the generation units in FYROM, Greece and New Yugoslavia, since the power systems of these countries have been already interconnected to each other and with UCPTE.

In Albania, the following modification is necessary in order to achieve effective primary power-frequency automatic control, according the PHARE study:

- Replacement of the primary power-frequency controllers as well as of the corresponding hydromechanical devices at the Fierza and Vau Dejes hydropower plants, in order to reduce their insensitivity.

In Bulgaria, the following modifications are required, according to PHARE study:

- In 16 thermal units, of a local capacity of 3360 MW, which will be still operating in 2005, their control philosophy must be changed from "turbine following" to "boiler following", with parallel replacement of the primary power frequency controllers in order to reduce their insensitivity.

- Installation of primary power-frequency controllers to the nuclear power plants, which will be in operation in the year 2005 and will have a total capacity of 2880 MW, at maximum, with respect to the relevant nuclear safety standards.
- Replacement of the primary power-frequency controllers as well as of the corresponding captors and electrohydranlic actuators, to all hydropower units of at least 20 MW, as to achieve continuous action and low insensitivity. This modification is concerning hydropower units of a total caracity equal to 1093 MW.
- testing devices must be provided in order to check the performance of the power-frequency controllers.

In Romania, the following modifications are necessary, according to PHARE study:

- Replacement of the overall control system, including the provision of equipment for primary power-frequency control in 14 thermal units of a total capacity equal to 3520 MW
- Replacement of some mechanical control devices, in order to achieve effective power-frequency control in a number of hydropower plants.

6.2.3 SECONDARY POWER - FREQUENCY AUTOMATIC CONTROL, CENTRALIZED DATA TRANSMISSION AND SYSTEM CONTROL

The power system of each Balkan country may be defined as a Power-Frequency Control Area (PFCA). It is proven as technically necessary, when operating in interconnected configuration, that each PFCA must have its own dispatch centre, where data from the whole power system shall be transmitted and which shall perform a centralized secondary power-frequency control sending command signals to the primary power-frequency controllers. Moreover, data must be transmitted from one dispatch centre to all the other ones. Modern SCADA systems are adequate for such purposes.

The centralized secondary power-frequency controller of each PFCA must contribute to the following tasks :

1. A sufficient degree of steady-state stability must be ensured.
2. Following a step load change, the frequency error should return to zero in the PFCA after a minimum time.
3. Following a step load change, the time integral of the frequency error or Area Control Error (ACE) must not exceed a prefixed value.
4. Following a step load change, the variation of the load at all the interconnections between one PFCA to the others or the UCPTE must return to zero.
5. It is recommended that the command signals to the individual primary power frequency controllers contribute to the economically optimum division of the load to the individual generation units of the PFCA.

If the individual PFCAs are considered as participating in the proposed REM and before they are interconnected with UCPTE, one member of the REM will survey the frequency error of each area (ACE) and will try to minimize it in a common effort. After the interconnection with UCPTE, the frequency survey may be transferred to another UCPTE member. The frequency profile must satisfy UCPTE requirements.

The conclusions of PHARE, study A as well as of an attentive survey of the power systems of the Balkan countries that will participate to the proposed REM make evident the following problems :

- Although in Albania the secondary power-frequency control can be performed through Vau Dejes and Komani, the construction of a modern dispatch centre and of a data transmission network seem to be necessary, as to ensure all the necessary functions of the secondary power-frequency control.
- Although Bulgaria has centralized dispatch with a central power/frequency controller according to UCPTE recommendations, it is necessary to extend the corresponding communication network and to modernize the centralized dispatch and data transmission system as to ensure all the necessary functions of the secondary power-frequency control.

  The major difficulty of the power system of Bulgaria, acting as a PFCA, is to compensate the loss of a 1,000 MW nuclear unit in Kozloduy. Therefore, secondary power-frequency control must be extended to all the power plants that must also acquire efficient primary power-frequency control. However, such a measure seems not to be sufficient and other measures as automatic starting of hydropower and thermal units and/or special contracts with the neighbouring power systems accompanied by selected load shedding may be envisaged.
- Although FYROM, Greece and F.R. Yugoslavia - FYROM are provided with centralized dispatch and equipment for secondary power-frequency control, according to the requirements of UCPTE, this control mode must be extended to a large number of units.

  Moreover, the dispatch centres and the data communication networks of the power systems of these countries must be extended and modernized as to ensure all the necessary functions of the secondary power frequency control.

  An additional dispatch centre must be constructed for the needs of the power system of FYROM.
- Although Romania has centralized dispatch with a central power-frequency control at five (5) dispatch centres, according to the requirements of UCPTE, it faces the problem of the increase of the load to be compensated, from 330 MW to 700 MW after the commissioning of the Cernavoda nuclear power plant. Therefore the 4 hydropower plants which now participate to the secondary power-frequency control are not sufficient and this control mode must be extended to other hydropower and thermal units.

  Moreover, the dispatch centres of RENEL and their data transmission systems must be modernized and extended as to ensure all the necessary functions of the secondary power-frequency control.
- An interconnection network must be constructed for data exchange between the dispatch centres of the six countries of the proposed REM.

6.2.4 VOLTAGE AND REACTIVE POWER CONTROL

The primary voltage and reactive power control is normally performed at each Generator by the Automatic Voltage Regulators (AVRs). This kind of control must be optimally co-ordinated and adjusted from the dispatch centre of the power system of each of the six (6) Balkan countries, in a process called secondary voltage control. The voltage profile must be in conformity to the UCPTE requirrements. According to the conclusions of the PHARE study:

- In Albania, the power system is not capable for full reactive power compensation. Moreover, the AVRs must be replaced in some important power stations and a modern centralized dispatch and data transmission system for secondary voltage control must be installed.
- In Bulgaria, improvements are necessary in the AVRs of Generators. Moreover, a centralized secondary voltage control would be useful, when implemented though the existing dispatch and data transmission system. Last, an optical fiber communications system to the neigbouring countries, i.e. Romania, New Yugoslavia and Greece must be installed.
- In Fyrom, the same need for centralized secondary voltage control from the new dispatch center is envisaged.
- In Greece, the centralized secondary voltage control though the existing dispatch and data transmission system must be reinforced. There exist some problems in the voltage profile at the North - Eastern part of the Greek network which must be comforted though a number of investments in the production and transmission systems, i.e. the construction of the new hydro power plant at Thissavros and the extension of the 400kV network.
- In Romania, a voltage supervision and telemeasuring system must be implemented. Moreover, centralized secondary voltage control will be useful. This mode may be implemented though the existing dispatch and data transmission system.
- In F.R. Yugoslavia, the secondary voltage control though the existing dispatch and data transmission system must be enhanced; however no important problem seems to exist as concerns the voltage profile at any part of the power system.

6.3 EXISTING LEVEL OF ECONOMIC RESULTS TRANSPARENCY FOR THE ELECTRIC UTILITIES OPERATING IN THE BALKAN REGION

The present structure of the Electric Utilities in the Balkan region has been dominated by government involvement and control through a single vertically integrated utility.

The main functions of Generation, Transmission and Distribution belong to the same company in parallel with other activities.

The accounting system for all the functions of each utility is unique for the whole company. There is not a separate income statement and balance sheet for each activity or function and there are not wholesale tariffs between the functional levels or different activities. The financial transparency through the separation of accounts for different functions is not applied in the present accounting systems of the Utilities.

The functions of the utilities which operate under loss or profit are unknown. The cross-subsidies between the functions can't determine and it is not possible to distinguish the profitable and non profitable activities.

Modern accounting systems should be applied according to international standards with the same and uniform principles.

In most of the six countries, the economic results of the utilities are determined, in such a way, that their operation is very close to break even point. This situation can't be continued since the capital structure of the companies will be deteriorated and the self financing capacity will get worst. The investment programs and generally the capital needs of these utilities should be covered not only by loans, but also by internal sources which must be generated among others, by the net earnings.

The criterion of revenues determination shouldn't be a tariff policy which directs to break even point, but a policy which takes into account a target of creation a profit, sufficient for self financing the capital needs. Such a policy could be for example the target of "return on capital" (ROC). The applied tariff policy in most of the utilities keeps the prices artificially low for social or antinflationary policy reasons, creating problems of wasting of energy and electricity:

The tariffs don't reflect the costs, in most of the cases, and don't give the correct signals to the consumers encouraging unnecessary consumption.

The cost structure of providing electricity could be reflected by a two part tariff system with different rates for different periods in order to transfer demand to off peak periods.

In principle, each consumer should be charged according to the cost he imposes to the electricity system. However, exceptions must be provided for special cases, i.e. for island consumers.

The unbundling through the separation of accounts, should be applied as a first step before the competition in the electricity sector.

The regulatory framework should be changed to clarify and determine the responsibilities of the companies and to transfer operational management to the utilities.

Contracts should be signed between the utilities and the States, for appropriate periods of time (e.g. three years).

The price revisions should be justified and controlled by special regulatory bodies which will audit the corresponding cost changes.

The cost of electricity should be constantly attended. All the above measures should direct the electric utilities towards a more competitive electricity market and in parallel will help each utility to improve its operation.

6.4 TRANSMISSION PRICING

6.4.1 INTRODUCTION

The transmission and distribution networks will be required to provide access to all potential users. This will enable byers and sellers to compete in the market for electricity. But network access needs to be on a fair and non discriminatory basis and to be organized as simply as possible to ensure that competition in the market is both fair and efficient.

On the other hand, the directive of the European Parliament on the completion of the internal market for electricity refers that each member country has the right to select one of two suggested models for organizing the electricity market, the single buyer and the negotiated access models. Regardless of which two models are chosen, separate pricing of transmission services has to be realized.

The same, for every organized electricity market, competitive or not, is very important, in order to have access to different electricity systems, to take the necessary steps for regulation of this market, specially, for the transmission function, in terms of access conditions, pricing and investments.

The first step for transmission pricing is the choice of the cost allocation method, which directs to the appropriate pricing method, taking into account several basic principles which are applied for every tariffication.

While, there is no one correct pricing method, always the criterion should be, to adopt the simplest method, in order to achieve a reasonable level of cost reflectiveness.

6.4.2 COST ALLOCATION METHODS

It is necessary, before the cost allocation methods be examined, to have a general overview over the three broad classifications of costs as transmission costs including Losses, Ancillary Services and Indirect cost components.

The most important transmission costs which play a major role in transmission pricing are:

Capital costs, network losses, operational costs, overhead costs, ancillary services, re-dispatching costs, costs of energy not supplied.

Many factors contribute to the level of cost, e.g. the shape of the country, the systems position in respect to neigbouring systems, location of generation and load, legislative constraints concerning the environment e.t.c. Some other external factors which affect the transport cost is the size of power to be made available at the peaks and the reliability of the system.

The transport cost can be classified into fixed and variable cost.

The fixed cost includes capital costs, operating and maintenance costs, management costs e.t.c.

Variable costs includes mainly losses and depends on the utilization of the network.

The major part of transport cost includes fixed costs.

Fixed cost has to be recovered independently of how much energy is demanded.

The term ancillary services includes:

- The ability to keep a reactive balance.
- The ability to provide a change in real power supplied to, or taken from, the system at short notice.
- The capability of generating plant to start while disconnected from off-site supplies (''black-start'').
- Load reduction.

The Term indirect components include:

- levys
- cost arising from regulatory review
- public service obligation
- stranded investments.

The Cost Allocation Methods are:

6.4.2.1 Average Cost of Methods

These methods are based on a division of capital costs and the operating and maintenance costs (yearly) of the existing network. The allocation is based on the «transmission capacity share» actually received or contractually available for each consumer.

In particular there are :

(a)Methods which don't require the use of network calculation, often adopted because of their simplicity. The allocation takes place on the basis of power demand during peaks and/or voltage and not on transmission distance.

(b)Methods based on network calculation, taking into account not only the criteria of (a) methods but as well as transmission distances.

6.4.2.2 Methods Based on Incremental Costs

These methods, as well as the methods of marginal costs, can send specific economic signals aiming at getting new users to pay the operating cost and/or the expansion cost of the system due to their required energy transfer.

They are :

(a)*Short run incremental costs*. The difference between total operating cost with and without a given transfer load is evaluated by means of an optimization of power flows without further network investment.

(b)*Long run incremental costs*. The above (a) method is used with reference to the total costs, taking into account the necessary investment in the medium long term. It involves many scenarios and many variables.

6.4.2.3 Methods Based on Marginal Costs

The marginal cost for transmission is decreasing with increasing usage and it is lower to the average costs.

These methods are based on the calculations of :

(a) Short Run Marginal Cost

(b)Long Run Marginal Cost

These methods are similar to the incremental methods but they are more complex, especially, the method for calculation the long run marginal cost, due the complicated procedure to estimate it.

6.4.3 PRICING METHODS

The methodologies used to allocate transmission costs can be different based on the following criteria:

- transparency
- efficiency
- stability
- fairness
- simplicity
- recovery of historic costs.

All the charging structures and tariffication methods, should reflect the foregoing costs and give the correct signals to the users.

The transmission pricing systems used, can be classified into two main categories, distance related systems and non distance related systems. These pricing methods use the allocation methods mentioned above and the tariffs used in practice, are often a mixture of the different pricing methods described below and, in addition, a mixture of the different cost allocation methods. These tariffs are always influenced by the rules of the regulator.

The methods which are usually used are the following:

6.4.3.1 Postage Stamp

This method is based on average costs and is not related to distance like the postal service and doesn't distinguish the entry and exit points. It is not «fair» method and doesn't reflect costs.

6.4.3.2 Contract Path

It is based on a possible path between entry and exit point, agreed in a contract. It takes into account the used assets for the possible path as well as the energy and capacity flow. This method allows us to identify the real transfer and the part of the transmission capacity which is used.

6.4.3.3 Physical Path

It is a more general method than the method mentioned in 3.2. It examines the load flows due to each load with and without it. The flows estimated are associated with the length of lines and the network costs of these lines.

6.4.3.4 Zonal

In this procedure, the transmission system is divided into zones and the systems power costs are associated to the zones.

The transmission tariffs are designed in different levels for each zone and a tariff which will characterize geographic dependence will be created.

6.4.3.5 Investment Cost Related Pricing

It is based on the evaluation of MW Km variation due to variation of 1 MW at 1 Km distance.

Considering the capital and operating cost for necessary transmission capacity equal to 1 MW Km, we allocate a share of costs to each node that depends on its location and utilization.

It identifies two cost components, transport cost (price per MW Km) and security cost (price per MW).

It calculates costs at load peak and provides an economic signal to new users of the transmission network.

It is preferred against methods like LRMC or SRMC due to the difficulties of predicting potential generation developments and utilizations. It has been adopted by the English National Grid Company.

6.4.4 PRACTICAL APPROACHES

The transmission operators use several practical approaches to create transmission tariffs. The generation of this approaches and techniques comes from the practical and real situations the operators could face.

The following remarks could be made as an accumulated experience from the operators:

There are costs associated with energy and power due to the actual conveyance of energy and the capacity available to a user, as well as corresponding related charges or tariffs.

Similarly, connection charges are applied, related to the above mentioned power and energy, based on the corresponding cost of connection assets.

The capacity charges per KW are related and based on the coincidence of third party load flows and network peak demands.

The capacity and energy charges could classified into seasonal and time of day to take into account the contributions of the users to network peaks. In some cases the actual direction of power flows is taken into account, by charging differently the transferred load in different regions. Transmission charges are wholly or partly distance related and are based on the «postage stamp» principle. These charges depend on network configuration and the network level at which third parties are connected.

Losses are usually taken into account by an adjustment to the metered third party load flows entering or leaving the network.

For losses estimations the voltage connection is taken into account. Specifically, in higher voltage, losses are estimated on an average basis, while at lower voltages some account is taken of the voltage of connection of the third party.

The time of day or seasonal charges, depending on the network load flows, are applied to capture the variations in the cost of losses.

6.4.5 CONCLUSION

The subject of transmission pricing is new and very complicated. The above mentioned material is very basic and fundamental. It comes from the edition of the Group of Experts of Unipede which is called «TARTRANS» of the Economics and Tariffs Study committee of Unipede.

Many other subjects could be described related to the transmission charges for independent generators, autoproducers, generators and customers.

In addition, an interest topic could be the method of charging the reactive energy and ancillary services.

Another very interest topic for examination, could be the description of the contracts related with the Electricity Transmission Networks, such contracts could be:

- Point to Point
- Fixed Price Quantity Contracts
- Contracts for Transmission Rights
- Contracts in Capacity Rights
- Transmission Price Insurance Contracts e.t.c.

As the market will continue to develop, the existing methodologies will be enriched and revised, while new ones will be appeared, depending on the degree of country's development and the maturity of the market.

6.5 ECONOMIC SITUATION AND OBSTACLES TO INVESTMENT UNDERTAKINGS IN THE BALKANS

Seven years after the revolutionnary changes in Central and Eastern Europe the Balkans are still trying to ovrecome the structural problems of the past.The great difficulty rises from the "double transition": the simultaneous change in the economic and political sphere. To these is added a third challenge: The systemic reform in these countries has to be linked with their relations with the European Union.

Two Balkan countries (Bulgaria and Romania) have Europe Agreements with the EU; Albania has signed in 1992 a non preferential agreement on commerce and economic cooperation without financial protocol, while FYROM has signed in 1996 a preferential agreement of cooperation with financial protocol.Yugoslavia, because of the war, has not yet any agreement with the EU.

A lot of things have been accomplished in the economic sphere during these years but there is still a long way ahead. The macroeconomic stabilization was priority number one during all this period and still is for most of the countries concerned.Still, interest is shifting towards problems of growth, structural policy and social questions.

One has to note the growing differentiation between the Balkan countries. The countries have opted for different transformation policies with various results. Ever if signs of recovery are obvious in most countries there are still serious problems in some of them.

Currently, most of the obstacles to investment rise from the difficulties in the privatisation process and the -in some instances- inadequate institutional and legal framework for foreign investment. We will examine each country seperately.

6.5.1 ROMANIA

Table 6.2. Main Economic Indicators for year 1995

GDP growth	6.9%
GDP ($bn)	35.5
GDP per capita ($)	1,567
Unemployment rate	8.9%
Inflation	32.3%
Exports of goods ($bn)	7.5
Imports of goods ($bn)	8.8

After five years of negative GDP growth, (1989-1992) the year 1993 marked the end of decline and a modest increase of 1.3%. In 1994 and 1995 due to the economic recovery the GDP growth accelerated to 3.9% in 1994 and 6.9% in 1995, one of the fastest growth rates in Europe.

During the last three years, the tendency has been to reduce the trade balance deficit. Fast export growth is sustainable as a result of the maintenance of a competitive exchange rate, the lift of sanctions against Serbia and Montenegro and further EU trade liberalisation.

Privatisation Process

Small privatisation started in 1990 with the liberalisation of free entreprises. The law no 31.1991 allowed for the setting up of private companies.

The pace of privatisation was slow ans relatively incosistent. In 1995, the private sector accounted for about 45% of GDP and was respondible for 80% of agricultural production, 44% of services but only 14% of industrial production. Under the new privatisation scheme, adopted in 1995, both the free property certificates handed out in 1992 and the new coupons amounting together to about 1 million lei (a month's salary) can be exchanged for shares that are to be traded at the new Romanian stock exchange. The aim of this programme was the privatisation of about 4,000 companies of the public sector.

Industrial restructuring has been one of the most important problems of the transition process, closely interwoven with the slow pace of privatisation.Up to now, privatisation has been restricted to worker-management buy-outs, which created a favourable attitude towards privatisation but had little impact on large and medium scale entreprises.

Only 8% of the nominal capital of the 6.600 entreprises which were to be privatised has been transferred into private ownership by the end of 1995.

Foreign Investment

Foreign investment is being encouraged as everywhere else in the Balkans. But one should note that Romania has been one of the first countries in the early 1970s to permit foreign joint venture investment. Still, there were many restrictions which impeded massive foreign investment. The new Foreign Investment Law in 1991 lifted many of the old controls and restrictions. The law allows 100% foreign ownership and the repatriation of hard-currency profits. An amendement to the law in 1993 removed restrictions on the transfer of lei profits.Yet, foreign land ownership is still not permitted in Romania.In 1994 a new law was adopted which extends significant tax exemptions to large scale foreign investors.

At present, the total volume of foreign investments in Romania amounts to 2 bn dollars, which is still insufficient to the needs and capacity of Romanian economy.

The capital investment in Romania is still dominated by small size investment.

Energy sector has been opened to foreign investors but the laws which will attract serious interest have not yet been approved by Parliament. The World Bank and other multilateral donors are backing a 20-year long term programme to revitalise Romania's oil and gas industry. In addition, the oil industry is scheduled to be privatised.

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6.5.2 BULGARIA

Table 6.3. Main Economic Indicators

GDP growth	(1994) 1.4%	(1995/est.) 1.4%
GDP ($bn)	(1994) 10	(1995/est.) 13.5%
GDP per capita ($)	(1994) 1,187	
Unemployment rate	(1994) 12.5%	(1995/est.) 11.2%
Inflation	(1994) 96%, (1995) 75%	(1996/est.) 224%
Export of goods ($bn)	(1994) 4.1	
Import of goods ($bn)	(1994) 4.0	

The important economic crisis which has devastated bulgarian economy during the last six months is partly due to the fact that large scale state owned entreprises absorb about 15% of the GDP.

The turbulence in the foreign exchange market in early January 1996 showed the real need for a consistent economic policy. The National Statistical Institute gave the cumulative figure for inflation for the first eleven months of the year to 223.6%. Since the beginning of the year, electricity prices have risen by 382%, transport and communication services by 203% and food prices by 227%.A study carried out by one presidential advisor concluded that one third of workers work informally, not paying taxes or paying only a part of them.This has cost the budget 193$ million this year.

Privatisation Process

Bulgaria with a share of 27% of private property is still lagging behind other central and eastern european countries.

Laws no 38 of 1992 and 51 of 1994,form the legal framework for the privatisation process. Bulgaria announced officially the start of its Mass Privatisation Programme on the 4th January 1996. Every Bulgarian citizen above the age of 18 is entitled to receive 25,000 "investment leva" in vouchers which cannot be traded. As of December 1995 a total of 24,000 business have been privatised, including 1,650 municipally owned and 535 relatively large and medium size state owned entreprises. Over 22,000 entreprises were re-privatised through restitution. The 1996 privatisation programme envisages opening of procedures for some 400 entreprises.The fulfillment of this programme will result in more than 20% of the state-owned entreprises passing into private hands.

Foreign Investment

The amendements to the foreign investment regime (Law of January 1992) introduced in 1995 aimed at broadening the scope of activity of foreign investors. The Law on Securities , stock exchanges and Investment Companies, of July 1995, opened up additional opportunities for diversifying the investment methods. The adoption of the Law on Concessions aimed at allowing the acquisition, through action or tender concessions, of property which is exclusively state-owned. The direct and indirect investment in 1995 amounted to 233,154 $million. Taking into account the 50 million $ of additional investment pledged under privatisation agreements, the total amount of foreign invetsment in 1995 reached 284 million $.The power generating sector poses both serious problems and major opporunities for Western firms. The goverment has failed to implement financial discipline programmes on the energy sector.

6.5.3 F.R. YUGOSLAVIA

Table 6.4. Main Economic Indicators

for 1995	
GDP growth	6%
GSP ($bn)*	14,8
GDP per capita ($)	1404.1
Unemployment rate	25%
Inflation	68.8%
Export of goods ($bn)	1.4
Import of goods ($bn)	2.4

**Gross social product differs from GDP in that it excludes goverment services*

Industrial production has been declining during the first six months of 1996, due to the lack of capital, the inadequate demand in the domestic market, the lack of foreign aid and the inadequate developemnt of the production. AE the end of the sanctions, business confidence is falling, with fewer than 40% of businessmen rating the economy's future prospects as good. Reasonably tight monetary policy and increased import supply kept inflation in check.

Privatisation Process

A privatisation bill was due to be discussed by the Parliament in spring. According to the new law, companies themselves were to decide whether to privatise, allowing them a year's time to decide. This would rather impede a radical transformation of the economy. In addition, Serbia's private sector, which generated one-third of the economy's income in 1995, is shrinking because of the heavy taxation.

Foreign Investment

Despite the country's foreign funding for a series of infrastrucrure projects, the uncertainty among foreign investors remains.The inadequacy of legal guaranties and the unreformed banking system are major obstacles for foreign businessmen.

Recent amendements to the foreign investment law have liberalised provisions on concessions for infrastructure projects.The amendements will allow foreign investors to set up their own erntreprises and have majority interests in the following sectors: power, railways, post and telecommunications, forestry, public information as well as communal services. The need to obtain approval to register foreign investment is abolished.

6.5.4 FYROM

Table 6.5. Main Economic Indicators

GDP growth	**-4% (1995/est)**	**+1 (1996/est)**
GDPper capita ($)	724 (estimation IMF/1995)	-
Unemployment rate	22% (1995 official)	-
Inflation	10% (IMF estimation for 1995)	-
Trade balance ($million)	-	-189 (est.1995)

The goverment has adopted a moderate approach for its transition to market economy. Several large state entreprises have been closed since 1991 and output is still decreasing.Although FYROM has acheived notable success in economic stabilisation it is the only country in eastern Europe in which officially recorded growth fell in 1995.

Privatisation Process

The pace of privatisation slowed in the first quarter of 1996 and restructuring of loss making state entreprises is behind schedule. In 1995 the government's aim has been to focus on the privatisation process and a restructuring programme for the 25 biggest loss making entreprises. The financial ministry estimates that about 30% of the country's GDP will be produced by the private sector this year.

Foreign Investment

The country's companies had, up to now, serious problems in attracting foreign invetsment. The goverment planned to pass new laws on property ownership, accounting standards and commercial practis as a way to attract foreign capital.Up to now foreign investors have been deterred by the political risk of investing in an unstable region.

6.5.5 ALBANIA

Table 6.6. Main Economic Indicators

for 1995	
GDP growth	11%
GDP per capita ($)	-
GDP	-
Unemployment rate (1994)	19.5%
Inflation	6%
Export of goods ($m)	187
Import of goods ($m)	603

The growth of the economy has been due to the recovery in agriculture, due to quick privatisation and radical land reform and the development of trading, services and construction. The most dramatic decline was that of the industrial sector which contributed to only 13% of GDP in 1994, compared with 37% in 1990. Still there are signs of an industrial recovery. While crude oil output in the first quarter of 1996 remained stable, copper output increased by 12% and chrome production was up by 16% compared with the same period in 1995.

Privatisation Process

For the albanian goverment the priority was the privatisation of the agricultural land, urban housing and transports. To date more that 90% of the land is in private hands. In what concerns the industry the objective was the gradual privatisation with the division of large entrepises in smaller units. With the decision 248 of 27th May 1993, the albanian government decided to quicken the process of selling of state owned entreprises. In August 1995 the government announced that 20 of the largest remaining state entreprises would shortly join the 30,000 businesses now in private hands.

Foreign Investment

Foreign investors have the same guaranties as albanian companies.The Law on Foreign Investment provides for the repatriation of revenues and profits and allows for 100% foreign ownership. Foreign debt settlement will improve investment prospects in the country. A double taxation agreement with Greece followed a similar arrangement signed with Italy at the beginning of 1995. This was extremely important as Greece and Italy are Albania's major trading partners and leading sources of foreign investment. The first private investment fund in Albania, the Anglo-Adriatic Investment Fund has been established with the aim to raise about $350m to be invested in Albania's privatisation programme. Once it has gathered adequate funds and attracted foreign investors, the fund expects to invest in such areas as telecommunications, tourism, railway construction, mines, transport and construction.

6.5.6 SOURCES

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7. PROPOSAL FOR A COMPETITIVE ELECTRICITY MARKET

7.1 INTRODUCTION

Power systems co-ordination in operation among interconnected systems is based on the physical characteristics of the electric power networks, the demand required by the network and the type of generating units (including fuel, unit capacities and availabilities). These electric power system properties have an important influence on the opportunities for economic and operating benefits.

The expected benefits of the Regional Electricity Market (REM) of the Balkan countries will mainly lie on the following power system characteristics in the region :

- Diversities in load
- Operating cost and fuel mix variations
- Economy in new investments
- Spinning reserves
- Systems reliability

A brief discussion of the above mentioned characteristics of the future REM will be given in the following section :

Diversities in load

Considerable saving can be obtained from co-ordinated operation of the Balkan systems due to load diversities. The power systems in the region reach maximum load at different times within the day, the season and the year. For example, the annual peak load in Greece occurs during the midday hours of the working days of the summer period (July) due to considerable air-conditioning demand of that season. On the other hand, the maximum load in Bulgaria appears in the winter, most likely in December, where the peak load of the electricity demand in Romania is required over the months of January to February.

The maximum demand for the power system of the F.R. Yugoslavia has been observed to occur during the late winter or beginning of spring (February to March), however, in this case more observations are required after stabilization of the system due to the war measures that have been existed in this country for the last years. Considering the small power systems of Albania and FYROM they have lately present their maximum load demand during the months of December to January.

In addition to the above maximum load diversities these are also difference of the daily load patterns in every system, however, the importance is not as significant as the annual or seasonal maximum demand diversity.

In close connection with the above mentioned load diversities significant economic savings will be achieved in the REM from the operational and new investment requirements of the power systems in each country as they will be discussed further on.

Operating costs and fuel mix variations

As they were previously presented (chapter 3), the generating system of the Balkan countries consists mainly from lignite, hydro, nuclear, gas and heavy fuel oil fired units. Even though, in total in the Balkan systems, 68% of the production of electricity comes from conventionally fired thermal units, 22% from hydroelectric generation and 9% from nuclear units (not including the production of the Chernavoda power station of 700 MW in Romania presently in operation), the proportion of utilization of the above mentioned generating facilities varies among the countries. In F.R. Yugoslavia, Greece and FYROM there is a significant proportion of domestic base load coal (lignite) fired units covering approximately 68%, 75% and 85% of the electricity production of these countries (for Greece consider only the mainland system).

On the other hand, Albania's power system is almost totally hydroelectric, generating more than 95% of the electricity demand mainly from peaking hydro units. In Bulgaria there is also mainly significant base load potential from nuclear and domestic lignite fired units, however, there is an increasing requirement of electricity production from imported fuels, mainly natural gas and fuel oil.

In Romania, a very significant part of the electricity production comes from natural gas and fuel oil generating units, however, in this case, the co-generation facilities producing also steam for space heating should be given special consideration.

In close connection with the previously mentioned characteristics of each power system of the Balkan countries, the present net electricity exchanges of the power systems in the region reveals a very limited operation of the tie-lines representing almost 1% to 4% of the total production of electricity for every country (See Table 3.55 Electricity exchanges of the Balkan countries in 1995).

Taking into consideration the fuel and technical characteristics of the generating facilities in every Balkan country in connection with the load pattern variations (chapter 3) in the region it is obvious that there is considerable room for reduction of the direct operating costs. The diversity of the peak loads among the interconnected systems of the proposed REM improves the combined system load factor and will allow better utilization of the base load power units. Presently, at any instant of time the power systems, normally, utilize a variety of generating units having different individual production costs. However, because of the variations between systems in the time of peak load (hourly, daily, monthly, e.t.c.), differences in the costs of fuels of a power system may have, for various periods, an incremental production cost significantly different from the corresponding operating cost of another neigbouring system. In this cases, it will be cheaper for the system of the higher cost to reduce production on its own system and purchase electricity from the country having lower production cost (taking also into consideration transmission losses). Of course, that applies to the degree that surplus of lower cost electricity is available in the region.

Furthermore in considering forced outages of the generating units, it is well understandable that in case of outages, the replacing unit does not have to be a fast running expensive unit within the generating system but the next in the incremental cost order unit in the proposed REM.

A very significant saving can also be derived from direct co-ordinated operation of the systems. For example, the hydroelectric system of Albania can utilize the hydro units for supplying exclusively the peaking demand in the region while the neigbouring systems (Greece, FYROM) will be responsible for covering the base load demand of Albania from their base load generating units.

Additional saving can be derived from co-ordinated maintenance of the generating units, however, extensive negotiations on that matter are required among the different power systems.

Economy in new Investments

Probably by for the most economic benefits of the Regional Electricity market will be derived from the significant reduction of the investment requirements for new generating units. As it can be seen from Tables, presenting the installed capacities and the maximum electricity demand for 1995 there is, on the total, reserve capacity of approximately 70% without even taking into consideration the peak load diversity existing among the different systems. That will increase another 35% to 50% the overall reserve capacity. In addition, when considering new additional generating facilities, reduction in expenses can be obtained from planning to construct larger in size units that cost less to build per unit output.

Spinning Reserve

It represents the generating capacity that has to be operating in-line in excess of the load for rapid load pick up to prevent a breakdown (black out) of the system due to unexpected or unscheduled outages of generating units and unforeseen increases in load causing a inbalance between supply and demand. Through provisions of the proposed REM, a reserve sharing agreement will require significantly less spinning reserve than it is were operating without such an agreement. Presently a considerably capacity runs without basically offering an input to the power system of every country. In Greece, for example, approximately 300 MW of hydroelectric generation is devoted to the spinning reserve of the system thus, loosing considerably valuable water. Similar losses are also occurring presently in the operating practices of other power systems.

Systems Reliability

Considerable benefits from maintaining a predetermined level of reliability with less generation reserve are available through access to support from the other power systems in the region. Reliability requires not only adequate reserve generation and reliable transmission, but also the ability to resolve various disturbances which could cause loss of synchronism and system collapse.

Stronger interconnections can improve the ability to resist disturbances arising within an individual system thus, reducing the probability of system black out during a contingency.

The benefits from reserve capacity can be realized from either reduction in reserves required for a given level of reliability at the interconnected systems. From Table 3.53 it can be observed that the present level of reserve capacity of the power systems in the proposed REM varies from almost 35% in Greece to more than 100% in Romania. Therefore, by accounting the existing potential capacities of the neigbouring systems, in connection with the tie-line capabilities, a significant reduction in the reserve capacity of each system can be targeted. It should be pointed out that at the present every power system in the region usually plans its system generating capacity to meet a desired level of reliability; for example in Greece the target reliability level for expansion planning purposes of the mainland system is 0,5 days annualy.

Therefore, in every case the reliability benefits can be translated directly into economic benefits.

7.2 OPERATING, DEVELOPMENT AND ELECTRICITY TRADE CRITERIA

It is universally recognized that open access and free wheeling in the interconnected networks are necessary conditions for the constitution of a peripheral electricity market. The pooling procedure, when established in such a market, will not only entail substantial benefits in reliability and stability of the interconnected networks, but also at operational and investment costs. In such a procedure, buyers and sellers, from any country participating in the market, can freely negotiate contracts for electric energy and power as well as for any related services.

The countries that will participate in the proposed REM are called to create a joint institution, conventionally named Balkan Electricity Operating and Development Center (BEODC) in the present study. The BEODC must have the following tasks:

- Survey of the problems related to the parallel and synchronous operation of the electrical systems of the proposed REM and more specifically of the frequency and voltage profiles. These profiles will be followed by the dispatch centers of the relevant countries; moreover, the frequency profiles will be watched by a dedicated dispatch center in the proposed REM or in the UCPTE when, later, complete integration to the UCPTE network is achieved. The BEODC will be entrusted to propose technical solutions for such problems, the means for their realization and the possible sources of their financing.
- Survey of the technical specifications, which will be applied in the countries of the future REM as concerns the design, operation and connection to the transmission networks of production units, distribution networks and equipment of customers directly connected to the transmission system. These technical specifications should be homogeneous and similar to the ones valid in the European Union, as far as possible; since Greece is a member of the European Union, its electrical system must be in conformity to the elementary technical requirements to be valid in the European Union, and an homogeneity in the technical recommendations is necessary in the future REM. Moreover the BEODC must survey the fulfillment of a series of common technical specifications related to the interconnections among the existing transmission networks. Thus, the BEODC shall be entrusted to survey the application of some minimum technical specifications throughout the area of the REM, which will create a reliable and equitable framework for the promotion of the interconnections among the existing transmission networks of the Balkan countries and their neighbouring countries as well as the connections of Production Utilities, Independent Power Producers (IPPs), Distribution Utilities or Eligible Clients, attributes recognized to public or private companies or persons in each of the participating Balkan countries. The BEODC shall be responsible for the determination of all necessary actions for the application of the commonly agreed technical specifications as well as of the possible sources of their financing.
- Collection of all necessary information related to the reliability, transient stability, short-circuit withstand, power-frequency and reactive power-voltage control of the electrical systems of each country. More specifically, all the deterministic criteria and probabilistic indices concerning the reliability of the production and transmission systems, and all the relevant studies must be collected by the BEODC.

Furthermore, the BEODC must study all data, criteria and indices related to the interconnected system of the participating Balkan countries; if such studies already exist they must be collected and taken into account.

The purpose of this review is:

✧ to determine all necessary improvements and technical means for the parallel operation of the electrical systems.

✧ to establish commonly acceptable reliability, transient stability, protection, defense, restoration, frequency and voltage control criteria as well as the actions to be carried out in each specific system in order to reach these criteria, where the electrical systems are deficient. These proposals shall be obligatory for the countries members of the REM.

✧ to establish the possible sources of financing of such actions.

✧ to establish the maximum power transfer and wheeling capabilities of the interconnected transmission system, so that these capabilities are given at any time to any interested party within the REM.

For this purpose the BEODC must be in continuous contact with the relevant companies which are responsible for the operation and maintenance of the individual transmission systems of the Balkan Countries. All relevant data must be known to the Electrical Production Utilities of the proposed REM as well as to the IPPs, Distribution Companies or Eligible Customers.

- Survey of the necessary economical parameters which will permit the transparency in the tariffs of the electric power and energy. The proposed REM will be based on the irrefutable existence of specific needs for electricity exchanges between the involved Utilities and IPPs and for cheaper electricity for the consumers, as well as on the willingness of all involved parties to establish a cross - border electricity trade in order to cope with the above needs. The contractual and pricing principles to be introduced for the operation of the proposed REM must be at the same time competitive, transparent, fair and non discriminatory. Economic transparency may be considered as difficult, but it seems to be necessary in view of the European Union Directive which will be valid in Greece from year 2001 as well as in view of the future integration of the REM to UCPTE and to the Electricity Market of the EU. The pricing in Short Term or Long Term Contracts may take into account the respective Short Run on Long Run Marginal Cost (SRMC or LRMC) of the Production including the Transmission and eventually the Distribution Cost, if the buyer is buying electricity through a distribution system. It seems better to establish competitiveness without neglecting the limits introduced by the electrical systems marginal costs, a procedure that will suggest a minimum level of cooperativeness, which, in any case, will not be obligatory.

  In case that the buyer is a vertically integrated Electricity Utility owning installations in one of the countries of the future REM, which include at least production and transmission or distribution, it could be suggested that the Short Run or Long Run Marginal Cost is taken into account in the tariffs. All this cost information may be known by the BEODC and available to all interested parties within the REM. The relevant cost data, which are generally variable and dependent on the load profile, i.e. the power-time curves required by the buyer, could be frequently published by the BEODC, at predetermined time intervals and for typical load curves to be agreed upon among the utilities participating in the REM. It may be understood that, for equitable pricing, the power and energy prices would be desirable to be settled between marginal costs of the seller and the buyer, if this buyer is a vertically integrated utility owning production units, so that both parties may have a percentage of profit; this percentage shall be defined on the basis of offers to be submitted by the presumptive sellers.

- The BEODC must collect all the demands and offers for Short Run and Long Run Contracts at definite time intervals to be agreed upon among the countries participating in the REM. The BEODC shall be the common information center which will transmit to any interested party all necessary qualitative and quantitative information on supply, demand and transmission constraints. Furthermore, the BEODC shall establish :

  ✧ common rules defining the dispatch priority of the cross-border contracts in the countries involved, including wheeling through the networks of the REM and trade with partners outside the REM; special provisions will be necessary for the trade with partners within the EU. The definition of the access and wheeling rights as well as the corresponding priority is the most delicate issue to be solved. Anyway, any refusal of these rights must be strictly avoided. The priority issue is more difficult and needs to be considered, commonly by the REM countries on a realistic and economic basis.

  ✧ which contracts are technically possible, taking account of their dispatch priority.

  ✧ eventually, which of the technically possible contracts have tariffs within the limits defined in the aforementioned paragraph; however, the contracts which do not fulfil said criterion must also be permissible.

  ✧ which of the technically possible contracts has the lowest overall price, including fixed and variable costs.

  The contracts shall be realized under the survey of the BEODC. However, the BEODC shall not be able to oblige any party to sign any contract. The contracts shall be realized after free negotiations between buyers and sellers and the role of the BEODC shall be only informative and advisory as concerns the financial part of the contracts. Nevertheless, as concerns the technical feasibility of the contracts, the criteria of the BEODC shall be obligatory. Demands and offers may be received also from countries outside the REM. For such cases, special collaboration with the companies responsible for the operation and maintenance of the involved transmission networks outside the REM should be necessary. Nevertheless after the signature of a contract the BEODC shall supervise its fair execution. The issue of contract enforcement is also delicate and is directly related to the priority question. Fair and non discriminatory rules must be established for contract execution. The standardizations of contractual arrangements will probably help towards this direction.

- Planning of the development of the production and transmission systems which are necessary for the interconnected power system of the participating Balkan Countries, with special attention to the interconnections among these countries and the connections to the neighbouring countries. The criteria to be taken into account by the BEODC in this planning are the following:

- ✧ Self sufficiency of the proposed REM as an interconnected power system and as concerns electric power and energy consumption inside the REM. This is the basic power pool criterion.
- ✧ Security of electricity supply by taking also into account the possibilities of supply with local or imported fuel.
- ✧ Securing of minimum reliability and transient stability, protection, defence and restoration criteria as well as of criteria for short-circuit withstand, and of frequency and voltage automatic control, as analysed above.
- ✧ Promotion of the profitable electricity import or export between the countries of the REM and the neighbouring countries.
- ✧ Economic exploitation of the production and transmission systems of the participating Balkan countries.
- ✧ Promotion of the connection of Independent Power Producers, Distribution Companies and/or Eligible Clients to the transmission or distribution networks, in accordance to the realization of Short or Long Term Contracts on a competitive basis, profitable to buyers and sellers of electricity.

The BEODC shall also establish the sources of financing of the proposed development. However, the proposals of the BEODC on the development shall be considered only as advisory and not obligatory for the countries of the proposed REM. Only the proposals related to the fulfillment of the commonly agreed minimum technical feasibility criteria will be considered as obligatory.

7.3 CRITERIA FOR AN INTEGRATED EXPANSION PLANNING IN THE REGION

Coordination of operations among electric utilities is based on the physical characteristics of electric power networks, the demand placed on the transmission and distribution circuits and the methods used to monitor and control the generation and power flows on the electricity network. These electric power system properties have an important influence on the reliable operation of the interconnected power systems and the opportunities for economic benefits derived mainly from the coordination of the most efficient production units and the possible integrated expansion development of new installation and the coordinated expansion development of the generating facilities.

Today, interconnection of national electric power grids is a common practice world wide as countries try to:

- diversify generation capacity mix and meet simultaneously the increasing load demand,
- avoid building new capacity by exporting to other areas excess of production,
- diversify energy sources,
- take advantage of different load profiles,
- manage in country or regional emission of pollutants.

Successful interconnected operation with other power systems requires the utilities to have an internal *transmission capability* greater than would be needed just to move power from its own units to its own load. The interconnections must be designed to meet certain adverse conditions or contingencies which could impose heavy loads on the tie-lines. A property of the Alternating Current (AC) networks, utilized in synchronous interconnections, is that the electricity flows in the various lines depend on the characteristics of the load, the network impedance and the relative outputs of the generating units. Consequently, generator outputs are controlled not only to meet aggregate customer demand, but also to keep transmission line loads within limits. Satisfactory interconnected operation requires a utility to *control* and to *manage* its generating units in a way which not jeopardize the safe operation of its neighbours. This requires *joint analysis* of the interconnected systems and constant communication among the connected utilities so that when changes are necessary they can be effected on a coordinated basis.

In general, the greater the size of the generating units, within an interconnected system, the greater must be the strength of its transmission ties for a reliable operation. Consequently, considerable cost may be involved in establishing an effective interconnection and transmission network.

Normally, to make individual grids compatible for an interconnected mode the following practices should at least followed:

- each power system provides enough *capacity* to cover its own expected load with provisions for adequate reserve margin; however, the evolution to a power pool scheme will necessitate the evolution of this criterion towards the self-sufficiency of the joint capacity of the power pool constituted by the interconnected networks.

- each power system *operates* in such a way that it will not impose a regulating burden, i.e., will not affect interchanges of energy through *frequency* changes or cause overloading to the transmission facilities of another system.
- each power system control continuously the *balance* of generation and load.

Every national power system should have at least one modern *dispatch center* or as otherwise called Energy Control Center (ECC) to monitor and control reliably the system generation output, system frequency and power line flows within its network borders as well as in connection with the neighbouring systems.

The coordinated and, even more, the integrated operation of independent power systems for their joint benefit may involve some form of *loss* of the *individual decision* making or sovereignty from the part of the participants as well as the acceptance of certain *obligations,* both expressed or implied and some exposure to new *risks.*

Under an integrated or pooling agreement, a utility may no longer be able to plan, construct and operate its facilities in the same manner that it could prior to becoming a member of the "group". Decision making authority relating to planning, construction of new facilities and operation must to some degree be transferred from the individual utilities to the group and a power system (utility) must accept some obligations to support its fellow members. Actually that is the price that the individual utility should pay to obtain its share of the benefits of the integrated or joint operation.

However, the degree to which coordinating utilities relinquish individual control over decision making differs widely among existing coordinating groups. In general, the more "tight" integration involves larger losses of sovereignty. Therefore, provision for specific agreements should be considered in the early stages to minimize loss of control of the individual utilities within their operating areas.

The common assumption by all members of a coordinated "group" is the obligation to follow planning and operating standards and to provide mutual support under various operating conditions.

Establishing the criteria of integrated operation and development of the electric power systems in the Balkan region, as in any other part of world, it is a difficult but not impossible task. The terms of the agreements should reflect the whole range of utility concerns about coordination benefits, costs, risks, obligations, loss of individual authority and responsibility, and other matters.

Integrated operation requires mutual trust that the proper amounts of capacity and operating reserves will be maintained while good operating and maintenance practices will be observed and every effort will be made to provide assistance in case of emergencies.

Development of the Electricity Market may be aided by some period of operation under more flexible agreements that allow the necessary mutual confidence to be developed and the benefits of specific responsibility allocations to become more clear.

7.4 MARKET STRUCTURE

The market structure, namely the description of the operational framework and the existing regulations are of paramount importance. The necessity of the organizational development becomes even greater when an energy or electricity market is developed for the first time. The political and socio-economic differences among the participating countries creates additional obstacles to the formation of the regional market and requires additional measures to be taken for the realization of the Market.

In addition, the complete absence of common policies and rules to regulate the economic relations of the countries aimed to participate in the market, like the common directives, policies and rules that exist in the European Community for many years add another obstacle but it is also a great challenge for the creation of the market.

The Regional Electricity Market (REM) should have from the first moment viability and expandability. Therefore, the rules that will be enacted must be loose and flexible enough so that they do not contradict with law of National sovereignty of the participating countries in order to assure the long lasting of the REM.

On the other hand, they should not divert the development of open-market forces and the free trade of exchanges that must create the necessary pressure that will ensure the expandability of the market.

7.4.1 ORGANISATION OF THE MARKET

The basic assumption for the creation of the market is the political agreement among the member states at the highest possible political level. That political agreement will determine, and will specifically define the targets of the market and it will propose the means for its implementation. In the course of creation of the Market the contribution of the EU will be significant.

It is obvious that the operation of a high level executive Board to oversee and to forward the targets and the daily operation of the Market will be absolutely necessary.

The following section describes the general directions of that Board.

7.4.1.1 Balkan Electricity and Development Operating Center

The multinational operating Board (BEODC) of the REM will be the highest Directory of the Market where representatives of each member state will be seated to take decisions for the market.

The decisions of that Board will assure the smooth daily operation of the Market and will forward the targets of the member states based on international accepted principles for competition.

The operating Board of REM, BEODC, will cooperate under a status that in details describes the responsibilities and the procedure that has to be followed for decision, the relations of the Board with the corresponding authorities for every member state as well as the overall operating principles.

The stability and efficient operation of the predetermined Board requires members with long lasting service, for example 4 years, that during their duties will not be able to be recalled from duty unless there are exceptional reasons that will be described in details within the statute.

A very important issue that has to be resolved among the participating countries in REM is the decision process that has already been mentioned.

It is up to the governments of the participating countries to accept or reject the principle of the application that has been already decided by the Board.

However, it has to be mentioned that the principle of unanimity besides of being generally acceptable by international organizations and bodies, secures the Board especially during the first stages of operation. Of course, the right of rejection by a member state can been excluded.

It is obvious, with respect to the bilateral subjects, they cannot been asked for unanimity to both parties which have to be resolved between themselves any differences. In this case, notification or announcement of any bilateral agreements to BEODC will be beneficial for the operation of the Market while the opposite may result to operating difficulties and possible distortions of the Market.

7.4.2 SUPPORTING DEPARTMENT OF THE BEODC

The Operating Board of REM will be supported by departments filled appropriately by skillful personnel that will secure the operation, the completion of technical and economic studies, the confirmation and introduction of various, related to the market subjects.

Specifically, the following departments belong in this category:

7.4.2.1 Technical Department

Connected directly with the Dispatching centers of the member states of REM that at any instant they are well aware of the status of the Production and Transmission systems for every member of the interconnected power networks.

This Department is the conversion "place" for the Supply and Demand of electricity of the overall Market. The potential suppliers or producers of electric energy as well as the potential buyers or consumers of electricity have the right of access to the information related to quantities and prices of electric energy within the Market region.

In essence, this department will be the "creator" of the market that will offer advisory services for the best buying-selling prices among the different customers.

- It will decide for the technical adequacy required for the implementation of the contracts or for the potential accomplishment of them within a given time horizon (short-medium or long lasting).

- It will propose to the BEODC and it will observe the accomplishment of the technical characteristics of the participating systems with respect to the interconnection, the system frequency, the security, the spinning reserve and generally the fulfillment of the technical requirements and limitations of UCPTE and the potential bilateral or multilateral agreements at emergency situations.

- It will control and introduce to the BEODC the soundness of refusal of a member state of REM to implement an agreement between a potential producer (supplier) and one particular customer.

- It will introduce to the BEODC methodologies for the pricing and the utilization of the networks and measuring the energy transfer based on a common and acceptable manner.

- It will introduce and develop a common and acceptable "Code of Operation" of the power systems participating in the REM.

- It will control and introduce measures with respect to the environment and it will secure the imposed constraints that have be accepted by the member states.

7.4.2.2 Commercial Department.

It will observe the operation of the market from the commercial point of view, the value of transactions and it will offer advisory services to the interested parties for the operation and efficiency of the contracts.

- Based on commonly accepted criteria confirms and clears transactions among producers and consumers.

- It will introduce to the BEODC the scope, the level and the manner of opening the Market.

- It will follow, investigate and introduce the reliability of the exchanging system that supports the transactions of the member states.

7.4.2.3 Planning Department.

It is an advisory department that is publishing regularly elements of the systems as well as the overall operating procedures of REM, like:

a) Energy balances and economic data,

b) Electricity demand forecasting,

c) Proposals, for development of the production systems,

d) Proposals for developing Transmission and Interconnection networks,

e) Proposals for interconnection and exchanges with neighbouring networks or pools.

- It will study any subject that is given by the Board having technico-economic nature.

- It will study and introduce to the BEODC measures of collaboration with the Commercial Department for the reduction of costs from the impacts of the power sector reform.

7.4.2.4 Legal Department

- It will design, study and introduce to the BEODC the formation of the institutional frame of REM.

- It will design study and introduce binding and commonly accepted rules for a step by step materialization of REM etc. Directives analogous to the 90/547 of **EU** for the transferring of electric energy through Transmission Networks may be considered as the first step for the implementation of the REM.

- It will study and propose advisory services for the member states through the BEODC institutional regulation for the control and the transparent operation of the electricity sector as well as the adaptation of the legislations to the minimum commonly acceptable level of REM.

- Other issues that the legal department will be envolved are:

  * Enviromental considerations.

  * Security of supply.

  * compatibility of the REM rules with the EU Internal Electricity Market Rules; this issue is related to the double membership of one or more partners.

  * Legality of the Contracts .

  * Enforceability of the Contracts.

  * Multilateral or Model Supply Contracts.

  * Other legal issues, such as:

    - Transitional period considerations.

    - Competion and anti-monopoly rules.

    - Constitutional law issues.

    - Exchange of electricity between countries in cases of emergency.

- Public service obligations, i.e.:
  - ✓ Obligation of supply.
  - ✓ Public Service pricing.

* Renewable energy issues.
* Analysis of the regulatory system and of the respective regulatory bodies.
* Uniform accounting principles and safeguards.

7.4.2.5 Administration Department

- It will support the administrative matters for the operation of the REM.
- It will follow and introduce to the BEODC the basic criteria and procedures for the participation in the REM of the Member States and their utilities, as well as of the IPPs and the Eligible Customers in accordance with the principle of subsidiarity.

7.4.3 ARBITRATION

This is an independent multinational Department responsible to deal exclusively with the disputes among the participating members of the REM.

If the decisions taken by the arbitrator are not accepted to be binding, for general political or other reasons, then they will be a valid testimony for any differences to be resolved in front of any international court.

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APPENDIX A

The ratios were examined are distinguished to ratios for the economic situation of the country, ratios related to sales and turnover of electricity and ratios which characterize the economic and financial situation of the undertakings.

These ratios are:

a) Ratios for the economic situation of the country	
• Growth of the gross domestic product	(Ratio 1.1)
• Evolution of the general consumer price index	(Ratio 1.2)
b) Ratios related to the sales and turnover of electricity sales	
• Evolution in volume of invoiced electricity	(Ratio 1.3)
• Evolution in KWh sales price, before tax and the corresponding ratio of the total sum billed in electricity invoices to the number of Kwh supplied.	(Ratio 1.4)
c) Ratios related to the economic and financial situation of the undertaking	
• ratio of investment in the electricity supply sector to its turnover	(Ratio 1.5)
• ratio of fixed assets to total assets	(Ratio 1.6)
• ratio of equity to total liabilities	(Ratio 1.7)
• ratio of dept to equity	(Ratio 1.8)
• ratio of total debt to total liabilities	(Ratio 1.9)
• ratio of financial charges to turnover	(Ratio 1.10)
• ratio of indebtedness at the end of fiscal year to turnover	(Ratio 1.11)
• ratio of debt servicing to turnover	(Ratio 1.12)
• ratio of earnings after interest to equity (or Financial profitability)	(Ratio 1.13)
• ratio concerning the internal resources to the financial needs.	
It indicates the share of self financing, capital contributions by owners and other resources (Government e.t.c.) except loans	(Ratio 1.14)
• Liquidity ratio, expressed by the ratio of current assets to current liabilities	(Ratio 1.15)
• Cost of capital	(Ratio 1.16)
This ratio is the sum of Financial cost to sum of Debt plus capital and reserves	

APPENDIX B

Financial Statements of KESH (Albanian Power Corporation) - ALBANIA

Income Statements 1992-1993 (In Leks' Million)

(At 1993 prices)

	(Actual) 1992	(Actual) 1993
REVENUES		
Total Revenue	3,772	3,934
EXPENSES		
Total Production and Supply of Electricity	747	1,522
Production of Steam and Other Operations	668	902
Total Operating Expenses (before Tax)	**1,415**	**2,424**
Total taxes	1,320	1,141
Total Operating Expenses (After Tax)	2,733	3,565
Operating income	1,037	369
Capital charges	0	7
NET INCOME	**1,037**	**362**
Total Provisions	208	57
RETAINED EARNINGS	**829**	**305**

Albanian Power Corporation (KESH)-ALBANIA

Balance Sheets (In Leks' Million)

(At 1993 prices)

	(Actual)	(Actual)
	1992	1993
ASSETS		
Fixed Assets		
Total Fixed Assets	5,757	6,669
Total Current Assets	2,709	3,372
TOTAL ASSETS	**8,466**	**10,041**
EQUITY AND LIABILITES		
Total Equity	6,774	7,680
Total Provisions	71	128
Total Long - Term Debt	9	825
Total Current Liabilities	1,612	1,408
TOTAL EQUITY AND LIABILITIES	**8,466**	**10,041**
*100 LEKS/US $		

Albanian Power Corporation (KESH)-ALBANIA

Sources and Application of Funds (In Leks' Million)

(At 1993 prices)

	(Actual) 1992	(Actual) 1993
SOURCES OF FUNDS		
Total Internal Cash Generation	1,196	545
External Sources	421	601
Total Debt	0	816
Total External Sources	421	1,417
Decrease (Increase) in Working Capital	(643)	172
TOTAL SOURCES OF FUNDS	**974**	**2,134**
APPLICATION OF FUNDS		
Total Application of funds	974	2,134

NEK - BULGARIA

BALANCE SHEET as of December 31,1995

	1994	1995
ASSETS	**thousand BGL**	**thousand BGL**
A. Long term assets		
1. Tangible assets	96,465,257	99,123,989
2. Intangible assets	47,768	89,472
3. Financial assets	83,415	231,147
TOTAL A	**96,596,440**	**99,444,608**
B. Current assets		
1. Tangible stocks	5,449,090	11,031,876
2. Receivables	6,940,280	11,070,632
3. Finances	1,399,984	3,118,117
4. Deffered costs	150,319	427,887
TOTAL B	**13,939,673**	**25,648,512**
C. Receivables on registered share installments	-	-
D. Loss	**4,222,590**	**6,072,379**
TOTAL ASSETS	**114,758,703**	**131,165,499**
E. Off balance sheet assets	97,514	1,217,052
LIABILITIES		
A. Equity capital		
1. Fixed capital	100,962,688	101,021,293
2. Special reserve	3,950	12,557
3. Reserve capital	3,655	3,806
TOTAL A	**100,970,293**	**101,037,656**
B. Borrowed capital		
1. Loans	5,205,418	8,064,906
2. Payables	6,181,102	18,644,607
3. Financing	2,265,250	3,343,603
TOTAL B	**13,651,770**	**30,053,116**
C. Deffered revenue	**136,640**	**74,727**
TOTAL LIABILITIES	**114,758,703**	**131,165,499**
D. Off balance sheet liabilities	97,514	1,217,052

NEK - BULGARIA

STATEMENT OF REVENUE AND EXPENSES OF NEK as of December 31, 1995

	1994	**1995**
EXPENSES	**thousand BGL**	**thousand BGL**
I. Ordinary costs	29,385,920	43,444,180
II. Financial costs	2,174,444	2,003,672
III. Extra charges	1,867,631	3,508,730
IV. Taxes	-	1,199,116
TOTAL EXPENSES	**33,427,995**	**50,155,698**
V. Current profit	**-**	**-**
TOTAL	**33,427,995**	**50,155,698**
REVENUES		
I. Ordinary revenues	27,955,448	46,582,493
II. Financial revenues	404,668	423,079
III. Extra revenues	1,107,466	1,300,337
TOTAL EXPENSES	**29,467,582**	**48,305,909**
IV. Current loss	**3,960,413**	**1,849,789**
TOTAL	**33,427,995**	**50,155,698**

ELEKTROSTOPANSTVO NA MAKEDONIJA - FYROM

BALANCE SHEET

As at 31 December 1995

(In thousand of Denars)	**1995**
CAPITAL AND RESERVES	
Social capital	35,363,307
Domestic permanent investments	10,619
Revaluation reserve	1.134,404
Retained earnings	118
Uncoverred loss	(423,584)
TOTAL CAPITAL AND RESERVES	**36,084,864**
Capital formation for development	1,474,754
LIABILITIES	
LONG-TERM LIABILITIES	
Long-term debt	1,399,197
TOTAL LONG-TERM LIABILITIES	**1,399,197**
CURRENT LIABILITIES	
Short term debt	1,354,208
Trade payable	682,629
Current portion of long term debt	174,566
Other current liabilities	302,344
TOTAL CURRENT LIABILITIES	**2,513,747**
TOTAL LIABILITIES	**3,912,944**
TOTAL OPERATING LIABILITIES	**41,472,562**
NON-OPERATING LIABILITIES	
Resources for housing purposes	181,910
Resources for other purposes	63,191
Other non operating liabilities	455
TOTAL NON-OPERATING LIABILITIES	**245,556**
TOTAL LIABILITIES	**41,718,118**

ELEKTROSTOPANSTVO NA MAKEDONIJA - FYROM

BALANCE SHEET

As at 31 December 1995

(In thousand of Denars)	**1995**
ASSETS	
NON-CURRENT ASSETS	
Investment	755,025
Fixed assets	35,636,660
Deposits for capital expenditure	200,736
Long-term borrowings	3,612
TOTAL NON-CURRENT ASSETS	**36,596,033**
CURRENT ASSETS	
Inventories	1,578,052
Payment in advance	418,161
Trade receivables	2,496,253
Other current assets	46,236
Cash	249,973
Internal balances	83,041
TOTAL CURRENT ASSETS	**4,871,716**
TOTAL OPERATING ASSETS	**41,467,749**
NON-OPERATING ASSETS	
Collective consumption assets for housing purposes	182,446
Collective consumption assets for other purpose	67,486
Other non-operating assets	437
TOTAL NON-OPERATING ASSETS	**250,369**
TOTAL ASSETS	**41,718,118**

ELEKTROSTOPANSTVO NA MAKEDONIJA - FYROM

PROFIT AND LOSS ACCOUNT

For the year ended 31 December 1995

(In thousand of Denars)	**1995**
SALES	
Distribution	6,538,289
Direct consumer	1,454,329
TOTAL SALES OF ELECTRICITY	**7,992,618**
Other	997,214
TOTAL SALES	**8,989,832**
OPERATING EXPENSES	
Depreciation	2,778,996
Revaluation of depreciation	45,256
Salaries and wages	2,204,811
Mining expenses	814,868
Capital formation for development	799,262
Maintenance	801,747
Material expenses	669,878
Insurance	638,561
Spare parts	493,624
Services	320,181
Electricity purchases	154,015
Cost of commodities sold	125,288
Fuel	30,326
Other	387,131
TOTAL OPERATING EXPENSES	**(10,263,944)**
OPERATING LOSS	**(1,274,112)**

ELEKTROSTOPANSTVO NA MAKEDONIJA - FYROM

PROFIT AND LOSS ACCOUNT

For the year ended 31 December 1995

(In thousand of Denars)	**1995**
OTHER INCOME	**1,327,286**
Interest receivable	390,184
Profit on exchange	133,474
Collected written off receivable	667,593
Sundry	136,035
OTHER EXPENSES	**476,722**
Interest expenses	201,661
Losses on exchange	71,252
Provision for bad debts	162,548
Sundry	41,261
LOSS BEFORE TAXES	**(423,548)**
TAXES	**(36)**
LOSS	**(423,548)**

ELECTROPOWER COMPANY OF MACEDONIA - FYROM

INFLATION ADJUSTED BALANCE SHEET AS AT 31ST DECEMBER 1994

	1994	1993		1994	1993
	Den.000	Den.000		Den.000	Den.000
ASSETS			**LIABILITIES**		
CURRENT ASSETS			**CURRENT LIABILITIES**		
Bank balances and cash	181408	102955	Bills payables	135366	56011
Bills receivables	15262	7394	Trade payables	205536	549524
Trade receivables	1811893	1166131	Customers' prepayment, deposits		
Payments in advance	568083	244921	and downpayments	428496	153045
Short term finance receivables	140	15	Short term financial liabilities	492075	293126
Other current receivables	7254	1851	Current portion of long term loans	224997	280789
Prepair expenses	188	5461	Accrued expenses	46608	233876
Inventories	1104007	526427	Other current liabilities	204172	105308
Total current assets	3688235	2055155	Total current liabilities	1737250	1671679
LONG-TERM BORROWINGS	3901	4655	**LONG TERM LOANS**	1766032	2131206
OBLIGATORY BORROWINGS AND INVESTMENTS	435	431	**LONG TERM PROVISION**	675493	36858
INVESTMENTS	83539	84879			
DEPOSITS FOR CAPITAL			**RESERVES**		
EXPENDITURES	153477	9223	Legal, statutory and free reserves	255	0
				118	
				383	

(Continued)

FIXED ASSETS					
Cost of valuation	69262012	52661402	SOCIAL CAPITAL		
Less Accumulated depreciation	33755507	24207818	(BUSINESS FUND)	35262150	26777232
Net book value	35506505	28453584			
INTANGIBLE ASSETS	0	1564	UNCOVERED LOSS	0	0
Total operating assets	39436092	30609491	Total operating liabilities	39441358	30616975
NON OPERATING ASSETS			NON-OPERATING LIABILITIES		
Collective consumption assets for housing purposes	94135	68276	Resources for housing purposes 16	92188	64598
Collective consumption assets for other purpose	68059	52940	Resources for other purpose 16	63952	48704
Other non operating assets	0	0	Other non operating liabilities	436	430
Total non operating assets	162242	121216	Total non operating liabilities	156776	113772
TOTAL ASSETS	39598334	30730708	TOTAL LIABILITIES	39598334	30730708

PUBLIC POWER CORPORATION - GREECE

BALANCE SHEET DEC 31 1995

ASSETS	**1995**	**1994**
(In thousand Drs.)		
Installation Expenses		
Organisation Expenses	93,298,259	86,082,651
Deferred Exchange Parity Differences	90,537,986	143,691,372
Interest During Construction	54,679,387	38,641,516
Other Installation Expenses	1,002,087	948,153
Less:Accumulated Depreciation	(78,743,092)	(62,640,214)
Total Installation Expenses	**160,774,627)**	**206,723,478**
Fixed Assets		
Land	45,857,965	45,364,243
Mines	11,089,772	11,089,772
Buildings	245,425,693	236,185,569
Machinery & Plant Equipment	1,320,079,730	1,212,019,784
Vehicles	13,113,221	12,870,485
Furniture & Fixtures	40,763,983	37,753,167
Construction in Progress & Prepayments	407,712,443	350,903,964
Less: Accumulated Depreciation	(754,206,681)	(685,141,329)
Total Fixed Assets	**1,329,836,126**	**1,221,045,655**
Current Assets		
Stores	154,425,519	140,677,045
Receivables	205,340,711	177,237,430
Doubtful Debtors	19,480,819	26,982,542
Securities	49,669,577	39,300,142
Cash	1,052,336	1,522,423
Bank Deposits	19,584,763	19,336,595
Total Current Assets	**449,553,725**	**405,056,177**
Deferred Debit Accounts		
Deferred Expenses	72,426,356	59,386,037
Total Deferred Debit Acc.	**72,426,356**	**59,386,037**
TOTAL ASSETS	**2,012,590,834**	**1,892,211,347**
TOTAL DEBIT CONTRA ACC.	**201,648,172**	**161,355,911**

PUBLIC POWER CORPORATION - GREECE

BALANCE SHEET DEC 31 1995

LIABILITIES	**1995**	**1994**
(In thousand Drs.)		
Capital		
Own Funds	65,872,408	65,872,408
Revaluation Adjustments of Fixed Assets	222,333,491	222,333,491
Revaluation Adjustments of Securities	39,810	32,523
Subsidized Capital	272,138,591	246,305,479
Retained Earnings	45,341,441	6,651,245
Total Capital	**605.725.741**	**541.195.146**
Provisions		
For Personnel Retirement	9,500,000	7,200,000
Other	27,619,606	16,020,989
Total Provisions	**37,119,606**	**23,220,989**
Debt		
Long Term Bond Issues	474.691.800	432,977,251
Long Term Bank Loans	529,667,721	518,852,096
Total Long Term Debt	**1,004,359,521**	**951,829,347**
Notes Payable	239,307	528,369
Short Term Bank Loans	103,514,881	131,834,824
Bonds Payable	23,238,040	75,216,383
Total Short Term Debt	**126,992,228**	**207,579,576**
Suppliers	48,604,095	45,382,010
Customers' Advances	53.903.689	46.614.160
Taxes and Duties Payable	44,408,721	1,198,795
Social Security Organizations	3,171,291	2,163,436
Other Creditors	64,946,473	52,397,936
Other Short Term Liabilities	**215,034,269**	**147,756,337**
Total Debt	**1,346,386,018**	**1,307,165,260**
Deferred Credit Accounts		
Deferred Income	722,018	347,115
Accrued Expenses	22,637,451	20,282,837
Total Deferred Credit Acc.	**23,359,469**	**20,629,952**
TOTAL LIABILITIES	**2,012,590,834**	**1,892,211,347**
TOTAL CREDIT CONTRA ACC.	**201,648,172**	**161,355,911**

PUBLIC POWER CORPORATION - GREECE

INCOME STATEMENT 1995

(In Thousand Drs)		
Operating Results	**1995**	**1994**
Turnover	685,451,333	605,376,311
Cost of Sales	(310,874,475)	(281,323,785)
Gross Profit on Sales	**374,576,858**	**324,052,526**
Other Operating Income	6,193,940	4,432,291
Total	**380,770,798**	**328,484,817**
Operating Expenses	(198,347,270)	(162,705,121)
Subtotal operating Profit	**182,423,528**	**165,779,696**
Income from Securities & Interest	16,152,130	7,868,775
Financing Expenses	(94,822,938)	(81,004,549)
Total Operating Profit	**103,752,720**	**92,643,922**
Non Operating Results		
Extraordinary & Non Operating Income	32,379,180	19,9545,627
Extraordinary & Non Operating Expenses	(77,011,024)	(103,248,097)
Total Non Operating Profit-Loss	**(44,631,844)**	**(83,302,470)**
Operating & Non Operating		
Profit - Loss	**59,120,876**	**9,341,452**
Less:		
Total Depreciation	85,369,307	78,364,551
Less:		
Depreciation in Operating Cost	(85,369,307)	(78,364,551)
Total Profit Before Taxes-Loss	**59,120,876**	**9,341,452**

PUBLIC POWER CORPORATION - GREECE

SOURCE & APPLICATION OF FUNDS

USE OF FUNDS	**1995**	**1994**
	(Inmillion Drs.)	
Investments	193,968	155,944
Price Escalation of Past Year	2,349	17,539
Change of Working Capital	(2,630)	11,809
Sinking Funds (Loan Repayments)	191,705	156,875
Interest During Construction	16,038	18,060
Payment of Income Tax	-	-
TOTAL USE OF FUNDS	**401,430**	**360,227**
SOURCE OF FUNDS		
1. Own Funds		
Net Operating Proceeds	216,732	200,877
State Contributions	105	332
E.U. Contribution	11,908	14,069
Subtotal of Own Funds (1)	**228,745**	**215,278**
2. Borrowing		
Contractors' Credits	465	8,276
E.I.B. Loans	6,900	14,124
Additional Borrowing from Other Sources	165,320	122,549
Subtotal of Borrowing (2)	**172,685**	**144,949**
TOTAL SOURCE OF FUNDS	**401,430**	**360,227**
NET ANNUAL BORROWING	**(19,020)**	**(11,926)**
(Total Borrowing less Sinking Funds		

RENEL - ROMANIA

BALANCE SHEET 31 DECEMBER 1995

ASSETS

INTANGIBLE ASSETS	**No. range**	**millions lei**
Research charges	1	46
Other assets	2	3,382
New intangible assets	3	392
TOTAL (1 to 3)	4	3,820
TANGIBLE ASSETS		
Land	5	170
Buildings	6	1,318,498
Special buildings	7	17,199,776
Transport assets	8	5,218,061
Other tangible assets	9	215,639
New tangible assets	10	2,717,458
Total (5 to 10)	11	26,669,602
FINANCIAL ASSETS	12	9,379
TOTAL FIXED ASSETS	**13**	**26,682,801**
STOCKS	14	559,773
RECEIVABLES	15	1,388,367
CASH & CASH EQUIVALENTS	16	209,821
OTHER	17	607,571
TOTAL CURRENT ASSETS	18	2,765,532
REGULARISATION ACCOUNTS	19	1,061,464
TOTAL ASSETS	**21**	**30,509,797**
LIABILITIES		
CAPITAL	22	25,632,826
Reserves	23	72,845
Profit	24	3,713
Profit allocation	25	615
Funds	26	887,472
Allocation to development fund	27	184,882
Subventions for investments	28	22,838
TOTAL OWN CAPITAL	**29**	**26,434,197**
RESERVES	30	13
PAYABLES	31	1,738,876
LOANS	32	1,781,736
OTHER	33	550,282
TOTAL CURRENT LIABILITIES	**34**	**4,070,907**
REGULARISATION ACCOUNTS	35	4,693
TOTAL LIABILITES	**40**	**30,509,797**

RENEL's financial highlights-ROMANIA

PROFIT AND LOSS ACCOUNT AT 31.12.1995

	No. range	millions lei
Merchandise sold	1	63,130
Production sold	2	4,958,487
Turnover (1+2)	3	5,021,617
Revenues from stocked production	4	60,704
Revenues from assets production	5	52,916
Operating production (2+4+5)	6	5,072,107
Other operating revenues	7	22,631
TOTAL OPERATING REVENUES (3+4+5+7)	**8**	**5,157,868**
Expenses for merchandise	9	64,529
Expenses for row materials	10	1,772,031
Expenses with materials	11	238,173
Expenses with energy, water	12	96,096
Other material expenses	13	766,989
Total material expenses (10 to 13)	14	2,873,289
Services from others	15	512,759
Taxes	16	335,199
Payroll & overhead	17	651,166
Social ensurance	18	211,851
Other operating expenses	19	106,896
Provisions & depreciation	20	318,352
TOTAL OPERATING EXPENSES (9+14TO20)	**21**	**5,074,041**
OPERATING PROFIT (8-21)	**22**	**83,827**
Revenues from participations	23	1
Revenues from exchange rates	24	4,551
Revenues from interest	25	9,608
Other financial revenues	26	845
Revenues from provisions	27	15
TOTAL FINANCIAL REVENUES (23 to 27)	**28**	**15,020**
Expenses from exchange rates	29	23,336
Interest	30	54,962
Other financial expenses	31	819
Provision & depreciation	32	13
TOTAL FINANCIAL EXPENSES (29 to 32)	**33**	**79,130**
FINANCIAL LOSSES (28-33)	**34**	**-64,110**
CURRENT EXERCISE PROFIT (22+34)	**35**	**19,717**
EXCEPTIONAL REVENUES	36	14,418
EXCEPTIONAL EXPENSES	37	30,422
EXCEPTIONAL LOSSES (36-37)	**38**	**-16,004**
TOTAL REVENUES (8+28+36)	39	5,187,306
TOTAL EXPENSES (21+33+37)	40	5,183,593
TOTAL PROFIT (39-40)	41	3,713

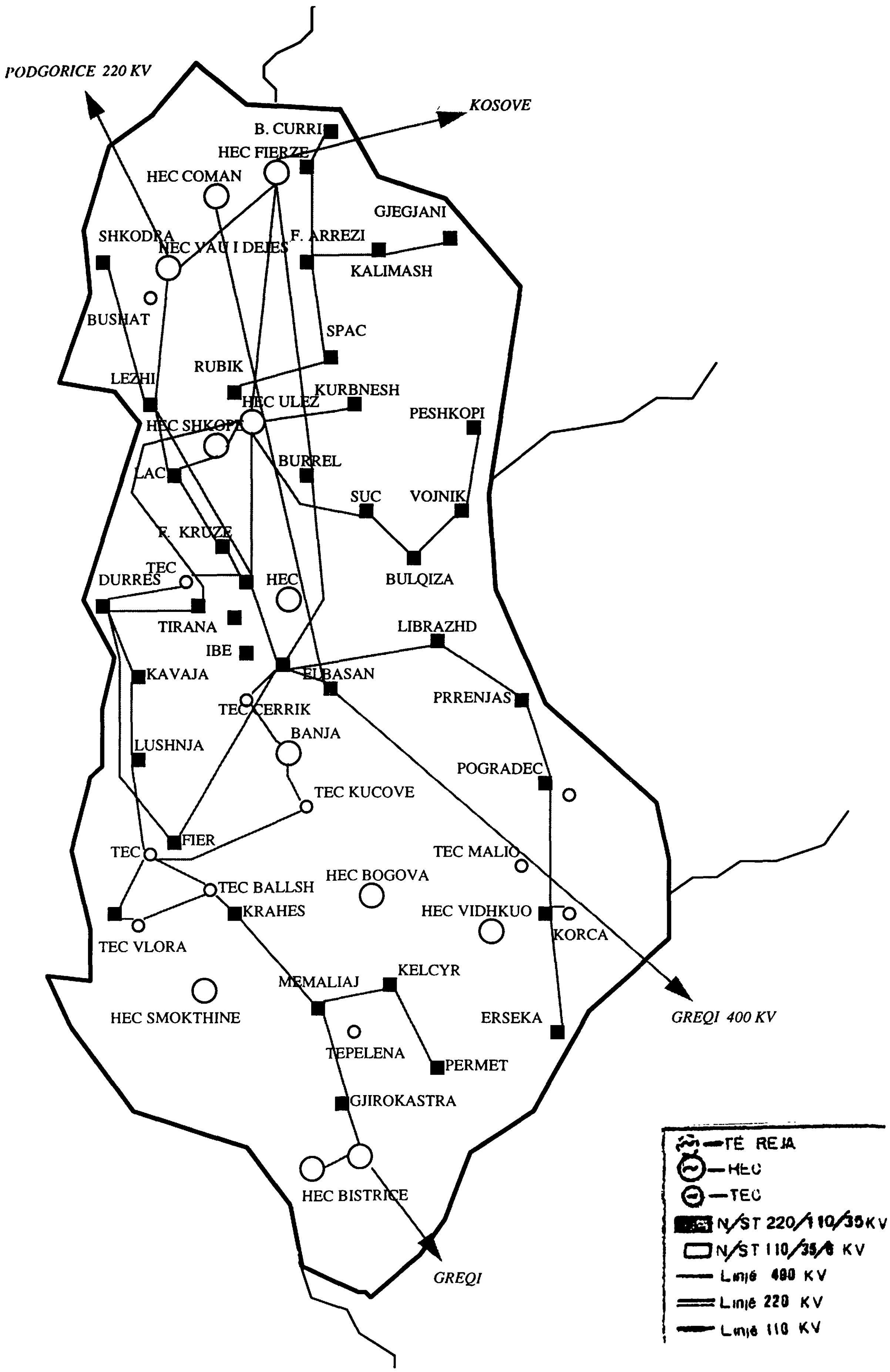

Figure 3.3. The Electric energy system of Republic of Albania

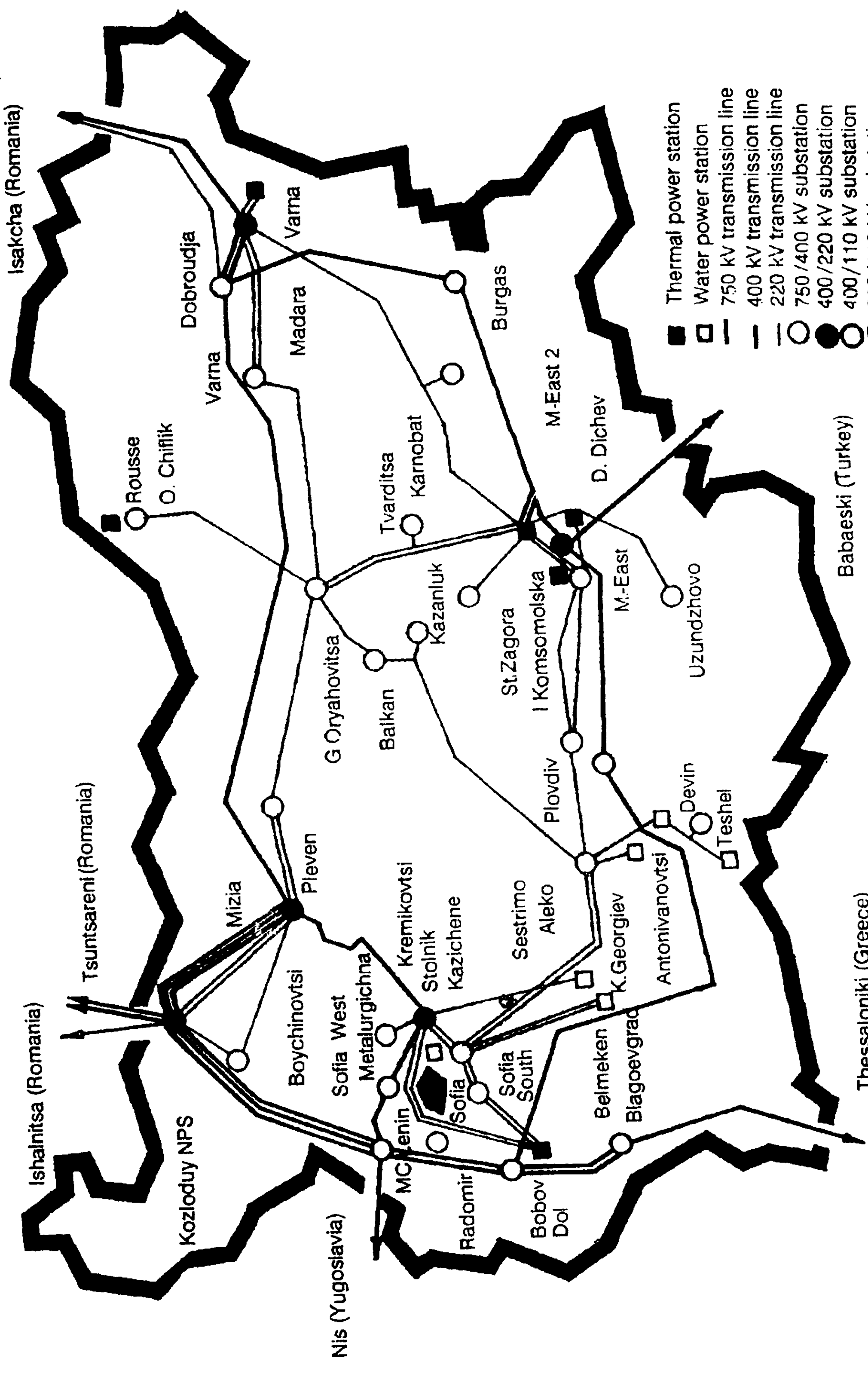

Figure 3.6. The Electricity Energy System of Bulgaria

Figure 3.9. The electric energy system of FYROM

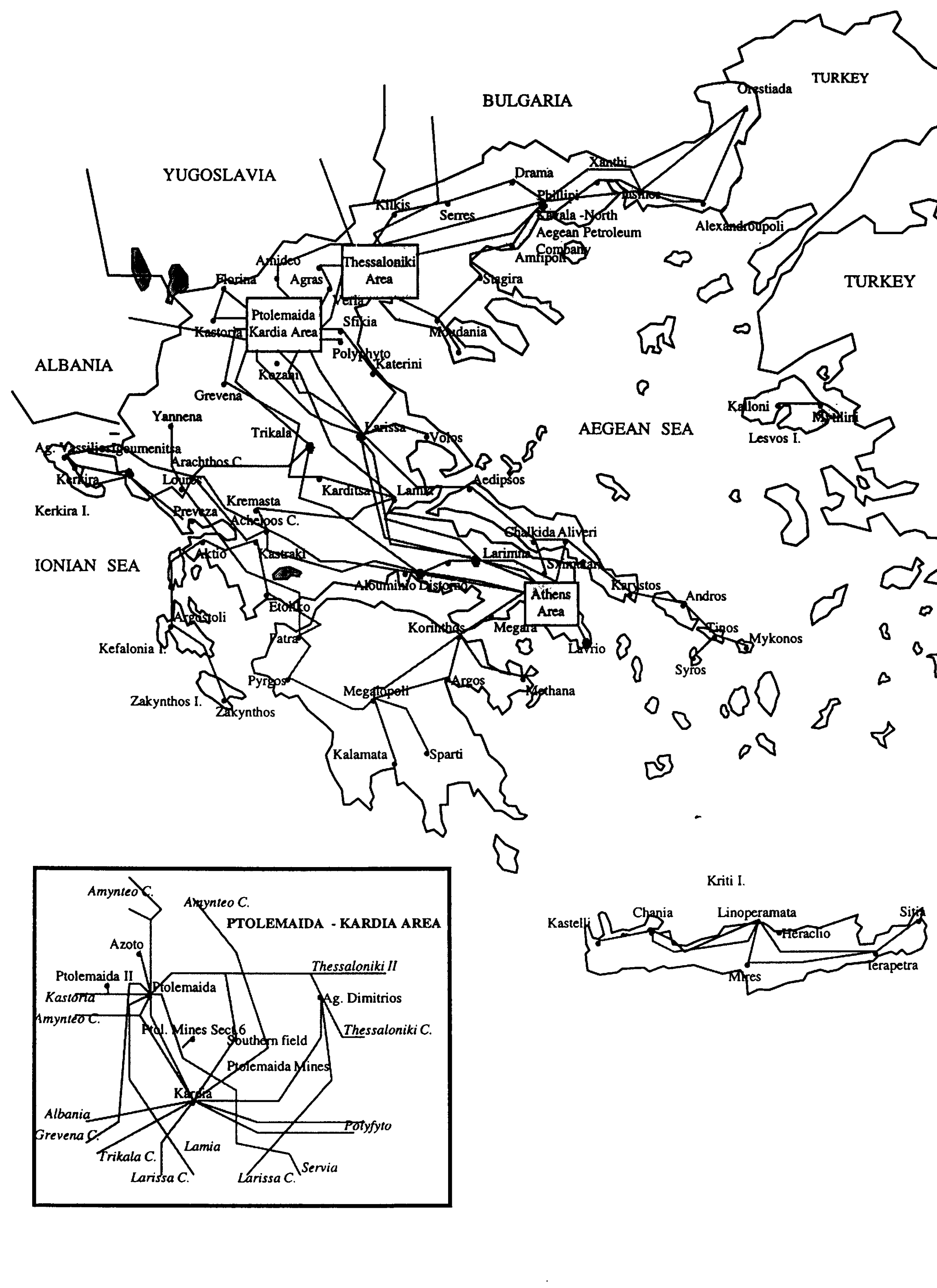

Figure 3.12. The Electric Energy System of Greece

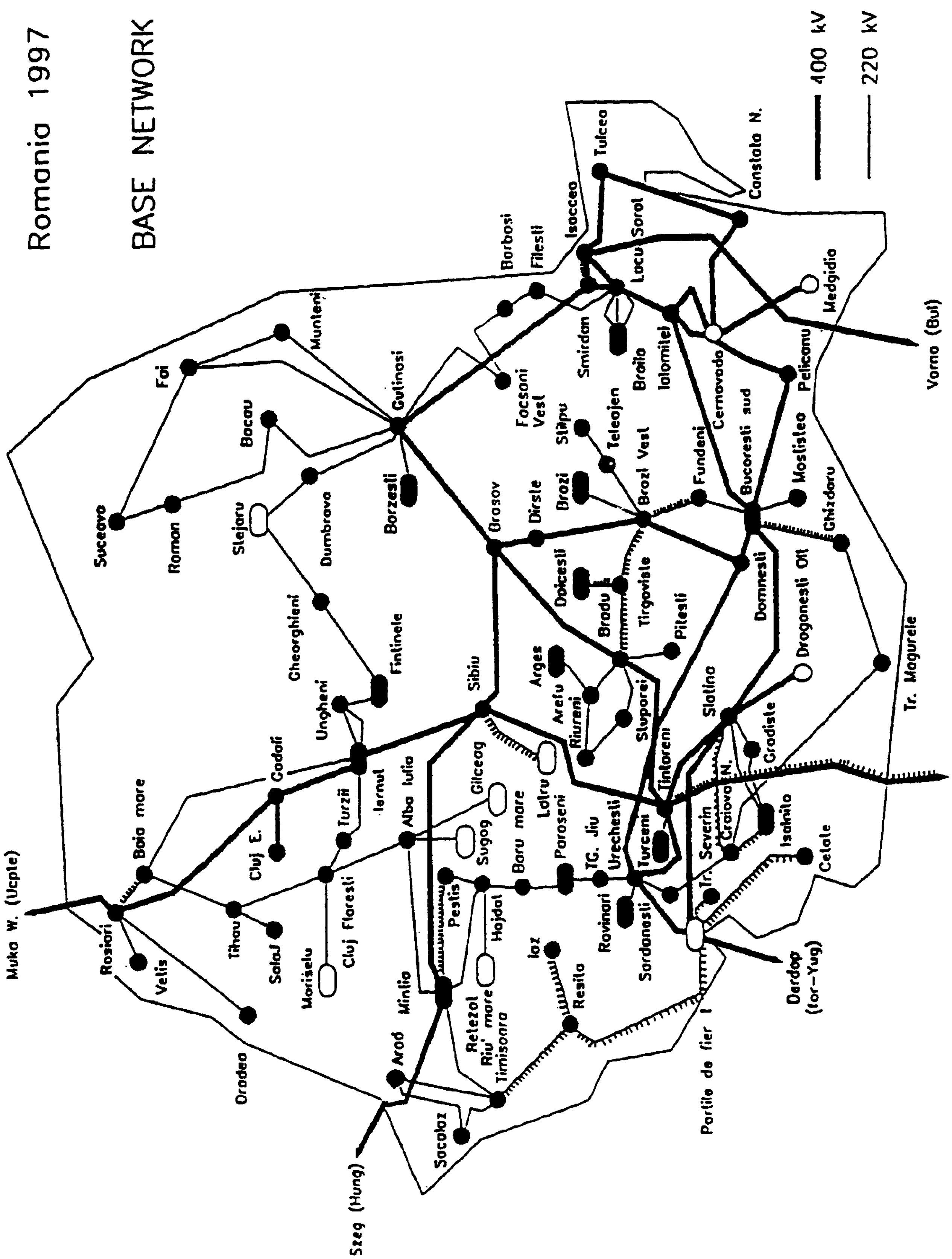

Figure 3.15. The electric Energy System of Romania

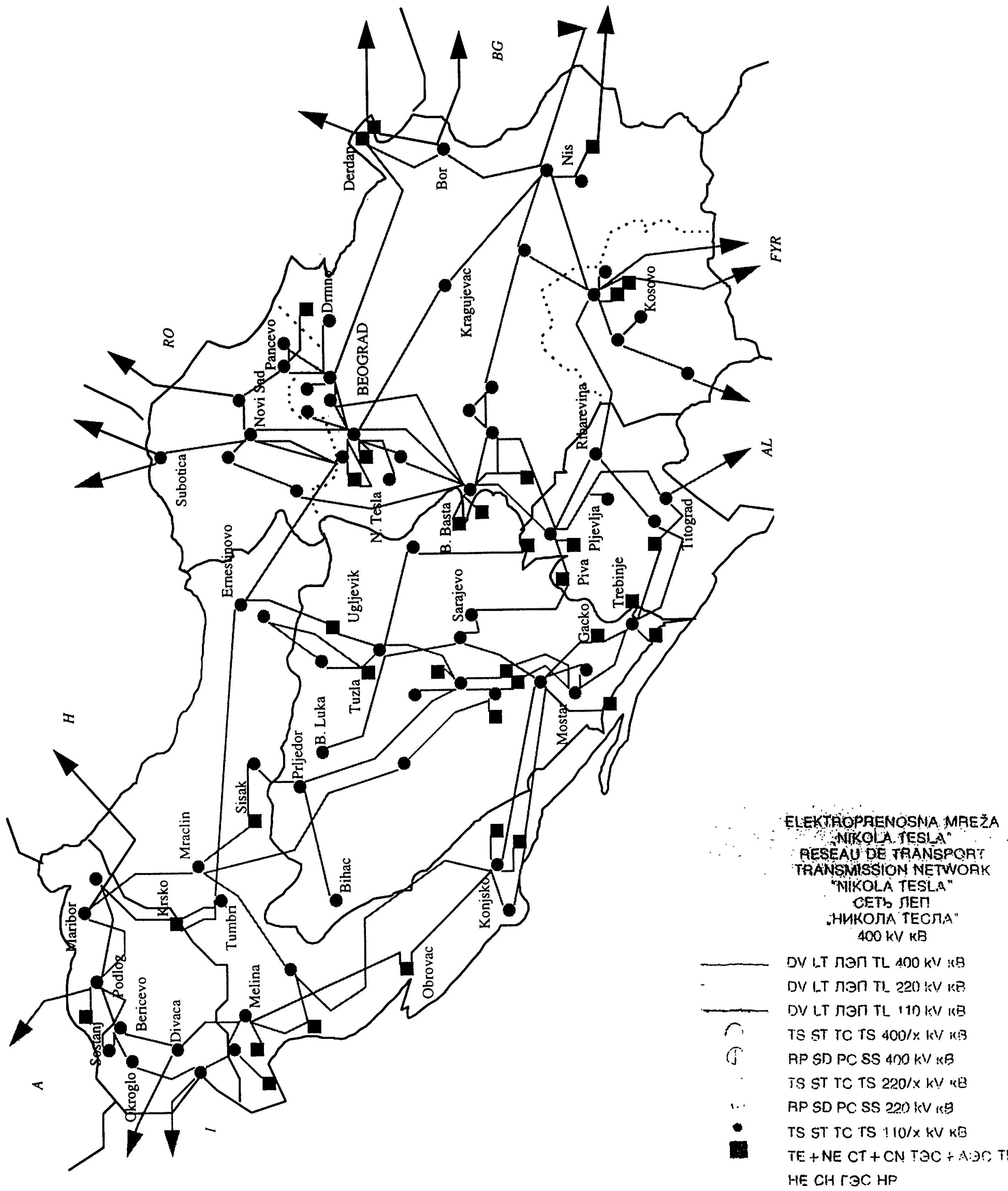

Figure 3.18. The electric energy system of Former Yugoslavia

European Commission

Prospects for the development of a peripheral electricity market in the Balkan region

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