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CENTREL Regional Activities
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Report on Review of Available CENTREL Documents – Task 2.1

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Task 2 1 - Report on Review of Available CENTREL Documents

COUNTRY CENTREL Regional
PROJECT Energy Efficiency in CEE and the Baltics
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Introduction to Report

This report summarizes the set of documents, listed in Table 1 below, which are pertinent to the subject of regional coordination, power pooling, deregulation and privatization and energy markets

The power systems of the CENTREL countries are in a transitional state with the final structure and organization of the power industry not fully defined Therefore, this report represents a snapshot of the situation as of mid 1997, Furthermore, all four countries are in the process of modifying/developing the Energy Laws and are also planning to harmonize with the Energy Laws of the European Union these developments should be monitored in order to get the most up-to-date status This summary highlights key points and provides some essential background, however, for more details the original documents must be consulted

The documents reviewed for this report are listed in Table 1

Table 1 LIST OF CENTREL RELATED DOCUMENTS REVIEWED

No	Title	Date (???)	999999
1	Report - CENTREL and VEAG Power System - Autonomous Parallel Trial Operation	December 1993	931200
2	Cooperation of the Polish, Czech, Slovakian, and Hungarian	May 1994	940500
3	Preparation and Implementation of the Control Response Capability Tests for Isolated CENTREL and VEAG power system in Dynamic and Static Operational Conditions	Ladislav SVARC undated	930900
4	Information on CEZ		
5	CEZ Annual Report	1992	920000
6	Polish Power Grid Co Presentation at Budapest	11 May 1994 ?	940511
7	Slovenia Power System	11 May 1994	940511
8	SEP Annual Report	1992	920000
9	MVM Annual Report	1992	920000

10	Polish Power Grid 1992 Annual Report	1992	920000
11	Energy Accounting and Control Center in Warsaw	Ireneusz RADZIO	970000
12	MVM CENTREL UCPTE	15 October 1995	951015
13	CEZ Annual Report	1995	950000
14	Hungarian Electricity Law	6 April 1994	940406
15	New Organizational Structure of CENTREL	21 October 1996	961021
16	Results of the CENTREL and VEAG Power System Autonomous Parallel Trial Operation (2 copies)	29 Sept 1993	930929
17	Demonopolization and Privatization of the Polish Power Sector	1996	960000
18	CEZ Annual Report	1995	950000
19	MVM Statistical Data for 1995	1996	960300
20	CENTREL 1995 Annual Report	1995	950000
21	Seminar CENTREL/VEAG (by VEAG in German)	March 8 1994	940308
22	Cooperation of the Polish, Czech, Slovakian and Hungarian Power Systems CENTREL	June 1994	940600
23	Catalogue of Measures for the Integration of the MVM, CEZ, SEP, PSE into UCPTE	June 1992	920600
24	Preparatory Calculations for a trial Operation	Gabor Tari of CALCAG	920000
25	Papers from the Conference in Budapest on 13-15 November 96 1 The first new interconnection between CENTREL and UCPTE 2 UCPTE interconnection of the CENTREL System 3 Restructuring and Marketing Opening Tendency in the Electric Supply Industry in Hungary 4 The development of the international interconnections of the Hungarian transmission grid	November 13 1996	961113
26	Discussion Paper Regarding CENTREL Regional Electric Regulatory Issues	Bechtel Consulting, September 1 1997	970901
27	Power Sector in Poland- Present state of Regulatory Reform	M Zerka, July 1997	970700
28	The Act of 10 April 1997 - Energy Law	Poland - April 10 97	970410
29	Slovak Republic - Energy Policy of the State and Regulations of Natural Monopolies	July 20-31 1997	970720
30	Understanding when and to what extent Polish Energy Markets will be Liberalised	Marek Zerka PPG 23-25 June 1997	970623
31	UCPTE Interconnection of the CENTREL Systems	same as 25-2	
32	Directive 96/92/EC of the European	Brussels 19 December	961219

	Parliament and of the Council of 19 December 1996 Concerning Common Rules for the Internal Market in Electricity	1996	

Historical Background

The Polish, Czech, Slovakian, and Hungarian power systems are located at the border of the two large European power systems, the UCPTE (interconnected power system of the West European countries) and the former CDO-IPS (interconnected power systems of the former COMECON countries with the Central Dispatch Office -CDO- in Prague) Prior to the early 1990's they were operating in parallel with the CDO-IPS via interconnections with Ukraine, Romania and Serbia Interconnections with UCPTE were via DC lines to Germany, Austria or via normally open ac lines The Polish and Czech power systems were also interconnected via ac lines to the East German (German Democratic Republic) power system This CPO-IPS network is illustrated in Figure 1(All figures are in Appendix B)

The CDO-IPS (Central Dispatching Organization of the Interconnected Power System) was founded in 1962 in order to improve the cooperation among the COMECON countries of the continent The governments of Bulgaria, Czechoslovakia, East Germany, Hungary, Poland, Romania, and the Soviet Union established a central dispatching office in Prague From 1962 to 1978 only the power system of western Ukraine of the Soviet Union worked in parallel with the COMECON countries From 1978, after the installation of the Soviet Union-Hungary 750 kV line, the whole Ukrainian and the European region of the Soviet Union took part in the cooperation In the mid 1980s, the Soviet Union to Poland and Soviet Union to Romania 750 kV lines were built and the technical possibility of 5,000 MW import from the Soviet Union to the CDO member countries was established The installed capacity of the CDO IPS system was 175,500 MW in 1990

The cooperation within the IPS-CDO system was characterized by the following (reference 25-2 "UCPTE interconnections of the CENTREL systems")

- interconnections were strong with the CDO-IPS countries and weak with UCPTE
- dependency on imports from the former USSR
- frequency control was responsibility of the Soviet system
- CDO Prague was responsible for energy accounting as well as other functions such as switching of lines, coordination with other dispatchers
- the quality of electric supply did not meet West European standards

One of the specific problems of the IPS-CDO operation was related to the fairly high one-way power delivery planned from the power system of the former Soviet Union to the other power systems The transmission capacity was not adequate to support the high transfers and periodically large scale load shedding was required following an outage on the transmission system

After the political changes in late 1980s and 1990's, the members or CDO changed, with Russia and Ukraine becoming members of CDO and the Czech Republic and Slovak becoming individual members following the split of Czechoslovakia,

Following operational problems, fuel shortages in Ukraine, need to reduce dependence on the Russian imports, and improve power quality, the CDO-IPS was broken up into three subsystems, and the connection with Russia was cut off The subsystem consisting of 7 power systems (VEAG, Poland, Czech, Slovakian, Hungarian, Romanian and West Ukrainian) operated without power frequency control In 1994, Romania switched to parallel operation with Yugoslav, and Greek systems In May 1994, the VEAG, Polish, Czech, Slovakian power system joined later by Hungary switched on primary frequency control thereby improving system frequency behavior

Developments since 1990, CENTREL, and interconnection with UCPTE

Following the breakup of the former Soviet Union and the collapse of COMECON, the power systems of Hungary, Poland, the Czech and Slovak Republics announced in 1990-1991 their intention to join UCPTE (which is the acronym for the French title "Union pour la Coordination de la Production et du Transport de l'Electricite") To discuss these questions, UCPTE formed a committee of general mangers of the UCPTE power companies neighboring the four power systems This committee, together with the general managers for the Polish, Czech, Slovak, and Hungarian power companies, formulated a Catalog of Measures (" Massnahmenkatalog") in 1992 The catalog of measures included Technical, Economic, and Organizational aspects The seven UCPTE representatives included BAG, PreussenElektra, VEAG, ÖVEG, JUGEL, ELES, and HEP These together with the four CENTREL companies formed the group of 11 A summary of the " Massnahmenkatalog" is attached as Appendix A

It was assumed that if the requirements of the Catalog of Measures are fulfilled, trial parallel operation with UCPTE could be realized During the preparation, the cooperation of the four power companies became more intense and the cooperation extended beyond the UCPTE interconnection to other fields such as economics, operation, trade, and development On October 11, 1992, the four companies institutionalized this cooperation and formed CENTREL

CENTREL is a regional group of four electric power companies from the Czech Republic Hungary, Poland and the Slovak Republic CENTREL was established in 1992 with the signing of the founding charter in October 1992 in Prague by

- CEZ, a s from the Czech Republic
- Magyar Villamos Muvek Rt (MVM Rt) from Hungary
- Polskei Sieci Elektroenergetyczne SA (PSE SA) from Poland Also referred to as the Polish Power Grid (PPG)

- Slovensky Energeticky Podnik s p today Slovenske Elektranrne a s (SE a s) from the Slovak Republic

CEZ, MVM, PSE, and SE are the current members of CENTREL The chairman of CENTREL is elected for a two year term from among the four companies on a rotating basis CENTREL activities are governed according to the Charter of CENTREL The Council of CENTREL is the General Assembly of the members and is formed by the four Presidents/General Managers and three appointed representatives from each member The Council of CENTREL has at least one annual meeting

In addition to the four members, the following organizations have observer status

- VEAG, Germany
- Verbund, Austria
- Ministry of Energy and Electronics, Ukraine
- RENEL, Romania
- NEK, Bulgaria

Any electric power company, previously with observer status, whose system is or shall be interconnected to the CENTREL network, can apply for membership, provided that all technical, economic, and organizational requirements set by the Council of CENTREL have been accomplished

The main objectives of CENTREL are

- promotion of cooperation of CENTREL with UCPTE and other associations of interconnected power systems
- improvement of Czech, Hungarian, Polish and Slovak power systems performance
- most efficient use of CENTREL generating and transmission systems
- facilitating the international exchange of electric power

The close cooperation among the four CENTREL members started much earlier when the leading power companies from four of, as it was known at that time, the "Vysehrad Group" countries, initiated the process of conforming to the standards binding the "Union for the Coordination of Production and Transmission of Electricity" (UCPTE) Because of their location, CENTREL systems will have a key role in the further development of the European interconnection towards the south, southeast (Slovenia, Croatia Romania, Bulgaria and Greece) towards the east (Ukraine, Russia, Belorussia), and towards north-east (Lithuania, Latvia, Estonia) The key parameters of the CENTREL power systems is shown in Table 2 below

Table 2 Key Parameters of the CENTREL and members (1995)

	Installed Capacity MW	Peak Load MW	Energy Consumption TWh
CENTREL	61393	42921	253 5
CEZ	14595	9916	61 3
MVM	6764	5273	36 2
PSE	32110	20394	138 9
SE	7114	3964	38 0

The data is for 1995 and is extracted from different sections of [20] This may account for the inconsistency between the sum of the individual quantities and the CENTREL totals Note also that the data is for the country as a whole

In comparison, UCPTE has an installed capacity of 386,000 MW with a peak load of 250,000MW with a total energy consumption of 1500 TW h (1992 data)

The activities of CENTREL are carried out by permanent and "ad hoc" working groups established by the Council of CENTREL The working groups are

- Interconnection Working Group (IWG)
- System Operation Working Group (SWG)
- Organization Working Group (OWG)
- Economy Working Group (EWG)
- Development Working Group (DWG)

The IWG deals with interconnection issues including power-frequency control, system calculation which includes data bases and dynamic behavior, and defence plans to deal with the consequences of system outages SWG deals with measurements, communication, coordination, autonomous operation, spot market transactions, dispatching OWG deals with the internal structure of CENTREL, monitoring of important documents that may influence CENTREL's future activities, exchange of experience on privatization and electricity laws The Economy Working Group deals with marginal prices, tariffs, developing pricing policy, and issues related to transit of energy Development Working Group deals with energy sector development policy, power network development plans, regional environmental plans, forecasting methodology and tools

In order to permit parallel operation with UCPTE the CENTREL members undertook many extensive and expensive changes to their power systems to meet the Catalog of Measures and supplementary requirements concerning, among others, the installation of power system stabilizers In order to prove the ability of the CENTREL system to operate autonomously (without interconnections with the CDO-IPS or UCPTE), a test was undertaken on 29-30 September 1993 CENTREL plus VEAG successfully completed this test which was designed to prove that this system could control disturbances During this test all international lines outward of CENTREL and VEAG

were opened, as illustrated in Figure 2 Appendix B, and the primary control of power units was activated During the two days of testing, nine planned outages from 300-500 MW took place in different power systems The total system peak load was about 45,000 MW Under steady state conditions the frequency deviations was practically within +- 20 mHz of the nominal frequency of 50 Hz During dynamic tests, the maximum frequency deviation was 50-80 mHz depending on the amount of outage MW In all cases, the primary regulation worked well The reserve margin for primary regulation in the interconnected VEAG systems was between 2 8% to 3 2% of the generated power during the whole testing period

The primary and secondary control was distributed over most of the power generating units and the range of primary regulation in most of these units was 5% Frequency dead band was set to zero and the droop was set to 4 or 5% The results fully met the expectation and the trial operation was considered successful

From November 1993 to 13 September 1995, the CDO-IPS/UPS system operated separately as three autonomous operating subsystems As the western subsystem of the CDO-IPS system, VEAG, Poland, Czech republic, Slovakia, Hungary, and an Ukrainian island (of about 1000 MW) operated in parallel The Romanian power system operated in parallel with this region until May 1994, then changed over to the Yugoslavian, Greek and Albanian systems

In May 1994, the VEAG, Polish, Czech, Slovak and Hungarian power systems switched on the primary control which has been in permanent operation since then

VEAG was to change over to UCPTE synchronous operation on 13 September 1995 Breaking the parallel operation with VEAG greatly affects CENTREL because the network connections became weaker Therefore, the CENTREL companies made a proposal at the 11 sided UCPTE-CENTREL executive committee meeting on 21 March 1995 to begin a synchronous trial operation with UCPTE through VEAG at the same time A technical working group was set up to survey the status of CENTREL companies with regard to fulfillment of the Catalog of Measures The technical committee summarized the measures that needed to be completed prior to trail parallel operation The UCPTE-CENTREL executive committee accepted the report of the technical committee at the meeting held on 30 August 1995 with the final decision made on 28 September 1995 The approved the CENTREL- UCPTE trial parallel operation, on condition that the technical group evaluates the results of a two week standalone CENTREL trial operation and decides on the exact time of the interconnection

On 13 September 1995, after the UCPTE interconnection of VEAG, the CENTREL system began their autonomous operation During this period, four planned outages took place, one in each CENTREL system of between 200-300 MW each- both generation and consumption The system performance was monitored continuously during the two week period and the results showed satisfactory performance of the system The tests were designed to

- Examine the efficiency of the primary and secondary control in each CENTREL system

- Evaluate the effect of normal and sudden power changes
- Determine the static and dynamic frequency characteristics as well as the frequency characteristics
- Examine the voltage conditions at the boundary
- Evaluate the operation of the Power System Stabilizers in the Polish and Hungarian power systems

The autonomous operation was divided into two phases The first phase for the first two days involved planned outages The second phase was the two week period when the systems were evaluated under normal conditions and during unplanned outages

During the system tests the total load was 25,000 MW The primary reserve was +-2 5% as required by UCPTE The droop of the primary regulators was 6-7% and the dead band setting was zero

The test results indicated satisfactory performance The UCPTE-CENTREL technical group met on 13 October 1995, and evaluated the test results They approved the results and recommended that trial parallel operation begin on 18 October From that time CENTREL systems operate in parallel with UCPTE through VEAG and BAG as shown in Figure 3 Appendix B, and subsequently with additional interconnections to Austria as shown in Figure 4 Appendix B

It was decided previously that pluralistic control is necessary for the CENTREL block operating in parallel with UCPTE Consequently, the CENTREL companies decided to establish an Accounting and Control Center in Warsaw VEAG offered that during the UCPTE-CENTREL trial operation through VEAG and BAG, the area control error of the CENTREL systems can be eliminated by pluralistic control of VEAG During this period the accounting among the CENTREL countries could be done by the CDO in Prague

It was also decided that after the CENTREL Accounting and Control Center in Warsaw becomes operational a second one year trial operation will start The CENTREL-UCPTE parallel operation can be approved after knowing the results of this second one year operation

The one year trial parallel operation with UCPTE which began in October 18, 1995 was completely satisfactorily The CENTREL Accounting and Control Center in Warsaw was completed in 1996 A second year of trial operation was begun in October 1996 and was successfully completed in 1997

The Power Systems Of The CENTREL Countries

Interconnections between CENTREL and UCPTE

The tie lines between CENTREL and UCPTE are,

From PSE to VEAG/Bewag, Germany

1	Krajnik to Vierraden	220kV
2	Mikulowa to Hagenwerder	220k V
3	Mikulowa to Kiesdorf	330kV

From CEZ to VEAG/Bewag, Germany

1	Hradec to Rohrsdorf	330kV
2	Hradec to Zwonitz	220 kV

From CEZ to Bayenwerk, Germany

1	Hradec to Etzenricht	330kV

From SE to ÖVG, Austria

1	Slavetice to Durnrohr	330kV

From MVM to ÖVG		330 kV
1	Gyor to Wien-Sudost	330kV

Type Of Capacity In CENTREL

The installed capacity by type of generation in the CENTREL countries is shown in the following table Table 3

Table 3 Installed capacity (in percent by type) in CENTREL region

	CENTREL	CEZ	MVM	PSE	SE
Thermal	71	64	74 4	84	41 9
Nuclear	16	13	24 9		24 7
Hydro	13	10	0 7	6	33 4
Industrial		13		10	

CEZ shareholders include the National Property Fund (67 46%), Restitution Investment Fund (1 1%), other legal persons (26 7%) for a total of 95 26% of which 83 06% is domestic and 12 2% foreign The remaining 4 74% is owned by private individuals CEZ is building a new Nuclear Plant at Temelin with a capacity of 2*981 MW Unit 1 is expected to be operational in 1998 and unit 2 in 1999 The majority (94 5% in 1995) of the electricity produced by CEZ is sold to eight distribution companies The remainder was for export (4 6%) and directly connected customers (0 9%) The price paid by the distribution companies to CEZ is a result of bilateral negotiations and has been a problem The end user price is regulated but does not appear to cover the costs of production and delivery CEZ generates over 80% of the total energy in the Czech republic in 1992[4] and 76 9% in 1995 [18]

MVM was the vertically integrated electric utility in Hungary which was disaggregated into 10 Generation, single Transporter (MVM Rt) and six Suppliers (distribution companies) by the middle of 1997 There is limited competition in generation but the transmission and distribution companies are monopolies New power stations are being acquired on a competitive basis Six of the generators and all six distribution companies are privately owned

PSE is the owner of all transmission assets and a majority share portfolio in the Pumped Storage Power Station Company (Elektrownie Szczytowo-Pompowe S A)- the company providing a significant part of the regulation power (approx 1,600 MW) for Poland's power system The distribution (and electricity supply) subsection consists of 33 distribution companies all of which are joint stock companies The generation sector consists of large power stations Among the large system power stations, 12 are state owned enterprises and 4 are joint stock companies All combined heat and power (CHP) - 19 in all- are joint stock companies Brown coal fired power stations are linked to the coal mines The latter (4) have the status of independent, state owned enterprises

SE a s , a joint stock company, was established in November 1994 from part of the assets of the state enterprise Slovensky energeticky podnik (SEP s,p) SE owns 6120 MW of installed capacity which is 86 % of the total There are three regional distribution companies which own 3% and industrial producers own 11% of the generating capacity respectively The three regional distribution utilities are ZSE, SSE, VSE

Transmission System in CENTREL countries

The CEZ Transmission System

The CEZ transmission system consists of 400 kV and 220 kV grid including 31 substations, 2,860 km of 400 kV and 1,555 km of 220 kV transmission lines See Figure 5 Appendix B

MVM Transmission System

The power transmission network in Hungary consists of 268 km of 750 kV, 1574 km of 400 kV, 1244 of 230 kV lines In addition, 130 km of the 120 kV lines are considered part of the main transmission grid See Figure 6 Appendix B

PSE Transmission System

The power transmission system in PSE consists of 114 km of 750 kV, 4522 km of 400 kV, 7884 km of 220 kV and 27km of 110 kV lines There are 1-750 kV, 26-400 kV, and 62 220 kV substations of which 1, 16, 14 and 0 substations respectively are owned by PSE See Figure 7 Appendix B

SE Transmission System

The SE transmission system consists of 1519 km of 400 kV and 964 km of 220 kV lines See Figure 8 Appendix B

Energy Accounting and Control Center in Warsaw [9]

The Energy Accounting and Control Center (EACC) is located in Warsaw at PSE SA and is responsible for

- Control of power exchange between CENTREL and UCPTE
- Accounting and offsetting unintentional deviations within CENTREL
- Accounting and offsetting of unintentional deviations between CENTREL and UCPTE

CENTREL's EACC will be included in the Block NORD of UCPTE (accounting center at Brauweiler) Block NORD includes the Netherlands, Belgium, Germany, Luxembourg, Denmark, Austria and now CENTREL Prior to the formation of the of the EACC, secondary load frequency control of the VEAG+CENTREL blocks was done by VEAG and the accounting of unintentional deviations by the CDO of the IPS in Prague

To realize pluralistic control of the CENTREL power system, communication lines from the tie-lines to the National Control Center were built The real time data for control is acquired at a periodicity of 1-2 sec over redundant communication paths The Polish power system is responsible for the control of CENTREL ACE while the individual power systems are responsible for their own ACE

High precision meters have been installed at all interconnection points with an integration period of 15 minutes with data collected once a day Direct access to this data is provided to both the EACC and the neighboring utilities

The EACC began operation on October 1, 1996

Privatization And Restructuring

Hungary

Via privatization transactions in 1995, nearly 70% of the state property has been transferred to private hands The new privatization act of May 17,1996, resulted in a significant acceleration of the privatization of industrial and commercial companies The partial sale of electric power companies, six distribution companies and 2 power stations was completed in 1995, Most of the investors were foreign companies including Bayenwerk (Munich), EDF International (Paris), RWE (Essen), Isar Ampwerke (Munich)

MVM is the sole transmission company and is also the single buyer for power in the country

Poland

Poland has over 30 generating companies all but three of which are Government owned Joint Stock Companies There are also over 30 distribution companies which are also being converted to Joint Stock Companies PSE is the sole transmission grid operator

Czech Republic

CEZ is a vertically integrated (generation and transmission) monopoly under state control Distribution companies have been disaggregated and partially privatized through the coupon scheme and they do not have a strong foreign partner

Slovakia

The entire power industry is government owned monopoly SE is the dominant generator and owns all transmission It supplies electricity to three regional distribution companies which also own the remaining 10% of the generation SE is a joint stock company but all stock is owned by two government entities - the National Property Fund (93 8%), the Restitution Investment Fund (2 9%) - and the Slovak Gas Company (3 3%),

ENERGY LAWS

Poland

An Energy Law was passed on 10 April 1997, published in June 1997, which sets forth the principles of structuring the energy policy of the country, terms and conditions of efficient procurement and utilization of fuels and energy, including heat, and activities of energy undertakings It also set forth the authorities responsible for fuel and energy management The Energy Act is to become in full force on December 4 1997

The Ministry of Economy shall be the supreme government authority appropriate in the energy policy issues (Article 12) The Ministry of Economy is directed by the Council of Ministers

An Energy Regulatory Office (ERO) is to be formed with the Chairman and Vice Chairman being appointed by the Prime Minister The Chairman of ERO shall regulate the activity of energy undertakings according to the state energy policy guidelines and the Act, aiming at balancing the interests of the energy undertakings and the consumers of fuels and energy Some of the tasks and competencies of the Chairman of the ERO shall include

- Granting, rejecting, withdrawing, amendment of concessions
- Approving and controlling gas, electricity, and heat tariffs
- Controlling quality of power
- Resolving disputes

etc

A seven member Consultancy Council (Council) will be appointed by the Prime Minister The Council may on its own initiative express opinions and take a stance with regard to any matters within the scope of the tasks of the Chairman of ERO Specifically, the Council shall express opinion in matters presented by the Chairman of ERO(Article 27)

The decisions of the Chairman of the ERO may be subject to an appeal before the Voivodship Court in Warsaw - Anti-monopoly court within a period of two weeks from the delivery of the decision

Third Party Access (TPA) rights in transmission and distribution of electricity is envisioned to be introduced while ensuring

- Reliability of Supply
- Quality of Services
- Stability of Prices and Scope of Supplies

TPA would first apply to wholesale transactions with retail transactions being implemented no later than 8 years later

Polish Power Grid company is the system operator and the operator of the system electricity market

Hungary

The Hungary Energy Law was passed by Parliament on April 6, 1994 (Act XLVIII of 1994) on the Production, Transport, and Supply of Electric Energy This Energy Law does not cover nuclear plants, and power plants and wire networks thereof with capacities less than 50 MW used exclusively for meeting internal demand

The Minister of Industry and Trade is the chief Government body for implementing the Hungarian Energy Policy An Energy Office shall be responsible for all task related to the production, transport, and supply of electric energy in a natural monopoly, the control of satisfying customers demands and the standard of services --- (see Section 5) The office shall (section 6)

- issue and amend licenses of operation of production, transport, and supply of electric energy
- approve the business rules
- prepare prices of electric energy
- establish order of restriction
- define economic data to be publicly disclosed
- approve rules of industrial operation

Article 7 address issues relating to protection of consumers

Sections 41, 42 and 43 address Electric Energy Production, Transport and Supply of electric energy Sections 41 and 42 imply that there is a single buyer ("transporter") of supply and that the transporter shall "purchase electric energy at the lowest price from producers including imports In addition, the transporter may not discriminate to the advantage or disadvantage of certain producers over others"

The Electricity Act of 1995 sets out the general outline of the power industry structure Under this act MVM is the single buyer and all generators above a certain size have to offer their output to MVM Only MVM can import and export Generators are supposed

to receive an 8% profit Price hikes to meet this requirement were delayed and the current situation is unclear

Slovak Republic (extracted mostly from Reference 29)

There are four key companies in the electric power sector of Slovakia These are Slovenske elektrarne, (SE- Slovakian Power Plants Corp), the dominant electricity generator and operator of the transmission systems, and the three distribution companies Western Slovakian Utilities Bratislava, Central Slovakian utilities Zilina, and Eastern Slovakian Utilities Kosice SE is a joint stock company with 93 7% of shares owned by the National Property Fund and 2 9% by the Restitution Investment Fund SE was established in November 1994 by transforming the former state owned company SEP into the joint stock company SE owns 86% of installed capacity of Slovakia's power plants and covers 90% of domestic consumption The distribution companies are owned by the state and have the acronyms ZSE, SSE and VSE

The energy strategy of the country is outlined in the Energy Concept of which a draft for 2005 has been recently submitted to the Government The basis of energy legislation will be the Act on conditions of doing business and performance of the state authorities in energy related branches (the Act on business activities in the energy sector) The objective of the Act is to make equal business conditions in the energy sector, modify rights and obligations for both natural and legal persons performing business activities in energy related branches and define the scope of state intervention It also covers the activities of the State Energy Inspection The bill also takes into account the EU regulations *The only exception will be the provision on third party access into grids*, implementing which will require a time delay until energy prices are adjusted while taking into account differences among class of consumers

An Act on Energy Management is also under preparation It deals with final energy use, focusing on energy intensity, energy conservation and the introduction of mechanisms supporting reasonable energy management The Act applies provisions of EU, IEA and the Energy Charter on energy efficiency and related ecological aspects

One of the tools for reaching the strategic objectives of the Energy Concepts of Slovakia is the regulation of natural monopolies Natural energy monopolies will retain significant portion of their monopolistic position in the future The reason for that is a need to provide continual, high quality and reliable network and the protection of the strategic state interests

The objective of the regulation in the energy sector is to create a sound competitive environment and balanced conditions for both investors requiring return on investment and consumers who cannot be merely guided by the market principles and select the most suitable supplier

The Ministry of Finance has been authorized to regulate the pricing policy, tariffs, and related conditions for the individual energy forms, to evaluate and provide Government guarantees for investment and reconstruction of key energy sources The antitrust authority SR performs the regulation of contractual relations posing threat to competition or the competitive environment

Under the bill on energy management, the Ministry of Economy will be in charge of regulation in other fields such as justified cost, product, and service quality etc

The development of the regulatory framework and the essential scope of regulation will gradually approach the deregulation trend in the EU to establish conditions for the equal access to the energy markets with transparent prices and investment, equal access to transmission networks and connection to the joint dispatching system

Many issues remain to be resolved before the new structure can be implemented in Slovakia

Czech Republic

CEZ, the vertically integrated monopoly, remains state owned and the dominant owner of generation CEZ controls about 75% of the generation, as well as all transmission Distribution companies have been disaggregated and partially privatized via the coupon privatization program of the Czech government

CEZ, the distribution companies, government agencies and others are in the process of creating a centralized dispatch system for realizing least cost dispatch regardless of ownership This is still in its formative stage

The energy sector is governed by Act 222 which is vague in some critical areas and does not open up the market to competition The Ministry of Industry and Trade is the principal ministry for the energy sector, and along with the Ministry of Finance, administers the sector These ministries are in the process of preparing amendments to Act 222 to address certain of the Act's shortcomings, particularly in planning, licensing, imports and exports, and pricing [Bechtel]

Prices and Tariffs are ultimately set by the Ministry of Finance while the licensing and approval of new investments is the responsibility of the Ministry of Industry and Trade

Nothing in the Act 222 requires third party access (TPA) and CEZ does not in fact allow such access

The European Union 96/92/EC Directive [32] and CENTREL

Three of the CENTREL countries - Poland, Hungary and the Czech republic- are in the first tier of countries from the former Eastern bloc scheduled to be considered for membership in the European Union Therefore, three of the CENTREL countries will be subject to the European Union rules and requirements The European Union (EU) issued a directive EU/96/92 on December 19, 1996 that defines the operation of the electric energy industry within the EU The salient features of this directive related to TPA and transmission system operation are summarized below since in the long run the CENTREL countries will have to conform to them

Chapter II - General Rules for the organization of the sector
Article 3

Member States shall ensure that electricity undertakings are operated in accordance with the principles of this Directive, with a view to achieving a competitive market in electricity, and shall not discriminate between these undertakings as regards either regards or obligations The two approaches in Articles 17 and 18 must lead to equivalent economic results and hence to a directly comparable level of opening up of markets and to a directly comparable degree of access to electricity markets

Member states may impose, on undertakings operating in the electricity sector, in the general economic interest, public service obligations which may relate to security of supply, regularity, quality and price of supplies and to environmental protection Such obligations must be clearly defined, transparent, non-discriminatory and verifiable

Chapter IV Transmission system operation
Article 7

Member states shall designate, or shall require the undertakings which own transmission systems to designate, for a period of time to be determined by Member States having regard to considerations of efficiency and economic balance, a system operator to be responsible for operating, ensuring the maintenance of, and, if necessary, developing the transmission system in a given area and its interconnections with other systems, in order to guarantee security of supply

Member States shall ensure that technical rules establishing the minimum technical design and operational requirements for the connection to the system of generating installations, distribution systems, directly connected consumers equipment, direct lines and interconnector circuits are developed and published These requirements shall be objective and non-discriminatory

The system operator shall be responsible for managing energy flows on the system and ensuring the availability of all necessary ancillary services

The system operator shall not discriminate between system users or classes of system users, particularly in favor of its subsidiaries or shareholders

, the system operator shall be independent at least in management terms from other activities not relating to the transmission system

Article 8

1 The transmission system operator shall be responsible for dispatching the generating installations in the area and determining the uses of interconnections with other systems

2 the dispatching of generating installations and the use of interconnectors shall be determined on the basis of criteria which may be approved by the Member State and which must be objective, published and applied in a non-discriminatory manner

3 A Member State may require the system operator, when dispatching generating operation, to give priority to generating installations using renewable energy sources or waste or producing combined heat and power

4 A Member State may, for reasons of security of supply, direct that priority be given to the dispatch of generating installations using indigenous primary energy fuel sources to an extent not exceeding in a 15% of the overall primary energy necessary to produce the electricity consumed in the Member State concerned

Note also the relevant clauses of the preamble Clause 25 of the preamble states " the transmission system operator must behave in an objective, transparent, and non-discriminatory manner" Clause 30 of the preamble states " the transmission function of vertically integrated undertakings should be operated independently from the other activities" Clause 37 states that " any abuse of a dominant position or any predatory behavior should be avoided"

Chapter VI Unbundling and Transparency of Accounts
Article 14

2 Electricity undertakings, whatever their system of ownership or legal form, shall draw up, submit to audit and publish their annual accounts in accordance with the rules of national law

3 Integrated electricity undertakings shall, in their internal accounting, keep separate accounts for their generation, transmission, and distribution activities and, where appropriate, consolidated accounts for other non-electricity activities, , with a view to avoiding discrimination, cross subsidization, and distortion of competition

Article 16

For the organization of access to the system Member States may choose between the procedures referred to in Article 17 and/or Article 18 Both sets of procedures shall operate in accordance with objective, transparent, and non-discriminatory manner

Article 17

In the case of negotiated access, Member States shall take the necessary measures for electricity producers supply undertakings and eligible customers either inside or outside the territory to be able to negotiate access to the system so as to conclude supply contracts with each other on the basis of voluntary commercial agreements

(additional paragraphs follow in original)

Article 18

In the case of a single buyer procedure, Member States shall designate a legal person to be the single buyer within the territory covered the system operator Member States shall take the necessary measures for

- the publication of a non-discriminatory tariff for the use of the transmission and distribution system

- eligible customers to be free to conclude supply contracts to cover their own needs with producers and with supply undertakings outside the territory covered by the system

(additional paragraphs follow in original)

Article 15 (this is out of sequence by intent)

Member States which designate as a single buyer a vertically integrated electricity undertaking or part of a vertically integrated electricity undertaking shall lay down provisions requiring the single buyer to operate separately form the generation and distribution activities of the integrated undertaking

Member States shall assure that there is no flow of information between the single buyer activities of vertically integrated electricity undertakings and their generation and distribution activities, except for the information necessary to conduct the single buyer responsibilities

Provisions regarding Schedule and Applicability

Article 22

Member States shall create appropriate and efficient mechanisms for regulation, control, and transparency so as to avoid any abuse of dominant position, in particular to the detriment of consumers, and any predatory behavior

The Member States shall bring into force the laws, regulations and administrative provisions necessary to comply with the Directive not later than 19 February 1999 (Note Belgium, Greece and Ireland are allowed extra time) (Article 27)

Nine years after this Directive goes into effect, further opening of the market may be considered by the European Parliament and Council, based on the experience gained in the functioning of the internal market (Article 26)

Article 19

1 Member States shall take the necessary measures to ensure an opening of their electricity markets so that contracts under the conditions stated in Article 17 and 18 can be concluded up to a significant level

  The share of the national market shall be calculated on the basis of the Community share of electricity consumed by final customers consuming more than 40 GWh per year (on a consuming basis and including autoproduction)

2 The share of the national market will be progressively increased over the period of 6 years by reducing the consumption threshold form 40 GWh to 20 GWh of annual

electricity consumption three years after entry into force of this Directive and to a level of 9 GWh six years after "

3 Member States shall specify those customers inside their territory representing shares specified in paragraph 1 and 2 which have the legal capacity to contract for electricity given that all final consumers consuming more than 100 GWh per year (on consumption site basis and including autoproduction) must be included in the above category

APPENDIX A

CATALOG OF MEASURES

10 Pages

ANNEX

to the

CATALOGUE OF MEASURES

Technical measures for the integration of MVM Rt, CEZ, SEP and PSE S.A. into the UCPTE

Summary prepared by:
BAG
ÖVG
PreussenElektra AG
VEAG
JUGEL
ELES
HEP

TECHNICAL MEASURES

1 Demand coverage

2 Primary control

3 Secondary control

4 General requirements for new power station units

5 Voltage control

6 (n-1)-security of the network components
(Required system expansion and power station construction)

7. Measures for the avoidance of large disturbances in interconnected operation

8 Technical requirements in the systems regarding load flow, short circuits and stability

In the following a summary of the technical measures required in preparation for the integration of MVM Rt, CEZ, SEP and PSE S A. into the UCPTE as defined by BAG, PreussenElektra AG, VEAG, ÖVG, JUGEL, ELES and HEP is given:

1 Demand coverage - power reserve

- The demand coverage must be secured at any time by own power stations, joint power stations or supply contracts

- In their long-term power balance the interconnection partners MVM Rt, CEZ, SEP and PSE S A have to be able at any time to cover their load curve by means of their own resources (also in case of single faults, like outage of the largest power station unit and/or non-occurence of a scheduled delivery), this autarky shall also apply to the necessary reserves) Given a good structure of the generating park, a power reserve of approximately 20-25 % is considered to be sufficient for large grids

2 Primary control - to be activated automatically within seconds - in order to maintain the balance between consumption and generation

- For primary control purpose each partner has to reserve at least 2 5 % of the respective generating capacity in its system

- The required control capacity should be distributed as equally as possible over the power station units connected to the system.

- Each power station should contribute to the best of its capacity to the control function In case a power station unit can not participate in the primary control, the respective controlling capacity has to be distributed over the other units

- Response time (T) for the control should amount to 10 s, i e given a sudden power change P a unit participating in the primary control could react exponentially with an initial increase T (=response time T)

The individual power station units equipped for primary control have to meet the following requirements

- Band of regulation for primary control at least +/- 5% of the rated capacity P_N

- The power change rate of conventional units has to be able to reach and maintain

  - a minimum of 50 % of the band of regulation within 5 seconds
  - 100% of the band of regulation within 30 seconds

- The power change rate of nuclear units has to be able to reach and maintain

  - 100% of the band of regulation within 5 seconds

- The frequency band, i e the range in which a load change does not result in a change in the output (dead band), should be as narrow as technically possible for a given reference value of "0"

- The frequency deviation remaining in the system is dependent on the power stations' droop and defined as S = (Δf/fn/(ΔP/Pn) x 100 % The droop of the power stations should remain between 2% and 6%

- Even in case of a modified frequency reference value and a resulting continuous operation at a frequency deviating from 50 Hz, the primary reserve must not be reduced

3 Secondary control - to be activated within minutes - to restore frequency and transnational electricity exchanges to their reference values

The partner systems participating in interconnected operation have to be equipped with a system control, the secondary control (power-frequency control), in order to balance disturbances as quickly as possible

- Installation of a system regulator (P-I regulator) according to the Recommendations of the UCPTE ;

- The spinning reserves to be provided by each interconnection partner for the various characteristic times of the day should - within the possibilities given by the existing facilities - comply with the upper value of the following conditions·

  - Output of the largest unit employed (to be dealt with separately in case several units are feeding to the same busbar. A division of such an injection to several busbars allows for reduction of the necessary reserve capacity)

  - Approx. 3 - 5 % of the capacity employed at a given time

- The units employed have to allow for continual variations of their capacity in the range of approx 10 % of their rated capacity

- For synchronous time correction, it has to be provided for the possibility of secondary control deviation from the reference value of 50 Hz to 49 95 Hz or 50 05 Hz over certain periods of time

- Secondary reserve control is automatic during the first minutes Additional secondary capacity reserves, e g in case of large disturbances, can by activated manullay within minutes

- The necessary information on power flow on transnational interconnection lines shall be transmitted in real time to an external coordination center

- Observation of a maximum interchange power deviation (balance scheduled value - real value to be registered , if possible, in intervals of 3 seconds) of 100 MW under normal operating conditions towards the UCPTE partners a a whole

- Observation of a maximum interchange energy deviation (balance scheduled value - real value) of 20 MWh/h under normal operating conditions (The unit is the hour and the compensation, equal in value, has to take place within one week)

4 General requirements for new power station units

The following requirements shall serve as guidelines whose applicability has to be examined from case to case

- Start-up times

Duration of unit shutdown	State of the unit	Max. start-up time to full power
< 8 h	hot	2 h
8 - approx. 50 h	warm	3 h
> 50 h	cold	5 h

Start-up times of conventional units

Duration of unit shutdown	State of the reactor	Max. start-up time to full power
< 8 h	no load, hot	2 h
8 - approx. 120 h	no load, hot	3 h
> 120 h	cold, subcritical	25 h

Start-up times of light-water reactors

- Number of unit start-up and shut-down cycles

  In dependance on the planned unit operation mode the number of start-ups and shut-downs has to be defined, in medium-load range this corresponds to approx 200 start-ups and shut-downs per unit and year

- Frequency range for parallel connection of a unit to the system . parallel connection of a unit to the system should be possible between 48 0 Hz et 51 5 Hz

- Technical minimum capacity

Minimum capacity of a unit in continuous operation should not exceed 40 % of the rated capacity P_N

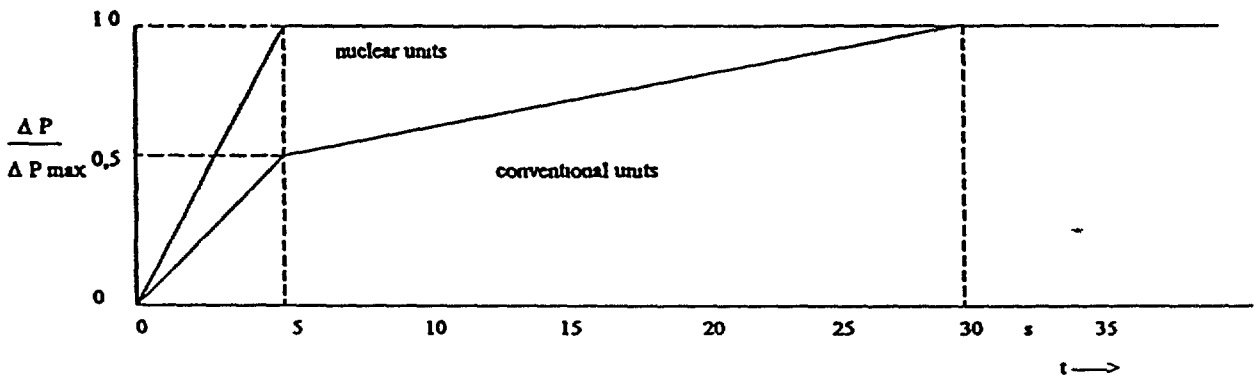
- Continuous power changes

Continuous power changes should be possible as follows

Primary energy	Oil, gas	Coal	Nuclear	
Power range % P_N	40 - 100			
Mean power change rate % P_N/min	8 - 12	4 - 8	5	10
Maximum power change rate % P_N	60	60	50	20

- Sudden power changes

Strong and fast frequency changes in the system require a high power change rate within the following limits.



Chronological development of sudden power changes in conventional and nuclear units (ΔPmax = maximum sudden power change)

5 Voltage control

- The voltage range for border nodes at transnational interconnection line ends is to be co-ordinated by the partners The reactive power flow has to be kept as low as possible

- The compensation equipment required to achieve these objectives (generators, synchronous compensators, capacitor banks, inductors, static compensators, etc) has to be employed as optimally as possible in dependance on the state of operation and in coordination between the partners

- In case a sufficent compensation level has not been achieved, the corresponding compensation possibilities have to be created

6 (n-1)-security of the network components
(Required system expansion and power station construction)

The system expansion must take place in such a way that (n-1)-security can be guaranteed for every possible operational mode (power stations and system) without requiring support by neighbouring systems

- Compliance with the requirements of the (n-1)-criterion is given when the system is able to cope with the loss of a network component without unadmissible restrictions of its functioning in any technically feasible and operationally reasonable initial situation In doing so, the network components remaining in operation must not exceed their permissible limit values and a further spreading of the incident must be prevented

- Network components according to the (n-1)-criterion

  - electrical circuit
  - transformer
  - power station unit
  - compensation device
  - (busbar, busbar faults have to be examined separately)

- After failure of a network component and/or single fault, the limit values in the system (current, voltage, frequency) must not be exceeded

- The maximum utilization has to be less than or equal to the rated capacity of the network component with extreme load situations (low load/peak load) having already been taken into account

- The (n-1)-criterion has to be absolutely observed in those cases where neighbouring systems would otherwise be negatively influenced (no support through neighbouring systems for the observance of the (n-1)-criterion)

- The necessary system expansion has to be done in consideration of the (n-1)-criterion while taking into account the specific tasks of the system operator and transits Thus, from today's point of view of the neighbouring UCPTE members the commissioning of the following 380 kV lines or corresponding alternatives are a prerequisite for the realization of parallel operation

Etzenricht - Prestice	single-circuit
Slavetice - Dürnrohr	double-circuit
Stupava - (Bisamberg) Wien Südost	single-circuit
Redwitz - Raitersaich (under construction)	single-circuit
Györ - Wien Südost (Bisamberg)	double-circuit
Wien Südost - Kainachtal	double-circuit
Kainachtal - Maribor	double-circuit

7. Measures for the avoidance of large disturbances in interconnected operation

These measures for the avoidance of large disturbances include the partial load shedding and the suitable design of the transnational interconnection lines and power stations

- In order to avoid the spreading of disturbances in the system it has to be provided for load reduction measures for frequencies of $f \leq 49$ Hz. For lower frequency values, a corresponding setting of the load shed relays should shed sufficient amounts of load before machine trip tresholds are reached

An example in case may be the following comparison of load shedding plans in France and Germany

France

at 49,0 Hz shedding of 20% of the load
at 48,5 Hz shedding of 20% of the load
at 48,0 Hz shedding of 20% of the load
at 47,5 Hz shedding of 20% of the load
at 47,0 Hz disconnection of the power stations from the system

Germany (DVG 5-stage plan)

at 49,0 Hz shedding of 10 - 15% of the load
at 48,7 Hz shedding of 10 - 15% of the load
at 48,4 Hz shedding of 15 - 20% of the load
at 47,5 Hz disconnection of the power stations from the system

- The transmission lines of a country which are important for interconnection must be designed for an adequate transmission capacity, so that they can acccomodate an additional load if internal or external disturbances occur and, in particular , if required for primary control purposes

- All interconnection lines should be equipped with single-pole rapid reclosing devices and automatic reclosing systems for single-phase faults The setting of the reclosing devices has to be agreed upon between the partners concerned

- In case of major voltage and frequency fluctuations the power stations should remain connected to the system as long as possible In case power stations have to be separated from the system, e g in the case of network failure or for safety reasons, they should automatically switch over to isolated plant operation with supply of the auxiliaries

- In case of a complete system break-down it has to be provided for some power station units that can be started up without external voltage for system reconstruction

- In the transformer stations, switching substations and in the load dispatching centers auxiliaries supply required for operation should be guaranteed for a sufficiently long time in order that all necessary switching operations can be executed also in case of failure of the surrounding networks

- The protective devices of all items of equipment must disconnect any faults occuring promptly and effectively

- It has to be provided for (n-1)-security for all information and communication equipment for transnational interconnected operation. Loss of one transmission route should have no impact on transnational interconnected operation

8 Technical prerequisites in the systems of PSE S A, CEZ, SEP and MVM Rt

Based on the existing interconnection lines the necessary further technical prerequisites for the interconnection of the electricity supply systems of PSE S A, CEZ, SEP and MVM Rt with the neighbouring UCPTE systems are to be defined Based on a system expansion plan, the observance of the necessary security of supply in accordance with Clause 6 the UCPTE interconnection has to be proven

For that purpose

- Load flow calculations for exchange balances (including transits) to be chosen in compliance with the (n-1)-criterion

- Short circuit current calculations (in particular for coupling transformer stations) and

- Stability calculations (static and transient stability for the generating park concerned) in compliance with the (n-1)-criterion

have to be carried out

Appendix B

8 pages

Figures 1 to 8

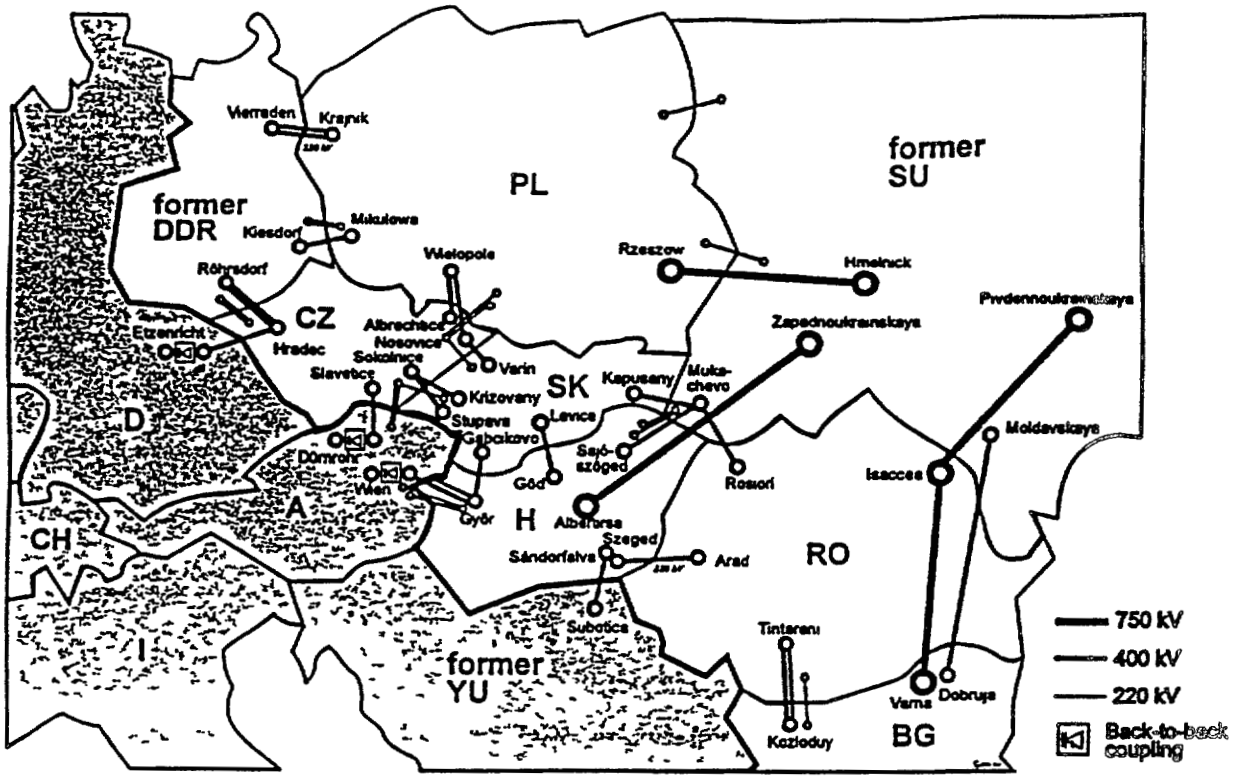


Figure 1: The most important interconnections of the IPS-CDO systems before 1993

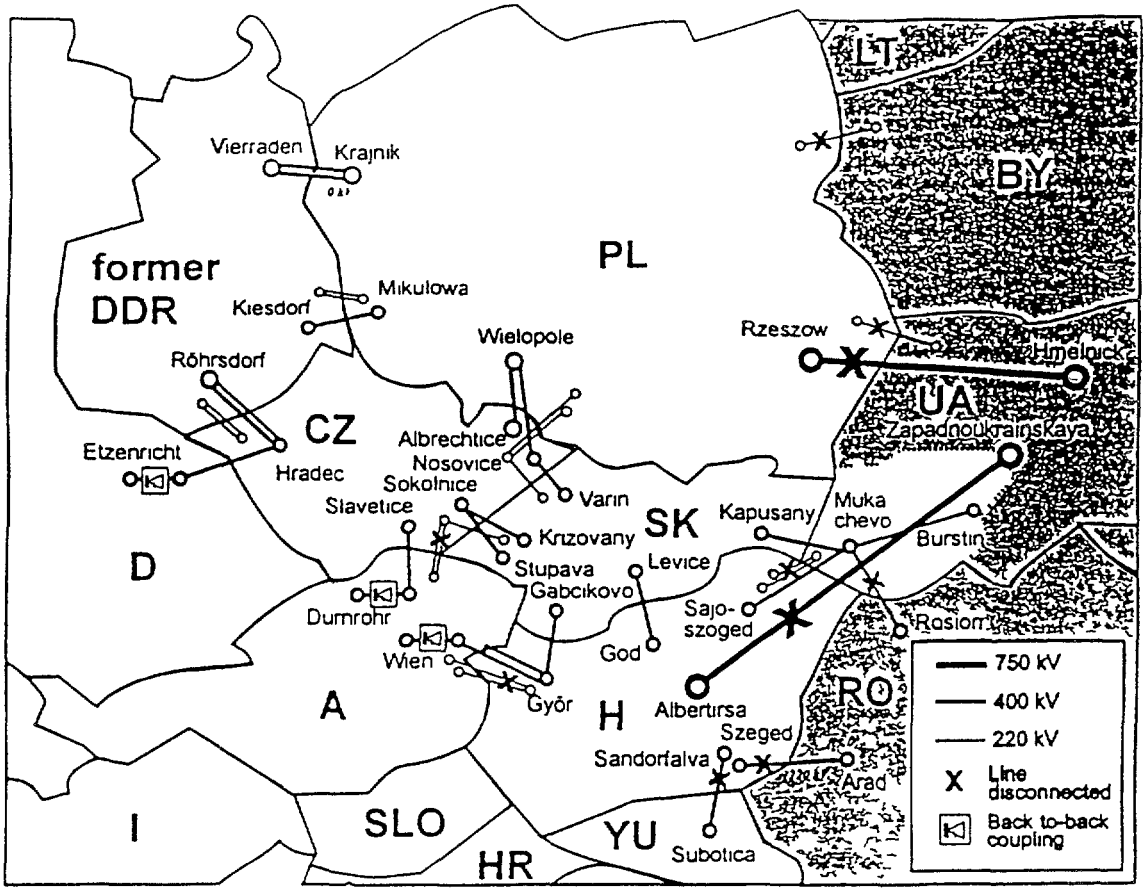


Figure 7 Operation of CENTREL systems with VEAG and the Ukrainian island

Figure 2

The CENTREL-UCPTE trial parallel operation

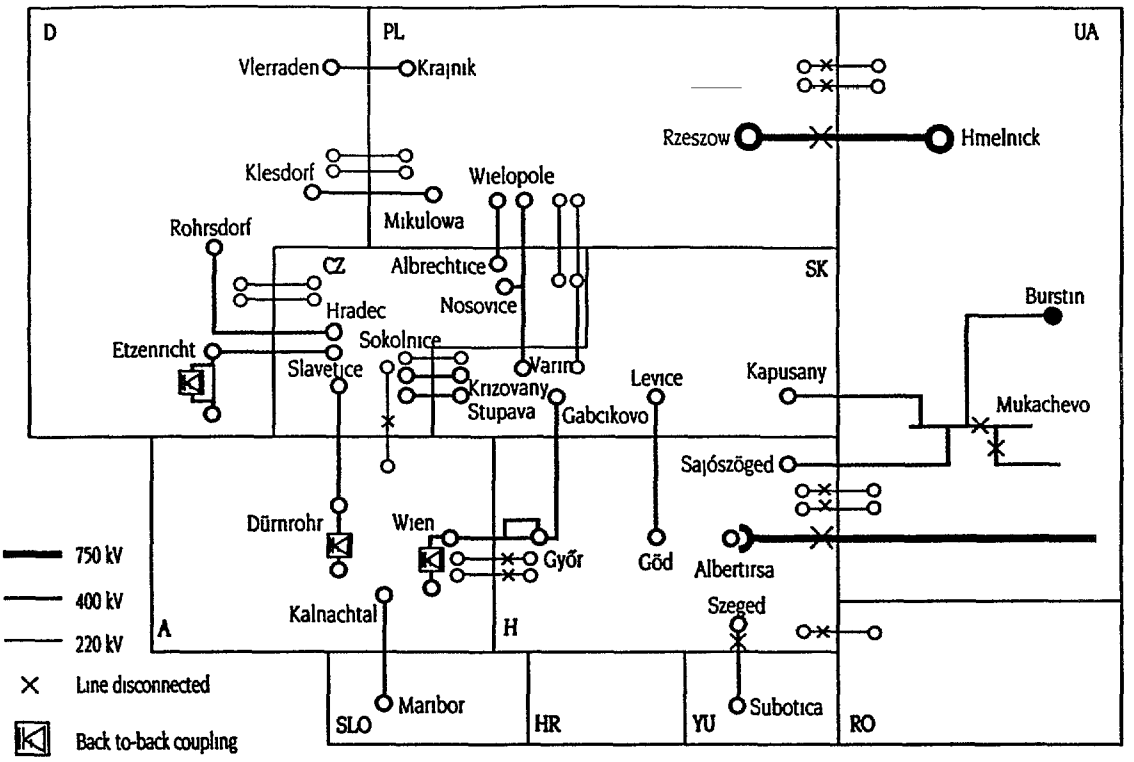


FIGURE 48
Trial parallel operation of CENTREL with UCPTE (the back-to-back couplings at Etzenricht Dürnrohr and Wien Südost are bypassed)

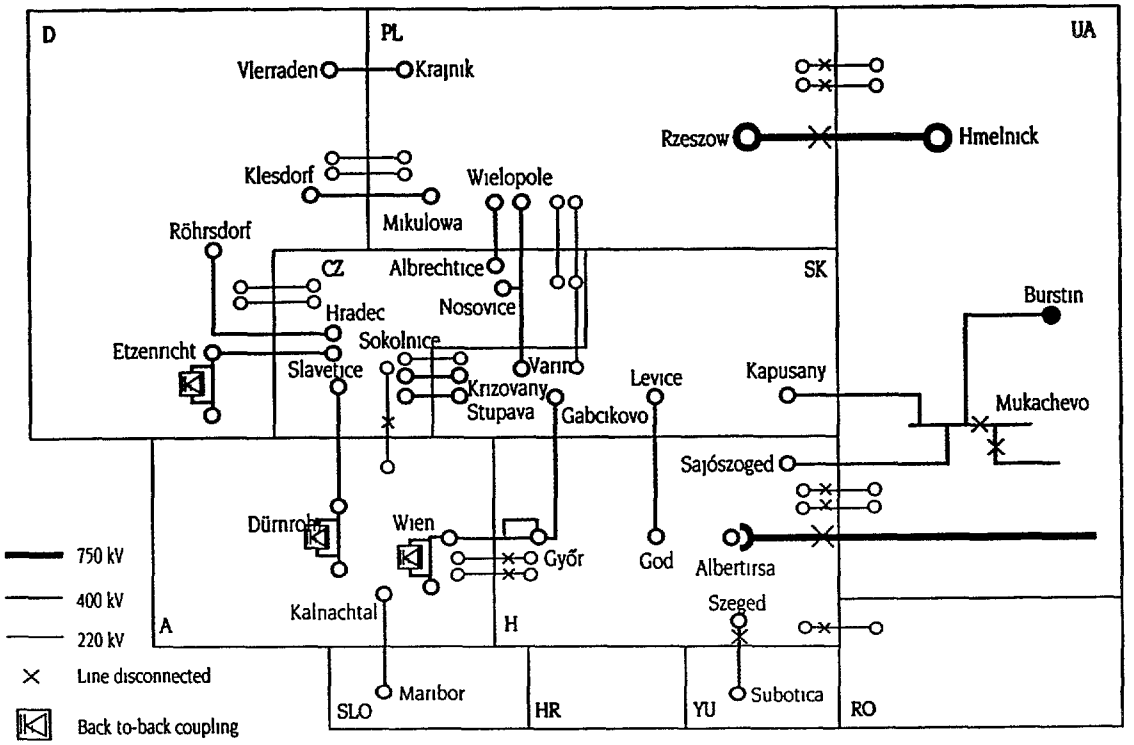


FIGURE 48
***Trial parallel operation of CENTREL with UCPTE** (the back-to-back couplings at Etzenricht Dürnrohr and Wien Südost are bypassed)*

Figure 3

Figure 4

POWER SYSTEM OF THE CZECH REPUBLIC

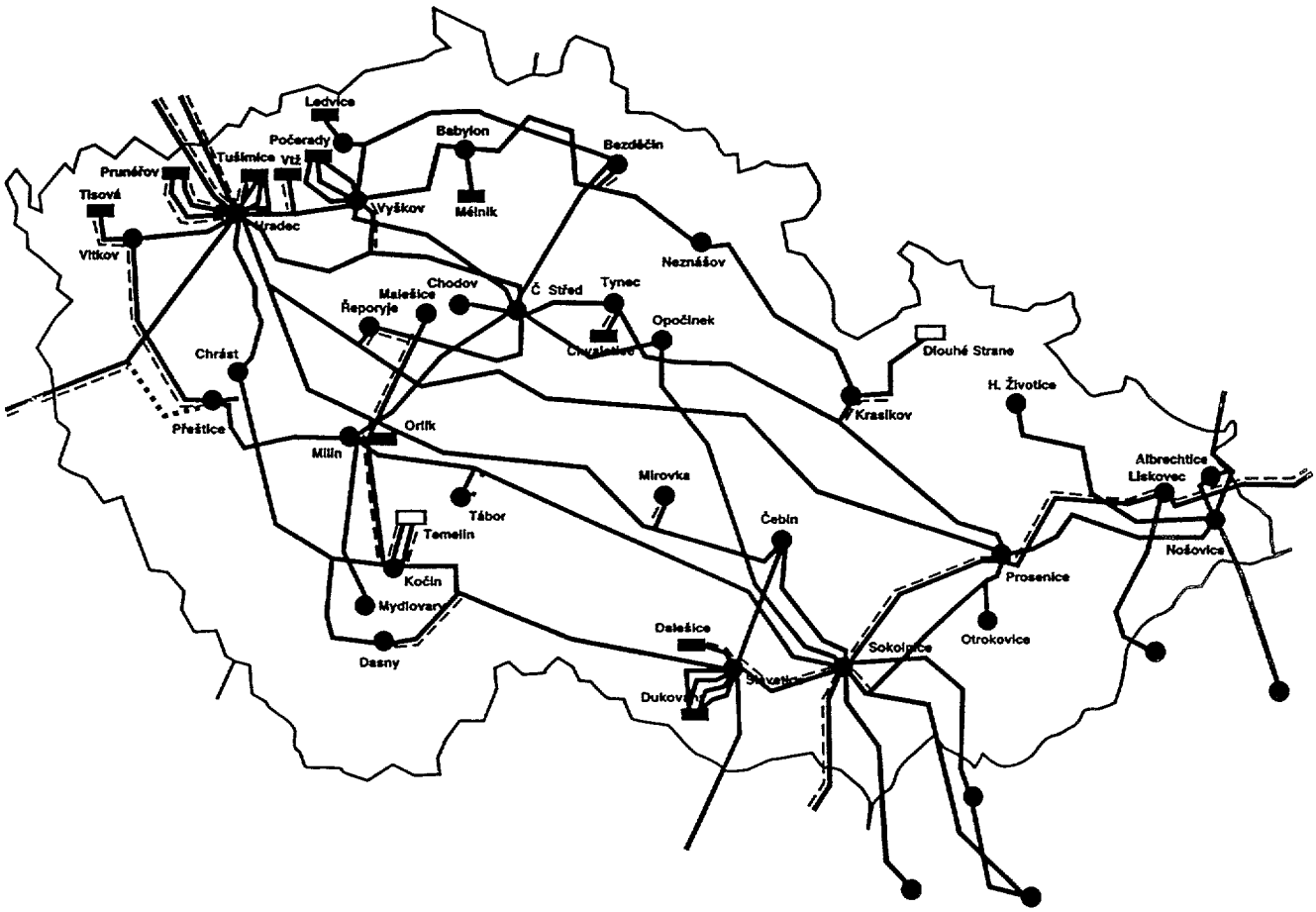
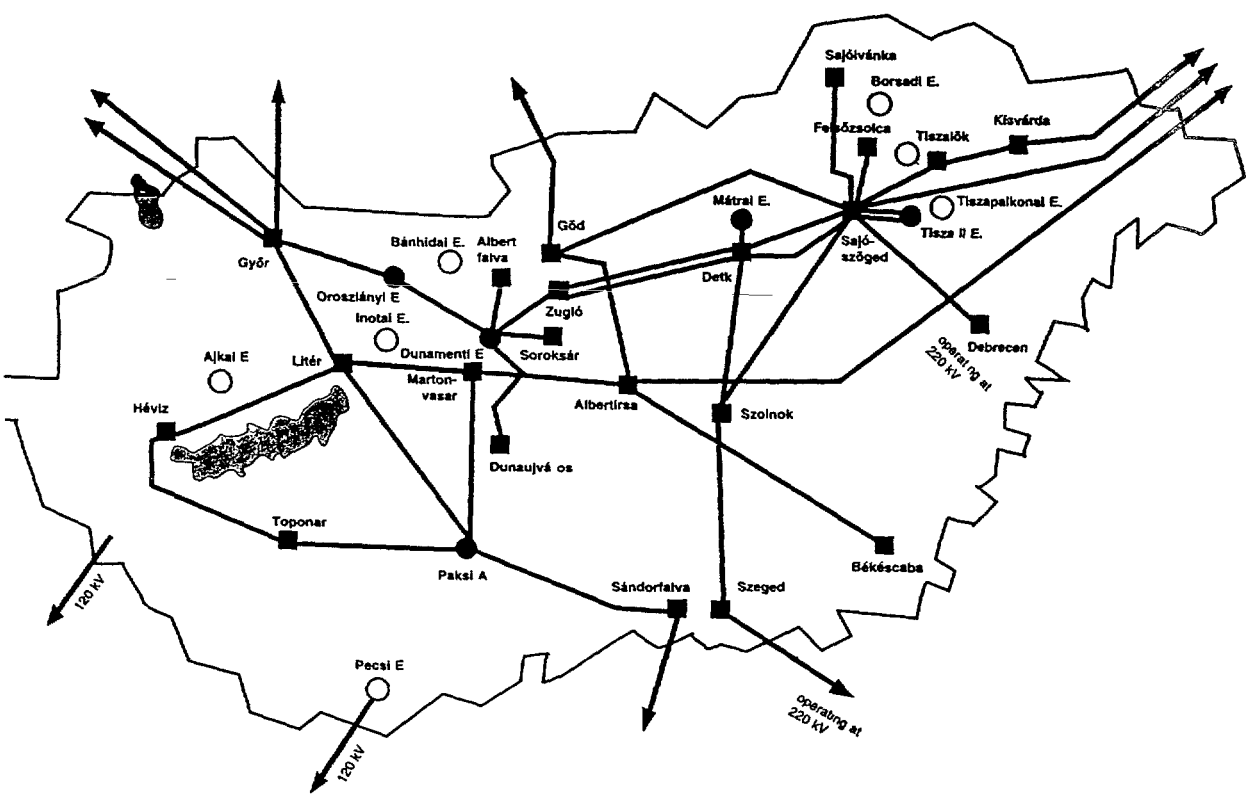


Figure 5

POWER SYSTEM OF HUNGARY



750 kV

400 kV

220 kV

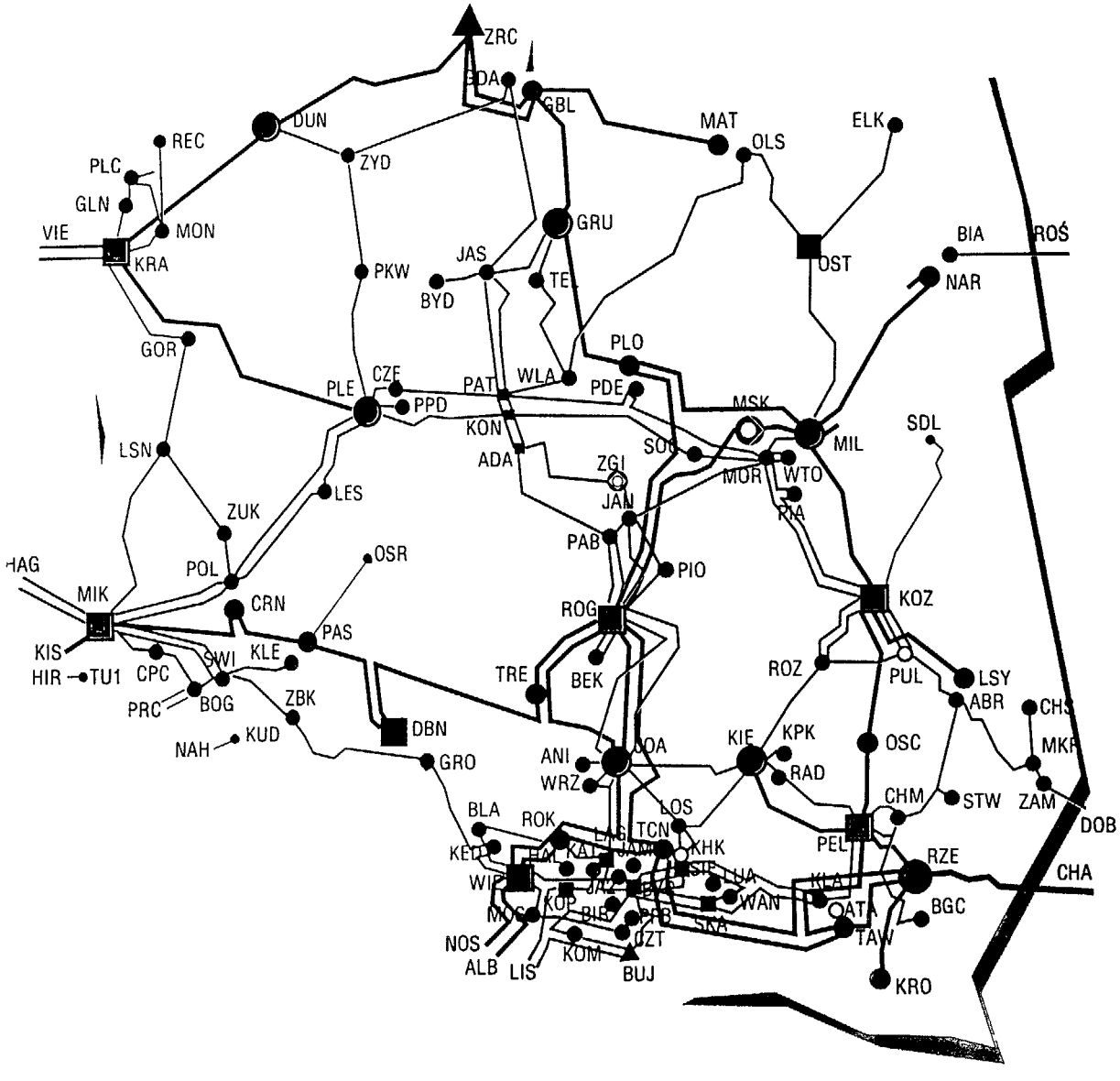
substation

power station

power station
connected
on 120 kV

Figure 6

POWER SYSTEM OF POLAND



Overhead Lines 750 kV 400 kV 220 kV 110 kV

In Operation

Temporary Operating on 220 kV
110 kV

Substations

In Operation

Under Construction

Power Stations

Thermal

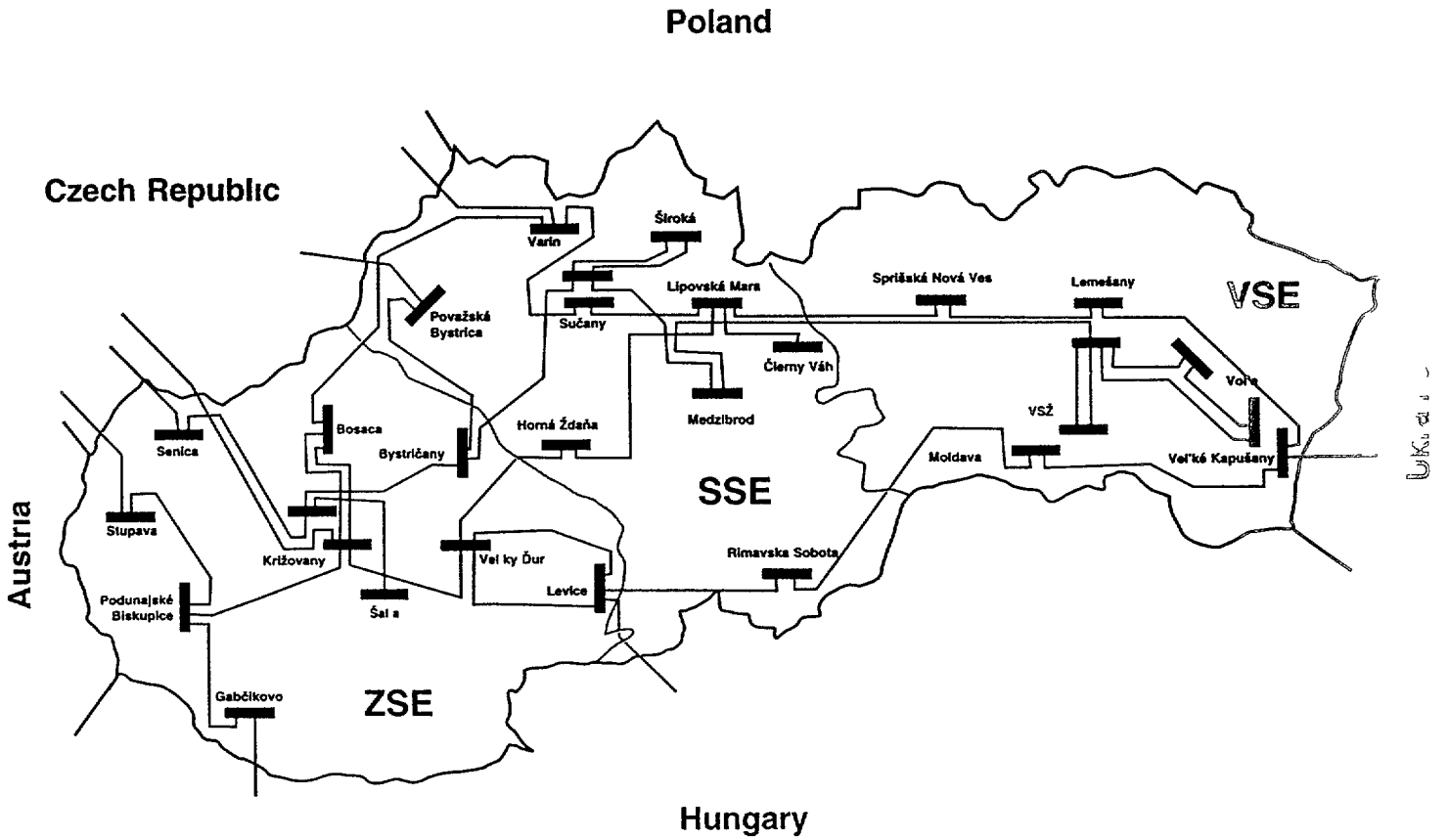
Hydro

Transformers

400/110 kV | 400/110 kV and 220/110 kV | 400/220/110 kV | 220/Medium Voltage

Figure 7

POWER SYSTEM OF THE SLOVAK REPUBLIC



— 400 kV lines
— 220 kV lines

ZSE
SSE - three regional distribution utilities
VSE

Figure 8