The Southeast European Cooperative Initiative (SECI)
Project Group on "Development of Interconnections of Electric Power Systems of SECI countries for better integration to European System"

PROJECT:

REGIONAL TRANSMISSION SYSTEM PLANNING

SECI Regional Electricity Interconnection Planning Study

Final Report

February 14, 2003

(Note: This report is a Draft that is being reviewed by SECI participants, revised and finalized for a planned January Steering Committee Meeting)

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SECI Interconnection Study Task Group (ISTG)

With Support From

United States Agency for International Development

Washington, DC, USA

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1. INTRODUCTION

According to the SECI (South East Europe Cooperative Initiative) Agenda Committee conclusions, the Project Group on "Development of Interconnection of Electric power Systems of SECI Countries for Better Integration to European System" was established. The Republic of Macedonia was nominated as host country and coordinator of the Project Group. The SECI Project Group, during the preparation phase, held five meetings at which, the main aspects of common interest for the cooperation of the power systems in the region were discussed. Five (5) issues were agreed upon as having priority for further development. These are briefly described as:

1. *Rehabilitation of the existing electricity lines and substations in Bosnia and Herzegovina and Croatia in order to reconnect the south wing of UCPTE*

Extensive technical and feasibility studies for reconstruction of the 400 kV network in Bosnia and Herzegovina (repair of Mostar 3 and Mostar 4 - 400/220 kV transformer substations) and in Croatia (Ernestinovo S/S and connected lines) have already been carried out. Funding of these projects has been completed through the IFI's (B&H) and internal Croatian funds (CRO) and construction is scheduled for completion by end of 2003 or beginning of 2004.

2. *Feasibility and Technical Study for east-west corridor in the high voltage transmission systems of the southeast European countries, including issues related to the interconnection of the region to the Turkish power grid*

The purposes of this proposed Study are:

- To carry out the feasibility of the construction of new interconnection lines between power systems in the region, including power system of Turkey.

- To examine the possibility of parallel and synchronous operation of the Turkish power system with the interconnected Electric Power system in the Balkans. This regards the compliance with UCTE requirements taking into consideration the existing tie-line between Turkey and Bulgaria and the prospective tie-line between Turkey and Greece.

- To identify all technical costs involved in the project and construction of the new line, and evaluate the possibilities for the improvement of the operation of this Interconnection, after the connection of a new electric power system.

3. *Investigation of economic and technical advantages of the integrated operation of the interconnected Balkan Electric Power Systems*

The purposes of this proposed Study are:

- Evaluation of the economical advantages of the integrated operation of the generation systems of the interconnected Balkan power systems taking into consideration the different structures of the load profiles, production capacities, hydro scheduling, etc. and the expected changes in the electric sector.

- Analyses of operational practices using a realistic environment provided by a close to real-time dispatchers training facility. In a regime of enhanced transactions in the area, close cooperation and exchange of information between the operating personnel in the control centers in the area is foreseen as necessary.

4. *Tele-information system for the connection of the dispatching centres of the power systems in the region in order to improve the cooperation, electricity exchange and opening of the electricity market*

5. *Study to define a revitalization methodology for high-voltage lines and transformer substations by identifying priority criteria*

1.1. Background

Recent economic and political changes in East European countries have created the conditions for closer cooperation within Europe. The electricity sector represents a very important area due to the possible beneficial effects of power systems interconnection such as installed capacity, reserve and operational cost savings, mutual assistance, etc. As the consequence of the further extension of the UCTE Interconnection, electric power systems of East Germany and CENTREL (Poland, Hungary, Czech Republic and Slovakia) have already joined the UCTE. The development of the European power networks and the establishment of the European internal electricity market will contribute to the improvement of the electricity trade to and from the EU.

The analyses already done on the subject of the possibilities for bulk power transits in the Balkan area show that some bottlenecks for the exchange of large quantities of electrical energy do exist.

1.2. Power Systems Status and Interconnection

Power Systems of the SECI countries have a different status concerning the UCTE membership: some of them are members of the UCTE (Slovenia, Croatia, B&H, FR Yugoslavia, R. of Macedonia and Greece); Bulgaria and Romania are in advanced process for full UCTE membership and Turkey has made the application and started the procedure. Hungary, through CENTREL, has become a member of UCTE.

On the other side, as a result of the war activities in ex-Yugoslavia, very important points in the high voltage network in the region were damaged and have been out of operation for many years. They are: Mostar Substation 400 kV with connected lines that caused the interruption of the Adriatic line; and Ernestinovo Substation 400 kV with connected lines that caused interruption of the North ex-Yugoslavian power corridor. As a result, the southeast UCTE wing was separated from the main European interconnected grid. In the mean time, UCTE members from the southeast island (Greece, Macedonia, Serbia, Montenegro and part of B&H) was interconnected and work in parallel synchronous operation mode with Bulgaria, Romania and Albania. At the moment there is only one Turkish interconnection line with the region and it is being used for exchange of power, in an island mode operation only. The second Interconnection line, 400 kV between Bulgaria and Turkey, is under construction and a new 400 kV interconnection line between Greece and Turkey is under study.

1.3. Related Initiatives in the Region

The European Commission project "Balkan Energy Interconnection Task Force" was established in 1997, and is one of the background documents for the SECI Project Group activities. In the framework of this Task Force, the Inventory of the potential interconnections in the Balkan region was described. The aim of the project was to help ensure the efficiency and coordination of electricity, oil and gas interconnection investment initiatives in the Balkan region.

The Stability Pact Program for the countries of the region was established to develop the coordinated policy for the SEE regional development and many power infrastructure studies and potential investments were identified and funds pledged.

In parallel with the SECI Project Group activities the Study for Regional Electricity Market (REM) was initiated in 1999, under the EC sponsorship. Based on this Study, the two Memorandums were signed by the Energy Ministers in the region, for the development of the REM. With the establishment of the SEEERF in June 2002 and the new MoU signed by the relevant ministers, the REM process is reestablished under the strong leadership of the EC and with support of the donors community.

The Project Group has in mind all of these activities, the necessity for cooperation without duplication and to develop the products which could be used for investment implementation decisions.

1.4. Project Identification and Preparation

Looking for the possibilities for realization of the projects from the SECI common interest list and in correlation with the other regional initiatives, the Regional Transmission Planning Project was identified and initiated with the main sponsorship of USAID, Energy and Infrastructure Bureau for Europe and Eurasia, headed by Dr. Robert Ichord.

This Project was initiated based on a SECI Project Group common interest list of studies and the interest of the Power Utilities in the region. Another aspect was the necessity for better regional evaluation of the possible investments through the Stability Pact. In this regard, one of the goals of this project is to evaluate the regional benefits of the proposed new investments in the power interconnections in the region.

USAID, as the main sponsor, contracted CMS Energy in the USA as lead consultant and Project Managers. The Consultant with ESM as coordinator and with the participation and supervision of USAID and the Ministry of Economy of the Republic of Macedonia reviewed the existing TORs and drafted the Memorandum of Understanding and Work Plan. They also assessed the interest of the potential participating utilities, prior the starting the project.

The formal Organizational Meeting was held in Skopje on March 6th and 7th, 2001. During this meeting the MoU was adopted and signed by the participants and the Work Plan was reviewed and adopted. In this Project the following countries/companies are involved: Albania – KESH; Bosnia and Herzegovina – ZEKC, EPBiH, EPRS, EPHZHB; Bulgaria – NEK; Croatia – HEP; Macedonia – ESM; Greece – PPC/HSTO; Hungary – MVM; Romania – Transelectrica; Turkey – TEAS; Yugoslavia, Serbia – EPS, Montenegro, EPCG.

1.5. SECI Regional Electricity Interconnection Planning Study

This report includes a summary of the study methodology, findings and conclusions as well as all detailed data tables. The study looked at the regional system Base Case for 2005 with only projected 2005 winter peak loads plus long term contracted exchanges, but without any incremental transits and without any of the 12 proposed new interconnections installed. Then the region was modeled by adding each of the 12 proposed new interconnections, one at a time, and subjecting it to each of 8 bulk power transit scenarios. Data for each scenario was collected to measure the impact of each proposed new line on Power Flows, Losses and the lines ability to increase Maximum Exchanges (Transits) across the region using the security (n-1) criteria.

The performance of this study was made possible by the hard work of the electric transmission planning experts in the participating SECI member companies. These experts participated in PSS/E training programs conducted by PTI and funded by USAID to learn the details of operating the software in order to perform studies in Power Flow and Steady State Analysis, Optimum Power Flow and Dynamic Simulations. They then converted national data to the PSS/E format and submitted the data for use in the construction of one regional transmission planning model. This model was distributed to all participants for their own use and was used by a special team of experts to perform this study.

A special team of experts was formed as a subgroup of Working Group #1 for the purpose of defining the technical terms of the studies and running the PSS/E software to obtain study results. This group took the name Interconnection Study Task Group (ISTG), attending meetings on many occasions in order to plan the studies and solve technical problems that continually arose. They divided the modeling tasks among them and each member personally ran several hundreds of planning scenarios. In addition, the ISTG members divided the duties of final report preparation between them and are the authors of this final technical report.

2. STARTING CONDITIONS

2.1. Prerequisites and Assumptions

The time frame for the completion of the study was set to be year 2005 and the winter and summer peak loads are considered. The two base scenarios of the observed year 2005 were analyzed with assumptions that the region is synchronously interconnected to UCTE with and without Turkey.

As a result of the war activities in ex-Yugoslavia, very important points in the high voltage network in the region were damaged and have been out of operation for many years. Those points are: (1) Mostar Substation 400 kV with connected lines that caused the interruption of the Adriatic line and (2) Ernestinovo Substation 400 kV with connected lines that caused interruption of the North ex-Yugoslavian power corridor. As a result, the southeast UCTE wing was separated from the main European interconnected grid. In the mean time, UCTE members from the southeast island (Greece, Macedonia, Serbia, Montenegro and part of B&H) were interconnected and work in parallel synchronous operation mode with Bulgaria, Romania and Albania. At this moment there is only one Turkish interconnection line with the region, the 400 kV OHL Maritsa 3 – Babaeski and it is being used for exchange of power in an island mode operation only. The second Interconnection line 400 kV between Bulgaria and Turkey (Maritsa 3-Hamitabat) is under construction and a new 400 kV interconnection line between Greece and Turkey is under study. The list of the existing interconnection lines in the region with their characteristics is presented in the table 2.1.3.

The separated UCTE zone will be reconnected to the main UCTE Interconnection trough repaired substations Mostar and Ernestinovo (400 kV Adriatic and north Croatia/Serbia corridors), existing interconnection Subotica (YUG) – Sandorfalva (HUN) and optionally interconnection of Romania with CENTREL trough Burshtin Island (UKR). The influence of connection of the huge power system of Turkey on regional power flows and its various effects have been considered and compared, especially taking into account the option that Turkey could be very strongly interconnected with the new line to Greece. UCTE interconnection is modeled with adequate equivalents in the border region in Hungary and Slovenia.

The power systems of the SECI countries have various UCTE membership statuses:

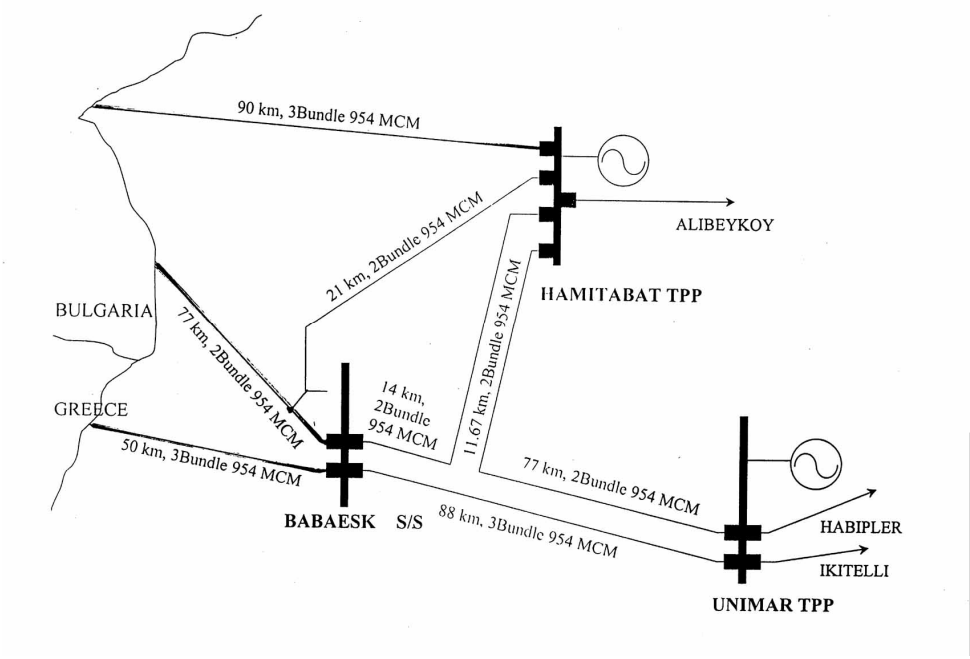
- Slovenia, Croatia, B&H, Serbia, Montenegro, Macedonia and Greece are currently members of UCTE;
- Bulgaria and Romania are in the advanced process for full UCTE membership;
- Turkey has made the application and the procedure for approval is in progress;
- Hungary, through CENTREL, is a member;
- Albania is not a member and, while no official process has begun, some recent discussions have taken place to find an official UCTE solution.

The regional model deals mostly with 400 kV, 220 kV and 150 kV network and some companies also implemented lower voltage levels in their models (e.g. modelling power plants). The influence of the 110 kV network in most of the power systems was taken into account through injections

(loads) in the adjacent nodes of the higher voltage network (400 kV or 220 kV). The network of voltage level 150 kV was modeled within the power system of Greece and the European and Anadolian part of Turkey. The rest of the Turkish power system is modeled using the 400 kV network.

Since the base voltages for the Bulgarian and Turkish system were different, the models of these two systems were connected using the ideal transformers (virtual) whose impedance parameters were zero (both resistance and reactance were neglected). Connection of the Turkish power system with its European part of network is shown in figure 1.

Figure 1: Interconnection lines with their parameters of the European part of Turkish Electric Power System



Each interconnection line is assigned an X node at the middle of the line, which divides it into two equal parts. All X nodes belong to one area (whose name is BORD and number is 99) and the losses on the tie lines are assigned to the corresponding power systems.

Voltage levels, with the upper and lower limits used in the study, are presented in the table 2.1.1.

Table 2.1.1. Defined limits for voltage levels

	Defined voltage levels									
	400 кV		220 кV		150 кV		110 кV		Generator	
	min	max	min	max	min	max	min	max	min	max
kV	380	420	198	242	135	165	99	126		
p.u.	0,95	1,05	0,90	1,10	0,90	1,10	0,90	1,15	0,95	1,05

Since the 120 kV network of the power system of Hungary is modeled using equivalent lines, the reactive power flows on some network elements during contingency analysis are not realistic. Therefore, the overloads of the power lines 220 kV Dunamenti – Martonvasar and Martonvasar – Oroszlany were ignored in the studies.

The overload limits in the vicinity of the 220 kV node Bajina Basta are 110%, but since most of the overloads are avoidable in real conditions (all hydro power plants on the river basin Drina are engaged with the maximum capacity), this overload condition was ignored in the studies.

Some overloads discovered during contingency analysis in some parts of the Albanian system (220 kV loop Tirana – Durres – Fier – Elbasan) are neglected since they also appear in the base case and can be controlled by the engagement of certain generating units.

The overloads on the 220 kV line Buchuresti Sud – Fundeni that appear in all investigated regimes in the Romanian power system are also neglected since they are not realistic (110 kV network of the Romanian power system eliminates those overloads).

Table 2.1.2 contains electrical parameters of the lines of different types.

Table 2.1.2. Electrical parameters for OHL per phase and kilometer

*Type of conductor		A	-	B	C
Positive sequence		ACSR (AlFe)	ACSR (AlFe)	CARDINAL	ACSR (AlFe)
		2x490 mm2	1x490 mm2	3x400 mm2	360 mm2
Series resistance	r [Ω/km per phase]	0.0294	0.058	0.0207	0.08
Series reactance	x [Ω/km per phase]	0.341	0.427	0.2824	0.436
Charging susceptance	b [μS/km per phase]	3.371	2.67	4.056	2.6
Rated current [A]		1920	960	2292	790

Table 2.1.3. List of existing interconnection lines in the region of South East Europe with their characteristics

Interconnection line	Interconnected countries	Voltage level (kV)	Conductors			Transfer Capacity (MVA)	length km		
			Type	Size (mm2)	Number per phase		I to border	border to II	total
Varna-Isaccea	BG-RO	750	ACSR	300	5	2390	150	85	235
Albertirsa-Zapado Ukrainska*	H-UA	750	ACSR	400	5	5360	268	254	522
Isaccea-Pivden Noukrainska*	RO-UA	750	ACSR	400	5	5360	5	395	400
Elbasan-Kardia	AL-GR	400	ACSR	500	2	1309	120	75	196
Mostar4-Konjsko	B&H-HR	400	ACSR	490	2	1318	41	69	110
Ugljevik-Ernestinovo	B&H-HR	400	ACSR	490	2	1318	39	53	92
Blagoevgrad-Thessaloniki	BG-GR	400	ACSR	500	2	1309	72	103	175
Dobruja-Molavaskja*	BG-MOLD	400	ACSR	400	3	1715	80	207	287
Kozlodui-Tintareni (double)	BG-RO	400	ACSR	500/300	2/3	2490	14	102	116
Sofia-Nis	BG-SER	400	ACSR	500	2	1330	37	86	123
Maritsa Istok-Babeski	BG-TU	400	ACSR	500	2	1309	50	77	127
Zerjavinec-Heviz	HR-HU	400	ACSR	490	2	1318	99	69	168
Dubrovo-Thessaloniki	FYROM-GR	400	ACSR	490	2	1330	55	60	115
Skopje-Kosovo B	FYROM-SER	400	ACSR	490	2	1330	36	68	104
Arachtos-Galatina HVDC*	GR-IT	400	HVDC			500	/	/	163
Gyor-Wien Sud (double)	H-A	400	ACSR	500	2	2563	59	63	122
Podgorica-Trebinje	MN-B&H	400	ACSR	490	2	1330	60	21	81
Arad-Sandorfalva	RO-H	400	ACSR	450/500	2	1212	5	52	57
Portile de Fier-Djerdap	RO-SER	400	ACSR	967	2	1330	1	2	3
Rosiori-Mukachevo	RO-UA	400	ACSR	450	2	1212	39	36	75
S. Mitrovica-Ernestinovo**	SER-HR	400	ACSR	490	2	1330	41	52	93
Subotica-Sandorfalva	SER-H	400	ACSR	490	2	1330	27	21	48
Maribor-Keinchtal	SLO-A	400	ACSR	490	2	1330	26	37	63
Maribor-Keinchtal	SLO-A	400	ACSR	490	2	1330	26	37	63
Divaca-Meline	SLO-HR	400	ACSR	490	2	1318	41	26	66
Krsko-Tumbri	SLO-HR	400	ACSR	490	2	1318	16	32	48
Krsko-Tumbri	SLO-HR	400	ACSR	490	2	1318	16	32	48
Divaca-Redipuglia	SLO-I	400	ACSR	490	2	1330	39	10	49
Mukachevo-Sajoszeged	UA-H	400	ACSR	400	2	1386	8	142	150
V.Dejes-Podgorica	AL-MN	220	ACSR	360	1	301	47	21	68
Fierze-Prizren	AL-SER	220	ACSR	360	1	301	26	45	71
Gradacac-Djakovo	B&H-HR	220	ACSR	360	1	300	19	27	46
Jajce2-Mraclin	B&H-HR	220	ACSR	360	1	300	138	66	204
Mostar4-Zakucac	B&H-HR	220	ACSR	360	1	300	49	50	99
Prijedor2-Medjuric	B&H-HR	220	ACSR	360	1	300	34	32	66
TE Tuzla-Djakovo	B&H-HR	220	ACSR	360	1	300	65	27	92
Sarajevo20-HE Piva	B&H-MN	220	ACSR	490	2/1	366	61	23	84
Trebinje-HE Perucica	B&H-MN	220	ACSR	360	1	301	20	42	63
Visegrad-Pozega	B&H-SER	220	ACSR	360	1	301	18	51	69
Zerjavinec-Cirkovce	HR-SLO	220	ACSR	360	1	300	19	51	70
Skopje-Kosovo A	FYROM-SER	220	ACSR	360	1	301	18	65	82
Skopje-Kosovo A	FYROM-SER	220	ACSR	360	1	301	18	65	82
Gyor-Wien Sud	H-A	220	ACSR	360	1	305	59	63	122
Gyor-Neusiedl	H-A	220	ACSR	360	1	305	55	27	82
Podlog-Obersielach	SLO-A	220	ACSR	490	1	366	46	20	65
Divaca-Pehlin	SLO-HR	220	ACSR	490	1	350	47	6	53
Divaca-Padriciano	SLO-I	220	ACSR	490	1	366	10	2	11
Mukachevo-Kisvarda	UA-H	220	ACSR	400	1	308	54	10	64
Mukachevo-Tiszalok	UA-H	220	ACSR	400	1	308	97	35	132

*not in model

**damaged

2.2. Power Balance

All power systems in the region were modeled as balanced systems, with no net imports or exports, except for those systems that presently have long term import/export contracts spanning beyond 2005 as follows:

- Slovenia has the obligation to export 316 MW to Croatia (Croatia has 50% ownership of the NPP Krsko) and that causes the electric power system of Slovenia to be unbalanced. It is assumed that this unbalance would be covered from the direction of the rest of UCTE.

- The power system of Hungary is unbalanced in both summer and winter regimes. It is assumed in the study that the energy for covering this unbalance is from the direction of the rest of CENTREL (UCTE).

- The export from Ukraine to the UCTE countries will be realized from the Burshtin Island. This is modelled as an export from Ukraine to Hungary considering the network topology.

- The long-term contract between Turkey and Bulgaria is modelled as 700 MW export from Bulgaria to Turkey in summer and winter.

WINTER 2005
without Turkey

MW

AREA	INTERCHANGE
ALB	0
BUL	0
BIH	0
UCTE	316
CRO	-316
HUN	-525
GRE	0
MKD	0
UKR	250
ROM	0
SLO	0
YUG	0
CENT	275

MW

FROM \ TO	ALB	BUL	BIH	UCTE	CRO	HUN	GRE	MKD	UKR	ROM	SLO	YUG	CENT
ALB													
BUL													
BIH													
UCTE											316		
CRO											-316		
HUN									-250				-275
GRE													
MKD													
UKR						250							
ROM													
SLO				-316	316								
YUG													
CENT						275							

one half of the power produced in NPP Krsko

Long term contract

WINTER 2005
withTurkey

MW

AREA	INTERCHANGE
ALB	0
BUL	700
BIH	0
UCTE	316
CRO	-316
HUN	-525
GRE	0
MKD	0
UKR	250
ROM	0
SLO	0
TUR	-700
YUG	0
CENT	275

MW

FROM \ TO	ALB	BUL	BIH	UCTE	CRO	HUN	GRE	MKD	UKR	ROM	SLO	TUR	YUG	CENT
ALB														
BUL												700		
BIH														
UCTE											316			
CRO											-316			
HUN									-250					-275
GRE														
MKD														
UKR						250								
ROM														
SLO				-316	316									
TUR		-700												
YUG														
CENT						275								

one half of the power produced in NPP Krsko

Long term contract

SUMMER 2005
without Turkey

MW

AREA	INTERCHANGE
ALB	0
BUL	0
BIH	0
UCTE	0
CRO	-316
HUN	-600
GRE	0
MKD	0
UKR	250
ROM	0
SLO	316
YUG	0
CENT	350

MW

FROM \ TO	ALB	BUL	BIH	UCTE	CRO	HUN	GRE	MKD	UKR	ROM	SLO	YUG	CENT
ALB													
BUL													
BIH													
UCTE													
CRO											-316		
HUN									-250				-350
GRE													
MKD													
UKR						250							
ROM													
SLO					316								
YUG													
CENT						350							

one half of the power produced in NPP Krsko

Long term contract

SUMMER 2005
withTurkey

MW

AREA	INTERCHANGE
ALB	0
BUL	700
BIH	0
UCTE	0
CRO	-316
HUN	-600
GRE	0
MKD	0
UKR	250
ROM	0
SLO	316
TUR	-700
YUG	0
CENT	350

MW

FROM \ TO	ALB	BUL	BIH	UCTE	CRO	HUN	GRE	MKD	UKR	ROM	SLO	TUR	YUG	CENT
ALB														
BUL												700		
BIH														
UCTE														
CRO											-316			
HUN									-250					-350
GRE														
MKD														
UKR						250								
ROM														
SLO					316									
TUR		-700												
YUG														
CENT						350								

one half of the power produced in NPP Krsko

Long term contract

2.3. Power System Data

Energy Balance

Electric Power System of	Year 2000			Year 2005					
	Annual Energy Consumption GWh	Summer Peak MW	Winter Peak MW	Annual Energy Consumption GWh	Energy Growth %	Summer Peak MW	Summer Peak Growth %	Winter Peak MW	Winter Peak Growth %
Albania	5738.931	858	1207	7368	5.12	1000	3.11	1350	2.26
EP BIH	*3410*	*490*	*704*	*3974*	*3.11*	*550*	*2.34*	*760*	*1.54*
ERS	*3000*	*390*	*690*	*3500*	*3.13*	*430*	*1.97*	*760*	*1.95*
EP HZHB	*2786.4*	*325*	*485*	*3230.4*	*3.00*	*382*	*3.28*	*597*	*4.24*
BIH	9196.4	1205	1879	10704.4	3.08	1362	2.48	2117	2.41
Bulgaria	36307	3850	7068	41284	2.60	4270	2.09	8090	2.74
Croatia	13836.1	1556	2661	17700	5.05			3171	3.57
Macedonia	6620	795	1195	7365	2.16	1015	5.01	1489	4.50
Romania	45520	5850	7346	53070	3.12	7390	4.78	8900	3.91
Turkey	128275	18110	19390	195470	8.79	28960	9.84	31010	9.85
Serbia	32567	4400	6593	32970	0.25		-100.00	6343	-0.77
Montenegro	3835	491	664	4316	2.39		-100.00	749	2.44

ELECTRIC POWER SYSTEM OF ALBANIA

BASIC DATA

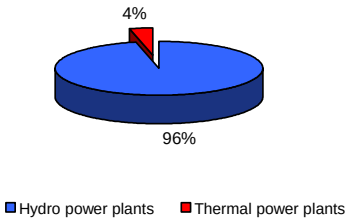
Population* Mil	Area km2	Capital	Currency		Electricity kWh/cap.	consumption* GWh
3.37	28748	Tirana	$=Lek 144.5	Euro=Lek 133.1	1214	5432

* for year 2001
Electricity consumption= Electricity gross consumption

PRODUCTION

	2001
Hydro power plants	**3545**
Thermal power plants	**137**

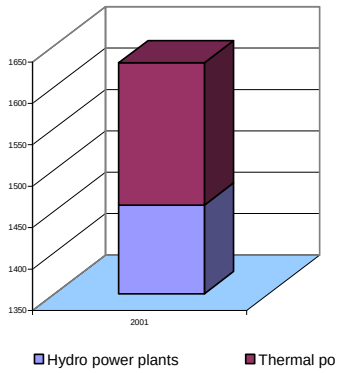
Hydro and Thermal Production



INSTALLED CAPACITIES MW

	2001
Hydro power plants	1457
Thermal power plants	172
TOTAL	1629

Installed capacity



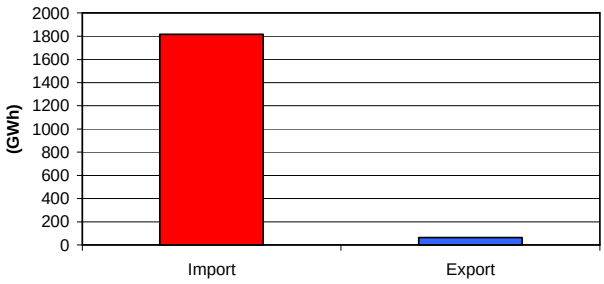
CONSUMPTION

	2001
GWh	5432

CAPACITIES OF THE TRANSMISSION AND DISTRIBUTION NETWORKS

	2001	
Voltage level (kV)	Installed capacities (MVA)	Length of the overhead lines and cables (km)
750	-	
400	600	
220	1400	
150	-	
110	-	
35	-	
10	-	
0.4	-	
(750+400+220)only	-	

Electric energy exchange



ELECTRIC ENERGY EXCHANGE

(GWh)	2001
Saldo	-1751
Import	1816
Export	65

ELECTRIC POWER SYSTEM OF BIH

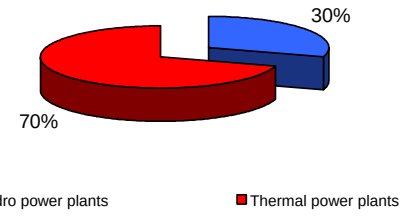
BASIC DATA

Population* Mil	Area km2	Capital	Currency		Electricity kWh/cap.	consumption* GWh
4.2	51233	Sarajevo	$=KM 2.263	Euro=KM 2.084	1788	9804

* for year 2001
Electricity consumption= Electricity gross consumption

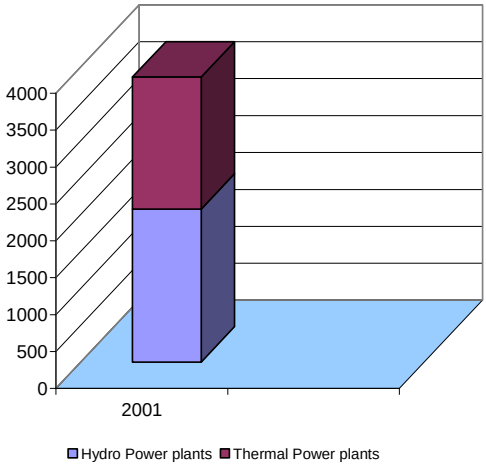
Hydro and Thermal Production

PRODUCTION	**GWh**
	2001
Hydro power plants	2392
Thermal power plants	5637



Installed capacity

INSTALLED CAPACITIES	MW
	2001
Hydro Power plants	2072
Thermal Power plants	1790
TOTAL	3862



CONSUMPTION

	2001
GWh	9804

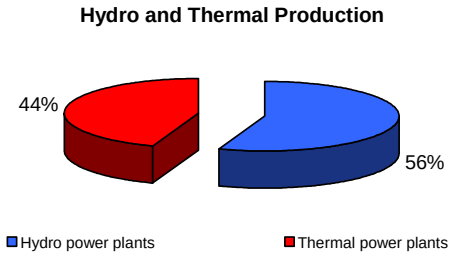
CAPACITIES OF THE TRANSMISSION AND DISTRIBUTION NETWORKS

	2001	
Voltage level (kV)	Installed capacities (MVA)	Length of the overhead lines and cables (km)
750	-	-
400	4200	742
220	1800	1219
150	-	-
110	4042	3390
35	-	-
10	-	-
0.4	-	-
(750+400+220)only		

ELECTRIC POWER SYSTEM OF REPUBLIC OF SRPSKA

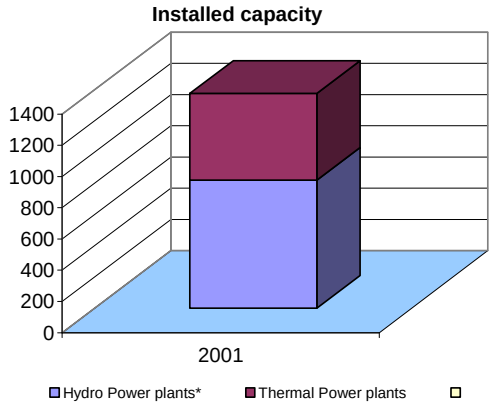
PRODUCTION **GWh**

	2001
Hydro power plants	2554
Thermal power plants	2048



INSTALLED CAPACITIES MW

	2001
Hydro Power plants*	820
Thermal Power plants	555
TOTAL	1375



CONSUMPTION

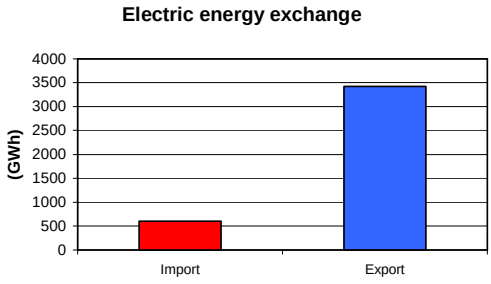
	2001
GWh	3237

CAPACITIES OF THE TRANSMISSION AND DISTRIBUTION NETWORKS

	2001	
Voltage level (kV)	Installed capacities (MVA)	Length of the overhead lines and cables (km)
750	-	-
400	2000	474
220	600	315
150	-	-
110	1360	1606
35	-	-
10	-	-
0.4	-	-
(750+400+220)only	-	-

ELECTRIC ENERGY EXCHANGE

(GWh)	2001
Saldo	2822
Import	602
Export	3424

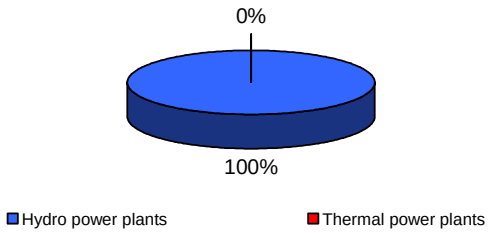


ELECTRIC POWER SYSTEM OF EPHZHB

PRODUCTION **GWh**

	2001
Hydro power plants	1639
Thermal power plants	0

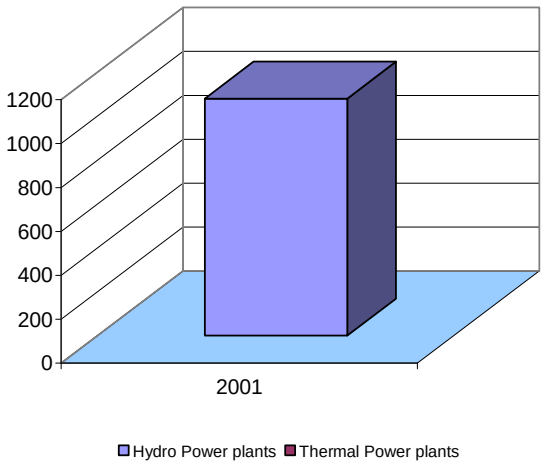
Hydro and Thermal Production



INSTALLED CAPACITIES **MW**

	2001
Hydro Power plants	1079
Thermal Power plants	
TOTAL all BiH	
TOTAL	1079

Installed capacity



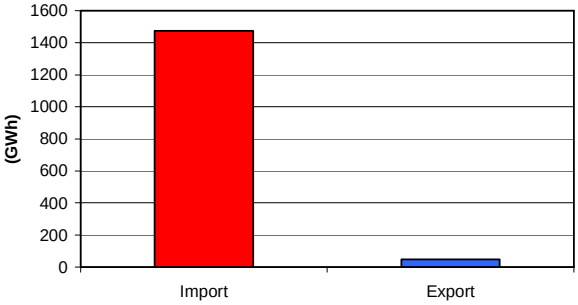
CONSUMPTION

	2001
GWh	3067

CAPACITIES OF THE TRANSMISSION AND DISTRIBUTION NETWORKS

	2001	
Voltage level (kV)	Installed capacities (MVA)	Length of the overhead lines and cables (km)
750	-	-
400	1100	89
220	150	358
150	-	-
110	630	453
35	130	511
10	750	3036
0.4	-	8697
(750+400+220)only	-	-

Electric energy exchange



ELECTRIC ENERGY EXCHANGE

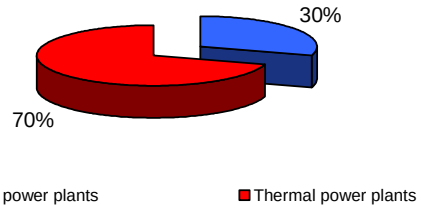
(GWh)	2001
Saldo	-1428
Import	1475
Export	47

ELECTRIC POWER SYSTEM OF EPBIH

PRODUCTION **GWh**

	2001
Hydro power plants	1527
Thermal power plants	3589

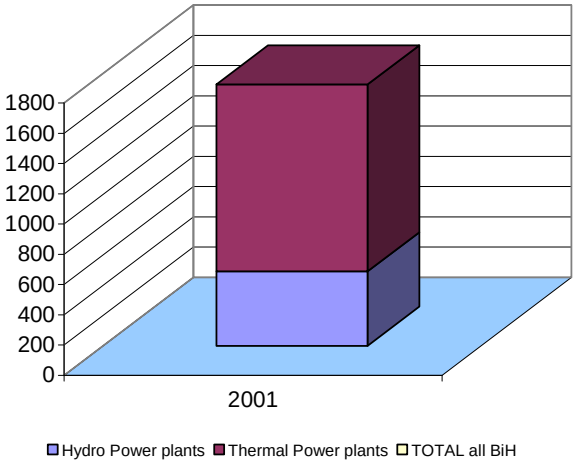
Hydro and Thermal Production



INSTALLED CAPACITIES **MW**

	2001
Hydro Power plants	493
Thermal Power plants	1235
TOTAL all BiH	
TOTAL	1728

Installed capacity



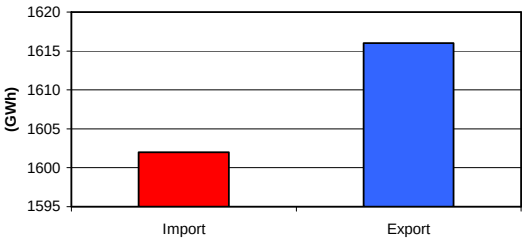
CONSUMPTION

	2001
GWh	3500

CAPACITIES OF THE TRANSMISSION AND DISTRIBUTION NETWORKS

	2001	
Voltage level (kV)	Installed capacities (MVA)	Length of the overhead lines and cables (km)
750	-	-
400	1100	179
220	1050	546
150	-	-
110	2052	1331
35	-	-
10	-	-
0.4	-	-
(750+400+220)only	-	-

Electric energy exchange



ELECTRIC ENERGY EXCHANGE

(GWh)	**2001**
Saldo	14
Import	1602
Export	1616

ELECTRIC POWER SYSTEM OF BULGARIA

BASIC DATA

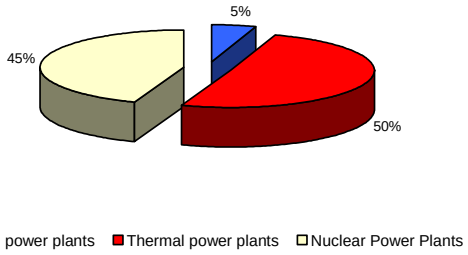
Population* Mil	Area km2	Capital	Currency		Electricity kWh/cap.	consumption* GWh
8.25	110910	Sofia	$=Lev 2.12	Euro=Lev 1.952	3081	36210

* for year 2001
Electricity consumption= Electricity gross consumption

PRODUCTION GWh

	2001
Hydro power plants	2158
Thermal power plants	22182
Nuclear Power Plants	19530

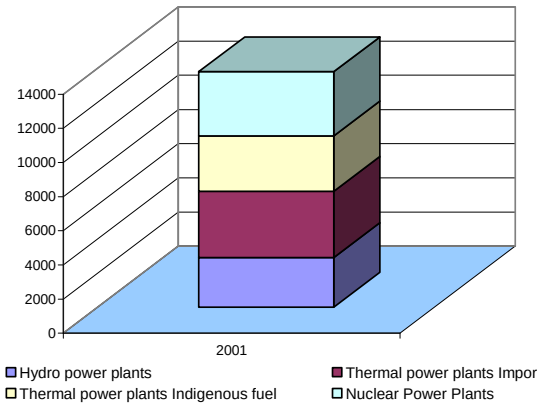
Hydro and Thermal Production



INSTALLED CAPACITIES **MW**

		2001
Hydro power plants		2909
Thermal power plants	Imported fuel	3879
	Indigenous fuel	3233
Nuclear Power Plants		3760
TOTAL		13781

Installed capacity



CONSUMPTION

	2001
GWh	36210

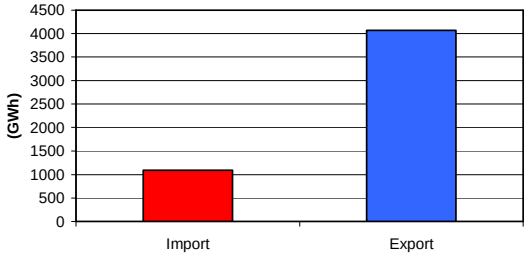
CAPACITIES OF THE TRANSMISSION AND DISTRIBUTION NETWORKS

	2001	
Voltage level (kV)	Installed capacities (MVA)	Length of the overhead lines and cables (km)
750	-	85
400	-	2207
220	-	2650
150	-	
110	11249	9167
35	-	-
10		-
0.4	-	-
(750+400+220)only	18344	-

ELECTRIC ENERGY EXCHANGE

(GWh)	2001
Saldo	2974
Import	1091
Export	4065

Electric energy exchange



ELECTRIC POWER SYSTEM OF CROATIA

BASIC DATA

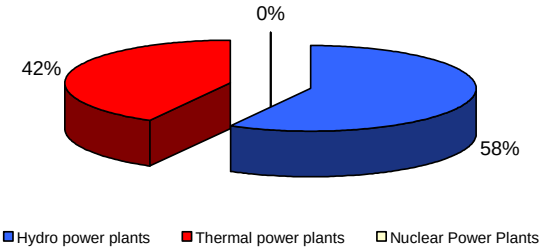
Population* Mil	Area km2	Capital	Currency		Electricity kWh/cap.	consumption* GWh
4.65	56538	Zagreb	$=Kuna 7.991	Euro=Kuna 7.359	2559	14455

* for year 2001
Electricity consumption= Electricity gross consumption

PRODUCTION **GWh**

	2001
Hydro power plants	6550
Thermal power plants	4712
Nuclear Power Plants	0

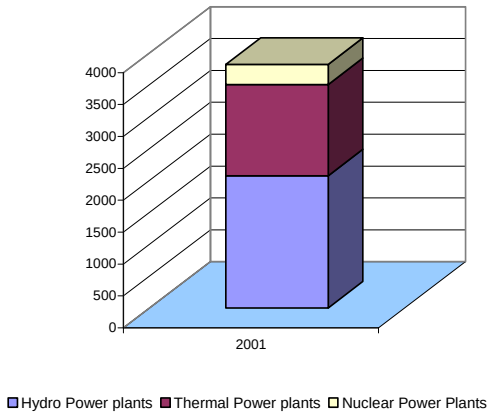
Hydro and Thermal Production



INSTALLED CAPACITIES **MW**

	2001
Hydro Power plants	2076
Thermal Power plants	1429
Nuclear Power Plants	316
TOTAL	3821

Installed capacity



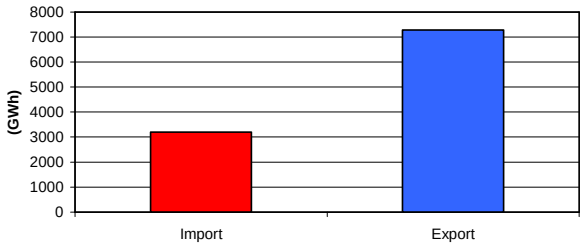
CONSUMPTION

	2001
GWh	14455

CAPACITIES OF THE TRANSMISSION AND DISTRIBUTION NETWORKS

	2001	
Voltage level (kV)	Installed capacities (MVA)	Length of the overhead lines and cables (km)
750	-	-
400	3400	1157
220	3150	1224
150		
110	7425.5	4807
35	3784	33614
10	-	79880
0.4	-	-
(750+400+220)only	-	-

Electric energy exchange



ELECTRIC ENERGY EXCHANGE

(GWh)	2001
Saldo	4092
Import	3192
Export	7284

ELECTRIC POWER SYSTEM OF MACEDONIA

BASIC DATA

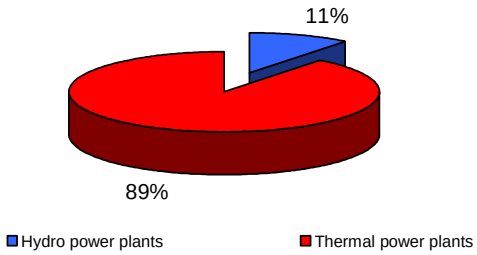
Population* Mil	Area km2	Capital	Currency		Electricity kWh/cap.	consumption* (source EKC) GWh
2	25715	Skopje	$=Denar 66.6	Euro=Denar 61.52	2147	6293

* for year 2001
Electricity consumption= Electricity gross consumption

PRODUCTION GWh

	2001
Hydro power plants	621
Thermal power plants	5241

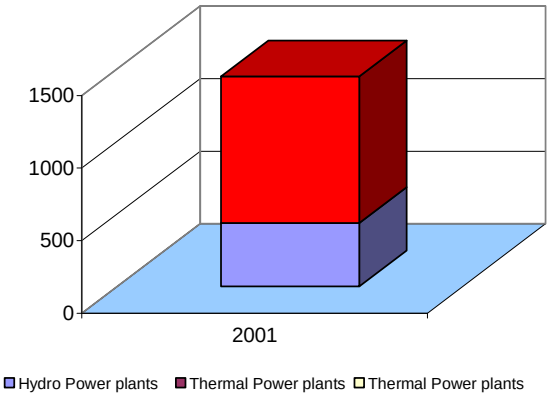
Hydro and Thermal Production



INSTALLED CAPACITIES MW

	2001
Hydro Power plants	436
Thermal Power plants	1010
TOTAL	1446

Installed capacity



CONSUMPTION

	2001
GWh	6293

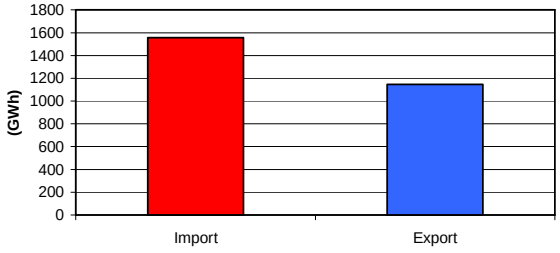
CAPACITIES OF THE TRANSMISSION AND DISTRIBUTION NETWORKS

	2001	
Voltage level (kV)	Installed capacities (MVA)	Length of the overhead lines and cables (km)
750	-	-
400	1800	371.2
220	450	166.5
150	100	22.4
110	478.5	1387.7
35	-	-
10	-	-
0.4	-	-
(750+400+220)only	-	-

ELECTRIC ENERGY EXCHANGE

(GWh)	2001
Saldo	-411
Import	1558
Export	1147

Electric energy exchange



ELECTRIC POWER SYSTEM OF MONTENEGRO

BASIC DATA

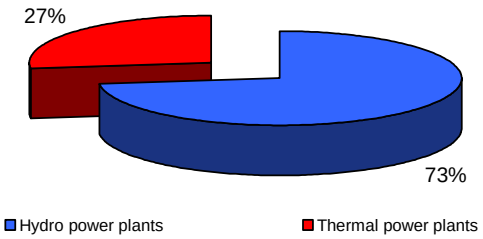
Population* Mil	Area km2	Capital	Currency		Electricity kWh/cap.	consumption* (source EKC) GWh
0.66	13812	Podgorica	Euro		2650	4116

* for year 2001
Electricity consumption= Electricity gross consumption

PRODUCTION GWh

	2001
Hydro power plants	1753
Thermal power plants	645

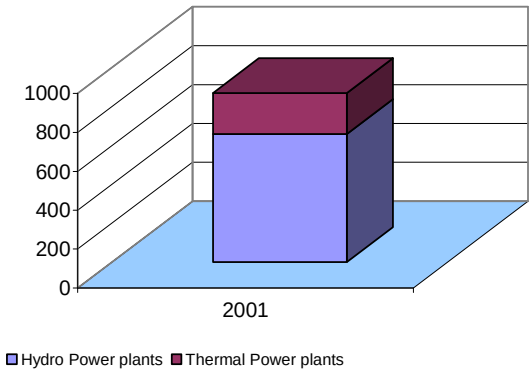
Hydro and Thermal Production



INSTALLED CAPACITIES MW

	2001
Hydro Power plants	658
Thermal Power plants	210
TOTAL	868

Installed capacity



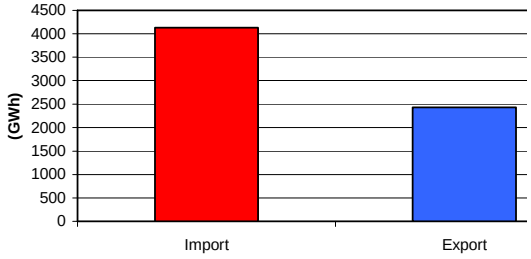
CONSUMPTION (source EPCG)

	2001
GWh	4116

CAPACITIES OF THE TRANSMISSION AND DISTRIBUTION NETWORKS

	2001	
Voltage level (kV)	Installed capacities (MVA)	Length of the overhead lines and cables (km)
750	-	-
400	1400	254
220	700	318
150	-	-
110	774	657
35	540	1150
10	1000	4230
0.4	-	14000
(750+400+220)only	-	-

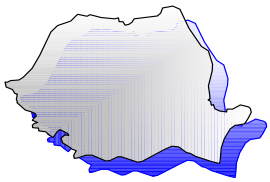
Electric energy exchange



ELECTRIC ENERGY EXCHANGE

(GWh)	**2001**
Saldo	-1702
Import	4131
Export	2429

ELECTRIC POWER SYSTEM OF ROMANIA



BASIC DATA

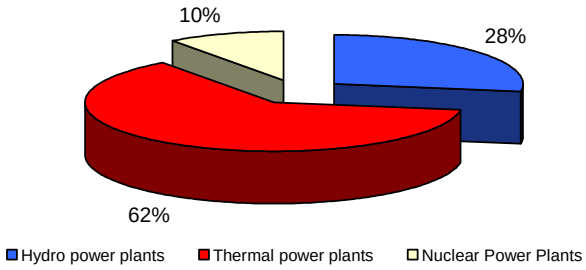
Population* Mil	Area km2	Capital	Currency		Electricity kWh/cap.	consumption* GWh
22.6	238000	Bucharest	$=Lei 17.84	Euro=Lev ***	2326	52577

* for year 2001
Electricity consumption= Electricity gross consumption

PRODUCTION GWh

	2001
Hydro power plants	14872
Thermal power plants	33570
Nuclear Power Plants	5446

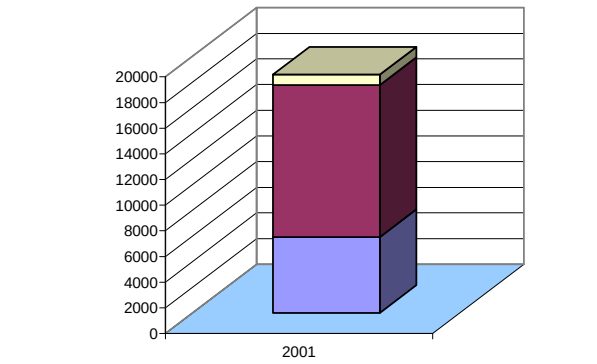
Hydro and Thermal Production



INSTALLED CAPACITIES **MW**

	2001
Hydro power plants	5905
Thermal Power plants	11845
Nuclear Power Plants	800
TOTAL	18550

Installed capacity



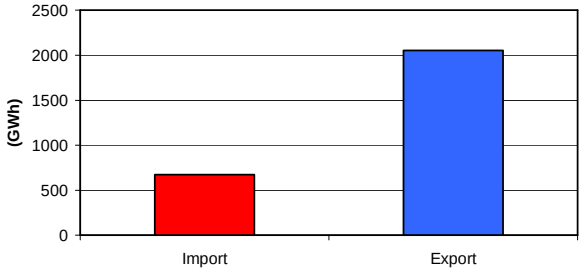
CONSUMPTION

	2001
GWh	52577

CAPACITIES OF THE TRANSMISSION AND DISTRIBUTION NETWORKS

	2001	
Voltage level (kV)	Installed capacities (MVA)	Length of the overhead lines and cables (km)
750	2500	154.5
400	13000	4599
220	18990	4892.5
150	-	
110	1458	6473.5
35	-	
10	-	
0.4	-	-
(750+400+220)only	-	-

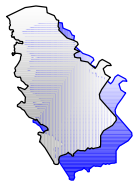
Electric energy exchange



ELECTRIC ENERGY EXCHANGE

(GWh)	2001
Saldo	1379
Import	673
Export	2052

ELECTRIC POWER SYSTEM OF SERBIA



BASIC DATA

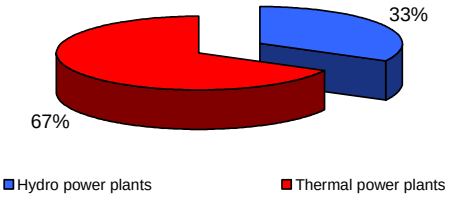
Population* Mil	Area km2	Capital	Currency		Electricity kWh/cap.	consumption* GWh
9.7	88361	Belgrade	$=Dinar 69.97	Euro=Dinar 59.99	2752	33797

* for year 2001
Electricity consumption= Electricity gross consumption

PRODUCTION GWh

	2001
Hydro power plants	10693
Thermal power plants	22043

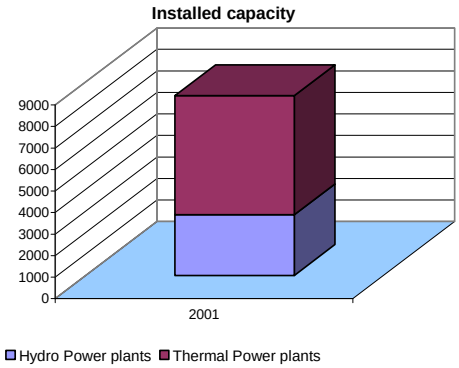
Hydro and Thermal Production



INSTALLED CAPACITIES MW

	2001
Hydro Power plants	2831
Thermal Power plants	5524
TOTAL	8355

Installed capacity



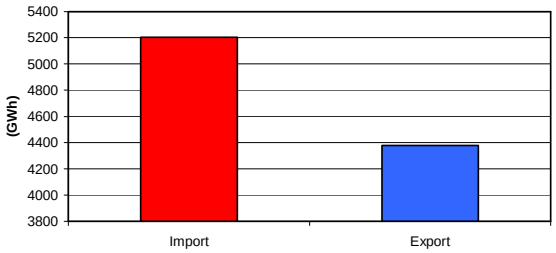
CONSUMPTION

	2001
GWh	33797

CAPACITIES OF THE TRANSMISSION AND DISTRIBUTION NETWORKS

	2001	
Voltage level (kV)	Installed capacities (MVA)	Length of the overhead lines and cables (km)
750	-	-
400	6450	1559
220	6801	2187
150	-	-
110	12984	6473.5
35	6592	7342.4
10	11426	35398
0.4	-	109956
(750+400+220)only	-	-

Electric energy exchange



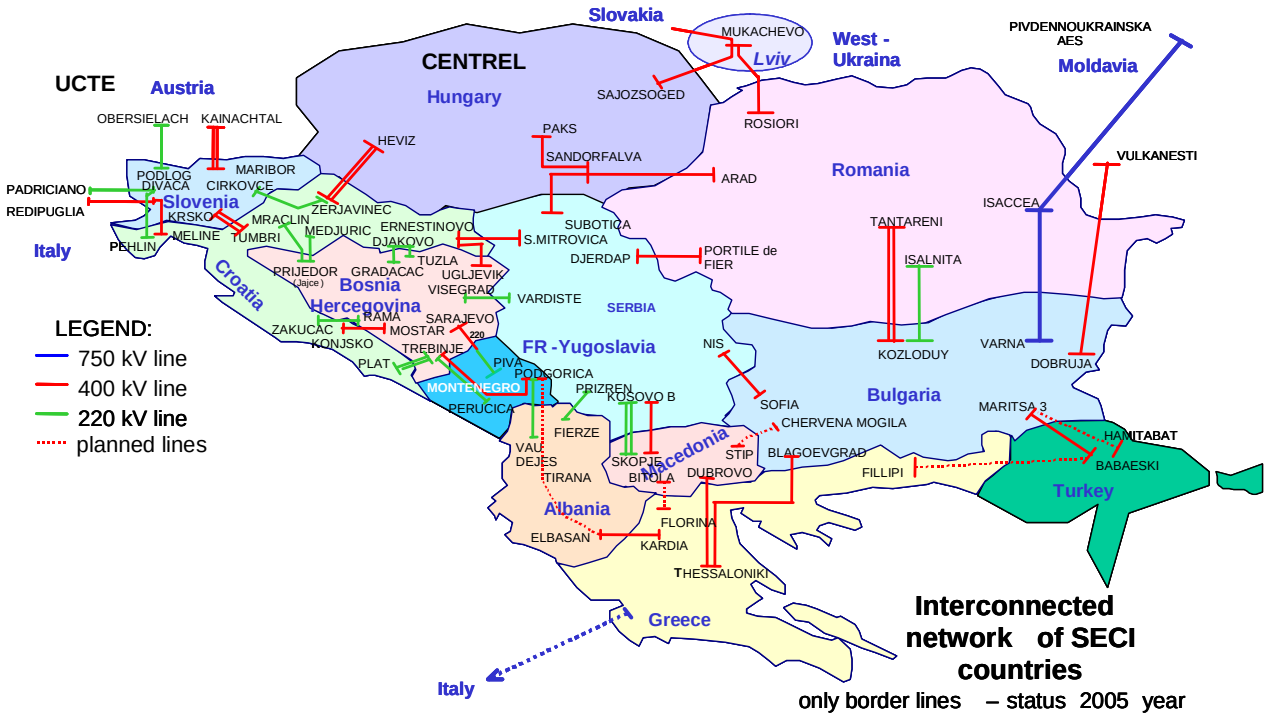
ELECTRIC ENERGY EXCHANGE

(GWh)	2001
Saldo	-825
Import	5203
Export	4378

2.4. Technical Specification of New Transmission Lines Candidates and Substations

The figure 2.4.1 depicts the interconnection lines between electric power systems of Southeast Europe forecasted to exist in the year 2005.

Figure 2.4.1. Interconnection lines in Southeast Europe in 2005 year



The following table contains basic technical data of new interconnection transmission lines candidates as well as the technical data for the substations that are to be constructed or repaired till 2005. Electrical parameters corresponding to a certain types of conductors are presented in the table 2.1.2.

Table 2.4.1. New transmission lines candidates and new substations in year 2005

Project	Type	U kV	Countries Involved	Status 2005	Current Status	Line length (km)	Conductors type	Type*
Mostar	S/S	400	B&H, CRO, YUG	In		-	-	-
Ernestinovo	S/S	400	CRO, YUG, B&H	In	Prepar. constr.	-	-	-
Skopje 5	S/S	400	MKD	In		-	-	-
Zerjavinec	S/S	400	CRO	In	Prepar. constr.	-	-	-
Sombor	S/S	400	YUG	In		-	-	-
Stip	S/S	400	MKD	In	Prepar. constr.	-	-	-
Bitola - Florina	OHL	400	GRE, MKD	In	Prepar. constr.	40	2x490	A
Maritza 3 - Hamitabat	OHL	400	BUL, TUR	In	Construction	149	3x400	B
Filippi - Babaeski	OHL	400	GRE, TUR	In	Waiting Decision	250	3x400	B
Sombor - Pecs	OHL	400	YUG, HUN	Option	Idea	80	2x490	A
Nis -Skopje 5	OHL	400	YUG, MKD	Option	Idea	156	2x490	A
Sremska Mitrovica - Ugljevik	OHL	400	YUG, B&H	Option	Prepar. constr.	75	2x490	A
Elbasan - Tirana - Podgorica	OHL	400	ALB, MN(YUG)	Option		203	2x490	A
Fierza - Prizren	OHL	220	ALB, SER(YUG)	Option	Idea	71	2x(360)	C
B. Luka-Zagreb	OHL	400	B&H, CRO	Option	Idea	230	2x490	A
Bekescaba-Oradea	OHL	400	HUN, ROM	Option	Idea	92	3x450	?
Heviz - Cirkovce	OHL	400	HUN, SLO	Option		160	2x490	A
Ernestinovo -Pecs	OHL	400	CRO, HUN	Option	Idea	85	2x(2x490)	A
Stip - Cervena Mogila	OHL	400	BUL, MKD	Option	Prepar. constr.	150	2x490	A
Skopje - Tirana	OHL	400	ALB, MKD	Option	Prelim. Analyses	200	2x490	A
Maritza 3 - Filippi	OHL	400	BUL, GRE	Option	Waiting Decision	257	3x400	B
Isaccea	B/B	400	ROM	Option		-	-	-
Tirana	S/S	400	ALB	Option		-	-	-

All interconnection lines candidates that are investigated in the analyses are coloured in the table 2.4.1 and depicted with red lines in the figure 2.4.2.

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Figure 2.4.2. Interconnection lines in Southeast Europe in year 2005

2.5. Exchange Scenarios and Injection Nodes

There are eight scenarios for 2005 winter and two scenarios for 2005 summer observed within the study. For winter 2005, energy transfer has been analyzed from north to south, south to north, west to east and east to west considering that Turkey is in parallel operation with the UCTE, and then again considering that Turkey is not in parallel operation with UCTE. The table 2.5.1 presents the assumed values of interchange programs in all cases.

Only two summer scenarios injection nodes tables are presented in the text as the most probable to occur since they refers to the energy transfer from west to east and from north to south in the topology with Turkish electric power system connected to the rest of the grid (scenarios 1 and 5, summer conditions).

Table 2.5.1. Interchange schedule table for the year 2005

	UCTE	CENTREL*	Burstin island	TURKEY	ROMANIA	BULGARIA	GREECE	ALBANIA		
1	1500			-1500					W to E	with TUR
2	-1500			1000			500		E to W	with TUR
3	1200					-200	-700	-300	W to E	without TUR
4	-1500				500	500	500		E to W	without TUR
5		500	500	-1000	500**		-500		N to S	with TUR
6		-1500		1000		500			S to N	with TUR
7		500	700			-200	-700	-300	N to S	without TUR
8		-1500			500	500	500		S to N	without TUR

+ Generation

- Load

*Border between Hungary and northern CENTREL countries

** From Isaccea

Used logic: the longest path of electric energy is from the east to the west and vice versa and from the south to the north and vice versa

According to the table 2.5.1 injection nodes tables were formed. These tables are presented in the appendix A (tables 2.5.2 – 2.5.11).

3. METHODOLOGY

3.1. Power System Modeling

The power systems of Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Greece, Hungary, Macedonia, Romania, Slovenia, Federal Republic of Yugoslavia (Serbia and Montenegro), and Turkey are represented by equivalent multipoles for voltage levels 750 kV, 400 kV, 380 kV, 220 kV, 154 kV, 150 kV, 120 kV, 110 kV. (There are several nodes at 30 kV in Greek power system). An equivalent "pi" circuit is used for modeling transmission lines 110, 120, 150, 154, 220, 380 and 400 kV. System transformers as well as step up transformers in power plants are modeled by a regular equivalent circuit. In the power system models of Albania, Bosnia and Herzegovina, Bulgaria, Greece, Yugoslavia, and Turkey main power plants are modeled with generator's busbars and corresponding step up transformers. In the power system models of Croatia, Hungary, Macedonia, Romania and Slovenia main power plants are modeled with generators directly connected to the high voltage nodes. Generator's models, synchronous compensators and Static Var Device models account for reactive power limits. Generators are modeled as reactive power sources within a range between Qmin and Qmax without voltage drop. Loads are modeled with constant active and reactive power that presumes a certain reserve in respect to steady-state stability analysis. Shunt reactors and capacitors, connected to the high voltage grid are simulated with their appropriate admittance. Calculated losses apply to the modeled high voltage network, could be used for comparative analysis only and should not be accepted as an absolute value.

UCTE power systems are modeled by a 400/220 kV equivalent of Austrian and Italian power systems. UCTE power systems are connected to the South East European power pool through the OHL 400 kV Redipuglia - Divaca and OHL 220 kV Padriciano -Divaca, connecting the power system of Italy to the power system of Slovenia and double circuit OHL 400 kV Kainachtal - Maribor and OHL 220 kV Obersielach - Podlog, connecting the power system of Austria to the power system of Slovenia.

CENTREL power systems are modeled with two distributed 400 kV buses, Gabcikovo and Levice of the Slovak power system, connected to the Hungarian power system through the OHL 400 kV Gabcikovo - Gyor and the OHL 400 kV Levice - God.

The power system of Ukraine is modeled with two distributed buses Mukachevo 400 kV and Mukachevo 220 kV. The power system of Ukraine is connected to the power system of Hungary using the OHL 400 kV Mukachevo - Sajoszoged and two 220 kV lines: OHL 220 kV Mukachevo - Kisvarda and OHL 220 kV Mukachevo - Tiszalok.

The connection between the power system of Italy and the power system of Greece through a 400 kV DC line is modeled by an injection at the 400 kV substation KARACQOU (Greece).

A back to back station, connecting Romania to Ukraine is modeled by an injection at the 400 kV substation of Isaccea (Romania).

Input data for the study, is provided by experts from KESH (Albania), ZEKC, EPBiH, EPRS, EPHZHB (Bosnia and Herzegovina), NEK (Bulgaria), HEP (Croatia), ESM (Macedonia), PPC/HTSO (Greece), MVM (Hungary), Transelectrica (Romania), ELES (Slovenia) TEIAS (Turkey), EPS (Yugoslavia - Serbia) EPCG (Yugoslavia - Montenegro), EKC (Yugoslavia) and EIHP "Hrvoje Pozar" (Croatia).

3.2. Data Processing Software

Load flow calculations and security assessment are performed using PSS/E software developed by Power Technologies Inc. (PTI), USA. Main power system operating parameters computed by the software package are:

- active and reactive power flows of the network;
- voltage profile in every node of the network;
- active and reactive power losses;
- relative effective rating of each component of the network in comparison with designated rating.

Special developed software tools in PSS/E software are used to automatically investigate outage operating conditions with "n-1" contingency criteria.

3.3. Study Methodology

To check the loading of network elements and the technical feasibility of operating parameters, absolute peak load conditions for a working day during winter and absolute peak load conditions for a working day during summer are modeled. The system adequacy is checked for operating conditions using "n-1" contingency criterion. Assessment of transmission lines loading is done in comparison to the maximum rated current for the relevant conductor's cross-section. Assessment of transformers loading is done in respect to their nominal capacity. A feasibility evaluation of operating condition parameters and a reactive power margins assessment for light load power systems conditions are done as well. Criteria used to estimate maximum transfer capability of the network are:

- Contingency criterion "n-1";
- Rated current - current for thermal limit.

3.4. Study Approach

Eight cases for electricity exchange between the power systems of the SECI Countries included in the scope of this study are considered, as well as electricity exchange between these power systems and that of the UCTE, CENTREL and the Burstin Island. It is considered that cases should be denominated with "EX" code (from Exchange) followed by a digit from 1 to 8 for each case. The approach considered in the study is summarized as follows:

- Exchange 1 is an export of 1500 MW from UCTE to Turkey.
- Exchange 2 is an export of 1000 MW from Turkey and 500 from Greece to UCTE.
- Exchange 3 is an export of 1200 MW from UCTE - 200 MW to Bulgaria, 700 MW to Greece and 300 MW to Albania.

- Exchange 4 is an export of 500 MW from Romania, 500 MW from Bulgaria and 500 MW from Greece - total 1500 MW to UCTE.

- Exchange 5 is an export of 500 MW from CENTREL, 500 MW from Burstin Island (Ukraine) and 500 MW from Romania - 1000 MW to Turkey and 500 MW to Greece.

- Exchange 6 is an export of 1000 MW from Turkey and 500 MW from Bulgaria - 1500 MW to CENTREL.

- Exchange 7 is an export of 500 MW from CENTREL and 700 MW from Burstin Island - 200MW to Bulgaria, 700 MW to Greece and 300 MW to Albania.

- Exchange 8 is an export of 500 MW from Romania, 500 MW from Bulgaria and 500 MW from Greece - total 1500 MW to CENTREL.

Exchanges No 1, 2, 5 and 6 are for parallel operation with the power system of Turkey. Exchanges 3, 4, 7 and 8 are for parallel operation without the power system of Turkey.

All exchanges are presented in Table 2.5.1.

These exchanges are in addition to the existing long term contract exchanges outlined in section 2.2 of this report and are summarized again as follows:

For the winter peak load:

Bulgaria exports 700MW to Turkey. UCTE exports 316 MW to Croatia. Ukraine exports 250 MW to Hungary and CENTREL exports 275 MW to Hungary.

For the summer peak load:

Bulgaria exports 700 MW to Turkey. Slovenia exports 316 MW to Croatia. Ukraine exports 250 MW to Hungary and CENTREL exports 350 MW to Hungary.

A description of the power balance modification for power systems participating in the relevant exchange is presented in table 2.5.2 – 2.5.11 in the appendix.

3.5. Contingency Schemes

Schemes of the power systems of SECI countries for contingency operating conditions have been investigated. Contingency schemes that are adopted for "n-1" evaluation in order to reduce the amount of computations are shown in the appendix A (tables 3.1 – 3.12):

Main considerations for adopting these contingency schemes are:

- They include the main existing interconnection lines between the SECI power systems;

- They have a strong influence on the rest of the system during states of emergency (N-1);

- They are the most loaded internal transmission lines and transformers in the high voltage networks of all SECI power systems.

4. ANALYSIS OF THE RESULTS

The models were used for technical study preparation to investigate the regional impact of the new interconnection investments considered by the different power companies in South East Europe. The Interconnection Study Task Group (ISTG), established to perform the calculations, consists of the experts from: Energy Institute "Hrvoje Pozar" in Croatia, Electricity Coordination Center (EKC) in Serbia, NEK in Bulgaria, Joint Electricity Coordination Center (ZEKC) in Bosnia and Herzegovina, CMS Energy in the USA (Project Managers) and ESM in Macedonia (Project Coordinators). The studies are based on the steady state and security analyses for the year 2005.

Analyses of the new candidate interconnection investment options procedure has been defined and approved by Technical Coordination Group. Technical analyses are based on: power flows, power losses, security, and maximum transits. Economical criteria have not been considered in this Project phase.

ISTG members performed the calculations using the PTI PSS/E software. As the ISTG considered 13 scenarios of exchange and 12 new candidate investment options, several hundreds of power flow calculations have been performed in order to consider possible bulk power transfers across the region. Analysis of all load flow cases (base case and exchange scenarios) for all interconnection lines candidates will be presented in this chapter. Tables with maximum active power flow exchanges, active power losses and contingency analysis are presented and along with summary comments.

4.1. Power Flows

New interconnection candidate line power flows in all scenarios are given in tables 4.1 – 4.12. in the appendix A. In these tables, power flows on chosen interconnection lines with their power load are presented in MW/Mvar and % of thermal limit, for every new line candidate and every investigated exchange scenario. These tables show power flows without new line (white rows) and with new line (orange rows). Purpose of these tables is to have a better view of influence of newly built line on power flows on interconnection lines in region depending on the exchange scenario. Table 4.13 represents a summary table, to compare line candidates between themselves.

From the Table 4.13 it is clear how much each line participates in load flows for each exchange scenario. In base case the highest loaded line is Sombor (Yug) – Pecs (Hun) (-182 MW/-30 Mvar with Turkey, -183 MW/-30 Mvar without Turkey, both for winter peak, and -131 MW/-30 Mvar for summer peak) and that is 14% of its thermal rate for the winter and 10% of its thermal rate for the summer. The highest loaded line in all scenarios is Ernestinovo (Cro) – Pecs (Hun) with the load of 408 MW /-150 Mvar (17% of the thermal rate) in scenario 6. Generally, in all analyzed cases line loads are lower than 27% of the thermal rate (maximum percentage for the line Sombor (Yug) – Pecs (Hun) in scenario 7).

Detailed results of the load flow calculations for each scenario and each interconnection line (existing and candidate) is presented in appendix B. In appendix B tables it can be seen how each new candidate line change the line load on other existing interconnection lines.

Table 4.13. Interconnection candidate lines power flows

No.	INTERCONNECTION LINE	POWER FLOWS																							
		WINTER																				SUMMER					
		Base case				Scenario 1		Scenario 2		Scenario 3		Scenario 4		Scenario 5		Scenario 6		Scenario 7		Scenario 8		Base case		Scenario 1		Scenario 5	
						UCTE >> TUR (W>>E)		TUR,GRE >> UCTE (E>>W)		UCTE >> BUL,GRE,ALB (W>>E)		BUL,GRE,ROM >> UCTE (E>>W)		CEN,UKR,ROM >> TUR,GRE (N>>S)		TUR,BUL >> CEN (S>>N)		CEN,UKR >> BUL,GRE,ALB (N>>S)		ROM,BUL,GRE >> CEN (S>>W)				UCTE >> TUR (W>>E)		TUR,GRE >> UCTE (E>>W)	
		With TUR		Without TUR		600		700		1000		700		1000		1500		1000		1500		With TUR		600		1200	
		MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%
1	OHL 400kV Podgorica (YUG)-Elbasan (ALB)	57/-4	4	47/-2	4	137/-10	10	-49/7	4	236/-13	18	-51/9	4	164/-12	12	-101/13	8	222/-11	17	-118/17	9	17/-4	1	102/-14	8	157/-15	12
2	OHL 400kV S.Mitrovica (YUG)-Ugljevik (B&H)	64/-14	5	61/-14	5	-6/-1	0	135/-16	10	-12/6	1	135/-16	10	60/41	6	158/-9	12	48/-6	4	153/-9	12	45/-60	6	-14/-48	4	36/-54	5
3	OHL 400kV Nis (YUG)-Skopje 5 (MKD)	8/-65	5	-12/-62	5	32/-69	6	-49/-58	6	128/-74	11	-55/-56	6	128/-74	11	-29/-64	5	141/-75	12	-83/-53	7	-2/-36	3	41/-40	4	156/-41	12
4	OHL 400kV Sombor (YUG)-Pecs (HUN)	-182/-30	14	-183/-30	14	-273/-19	21	-70/-50	7	-333/-12	25	-71/-50	7	-284/-16	22	107/-101	11	-356/-12	27	104/-99	11	-131/-30	10	-217/-21	17	-251/-18	19
5	OHL 220kV Prizren (YUG)-Fierze (ALB) 2	-57/-23	18	-58/-23	18	-59/-22	18	-57/-24	18	-6/-32	9	-57/-24	18	-51/-24	17	-51/-26	17	0/-34	10	-58/-25	18	-32/-22	11	-32/-22	11	-22/-24	9
6	OHL 400kV B.Luka (B&H)-Tumbri (CRO)	-85/-61	6	-85/-61	2	-172/-43	12	15/-78	6	-228/-28	17	12/-73	5	-139/-53	10	57/-74	7	-185/-45	14	52/-74	7	-63/-50	6	-157/-36	12	-135/-42	10
7	OHL 2x400kV Ernestinovo (CRO)-Pecs (HUN)	- 34 / -66	3	- 34 / -68	3	- 122 / -64	5	84 / -92	5	216 / -64	9	80 / -92	5	- 240 / -42	9	408 / -150	17	-360 / -32	14	380 / -144	15	-70 / 10	3	-164 / 12	6	-318 / 34	12
8	OHL 400kV Bekescaba (HUN)-Oradea (ROM)	71 / -41	8	74 / -41	8	140 / -44	6	-9 / -33	3	173 / -45	18	-8 / -33	3	150 / -48	16	-149 / -10	15	216 / -48	22	-169 / -5	17	17 / -43	5	89 / -49	10	110 / -52	12
9	OHL 400kV Heviz (HUN)-Cirkovce (SLO)	-145 / -29	11	-147 / -29	11	-220 / -7	17	-87 / -34	7	-218 / 6	17	88 / -34	7	-74 / -38	6	-286 / -6	22	-29 / -42	4	-281 / -7	21	-90 / -75	9	-163 / -61	13	-8 / -84	6
10	OHL 400kV Skopje (MKD)-Tirana (ALB)	25 / -63	5	27 / -65	5	-19 / -56	4	155 / -17	4	-2 / -52	4	74 / -67	7	-20/ -55	4	113 / -65	10	10 / -56	4	102 / -66	9	43 / -79	7	0 / -74	5	-2/ -73	5
11	OHL 400kV C.Mogila (BUL)-Stip (MKD)	13 / -52	5	-11 / -48	4	18 / -53	5	-27 / -48	4	120 / -57	10	-38 / -45	5	120 / -61	11	32 / -54	5	129 / -62	12	-56 / -43	6	7 / -31	3	-6 / -30	3	115/ -38	10
12	OHL 400kV Maritza East 3 (BUL)-Phillipi (GRE)	125 / -103	10	76 / 94	7	78 / -98	7	134 / -49	8	192/ 90	16	36 / -73	6	178/ -103	10	224 / -103	13	200 / -95	17	16 / -92	6	112 / 48	7	60 / 55	4	176/ 41	11

4.2. Active Power Losses

In the tables 4.14-4.25 in appendix A, active power losses are presented in individual systems and whole model in MW, for every new line candidate and every investigated exchange scenario. These tables show active power losses without (white rows) and with new line (orange row), as well as relative change of active power losses in % (yellow rows).

Power losses in every power system in South East Europe have been determined for every power exchange scenario. Losses are determined with and without new candidate line. Table 4.26 represents a summary table of active power losses for every power system in the region without any new candidate line. These values can be used as reference values for power loss comparison with the cases when new interconnection lines are in operation.

As it can be seen from the table 4.26 the highest active power losses are in the Greek, Turkish and Romanian systems (239 MW, 186 MW and 140 MW respectively), while the lowest losses level is in Macedonian and Slovenian system (1.9 MW and 5.0 MW, respectively). Because of this great power losses difference from system to system, new candidate line influence on power losses decreasing in percentage in each system can be significantly different.

In general, new candidate line influence on total regional active power losses is very limited (less than 1%). But, active power losses in some systems in the region are significantly reduced with new line in comparison with power losses without new line. Those systems are neighboring systems connected by new candidate line. Loss reduction in those cases varies from 1% to 22% of active power losses. In some cases active power losses reduction is very high, the most significantly for the line Ernestinovo (Cro) – Pecs (Hun) in scenario 8 in which active power losses in Croatian system are 22% lower than without line, and at the same time loss reduction in Hungarian system is 11%, even though total regional power losses are not significantly reduced (0.9%). One of the reasons for this great change is the relatively small power loss level in Croatian and Hungarian system in the base case. Also, in some cases power losses are reduced or increased in the neighboring systems that are not connected with a new line. The most significant is the case of the line Heviz (Hun) – Cirkovce (Slo), when power losses in Croatian system are decreased for 16.5% for summer scenario 1. Also new line 400kV Podgorica (YUG) – Tirana (ALB) – Elbasan (ALB) has a big influence on active power losses in Albania, Yugoslavia and Macedonia, for two reasons:

1. Upgrade of part of Albanian network on 400 kV level (causes slight decrease of losses in Albanian transmission system up to 3.6%)
2. This line represents a alternative path for energy transfer from East to West, parallel to path over power systems of Serbia and Macedonia

This is the reason why in some investigated exchange scenarios we have an increase of active power losses in Albania (up to 6%) and a decrease of active power losses in systems of Yugoslavia (up to 2%) and Macedonia (up to 16%) at the same time (consequence of transit increase over Albanian system and reduction of transit over systems of Serbia and Macedonia).

Values in tables 4.14-4.26 in the appendix A show power losses change in each country per scenario (all without new lines). Depending on power exchange direction power losses changes can be significant. For detailed analyses all power losses data with new interconnection lines are given in appendix B.

Table 4.26. Power losses in South East Europe for all scenarios without new interconnection lines

	ACTIVE POWER LOSSES												
	WINTER										SUMMER		
	Base case		Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6	Scenario 7	Scenario 8	Base case	Scenario 1	Scenario 5
			UCTE >> TUR (W>>E)	TUR,GRE >> UCTE (E>>W)	UCTE >> BUL,GRE,ALB (W>>E)	BUL,GRE,ROM >> UCTE (E>>W)	CEN,UKR,ROM >> TUR,GRE (N>>S)	TUR,BUL >> CEN (S>>N)	CEN,UKR >> BUL,GRE,ALB (N>>S)	ROM,BUL,GRE >> CEN (S>>W)		UCTE >> TUR (W>>E)	TUR,GRE >> UCTE (E>>W)
AREA	With TUR	Without TUR	600	700	1000	700	1000	1500	1000	1500	With TUR	600	1200
Albania	25,7	25,5	27,8	24,2	24,7	24,3	29,2	24,4	24,3	24,2	21,8	23,3	25,5
Bulgaria	67,5	68,2	74,5	69,4	69,6	70,1	75,2	83,8	70	73,2	25	32,6	37,6
Bosnia and Herzegovina	13,6	13,6	14,6	16,3	17,6	16,4	13,9	20,3	15,6	20,3	5,1	7,1	7,3
UCTE	87,9	87,9	109,4	111,6	110,4	110,5	86,4	101,9	86,6	101,6	51,8	72,8	51,1
Croatia	8,8	8,8	14,4	10,3	19,8	10	10	18,6	12,6	17,6	5,4	10,9	8,3
Hungary	37,5	37,5	40,1	44,7	45,1	44,5	49,9	74,8	64,8	75,7	17,1	19,1	26,6
Greece	239,2	239,6	241,7	236,1	244	243,9	240,6	243,1	244,4	240,3	321,8	326,3	325,4
Macedonia	1,9	1,9	2,2	2,6	2,8	2,7	2,8	3	2,8	3,9	1,3	2,1	3,6
Romania	139,9	141,2	141,9	144,3	140,3	141,6	127,7	164,2	140,1	157,9	100,9	106,7	95,3
Slovenia	5	5	6,7	6,2	8,3	6,1	5,1	5,7	5,3	5,7	3,4	4,8	3,6
Turkey	185,9	/	180,7	194,5	/	/	184,3	213,9	/	/	136,9	148,8	146,4
Yugoslavia	99,7	99,7	102,3	108,6	112,3	108,7	103,9	137,8	110,7	134,1	41,1	42,6	47,7
TOTAL	**913,6**	**730**	**957,3**	**969,8**	**796**	**779,6**	**933,3**	**1096,1**	**786,3**	**859**	**732,8**	**798,1**	**783,4**

4.3. Maximum Power Flow Exchanges

Analyses started with scheduled exchanges shown in table 4.27. Power exchange values are chosen on the base of regional system reserves and possible future market expectations. For examined scheduled power exchanges some limitations in internal networks have been determined. Due to those limitations, exchange programs were not possible according to N-1 criteria. To solve this, decreasing of scheduled bulk power transfers was done using a 100 MW steps approach. As a result, maximum possible transfers according to N-1 criteria were calculated as shown in table 4.27. Maximum power exchanges are decreased in scenarios 1 (600 MW), 2 (700 MW), 3 (1000 MW), 4 (700 MW), 5 (1000 MW) and 7 (1000 MW) for winter regime and scenarios 1 (600 MW) and 5 (1200 MW) for summer regime. Starting scheduled exchange of 1500 MW is possible only in scenarios 6 and 8 for winter peak.

Table 4.27. Bulk power exchange scenarios

Winter peak			
From	To	Scheduled exchange (MW)	Maximum exchange (MW)
UCTE	TUR	1500	600
TUR, GR	UCTE	1500	700
UCTE	BUL, GR, ALB	1200	1000
ROM, BUL, GR	UCTE	1500	700
CENTR,Burstin Isl.,ROM	TUR,GR	1500	1000
TUR,BUG	CENTR	1500	1500
CENTR,Burstin Isl.	BUL,GR,ALB	1200	1000
ROM,BUL,GR	CENTR	1500	1500
Summer peak			
UCTE	TUR	1500	600
CENTR,Burs,ROM	TUR,GR	1500	1200

Every scenario is calculated with and without the single candidate line. Hence, each interconnection candidate lines benefit and participation in power exchanges was defined. Table 4.28 shows the influence of each new interconnection line on maximum power exchanges for all examined regimes. The purpose of this table is to show the influence of each new proposed interconnection line in enlarging possible bulk power exchanges. The table shows the maximum transit reached without the new line (white rows) and with the new line (orange rows), in order to evaluate the new lines. In the yellow column is a code of outage overloading causes. Codification for limiting outages is presented in table 4.29.

Table 4.28. Maximum power exchanges with and without new lines

		MAXIMUM REACHED EXCHANGES																					
		WINTER																		SUMMER			
		UCTE >> TUR (W>>E)		TUR,GRE >> UCTE (E>>W)		UCTE >> BUL,GRE,ALB (W>>E)		BUL,GRE,ROM >> UCTE (E>>W)		CEN,UKR,ROM >> TUR,GRE (N>>S)		TUR,BUL >> CEN (S>>N)		CEN,UKR >> BUL,GRE,ALB (N>>S)		ROM,BUL,GRE >> CEN (S>>W)		UCTE >> TUR (W>>E)		TUR,GRE >> UCTE (E>>W)	
No.	NEW LINE	scenario 1	*	scenario 2	*	scenario 3	*	scenario 4	*	scenario 5	*	scenario 6	*	scenario 7	*	scenario 8	*	scenario 1	*	scenario 5	*
1	OHL 400kV Podgorica (YUG)-Elbasan (ALB)	600	B	700	C	1000	D	700	C	1000	B	1500	A	1000	E	1500	A	600	B	1200	B
		600	B	700	C	1100	E	700	C	1000	B	1500	A	1000	E	1500	A	600	B	1200	B
2	OHL 400kV S.Mitrovica (YUG)-Ugljevik (B&H)	600	B	700	C	1000	D	700	C	1000	B	1500	A	1000	E	1500	A	600	B	1200	B
		600	B	700	C	1000	D	700	C	1000	B	1500	A	1000	E	1500	A	600	B	1200	B
3	OHL 400kV Nis (YUG)-Skopje 5 (MKD)	600	B	700	C	1000	D	700	C	1000	B	1500	A	1000	E	1500	A	600	B	1200	B
		600	B	700	C	1100	D	700	C	1000	B	1500	A	1000	E	1500	A	600	B	1200	B
4	OHL 400kV Sombor (YUG)-Pecs (HUN)	600	B	700	C	1000	D	700	C	1000	B	1500	A	1000	E	1500	A	600	B	1200	B
		600	B	700	C	1100	D	700	C	1000	B	1500	A	1000	E	1500	A	600	B	1200	B
5	OHL 220kV Prizren (YUG)-Fierze (ALB) 2	600	B	700	C	1000	E	700	C	1000	B	1500	A	1000	E	1500	A	600	B	1200	B
		600	B	700	C	1000	E	700	C	1000	B	1500	A	1000	E	1500	A	600	B	1200	B
6	OHL 400kV B.Luka (B&H)-Tumbri (CRO)	600	B	700	C	1000	E	700	C	1000	B	1500	A	1000	E	1500	A	600	B	1200	B
		600	B	700	C	1000	E	700	C	1000	B	1500	A	1000	E	1500	A	600	B	1200	B
7	OHL 2x400kV Ernestinovo (CRO)-Pecs (HUN)	600	B	700	C	1000	D	700	C	1000	B	1500	A	1000	E	1500	A	600	B	1200	B
		600	B	700	C	1000	D	700	C	1000	B	1500	A	1100	E	1500	A	600	B	1200	B
8	OHL 400kV Bekescaba (HUN)-Oradea (ROM)	600	B	700	C	1000	D	700	C	1000	B	1500	A	1000	E	1500	A	600	B	1200	B
		600	B	700	C	1100	D	700	C	1000	B	1500	A	1100	E	1500	A	600	B	1200	B
9	OHL 400kV Hevitz (HUN)-Cirkovce (SLO)	600	B	700	C	1000	D	700	C	1000	B	1500	A	1000	E	1500	A	600	B	1200	B
		600	B	700	C	1100	D	700	C	1000	B	1500	A	1000	E	1500	A	600	B	1200	B
10	OHL 400kV Skopje (MKD)-Tirana (ALB)	600	B	700	C	1000	D	700	C	1000	B	1500	A	1000	E	1500	A	600	B	1200	B
		600	B	700	C	1100	E	700	C	1000	B	1500	A	1000	E	1500	A	600	B	1200	B
11	OHL 400kV C.Mogila (BUL)-Stip (MKD)	600	B	700	C	1000	D	700	C	1000	B	1500	A	1000	E	1500	A	600	B	1200	B
		600	B	700	C	1100	D	700	C	1000	B	1500	A	1000	E	1500	A	600	B	1200	B
12	OHL 400kV Maritza East 3 (BUL)-Phillipi (GRE)	600	B	700	C	1000	D	700	C	1000	B	1500	A	1000	E	1500	A	600	B	1200	B
		600	B	700	C	1100	D	700	C	1000	B	1500	A	1100	E	1500	A	600	B	1200	B

without new line
with new line
*REMARKS (constraint)

Table 4.29. Constraints in power exchanges

No.	outaged branch	overloaded branch
A	sheduled exchange	/
B	OHL 380kV 4HABIPLR (TUR) - 4UNIMRDG (TUR)	OHL 380kV 4IKITELL (TUR) - 4UNIMRDG (TUR)
C	OHL 400kV IRDPV111 (ITA) - LDIVAC1 (SLO)	DID NOT CONVERGE
D	OHL 220kV PLJEVLJA (YUG) - MOJKO(O) (YUG)	OHL 220kV PODGORI1 (YUG) - HEPERUCI (YUG)
E	TR 400/220kV SMIT24 (YUG)	OHL 220kV SRB 22 (YUG) - NSA 32 (YUG)

Because of the previously mentioned limitations in certain internal networks, all of the new candidate lines have a low impact on increasing maximum exchanges. Limiting internal lines and transformers are located in Turkey (OHL 380 kV Habipler – Unimar DG) and Yugoslavia (transformer 400/220 kV Sremska Mitrovica and OHL 220 kV Pljevlja – Mojkovac), as shown in table 4.29. There is also one existing interconnection line that limits power exchanges (scenarios 1 and 4 for winter and scenario 1 for summer regime) and that is OHL 400 kV Redipuglia (ITA) – Divaca (SLO). For detailed analyses of mentioned limiting interconnection line it would be necessary to model complete Italian, Austrian and German network.

Several other limiting events and transmission elements were discovered that are constant in all scenarios (present also in base case). These limitations are shown in table 4.30.

Table 4.30. Other constraints in power exchanges

outaged branch	overloaded branch
limitations in all scenarious including base case	
OHL 220 kV Tirana (Alb) – Rashb (Alb)	OHL 220 kV Elbasan (Alb) – Fier (Alb)
OHL 220 kV Bucuresti (Rom) – Fundeni (Rom) 1	OHL 220 kV Bucuresti (Rom) – Fundeni (Rom) 2
limitations that can be removed by dispatcher manipulations	
OHL 400 kV Djerdap (Yug) – Bor (Yug)	OHL 220 kV Bajina Basta (Yug) – Pozega (Yug)
OHL 400 kV Bor (Yug) – Nis (Yug)	OHL 220 kV Bajina Basta (Yug) – Pozega (Yug)
OHL 400 kV Kragujevac (Yug) – Svetozarevo (Yug)	OHL 220 kV Bajina Basta (Yug) – Pozega (Yug)
OHL 400 kV Kragujevac (Yug) – Kolubara (Yug)	OHL 220 kV Bajina Basta (Yug) – Pozega (Yug)

Two constraints appear in all scenarios. Unavailability of 220 kV line Tirana – Rashb in Albania causes 220 kV line Elbasan – Fier to be overloaded (120 % - 123 %). Unavailability of 220 kV line Bucuresti – Fundeni in Romania leads to the overloading of the parallel line (111 % - 121 % of thermal rating).

Constraints in the Yugoslav network shown in table 4.30 can be removed by production decreasing in HPP Bajina Basta or by using 110 kV network (that is not modeled in regional PSS model). So, those constraints were not taken into accounts during calculations.

The Hungarian power system is modeled by MVM experts. Since 120 kV network is not MVM's property, the Hungarian power system has been modeled using equivalents. Because of this some transit limitations occurred in Hungarian system in winter exchange scenarios 2, 4, 6 and 8. However, due to a lack of a clear understanding of these limitations, they were not taken into account in this study.

According to all mentioned limitations none of new candidate lines is significantly improving maximum possible exchanges as shown in table 4.28.

Lines Maritza East (Bul) – Philipi (Gre) and Becescaba (Hun) – Oradea (Rom) are improving maximum power exchanges for 100 MW step in winter scenarios 3 and 7, lines Podgorica (Yug) - Elbasan (Alb), Sombor (Yug) – Pecs (Hun), Nis (Yug) – Skopje (Mkd) and Skopje (Mkd) – Tirana (Alb) are improving power exchange for 100 MW step in winter scenario 3, while lines Ernestinovo (Cro) – Pecs (Hun) and Cirkovce (Slo) – Heviz (Hun) do the same improvement in winter scenario 7. But, it has to be noticed that improvements are not significant.

4.4. Contingency Analysis

Power system security was analyzed using N-1 criterion. N-1 means that the system has to operate normally (without overloads and voltages out of limits) when one element (line or transformer) is out of operation. According to this criterion, maximum power exchange scenarios are defined as shown in table 4.27. Those exchanges do not cause any overloads (except special constraints mentioned above) or any voltage troubles (voltage out of limits) in the system.

Every candidate line is also tested using the n-1 criterion during maximum power exchanges in every scenario, which means that contingency constraints were determined with and without the new line. In the table 4.31, critical elements are presented (loaded more then 95% of their thermal limit) by security n-1 criterion for all investigated exchange scenarios. The purpose of this table is to compare the influence of each proposed new interconnection line in reducing loadings. The green color (shadow) indicates the outages that are limiting bulk power transits. For a more detailed view, contingency analysis tables in the appendix B can be used (there, all elements loaded over 90% by n-1 criterion and also out of limits voltages are shown).

In table 4.31 it is obvious that new interconnection lines have very limited influence on contingency analysis results in all scenarios. This is caused by internal networks limitations mentioned above.

In table 4.31 there are some outages that limit higher power exchange for some scenarios with all line candidates. Those elements are: OHL 380 kV Habibler – Unimar DG (Turkey) in scenarios 1 and 5, winter and summer regime with Turkey, OHL 220 kV Pljevlja – Mojkovac (Yugoslavia) in scenario 3, winter with Turkey and transformer 400/220 kV Sremska Mitrovica (Yugoslavia) in scenario 7, winter with Turkey.

In all cases there are also some voltages out of limits. All data about voltages out of limits are given in the appendix B. It is assumed that all voltage problems can be solved locally.

Table 4.31. Contingency analysis results for new interconnection lines

	scenario	outage	Line	Without new line		with new line: Niš-Skopje 5		Podgorica-Elbasan		S.Mitrovica-Ugljevik		Sombor-Pecs		Bekescaba-Oradea		Ernestinovo-Pecs		Heviz-Cirkovce		M.East3-Fillipi		Ch.Mogila-Stip		Skopje-Tirana*		B.Luka-Tumbri		Prizren - Fierze 2	
				MW	%	MW	%	MW	%	MW	%	MW	%	MW	%	MW	%	MW	%	MW	%	MW	%	MW	%	MW	%	MW	%
WINTER	base case WITH TURKEY	BASE CASE	OHL 154kV AMBAR_2B-ICDAS	236	97	236	97	236	97	236	97	236	97	236	97	236	97	236	97	236	97	236	97	236	97	236	97	236	97
		OHL 220kV TIR22-RASHB22	OHL 220kV ELB122-FIER22	302	122	302	121	302	120	302	122	302	121	301	121	301	121	301	121	302	121	302	122	301	117	302	121	302	121
		OHL 220kV BUC S A-FUNDENI	OHL 220kV BUC S B-FUNDENI	372	113	372	113	373	113	372	113	373	113	372	113	372	113	372	113	372	113	372	113	372	113	373	113	373	113
		OHL 220kV BUC S B-FUNDENI	OHL 220kV BUC S A-FUNDENI	373	113	373	113	373	114	373	113	373	113	372	113	372	113	372	113	372	113	372	113	372	113	373	114	373	114
		OHL 380kV 4ADANA-4ISKENDR	OHL 154kV ALIBEY_A-YILDIZ_A	236	97	236	97	236	97	236	97	236	97	236	97	236	97	236	97	236	97	236	97	236	97	236	97	236	97
		OHL 380kV 4ADANA-4ISKENDR	OHL 154kV ALIBEY_A-YILDIZ_A	236	97	236	97	236	97	236	97	236	97	236	97	236	97	236	97	236	97	236	97	236	97	236	97	236	97
		TR 400/220kV SMIT24	OHL 220kV NSA 32-SRB 22	264	97	263	97	264	97	262	96	265	97	263	96	263	96	264	97	264	97	264	97	264	97	263	97	264	97
	base case WITHOUT TURKEY	OHL 220kV TIR22-RASHB22	OHL 220kV ELB122-FIER22	302	122	302	122	302	120	302	122	302	122	301	121	301	121	301	121	301	121	301	121	301	118	372	113	372	113
		OHL 220kV BUC S A-FUNDENI	OHL 220kV BUC S B-FUNDENI	372	113	372	113	372	113	372	113	372	113	371	113	372	113	371	113	371	113	371	113	371	113	373	113	372	113
		OHL 220kV BUC S B-FUNDENI	OHL 220kV BUC S A-FUNDENI	373	113	373	113	373	113	373	113	373	113	372	113	372	113	372	113	372	113	372	113	373	113	302	122	302	122
		TR 400/220kV SMIT24	OHL 220kV SRB 22-NSA 32	263	97	263	97	264	97	262	96	265	97	263	96	263	96	264	96	263	96	263	96	263	96	262	96,1	263	96,7
	SCENARIO 1 (600MW)	BASE CASE	OHL 154kV AMBAR_2B-ICDAS	236	97	281	92	236	97	236	97	281	92	236	97	236	97	236	97	236	97	236	97	236	97	236	97	236	97
		OHL 220kV TIR22-RASHB22	OHL 220kV ELB122-FIER22	302	122	302	122	302	120	302	122	302	122	301	122	301	122	301	122	302	122	302	123	302	122	302	122	302	122
		OHL 220kV BUC S A-FUNDENI	OHL 220kV BUC S B-FUNDENI	369	113	369	112	369	113	369	113	369	113	368	112	369	112	368	112	369	112	369	112	369	112	369	112	369	112
		OHL 220kV BUC S B-FUNDENI	OHL 220kV BUC S A-FUNDENI	370	113	370	113	370	113	370	113	370	113	368	112	369	112	369	112	369	112	369	112	369	112	369	112	369	112
		OHL 380kV 4ALIBEY-4HAMIT	OHL 154kV HAMIT-LULEBURG	207	95	207	95	207	95	207	95	207	95	206	95	206	95	206	95	207	95	207	95	207	95	207	95	207	95,2
		OHL 380kV 4HABIPLR-4UNIMRDG	OHL 380kV 4IKITELL-4UNIMRDG	995	99	995	99	995	99	995	99	995	99	995	99	995	99	995	99	995	99	995	99	995	99	1010	101	1010	101
		TR 400/220kV SMIT24	OHL 220kV SRB 22-NSA 32	266	98	266	98	267	98	265	97	268	98		<95	264	97	266	97	266	98	266	98	266	98	264	96,8	266	97,6
	SCENARIO 2 (700MW)**	BASE CASE	OHL 154kV AMBAR_2B-ICDAS	236	97	236	97	236	97	236	97	236	97	236	97	236	97	236	97	236	97	236	97	236	97	236	97,3	236	97,3
		OHL 220kV TIR22-RASHB22	OHL 220kV ELB122-FIER22	302	121	302	121	302	120	302	120	302	121	301	120	301	120	301	120	301	121	301	121	301	118	302	121	302	121
		OHL 220kV BUC S A-FUNDENI	OHL 220kV BUC S B-FUNDENI	376	115	376	115	376	115	376	115	376	115	376	114	376	114	376	114	380	116	380	116	380	116	377	115	377	115
		OHL 220kV BUC S B-FUNDENI	OHL 220kV BUC S A-FUNDENI	377	115	377	115	377	115	377	115	377	115	377	114	376	114	376	114	380	116	380	116	381	116	378	115	378	115
		TR 400/220kV SMIT24	OHL 220kV SRB 22-NSA 32	261	96	262	96	261	96	261	96	262	96	260	96	261	96	261	96	262	97	262	97	260	96	261	96,1	261	96,3
		OHL 400 kV KOSOV4 - PEC 34	OHL 220 kV KOM22 - VD22	342	98		<95		<95		<95		<95		<95		<95		<95	341	98,7	341	97,8		<95	341	97,8		<95
	SCENARIO 3 (1000MW)	OHL 220kV TIR22-RASHB22	OHL 220kV ELB122-FIER22	302	123	302	123	302	121	302	121	302	123	301	122	301	122	301	122	302	123	302	123	301	118	302	123	302	123
		OHL 220kV BUC S A-FUNDENI	OHL 220kV BUC S B-FUNDENI	368	112	368	112	369	112	368	112	369	112	367	112	369	112	368	112	368	112	368	112	368	112	369	113	369	112
		OHL 220kV BUC S B-FUNDENI	OHL 220kV BUC S A-FUNDENI	369	112	369	112	369	112	369	112	369	112	368	112	369	112	369	112	369	112	369	112	369	112	369	113	369	113
		OHL 220kV PLJEVLJA-MOJKO(O)	OHL 220kV PODGORI1-HEPERUCI	266	102	260	99		<95	265	101	262	100	249	95	256	97		<95	256	98	261	99		<95		<95		<95
		TR 400/220kV SMIT24	OHL 220kV SRB 22-NSA 32	271	99	271	99	272	100	271	99	274	100	270	99	268	98	271	99	270	99	270	99	270	99	268	98,2	270	99,1
		OHL 400kV PODGORI2-RP TREB	OHL 220kV PODGORI1-HEPERUCI	262	99	255	97	252	96	259	98	255	97		<95		<95		<95	254	96	257	98		<95		<95		<95
		OHL 400kV RPRIBARE-PEC 34	OHL 220kV PODGORI1-VD22	292	101	279	96		<95	288	100	285	99	285	99	285	99	285	99	285	99	285	99	285	99	285	99	285	99
	SCENARIO 4 (700MW)**	OHL 220kV TIR22-RASHB22	OHL 220kV ELB122-FIER22	302	121	302	121	302	120	302	121	302	121	301	121	301	121	301	121	302	121	301	121	301	117	302	121	302	121
		OHL 220kV BUC S A-FUNDENI	OHL 220kV BUC S B-FUNDENI	397	120	397	120	397	120	397	120	397	120	396	119	395	119	395	119	396	119	396	119	396	119	394	119	394	119
		OHL 220kV BUC S B-FUNDENI	OHL 220kV BUC S A-FUNDENI	397	120	397	120	397	120	397	120	397	120	396	119	395	119	396	119	396	119	396	119	396	119	394	119	394	119
		TR 400/220kV SMIT24	OHL 220kV SRB 22-NSA 32	261	96	261	96	261	96	259	95	262	96	261	96	261	96	261	96	262	96	262	96	260	96	262	96,4	262	96,7
	SCENARIO 5 (1000MW)	BASE CASE	OHL 154kV AMBAR_2B-ICDAS	236	97	236	97	236	97	236	97	236	97	236	97	236	97	236	97	236	97	236	97	236	97	236	97	236	97,3
		OHL 220kV TIR22-RASHB22	OHL 220kV ELB122-FIER22	302	123	302	123	302	121	302	123	302	123	301	122	301	122	301	122	302	123	302	123	302	119	302	121	302	121
		OHL 220kV BUC S A-FUNDENI	OHL 220kV BUC S B-FUNDENI	374	113	374	113	375	113	374	113	374	113	373	113	374	113	374	113	374	113	373	113	374	113	377	115	377	115
		OHL 220kV BUC S B-FUNDENI	OHL 220kV BUC S A-FUNDENI	375	114	375	113	375	114	375	113	375	114	373	113	375	113	374	113	375	114	373	113	375	114	378	115	378	115
		OHL 380kV 4ALIBEY-4HAMIT	OHL 154kV HAMIT-LULEBURG	207	95	207	95	207	95	207	95	207	95	206	95	206	95	206	95	207	95	1390	92	207	95	207	95	207	95
		OHL 380kV 4HABIPLR-4UNIMRDG	OHL 380kV 4IKITELL-4UNIMRDG	993	99	994	99	994	99	993	99	993	99	993	99	993	99	993	99	995	99,4	1033	103	995	99,2	993	99,2	993	99,2
		OHL 400kV KRAG24-KOLUB4	OHL 220kV POZEGA2-RPBBASTA	348	97	348	96	348	96	340	92	350	97	345	96	347	96	348	96	347	96	352	98	341	94	345	96	347	96,4
		TR 400/220kV SMIT24	OHL 220kV SRB 22-NSA 32	270	99	270	99	265	96	262	96	273	100	270	99	268	98	270	99	270	99	271	99,4	270	99	268	98,3	270	99,1
	SCENARIO 6 (1500MW)	BASE CASE	OHL 154kV AMBAR_2B-ICDAS	236	97	236	97	236	97	236	97	236	97	236	97	236	97	236	97	236	97	236	97	236	97	236	97,3	236	97,3
		OHL 220kV TIR22-RASHB22	OHL 220kV ELB122-FIER22	302	121	302	121	302	120	302	121	302	121	301	121	301	121	301	121	301	121	301	121	301	118	456	173	456	173
		OHL 220kV BUC S A-FUNDENI	OHL 220kV BUC S B-FUNDENI	383	117	383	117	382	117	382	117	383	117	384	117	382	116	383	116	383	117	383	117	383	117	377	115	377	115
		OHL 220kV BUC S B-FUNDENI	OHL 220kV BUC S A-FUNDENI	383	117	383	117	383	117	383	117	383	117	385	117	382	116	383	116	383	117	383	117	383	117	378	115	378	115
		OHL 400kV BGD 84-DRMNO	OHL 400kV DRMNO-PANC24	1221	98	1221	98	1219	98	1234	99	1223	98	1213	97	1236	99	1226	98	1225	98	1225	98	1214	97	1214	97	1214	97
		TR 400/220kV SMIT24	OHL 220kV SRB 22-NSA 32	255	95	255	95	254	95	253	94	255	95	255	95	258	95	256	95	255	95	255	95	254	95	261	96,2	262	96,5

Table 4.31. Contingency analysis results for new interconnection lines (continued)

	scenario	outage	Line	Without new line		with new line: Niš-Skopje 5		Podgorica-Elbasan		S.Mitrovica-Ugljevik		Sombor-Pecs		Bekescaba-Oradea		Ernestinovo-Pecs		Heviz-Cirkovce		M.East3-Fillipi		Ch.Mogila-Stip		Skopje-Tirana*		B.Luka-Tumbri		Prizren - Fierze 2	
				MW	%	MW	%	MW	%	MW	%	MW	%	MW	%	MW	%	MW	%	MW	%	MW	%	MW	%	MW	%	MW	%
WINTER	SCENARIO 7 (1000MW)	OHL 220kV TIR22-RASHB22	OHL 220kV ELB122-FIER22	302	122	302	122	302	120	302	123	302	123	301	122	301	122	301	122	302	122	302	122	301	118	302	123	302	123
		OHL 220kV BUC S B-FUNDENI	OHL 220kV BUC S A-FUNDENI	369	112	368	112	368	112	368	112	368	112	366	111	368	112	367	112	368	112	368	112	368	112	367	112	368	112
		OHL 220kV BUC S A-FUNDENI	OHL 220kV BUC S B-FUNDENI	368	112	368	112	369	112	369	112	369	112	367	111	369	112	368	112	367	112	367	112	367	112	368	112	368	112
		TR 400/220kV SMIT24	OHL 220kV SRB 22-NSA 32	273	100	273	100	275	101	273	100	277	101	274	100	271	99	274	100	274	100	274	100	275	100	272	99,7	274	101
	SCENARIO 8 (1500MW)	OHL 220kV TIR22-RASHB22	OHL 220kV ELB122-FIER22	302	121	302	121	302	120	302	121	302	121	301	121	301	121	301	121	302	121	302	121	301	118	302	122	302	121
		OHL 220kV SLATINA-GRADISTE	OHL 220kV CRAIOVAA-ISALNITB	333	97	333	97	347	100	347	100	333	97	332	96	332	96	332	96	332	97	332	96	333	97	333	96,7	333	96,7
		OHL 220kV BUC S A-FUNDENI	OHL 220kV BUC S B-FUNDENI	403	122	403	121	405	122	405	122	403	121	404	121	402	121	403	121	404	122	404	122	403	121	404	121	404	122
		OHL 220kV BUC S B-FUNDENI	OHL 220kV BUC S A-FUNDENI	404	122	404	122	405	122	405	122	403	121	404	121	402	121	403	121	404	122	404	122	403	121	404	122	404	122
		OHL 400kV BGD 84-DRMNO	OHL 400kV DRMNO-PANC24	1218	98	1220	98	1211	97	1226	98	1220	98	1205	96	1227	98	1218	97	1217	97	1220	98	1206	97	1205	96,4	1205	96,4
		TR 400/220kV SMIT24	OHL 220kV SRB 22-NSA 32	256	95	256	95	255	95		<95	256	95	255	95	259	96	256	95	255	95	255	95	254	95		<95		<95
SUMMER	base case WITH TURKEY	OHL 220kV TIR22-RASHB22	OHL 220kV ELB122-FIER22	268	105	268	105	268	104	268	105	268	105	268	105	268	105	268	105	268	105	268	105	268	103	268	105	268	105
	SCENARIO 1 (600MW)	OHL 220kV TIR22-RASHB22	OHL 220kV ELB122-FIER22	269	106	269	106	268	105	269	106	269	106	268	106	268	106	268	106	269	106	268	107	268	103	268	105	268	106
		OHL 380kV 4HABIPLR-4UNIMRDG	OHL 380kV 4IKITELL-4UNIMRDG	1004	99	1004	99	1004	99	1004	99	1004	99	1003	98	1003	98	1003	98	1004	99	1004	99	1003	99	1004	98,9	1004	98,9
	SCENARIO 5 (1200MW)	OHL 220kV TIR22-RASHB22	OHL 220kV ELB122-FIER22	269	107	269	107	268	105	269	107	269	107	268	106	268	107	268	107	268	107	268	107	268	104	268	107	268	107
		OHL 380kV 4HABIPLR-4UNIMRDG	OHL 380kV 4IKITELL-4UNIMRDG	923	91	923	91	923	91		<90		<90		<90		<90		<90		<90		<90		<90		<90		<90

*Simultaneously in operation with OHL 400kV Podgorica-Tirana-Elbasan

**Did not converge by higher power exchanges

Outage that limits higher power exchanges

5. OBSERVATIONS AND CONCLUSIONS

The performance of this study was made possible by the hard work of the electric transmission planning experts in the participating SECI member companies. These experts participated in PSS/E training programs conducted by PTI and funded by USAID to learn the details of operating the software in order to perform studies in Power Flow and Steady State Analysis, Optimum Power Flow and Dynamic Simulations. They then converted national data to the PSS/E format and submitted the data for use in the construction of one regional transmission planning model. This model was distributed to all participants for their own use and was used by a special team of experts to perform this study.

As has been described in previous sections of this report, it was the goal of this study to analyze the electric transmission system on winter and summer peak day in the year 2005 considering that the entire region will be reconnected to UCTE by that time. Since it was not certain whether Turkey will be admitted to the UCTE by 2005, the complete study was done with Turkey connected and fully synchronous with UCTE and again without Turkey being connected.

The development of a Regional Electric Market (REM) in South Eastern Europe by 2005 is a goal of the participating countries and of the European Commission. When such a market develops, the regional transmission system will be called upon to transfer power in ways not experienced to date. In order to test the regional transmission system under REM conditions, the study looks at bulk power transits in all directions as described in Section 3.4, and as illustrated in table 2.5.1, of this report. It was the project goal to see how the system, as it is predicted to exist in 2005, would react to winter peak loads as a base case and then how it would react to the added bulk power transits predicted to occur under REM conditions.

In addition, the study goals include a detailed look at twelve (12) proposed interconnections between countries to see which of them, if any, would provide the most regional benefit in terms of increasing maximum exchanges, reducing system losses and improving system security. These 12 proposed interconnections are described earlier in this report in Table 2.1.2 and are summarized as follows:

1. 203 km of 400kV Overhead Line from Podgorica (Montenegro, Yug) to Elbasan (Albania)
2. 75 km of 400kV Overhead Line from Sremska Mitrovica (Serbia, Yug) to Ugljevik (B&H)
3. 156 km of 400kV Overhead Line from Nis (Serbia, Yug) to Skopje 5 (Macedonia)
4. 80 km of 400kV Overhead Line from Sombor (Serbia, Yug) to Pecs (Hungary)
5. 71 km of 220kV Overhead Line (second circuit) from Prizren (Serbia, Yug) to Fierze (Albania)
6. 230 km of 400kV Overhead Line from Banja Luka (B&H) to Tumbri (Croatia)
7. 85 km of 400kV (double circuit) Overhead Line from Ernestinovo (Croatia) to Pecs (Hungary)
8. 92 km of 400kV Overhead Line from Bekescaba (Hungary) to Oradea (Romania)
9. 160 km of 400kV Overhead Line from Heviz (Hungary) to Cirkovce (Slovenia)
10. 200 km of 400kV Overhead Line from Skopje (Macedonia) to Tirana (Albania)
11. 150 km of 400kV Overhead Line from Chervena Mogila (Bulgaria) to Stip (Macedonia)
12. 257 km of 400 kV Overhead Line from Maritza East 3 (Bulgaria) to Phillipi (Greece)

The study looked at the regional system Base Case for 2005 with only projected 2005 winter peak loads plus long term contracted exchanges but without any incremental transits and without any of the 12 proposed new interconnections installed. Then, the region was modeled by adding each of the 12 proposed new interconnections, one at a time, and subjecting it to each of 8 bulk power transit scenarios.

Data for each scenario was collected to measure the impact of each proposed new line on Power Flows, Losses and the lines ability to increase Maximum Exchanges (Transits) across the region using the security (n-1) criteria.

5.1. Base Case

The Maximum Exchanges reached in the Base Case (without any of the proposed interconnections installed) for each of the Transit Scenarios is shown on Table 5.1. Even though a bulk power transit of 1,500MW was attempted in 6 of the Scenarios and 1,200MW in 2 Scenarios, the full transit attempted was only achieved in the South to North Scenarios #6 and #8. All other transits were limited by the overloading of one or more of the system elements located in Turkey, Slovenia, Italy and Serbia (Yug) as listed in Table 4.29 and detailed in Table 4.31.

Table 5.1. Maximum reached exchange without new line

General	winter	scenario 1	UCTE >> TUR (W→E)	600 MW
		scenario 2	TUR, GRE >> UCTE (E→W)	700 MW
		scenario 3	UCTE >> BUL, GRE, ALB (W→ E)	1000 MW
		scenario 4	BUL, GRE, ROM >> UCTE (E→W)	700 MW
		scenario 5	CENT, UKR, ROM >> TUR, GRE (N→ S)	1000 MW
		scenario 6	TUR, BUL >> CENT (S→N)	1500 MW
		scenario 7	CENT, UKR >> BUL, GRE, ALB (N→ S)	1000 MW
		scenario 8	ROM, BUL, GRE >> CENT (S→N)	1500 MW
	summer	scenario 1	UCTE >> TUR (W →E)	600 MW
		scenario 5	TUR, GRE >> UCTE (E→W)	1200 MW

5.2. Proposed New Interconnections and Transits

As each new proposed interconnection was added (one at a time) to the regional model and was subjected to each of the 8 transit scenarios, data was collected regarding the lines ability to increase bulk power transits across the region, its impact in reducing losses on the regional system and its participation in moving power compared to the base case. This data is summarized in Table 5.2.

Power Flows

Each candidate line was inserted into the regional model and a Base Case (2005 winter peak loads plus long term contracted exchanges but without any bulk power transit applied) was run to determine the loading of the new line. Table 5.2 summarizes the Power Flows obtained for this Base Case. Then, the 8 transit scenarios were applied, one at a time and Table 5.2 lists the Maximum Reached Loadings and the Scenario where that maximum occurred. While only the Maximum Reached Loading for one scenario is shown in this summary table, all loadings for all scenarios are shown in the detailed tables of this report.

The intent of these calculations was to find the level of participation of the new proposed line in wheeling the power across the region. Participation is important because it is an indicator of how the line contributes to reduce overloadings and losses of the regional system and it gives an estimate of the level of loadings for future calculations of potential transmission charges that may be due to the owner of the new line.

From the summary table 5.2 we can see that three of the proposed new lines stand out from the rest in their ability to participate in the planned exchanges as follows:

- Line #1 - 203 km of 400kV Overhead Line from Podgorica (Montenegro, Yug) to Elbasan (Albania)
- Line #4 - 80 km of 400kV Overhead Line from Sombor (Serbia, Yug) to Pecs (Hungary)
- Line #7 - 85 km of 400kV (double circuit) Overhead Line from Ernestinovo (Croatia) to Pecs (Hungary)

Losses

As each proposed new interconnection line was added to the regional model and subjected to the each of the 8 exchange scenarios, the reduction in losses was recorded. Table 5.2 shows the maximum loss reduction for each line and the scenario where it occurs. Loss reductions for all scenarios and all lines are shown in Tables 4.14 through 4.26 of this report.

While this reduction in losses, expressed as a % of total losses for the region, is only for the study conditions of 2005 winter peak, it does give us an indicaton how each of the proposed new lines influence the total system losses and of which one will have the greatest impact on an annual basis.

From the summary table 5.2 we can see that four of the proposed new lines stand out from the rest in their ability to reduce system losses in the region as follows:

- Line #1 - 203 km of 400kV Overhead Line from Podgorica (Montenegro, Yug) to Elbasan (Albania)

- Line #4 - 80 km of 400kV Overhead Line from Sombor (Serbia, Yug) to Pecs (Hungary)
- Line #7 - 85 km of 400kV (double circuit) Overhead Line from Ernestinovo (Croatia) to Pecs (Hungary)
- Line #10 - 200 km of 400kV Overhead Line from Skopje (Macedonia) to Tirana (Albania)

Maximum Exchange

Just as the Base Case Maximum Exchanges are limited by the overloading of one or more of the system elements located in Turkey, Slovenia, Italy, Montenegro (Yug) and Serbia (Yug) as discussed above and listed in Table 4.29 and detailed in Table 4.31, so too are the Maximum Exchanges with the proposed new interconnection lines installed using the N-1 security criteria. Table 5.2 clearly shows that seven (7) of the interconnection candidates increase Maximum Exchanges by 100MW in one scenario and three (3) of the candidates do not increase the exchanges at all. Two (2) of the proposed new lines contribute on increasing the Maximum Exchange by 100 MW both for scenario 3 and scenario 7 as follows:

- Line #8 - 92 km of 400kV Overhead Line from Bekescaba (Hungary) to Oradea (Romania)

- Line #12 - 257 km of 400kV Overhead Line from Maritza East 3 (Bulgaria) to Phillipi (Greece)

New interconnection lines do not provide significant increase in exchange capability (only 100 MW in some cases). This result occurs because one or more of the internal system elements in Turkey, Slovenia, Italy, Montenegro and Serbia fail before the new candidate line has a chance to contribute, except in the case of 400kV Overhead Line from Podgorica (Montenegro, Yug) to Elbasan (Albania). This places added importance on addressing the known limiting system components listed in the table below, and any others that might arise once these are upgraded, in order to find the real capabilities of each of the 12 proposed new interconnection lines.

Location	Outage Branch	Overload Branch
Turkey	380kV OHL Habibler-Unimar DG	380kV OHL Ikiteli-Unimar DG
Slovenia/Italy	400kV OHL Redipuglia-Divaca	Did not converge-Reactive Power Problems
Montenegro(Yug)	220kV OHL Pljevlja-Mojkovac	220kV OHL Podgorica 1-HE Perucica
Serbia(Yug)	400/220kV Transformer S.Mitrovica 2	220kV OHL Srbobran 2-N.Sad 3

5.3. Conclusions and Recommendations

One of the most important benefits of this Project is construction of the Regional transmission network model in common format. The Regional model was built using the PSS/E software. In the framework of the project this software was purchased and delivered and appropriate training courses for the experts from the power companies in SECI countries were performed. That means that transmission planning engineers obtained the universal software tool and establish efficient way for exchange the information and data, as well as opportunities for regional transmission operation and planning.

This study has shown that the regional electric transmission system as predicted to exist in the year 2005, fully interconnected to UCTE, with and without Turkey and without any of the 12 proposed interconnections, is robust and capable of serving projected 2005 demands plus all long term

contracted exchanges plus an additional 600 – 1500 MW bulk power exchange (depending on the Scenario). The system limitations are currently the four system elements listed above in section 5.2 but it is probable that other internal limiting conditions will be found when these four are removed.

Analyses and computational efforts have emphasized the need of further tight cooperation between experts from SECI countries, especially on investigation of power transit margins. All planned interconnection lines, observed as single elements in the network, do not increase transit margins significantly. In future studies alternative regional approach should be applied, taking into consideration power transits corridors as combination of several new and existing interconnection lines in order to gain more accurate evaluation of contribution of each new line on power transit boost.

Load flow and contingency analyses alone are not sufficient criteria to make right operational and planning decision. This requires upgrading of the Regional model to enable additional technical investigation of short circuits level and dynamics phenomena in power system.

It is recommended that the study team continue to work on the regional model and perform additional studies as follows:

- The internal bottlenecks have to be identified and remedied for further evaluation of utilization of new options for interconnection.
- Evaluate combination of lines.
- Implement economical aspects in evaluation.
- Simulations for predicted realistic market based scenarios (using output from related projects in the region).
- Use of additional planning criteria (N-2 criteria for interconnections, EU criteria for level of interconnection capacity, etc).
- Improving and expanding the model for short circuit and dynamics analyses.

Table 5.2. General conclusions

#1 - OHL 400 kV Podgorica (MN) - Elbasan (ALB)			
length		203 km	
power flows	base case	47 MW	tables 4.13 & 4.1
	maximum reached loading	236 MW (winter scenario 3)	
losses	Maximum reduction in losses is 1.75 % in the region in winter scenario 3		tables 4.26 & 4.14
maximum exchange*	Increases maximum exchange in scenario 3 by 100 MW		tables 4.28 - 4.31

#2 - OHL 400 kV Sremska Mitrovica (YUG) - Ugljevik (B&H)			
length		75 km	
power flows	base case	64 MW	tables 4.13 & 4.2
	maximum reached loading	158 MW (winter scenario 6)	
losses	Has not significiant effect on losses in the region		tables 4.26 & 4.15
maximum exchange*	Does not increase maximum exchange		tables 4.28 - 4.31

#3 - OHL 400 kV Nis (YUG) - Skopje 5 (MKD)			
length		156 km	
power flows	base case	2 MW	tables 4.13 & 4.3
	maximum reached loading	156 MW (summer scenario 5)	
losses	Maximum reduction in losses is 0.34 % in the region in winter scenario 3		tables 4.26 & 4.16
maximum exchange*	Increases maximum exchange in scenarios 3 by 100 MW		tables 4.28 - 4.31

#4 - OHL 400 kV Sombor (YUG) - Pecs (HUN)			
length		80 km	
power flows	base case	183 MW	tables 4.13 & 4.4
	maximum reached loading	356 MW (winter scenario 7)	
losses	Maximum reduction in losses is 1.24 % in the region in winter scenario 7		tables 4.26 & 4.17
maximum exchange*	Increases maximum exchange in scenarios 3 by 100 MW		tables 4.28 - 4.31

#5 - OHL 220 kV Prizren (YUG) - Fierze (ALB) 2^{-nd} circuit			
length		71 km	
power flows	base case	57 MW	tables 4.13 & 4.5
	maximum reached loading	59 MW (winter scenario 1)	
losses	Maximum reduction in losses is 0.13 % in the region in winter scenario 5		tables 4.26 & 4.18
maximum exchange*	Does not increase maximum exchange		tables 4.28 - 4.31

#6 - OHL 400 kV Banja Luka (B&H) - Tumbri (CRO)			
length		230 km	
power flows	base case	85 MW	tables 4.13 & 4.6
	maximum reached loading	228 MW (winter scenario 3)	
losses	Maximum reduction in losses is 0.95 % in the region in winter scenario 3		tables 4.26 & 4.19
maximum exchange*	Does not increase maximum exchange		tables 4.28 - 4.31

Table 5.2. General conclusions (continued)

#7 - OHL 2x400 kV Ernestinovo (CRO) - Pecs (HUN)			
length		85 km	
power flows	base case	34 MW	tables 4.13 & 4.7
	maximum reached loading	408 MW (winter scenario 6)	
losses	Maximum reduction in losses is 1.11 % in the region in winter scenario 8		tables 4.26 & 4.20
maximum exchange*	Increases maximum exchange in scenarios 7 by 100 MW		tables 4.28 - 4.31

#8 - OHL 400 kV Bekescaba (HUN) - Oradea (ROM)			
length		92 km	
power flows	base case	74 MW	tables 4.13 & 4.8
	maximum reached loading	216 MW (winter scenario 7)	
losses	Maximum reduction in losses is 0.76 % in the region in winter scenario 7		tables 4.26 & 4.21
maximum exchange*	Increases maximum exchange in scenarios 3 & 7 by 100 MW		tables 4.28 - 4.31

#9 - OHL 400 kV Heviz (HUN) - Cirkovce (SLO)			
length		160 km	
power flows	base case	145 MW	tables 4.13 & 4.9
	maximum reached loading	286 MW (winter scenario 6)	
losses	Maximum reduction in losses is 0.79 % in the region in winter scenario 8		tables 4.26 & 4.22
maximum exchange*	Increases maximum exchange in scenarios 3 by 100 MW		tables 4.28 - 4.31

#10 - OHL 400 kV Skopje (MKD) - Tirana (ALB)			
length		200 km	
power flows	base case	25 MW	tables 4.13 & 4.10
	maximum reached loading	155 MW (winter scenario 2)	
losses	Maximum reduction in losses is 1.96 % in the region in winter scenario 3		tables 4.26 & 4.23
maximum exchange*	Increases maximum exchange in scenarios 3 by 100 MW		tables 4.28 - 4.31

#11 - OHL 400 kV Chervena Mogila (BUL) - Stip (MKD)			
length		150 km	
power flows	base case	11 MW	tables 4.13 & 4.11
	maximum reached loading	129 MW (winter scenario 7)	
losses	Maximum reduction in losses is 0.30 % in the region in summer scenario 5		tables 4.26 & 4.24
maximum exchange*	Increases maximum exchange in scenarios 3 by 100 MW		tables 4.28 - 4.31

#12 - OHL 400 kV Maritza East 3 (BUL) - Phillipi (GRE)			
length		257 km	
power flows	base case	125 MW	tables 4.13 & 4.12
	maximum reached loading	224 MW (winter scenario 6)	
losses	Maximum reduction in losses is 0.62 % in the region in winter scenario 7		tables 4.26 & 4.25
maximum exchange*	Increases maximum exchange in scenarios 3 & 7 by 100 MW		tables 4.28 - 4.31

6. APPENDIX A

In this appendix A are shown tables with detailed computational results that are comment in chapters 2, 3 and 4, respectively.

6.1. Tables and Details from Chapter 2 of the Report

Table 2.5.2. Energy transfer from West to East with Turkey

SCENARIO 1 WINTER

Power System	Balance [MW]	NODE NAME	INCREASE
UCTE WINTER	BASE INTERCHANGE (+1500)	OBUERS1	800
		OZELTW2	400
		OKAPRU2	100
		OROSEG2	100
		OZELL_2	100
	Balance [MW]	DECREASING NODE	DECREASED FOR
	+ 1400	OBUERS1	100
	+ 1300	OBUERS1	200
	+ 1200	OBUERS1	300
	+ 1100	OBUERS1	400
	+ 1000	OBUERS1	500
	+ 900	OBUERS1	600
	+ 800	OBUERS1	700
	+ 700	OBUERS1	800
	+ 600	OBUERS1	800
		OZELTW2	100
	+ 500	OBUERS1	800
		OZELTW2	200
	+ 400	OBUERS1	800
		OZELTW2	300
	+ 300	OBUERS1	800
		OZELTW2	400
	+ 200	OBUERS1	800
		OZELTW2	400
		OKAPRU2	100
	+ 100	OBUERS1	800
		OZELTW2	400
		OKAPRU2	100
		OROSEG2	100

Power System	Balance [MW]	INCREASING NODE	DECREASE
TURKEY WINTER	BASE INTERCHANGE (-1500)	G-4HAMIT	100+100+111
		G-4ADADG	39+39+43
		G-4GBZDG	39+39+42+39+39+42
		G-4TEMEL	58+58
		G-4SEYIT	153+153
		G-4ALIDG	39+39+42+39+39+42
		G-4ISKEN	99+99
	Balance [MW]	INCREASING NODE	INCREASED FOR
	- 1400	G-4HAMIT	100
	- 1300	G-4HAMIT	100+100
	- 1200	G-4HAMIT	100+100+111
	- 1100	G-4HAMIT	100+100+111
		G-4TEMEL	58
		G-4ADADG	39
	- 1000	G-4HAMIT	100+100+111
		G-4ADADG	39+39+43
		G-4GBZDG	39+39
	- 900	G-4HAMIT	100+100+111
		G-4ADADG	39+39+43
		G-4GBZDG	39+39+42
		G-4TEMEL	58
	- 800	G-4HAMIT	100+100+111
		G-4ADADG	39+39+43
		G-4GBZDG	39+39+42+39
		G-4TEMEL	58+58
	- 700	G-4HAMIT	100+100+111
		G-4ADADG	39+39+43
		G-4GBZDG	39+39+42
		G-4TEMEL	58+58
		G-4SEYIT	153
	- 600	G-4HAMIT	100+100+111
		G-4ADADG	39+39+43
		G-4GBZDG	39+39+42
		G-4TEMEL	58
		G-4SEYIT	153+153
	- 500	G-4HAMIT	100+100+111
		G-4ADADG	39+39+43
		G-4GBZDG	39+39+42+39+39+42
		G-4SEYIT	153+153
		G-4ALIDG	39
	- 400	G-4HAMIT	100+100+111
		G-4ADADG	39+39+43
		G-4GBZDG	39+39+42+39+39+42
		G-4TEMEL	58
		G-4SEYIT	153+153
		G-4ALIDG	39+39
	- 300	G-4HAMIT	100+100+111
		G-4ADADG	39+39+43
		G-4GBZDG	39+39+42+39+39+42
		G-4TEMEL	58+58
		G-4SEYIT	153+153
		G-4ALIDG	39+39+42
	- 200	G-4HAMIT	100+100+111
		G-4ADADG	39+39+43
		G-4GBZDG	39+39+42+39+39+42
		G-4TEMEL	58+58
		G-4SEYIT	153+153
		G-4ALIDG	39+39+42
		G-4ISKEN	99
	- 100	G-4HAMIT	100+100+111
		G-4ADADG	39+39+43
		G-4GBZDG	39+39+42+39+39+42
		G-4TEMEL	58+58
		G-4SEYIT	153+153
		G-4ALIDG	39+39+42

Table 2.5.3. Energy transfer from East to West with Turkey

SCENARIO 2 WINTER

Power System	Balance [MW]	NODE NAME	INCREASE
Turkey	BASE INTERCHANGE TUR +1000 GRE +500	G-4HAMIT	100+100+111
Turkey		G-4CAYIR	160
Turkey		G-4ELBS2	350
Greece		KARACOOU-Italy DC	200
Greece		OHSAUROS	100
Turkey		G-4YENIK	210
Greece		PTOLEM G4	50
Greece		AWOS G1-G2	25+25
Greece		SFHIKIA G1-G3	13+13+13
Greece		KASTRAKI G1-G4 +STRATOS	10+10+10+10 10+10
	Balance [MW]	DECREASING NODE	DECREASED FOR
Turkey	+ 1400	G-4HAMIT	100
Turkey	+ 1300	G-4HAMIT	100+100
Turkey	+ 1200	G-4HAMIT	100+100
Greece		KARACOOU-Italy DC	100
Turkey	+ 1100	G-4HAMIT	100+100+111
Greece		KARACOOU-Italy DC	100
Turkey	+ 1000	G-4HAMIT	100+100+111
Greece		KARACOOU-Italy DC	200
Turkey	+ 900	G-4HAMIT	100+100
Turkey		G-4YENIK	210
Greece		KARACOOU-Italy DC	200
Turkey	+ 800	G-4HAMIT	100+100+111
Turkey		G-4YENIK	210
Greece		KARACOOU-Italy DC	200
Turkey	+ 700	G-4HAMIT	100+100+111
Turkey		G-4YENIK	210
Greece		KARACOOU-Italy DC	200
Greece		OHSAUROS	100
Turkey	+ 600	G-4HAMIT	100
Turkey		G-4CAYIR	160
Turkey		G-4ELBS2	350
Greece		KARACOOU-Italy DC	200
Greece		OHSAUROS	100
Turkey	+ 500	G-4HAMIT	100+100
Turkey		G-4CAYIR	160
Turkey		G-4ELBS2	350
Greece		KARACOOU-Italy DC	200
Greece		OHSAUROS	100
Turkey	+ 400	G-4HAMIT	100+100+111
Turkey		G-4CAYIR	160
Turkey		G-4ELBS2	350
Greece		KARACOOU-Italy DC	200
Greece		OHSAUROS	100
Turkey	+ 300	G-4HAMIT	300
Turkey		G-4CAYIR	150
Turkey		G-4ELBS2	350
Greece		KARACOOU-Italy DC	200
Turkey		G-4YENIK	210
Turkey	+ 200	G-4HAMIT	100+100+111
Turkey		G-4CAYIR	160
Turkey		G-4ELBS2	350
Greece		KARACOOU-Italy DC	200
Greece		OHSAUROS	100
Turkey		G-4YENIK	210
Turkey	+ 100	G-4HAMIT	100+100+111
Turkey		G-4CAYIR	160
Turkey		G-4ELBS2	350
Greece		KARACOOU-Italy DC	200
Greece		OHSAUROS	100
Turkey		G-4YENIK	210
Greece		PTOLEM G4	50
Greece		AWOS G1-G2	25+25

Power System	Balance [MW]	INCREASING NODE	DECREASE
UCTE WINTER	BASE INTERCHANGE (-1500)	IRDPV111	800
		OBUERS1	400
		OZELTW2	100
		OKAPRU2	100
		OKAPRU2	100
	Balance [MW]	DECREASING NODE	INCREASED FOR
	- 1400	OBUERS1	100
	- 1300	IRDPV111	200
	- 1200	OBUERS1	100
		IRDPV111	200
	- 1100	IRDPV111	400
	-1000	OBUERS1	100
		IRDPV111	400
	-900	IRDPV111	600
	-800	OBUERS1	100
		IRDPV111	600
	-700	IRDPV111	800
	-600	OBUERS1	100
		IRDPV111	800
	-500	IRDPV111	800
		OBUERS1	200
	-400	IRDPV111	800
		OBUERS1	300
	-300	IRDPV111	800
		OBUERS1	400
	-200	IRDPV111	800
		OBUERS1	400
		OZELTW2	100
	-100	IRDPV111	800
		OBUERS1	400
		OZELTW2	100
		OKAPRU2	100

Table 2.5.4. Energy transfer from West to East without Turkey

SCENARIO 3 WINTER

Power System	Balance [MW]	NODE NAME	INCREASE
UCTE WINTER	BASE (+1200)	OBUERS1	800
		OZELTW2	400
	Balance [MW]	DECREASING NODE	DECREASED FOR
	+ 1100	OBUERS1	100
	+ 1000	OBUERS1	200
	+ 900	OBUERS1	300
	+ 800	OBUERS1	400
	+ 700	OBUERS1	500
	+ 600	OBUERS1	600
	+ 500	OBUERS1	700
	+ 400	OBUERS1	800
	+ 300	OBUERS1	800
		OZELTW2	100
	+ 200	OBUERS1	800
		OZELTW2	200
	+ 100	OBUERS1	800
		OZELTW2	300

Power System	Balance [MW]	INCREASING NODE	DECREASE
Greece	BASE INTERCHANGE (-1200)	KARACQOU-Italy DC	400
Greece		FLORINA	300
Bulgaria		NKOZ G5	205
Albania		KOMG	300
	Balance [MW]	DECREASING NODE	INCREASED FOR
Greece	- 1100	KARACQOU-Italy DC	100
Greece	- 1000	KARACQOU-Italy DC	200
Greece	- 900	KARACQOU-Italy DC	200
Albania		KOMG	100
Greece	- 800	KARACQOU-Italy DC	300
Albania		KOMG	100
Greece	-700	KARACQOU-Italy DC	400
Albania		KOMG	100
Greece	- 600	KARACQOU-Italy DC	200
Greece		FLORINA	300
Albania		KOMG	100
Greece	- 500	KARACQOU-Italy DC	200
Greece		FLORINA	300
Albania		KOMG	200
Greece	- 400	KARACQOU-Italy DC	200
Greece		FLORINA	300
Bulgaria		NKOZ G5	205
Albania		KOMG	100
Greece	- 300	KARACQOU-Italy DC	200
Greece		FLORINA	300
Bulgaria		NKOZ G5	205
Albania		KOMG	200
Greece	- 200	KARACQOU-Italy DC	300
Greece		FLORINA	300
Bulgaria		NKOZ G5	205
Albania		KOMG	200
Greece	- 100	KARACQOU-Italy DC	300
Greece		FLORINA	300
Bulgaria		NKOZ G5	205
Albania		KOMG	300

Table 2.5.5. Energy transfer from East to West without Turkey

SCENARIO 4 WINTER

Power System	Balance [MW]	NODE NAME	INCREASE
Greece	BASE INTERCHANGE (+1500)	KARACOOU-Italy DC	200
Greece		OHSAUROS	100
Greece		PTOLEM G4	50
Greece		AWOS G1-G2	25+25
Greece		SFHIKIA G1-G3	13+13+13
Greece		KASTRAKI G1-G4 +STRATOS	10+10+10+10 10+10
Romania		GALCEG	50
Romania		ISALNITB	150
Romania		MINTIAB	200
Romania		BUCSB	100
Bulgaria		NKOZ G7	190
Bulgaria		NKOZ G8	190
Bulgaria		CHAG34	100
Power System	Balance [MW]	DECREASING NODE	DECREASED FOR
Greece	+ 1400	KARACOOU-Italy DC	100
Greece	+ 1300	KARACOOU-Italy DC	100
Romania		BUCSB	100
Greece	+ 1200	KARACOOU-Italy DC	100
Romania		BUCSB	100
Bulgaria		CHAG34	100
Greece	+ 1100	KARACOOU-Italy DC	100
Romania		GALCEG	50
Romania		ISALNITB	150
Bulgaria		CHAG34	100
Greece	+ 1000	KARACOOU-Italy DC	200
Romania		GALCEG	50
Romania		ISALNITB	150
Bulgaria		CHAG34	100
Greece	+ 900	KARACOOU-Italy DC	200
Romania		GALCEG	50
Romania		ISALNITB	150
Bulgaria		NKOZ G7	190
Greece	+ 800	KARACOOU-Italy DC	200
Romania		GALCEG	50
Romania		ISALNITB	150
Bulgaria		BUCSB	100
Bulgaria		NKOZ G7	190
Greece	+ 700	KARACOOU-Italy DC	200
Romania		GALCEG	50
Romania		ISALNITB	150
Romania		MINTIAB	200
Bulgaria		NKOZ G7	190
Greece	+ 600	KARACOOU-Italy DC	200
Greece		OHSAUROS	100
Romania		GALCEG	50
Romania		ISALNITB	150
Romania		MINTIAB	200
Bulgaria		NKOZ G7	190
Greece	+ 500	KARACOOU-Italy DC	200
Greece		OHSAUROS	100
Romania		GALCEG	50
Romania		ISALNITB	150
Romania		MINTIAB	200
Bulgaria		NKOZ G7	190
Bulgaria		CHAG34	100
Greece	+ 400	KARACOOU-Italy DC	200
Greece		OHSAUROS	100
Greece		PTOLEM G4	50
Greece		AWOS G1-G2	50
Romania		GALCEG	50
Romania		ISALNITB	150
Romania		MINTIAB	200
Bulgaria		NKOZ G7	190
Bulgaria		CHAG34	100
Greece	+ 300	KARACOOU-Italy DC	200
Greece		OHSAUROS	100
Greece		PTOLEM G4	50
Greece		AWOS G1-G2	50
Romania		GALCEG	50
Romania		ISALNITB	150
Romania		MINTIAB	200

Power System	Balance [MW]	INCREASING NODE	DECREASE
UCTE WINTER	BASE INTERCHANGE (-1500)	IRDPV111	800
		OBUERS1	400
		OZELTW2	100
		OKAPRU2	100
		OKAPRU2	100
	Balance [MW]	INCREASING NODE	INCREASED FOR
	- 1400	OBUERS1	100
	- 1300	IRDPV111	200
	- 1200	OBUERS1	100
		IRDPV111	200
	- 1100	IRDPV111	400
	-1000	OBUERS1	100
		IRDPV111	400
	-900	IRDPV111	600
	-800	OBUERS1	100
		IRDPV111	600
	-700	IRDPV111	800
	-600	OBUERS1	100
		IRDPV111	800
	-500	IRDPV111	800
		OBUERS1	200
	-400	IRDPV111	800
		OBUERS1	300
	-300	IRDPV111	800
		OBUERS1	400
	-200	IRDPV111	800
		OBUERS1	400
		OZELTW2	100
	-100	IRDPV111	800
		OBUERS1	400
		OZELTW2	100
		OKAPRU2	100

Table 2.5.6. Energy transfer from North to South with Turkey

SCENARIO 5 WINTER

Power System	Balance [MW]	NODE NAME	INCREASE
Centrel	BASE INTERCHANGE	GABICK1	350
Centrel		LEVIC 1	150
Burstin		UMUKACH2	100
Burstin		UMUKACH1	400
Romania		ISACCEA	500
Power System	Balance [MW]	DECREASING NODE	DECREASED FOR
Centrel	+ 1400	GABICK1	70
Centrel		LEVIC 1	30
Centrel	+ 1300	GABICK1	140
Centrel		LEVIC 1	60
Centrel	+ 1200	GABICK1	140
Centrel		LEVIC 1	60
Burstin		UMUKACH2	20
Burstin		UMUKACH1	80
Centrel	+ 1100	GABICK1	140
Centrel		LEVIC 1	60
Burstin		UMUKACH2	20
Burstin		UMUKACH1	80
Romania		ISACCEA	100
Centrel	+ 1000	GABICK1	210
Centrel		LEVIC 1	90
Burstin		UMUKACH2	20
Burstin		UMUKACH1	80
Romania		ISACCEA*	100
Centrel	+ 900	GABICK1	210
Centrel		LEVIC 1	90
Burstin		UMUKACH2	20
Burstin		UMUKACH1	80
Romania		ISACCEA	200
Centrel	+ 800	GABICK1	210
Centrel		LEVIC 1	90
Burstin		UMUKACH2	40
Burstin		UMUKACH1	160
Romania		ISACCEA	200
Centrel	+700	GABICK1	210
Centrel		LEVIC 1	90
Burstin		UMUKACH2	40
Burstin		UMUKACH1	160
Romania		ISACCEA	300
Centrel	+ 600	GABICK1	280
Centrel		LEVIC 1	120
Burstin		UMUKACH2	40
Burstin		UMUKACH1	160
Romania		ISACCEA	300
Centrel	+ 500	GABICK1	280
Centrel		LEVIC 1	120
Burstin		UMUKACH2	60
Burstin		UMUKACH1	240
Romania		ISACCEA	300
Centrel	+ 400	GABICK1	280
Centrel		LEVIC 1	120
Burstin		UMUKACH2	60
Burstin		UMUKACH1	240
Romania		ISACCEA	400
Centrel	+ 300	GABICK1	350
Centrel		LEVIC 1	150
Burstin		UMUKACH2	60
Burstin		UMUKACH1	240
Romania		ISACCEA	400
Centrel	+ 200	GABICK1	350
Centrel		LEVIC 1	150
Burstin		UMUKACH2	80
Burstin		UMUKACH1	320
Romania		ISACCEA*	400
Centrel	+ 100	GABICK1	350
Centrel		LEVIC 1	150
Burstin		UMUKACH2	80
Burstin		UMUKACH1	320
Romania		ISACCEA	500

Power System	Balance [MW]	NODE NAME	DECREASE
Turkey	BASE INTERCHANGE	G-4HAMIT	100+100+111
Turkey		G-4ADADG	39+39+43
Turkey		G-4GBZDG	39+39+42+39+39+42
Turkey		G-4SEYIT	153+153
Turkey		G-4ALIDG	39
Greece		KARACQOU-Italy DC	200
Greece		FLORINA	300
Power System	Balance [MW]	INCREASING NODE	INCREASED FOR
Turkey	- 1400	G-4HAMIT	100
Turkey	- 1300	G-4HAMIT	100+100
Turkey	- 1200	G-4HAMIT	100+100+111
Turkey	- 1100	G-4HAMIT	100+100+111
Greece		KARACQOU-Italy DC	100
Turkey	- 1000	G-4HAMIT	100+100+111
Turkey		G-4TEMEL	58
Turkey		G-4ADADG	39
Greece		KARACQOU-Italy DC	100
Turkey	-900	G-4HAMIT	100+100+111
Turkey		G-4TEMEL	58
Turkey		G-4ADADG	39
Greece		KARACQOU-Italy DC	200
Turkey	-800	G-4HAMIT	100+100+111
Turkey		G-4ADADG	39+39+43
Turkey		G-4GBZDG	39+39
Greece		KARACQOU-Italy DC	200
Turkey	-700	G-4HAMIT	100+100+111
Turkey		G-4ADADG	39+39+43
Turkey		G-4GBZDG	39+39
Greece		KARACQOU-Italy DC	300
Turkey	-600	G-4HAMIT	100+100+111
Turkey		G-4ADADG	39+39+43
Turkey		G-4GBZDG	39+39+42
Turkey		G-4TEMEL	58
Greece		KARACQOU-Italy DC	300
Turkey	- 500	G-4HAMIT	100+100+111
Turkey		G-4ADADG	39+39+43
Turkey		G-4GBZDG	39+39+42+39
Turkey		G-4TEMEL	58+58
Greece		KARACQOU-Italy DC	300
Turkey	- 400	G-4HAMIT	100+100+111
Turkey		G-4ADADG	39+39+43
Turkey		G-4GBZDG	39+39+42+39
Turkey		G-4TEMEL	58+58
Greece		KARACQOU-Italy DC	400
Turkey	- 300	G-4HAMIT	100+100+111
Turkey		G-4ADADG	39+39+43
Turkey		G-4GBZDG	39+39+42
Turkey		G-4TEMEL	58+58
Turkey		G-4SEYIT	153
Greece		KARACQOU-Italy DC	400
Turkey	- 200	G-4HAMIT	100+100+111
Turkey		G-4ADADG	39+39+43
Turkey		G-4GBZDG	39+39+42
Turkey		G-4TEMEL	58
Turkey		G-4SEYIT	153+153
Greece		KARACQOU-Italy DC	400
Turkey	- 100	G-4HAMIT	100+100+111
Turkey		G-4ADADG	39+39+43
Turkey		G-4GBZDG	39+39+42
Turkey		G-4TEMEL	58
Turkey		G-4SEYIT	153+153
Greece		KARACQOU-Italy DC	200
Greece		FLORINA	300

Table 2.5.7. Energy transfer from South to North with Turkey

SCENARIO 6 WINTER

Power System	Balance [MW]	NODE NAME	INCREASE
Turkey	BASE INTERCHANGE (+1500)	G-4HAMIT	100+100+111
Turkey		G-4CAYIR	160
Turkey		G-4ELBS2	350
Turkey		G-4YENIK	210
Bulgaria		CHAG34	100
Bulgaria		NKOZ G5	190
Bulgaria		TVARN G4	190
Power System	Balance [MW]	DECREASING NODE	DECREASED FOR
Turkey	+ 1400	G-4HAMIT	100
Turkey	+ 1300	G-4HAMIT	100+100
Turkey	+ 1200	G-4HAMIT	100+100
Bulgaria		CHAG34	100
Turkey	+1100	G-4HAMIT	100+100+111
Bulgaria		CHAG34	100
Turkey	+1000	G-4HAMIT	100+100+111
Bulgaria		NKOZ G7	190
Turkey	+ 900	G-4HAMIT	100+100
Turkey		G-4YENIK	210
Bulgaria		NKOZ G7	190
Turkey	+800	G-4HAMIT	100+100+111
Turkey		G-4YENIK	210
Bulgaria		NKOZ G7	190
Turkey	+ 700	G-4HAMIT	100+100+111
Turkey		G-4YENIK	210
Bulgaria		NKOZ G7	190
Bulgaria		CHAG34	100
Turkey	+ 600	G-4HAMIT	100
Turkey		G-4CAYIR	160
Turkey		G-4ELBS2	350
Bulgaria		NKOZ G7	190
Bulgaria		CHAG34	100
Turkey	+ 500	G-4HAMIT	100+100
Turkey		G-4CAYIR	160
Turkey		G-4ELBS2	350
Bulgaria		NKOZ G7	190
Bulgaria		CHAG34	100
Turkey	+ 400	G-4HAMIT	100+100
Turkey		G-4CAYIR	160
Turkey		G-4ELBS2	350
Bulgaria		NKOZ G7	190
Bulgaria		NKOZ G8	190
Turkey	+ 300	G-4HAMIT	100+100+111
Turkey		G-4CAYIR	160
Turkey		G-4ELBS2	350
Bulgaria		NKOZ G7	190
Bulgaria		NKOZ G8	190
Turkey	+ 200	G-4HAMIT	100+100
Turkey		G-4CAYIR	160
Turkey		G-4ELBS2	350
Turkey		G-4YENIK	210
Bulgaria		NKOZ G7	190
Bulgaria		NKOZ G8	190
Turkey	+ 100	G-4HAMIT	100+100
Turkey		G-4CAYIR	160
Turkey		G-4ELBS2	350
Turkey		G-4YENIK	210
Bulgaria		CHAG34	100
Bulgaria		NKOZ G7	190
Bulgaria		NKOZ G8	190

Power System	Balance [MW]	NODE NAME	DECREASE
CENTREL WINTER	BASE INTERCHANGE (-1500)	GABICK1	1050
		LEVIC 1	450
	Balance [MW]	INCREASING NODE	INCREASED
	-1400	GABICK1	70
		LEVIC 1	30
	-1300	GABICK1	140
		LEVIC 1	60
	- 1200	GABICK1	210
		LEVIC 1	90
	- 1100	GABICK1	280
		LEVIC 1	120
	- 1000	GABICK1	350
		LEVIC 1	150
	- 900	GABICK1	420
		LEVIC 1	180
	- 800	GABICK1	490
		LEVIC 1	210
	- 700	GABICK1	560
		LEVIC 1	240
	- 600	GABICK1	630
		LEVIC 1	270
	- 500	GABICK1	700
		LEVIC 1	300
	- 400	GABICK1	770
		LEVIC 1	330
	- 300	GABICK1	840
		LEVIC 1	360
	- 200	GABICK1	910
		LEVIC 1	390
	- 100	GABICK1	980
		LEVIC 1	420

Table 2.5.8. Energy transfer from North to South without Turkey

SCENARIO 7 WINTER

Power System	Balance [MW]	NODE NAME	INCREASE
Burstin	BASE INTERCHANGE (+1200)	UMUKACH2	560
Burstin		UMUKACH1	140
Centrel		GABICK1	350
Centrel		LEVIC 1	150
Power System	Balance [MW]	DECREASING NODE	DECREASED FOR
Burstin	+ 1100	UMUKACH2	80
Burstin		UMUKACH1	20
Burstin	+ 1000	UMUKACH2	160
Burstin		UMUKACH1	40
Burstin	+ 900	UMUKACH2	160
Burstin		UMUKACH1	40
Centrel		GABICK1	70
Centrel		LEVIC 1	30
Burstin	+ 800	UMUKACH2	160
Burstin		UMUKACH1	40
Centrel		GABICK1	140
Centrel		LEVIC 1	60
Burstin	+ 700	UMUKACH2	240
Burstin		UMUKACH1	60
Centrel		GABICK1	140
Centrel		LEVIC 1	60
Burstin	+ 600	UMUKACH2	240
Burstin		UMUKACH1	60
Centrel		GABICK1	210
Centrel		LEVIC 1	90
Burstin	+ 500	UMUKACH2	320
Burstin		UMUKACH1	80
Centrel		GABICK1	210
Centrel		LEVIC 1	90
Burstin	+ 400	UMUKACH2	400
Burstin		UMUKACH1	100
Centrel		GABICK1	210
Centrel		LEVIC 1	90
Burstin	+ 300	UMUKACH2	400
Burstin		UMUKACH1	100
Centrel		GABICK1	280
Centrel		LEVIC 1	120
Burstin	+ 200	UMUKACH2	480
Burstin		UMUKACH1	120
Centrel		GABICK1	280
Centrel		LEVIC 1	120
Burstin	+ 100	UMUKACH2	480
Burstin		UMUKACH1	120
Centrel		GABICK1	350
Centrel		LEVIC 1	150

Power System	Balance [MW]	NODE NAME	DECREASE
Greece	BASE INTERCHANGE (-1200)	KARACQOU-Italy DC	400
Greece		FLORINA	300
Bulgaria		NKOZ G5	205
Albania		KOMG	300
Power System	Balance [MW]	INCREASING NODE	INCREASED FOR
Greece	- 1100	KARACQOU-Italy DC	100
Greece	-1000	KARACQOU-Italy DC	200
Greece	-900	KARACQOU-Italy DC	200
Albania		KOMG	100
Greece	-800	KARACQOU-Italy DC	200
Bulgaria		NKOZ G5	205
Greece	-700	KARACQOU-Italy DC	300
Bulgaria		NKOZ G5	205
Greece	-600	KARACQOU-Italy DC	300
Albania		KOMG	100
Bulgaria		NKOZ G5	205
Greece	-500	KARACQOU-Italy DC	100
Greece		FLORINA	300
Albania		KOMG	100
Bulgaria		NKOZ G5	205
Greece	-400	KARACQOU-Italy DC	200
Greece		FLORINA	300
Albania		KOMG	100
Bulgaria		NKOZ G5	205
Greece	-300	KARACQOU-Italy DC	200
Greece		FLORINA	300
Bulgaria		NKOZ G5	205
Albania		KOMG	200
Greece	-200	KARACQOU-Italy DC	300
Greece		FLORINA	300
Bulgaria		NKOZ G5	205
Albania		KOMG	200
Greece	-100	KARACQOU-Italy DC	300
Greece		FLORINA	300
Bulgaria		NKOZ G5	205
Albania		KOMG	300

Table 2.5.9. Energy transfer from South to North without Turkey

SCENARIO 8 WINTER

Power System	Balance [MW]	NODE NAME	INCREASE
Greece	BASE INTERCHANGE (+1500)	KARACQOU-Italy DC	200
Greece		OHSAUROS	100
Greece		PTOLEM G4	50
Greece		AWOS G1-G2	25+25
Greece		SFHIKIA G1-G3	13+13+13
Greece		KASTRAKI G1-G4 +STRATOS	10+10+10+10 10+10
Romania		GALCEG	50
Romania		ISALNITB	150
Romania		MINTIAB	200
Romania		BUCSB	100
Bulgaria		NKOZ G7	190
Bulgaria		NKOZ G8	190
Bulgaria		CHAG34	100
Power System	Balance [MW]	DECREASING NODE	DECREASED FOR
Greece	+ 1400	KARACQOU-Italy DC	100
Greece	+ 1300	KARACQOU-Italy DC	100
Romania		BUCSB	100
Greece	+ 1200	KARACQOU-Italy DC	100
Romania		BUCSB	100
Bulgaria		CHAG34	100
Greece	+ 1100	KARACQOU-Italy DC	100
Romania		GALCEG	50
Romania		ISALNITB	150
Bulgaria		CHAG34	100
Greece	+ 1000	KARACQOU-Italy DC	200
Romania		GALCEG	50
Romania		ISALNITB	150
Bulgaria		CHAG34	100
Greece	+ 900	KARACQOU-Italy DC	200
Romania		GALCEG	50
Romania		ISALNITB	150
Bulgaria		NKOZ G7	190
Greece	+ 800	KARACQOU-Italy DC	200
Romania		GALCEG	50
Romania		ISALNITB	150
Bulgaria		BUCSB	100
Bulgaria		NKOZ G7	190
Greece	+ 700	KARACQOU-Italy DC	200
Romania		GALCEG	50
Romania		ISALNITB	150
Romania		MINTIAB	200
Bulgaria		NKOZ G7	190
Greece	+ 600	KARACQOU-Italy DC	200
Greece		OHSAUROS	100
Romania		GALCEG	50
Romania		ISALNITB	150
Romania		MINTIAB	200
Bulgaria		NKOZ G7	190
Greece	+ 500	KARACQOU-Italy DC	200
Greece		OHSAUROS	100
Romania		GALCEG	50
Romania		ISALNITB	150
Romania		MINTIAB	200
Bulgaria		NKOZ G7	190
Bulgaria		CHAG34	100
Greece	+ 400	KARACQOU-Italy DC	200
Greece		OHSAUROS	100
Greece		PTOLEM G4	50
Greece		AWOS G1-G2	25+25
Romania		GALCEG	50
Romania		ISALNITB	150
Romania		MINTIAB	200
Bulgaria		NKOZ G7	190
Bulgaria		CHAG34	100
Greece	+ 300	KARACQOU-Italy DC	200
Greece		OHSAUROS	100
Greece		PTOLEM G4	50
Greece		AWOS G1-G2	25+25
Romania		GALCEG	50
Romania		ISALNITB	150
Romania		MINTIAB	200

Power System	Balance [MW]	NODE NAME	DECREASE
CENTREL WINTER	BASE INTERCHANGE	GABICK1	1050
		LEVIC 1	450
	Balance [MW]	INCREASING NODE	INCREASED FOR
	-1400	GABICK1	70
		LEVIC 1	30
	-1300	GABICK1	140
		LEVIC 1	60
	- 1200	GABICK1	210
		LEVIC 1	90
	- 1100	GABICK1	280
		LEVIC 1	120
	- 1000	GABICK1	350
		LEVIC 1	150
	- 900	GABICK1	420
		LEVIC 1	180
	- 800	GABICK1	490
		LEVIC 1	210
	- 700	GABICK1	560
		LEVIC 1	240
	- 600	GABICK1	630
		LEVIC 1	270
	- 500	GABICK1	700
		LEVIC 1	300
	- 400	GABICK1	770
		LEVIC 1	330
	- 300	GABICK1	840
		LEVIC 1	360
	- 200	GABICK1	910
		LEVIC 1	390
	- 100	GABICK1	980
		LEVIC 1	420

Table 2.5.10. Energy transfer from West to East with Turkey

SCENARIO 1 SUMMER

Power System	BASE INTERCHANGE (+1500)	NODE NAME	INCREASED FOR
UCTE SUMMER		OBUERS1	800
		OZELTW2	400
		OKAPRU2	100
		OROSEG2	100
		OZELL_2	100
	Balance [MW]	NODE NAME	DECREASED FOR
	+ 1400	OBUERS1	100
	+ 1300	OBUERS1	200
	+ 1200	OBUERS1	300
	+ 1100	OBUERS1	400
	+ 1000	OBUERS1	500
	+ 900	OBUERS1	600
	+ 800	OBUERS1	700
	+ 700	OBUERS1	800
	+ 600	OBUERS1	800
		OZELTW2	100
	+ 500	OBUERS1	800
		OZELTW2	200
	+ 400	OBUERS1	800
		OZELTW2	300
	+ 300	OBUERS1	800
		OZELTW2	400
	+ 200	OBUERS1	800
		OZELTW2	400
		OKAPRU2	100
	+ 100	OBUERS1	800
		OZELTW2	400
		OKAPRU2	100
		OROSEG2	100

Power System	BASE INTERCHANGE (-1500)	NODE NAME	DECREASED FOR
TURKEY SUMMER		G-4HAMIT	100+100+111
		G-4ADADG	39+39+43
		G-4GBZDG	39+39+42+39+39+42
		G-4TEMEL	58+58
		G-4SEYIT	153+153
		G-4ALIDG	39+39+42+39+39+42
		G-4ISKEN	99+99
	Balance [MW]	NODE NAME	INCREASED FOR
	- 1400	G-4HAMIT	100
	- 1300	G-4HAMIT	100+100
	- 1200	G-4HAMIT	100+100+111
	- 1100	G-4HAMIT	100+100+111
		G-4TEMEL	58
		G-4ADADG	39
	- 1000	G-4HAMIT	100+100+111
		G-4ADADG	39+39+43
		G-4GBZDG	39+39
	- 900	G-4HAMIT	100+100+111
		G-4ADADG	39+39+43
		G-4GBZDG	39+39+42
		G-4TEMEL	58
	- 800	G-4HAMIT	100+100+111
		G-4ADADG	39+39+43
		G-4GBZDG	39+39+42+39
		G-4TEMEL	58+58
	- 700	G-4HAMIT	100+100+111
		G-4ADADG	39+39+43
		G-4GBZDG	39+39+42
		G-4TEMEL	58+58
		G-4SEYIT	153
	- 600	G-4HAMIT	100+100+111
		G-4ADADG	39+39+43
		G-4GBZDG	39+39+42
		G-4TEMEL	58
		G-4SEYIT	153+153
	- 500	G-4HAMIT	100+100+111
		G-4ADADG	39+39+43
		G-4GBZDG	39+39+42+39+39+42
		G-4SEYIT	153+153
		G-4ALIDG	39
	- 400	G-4HAMIT	100+100+111
		G-4ADADG	39+39+43
		G-4GBZDG	39+39+42+39+39+42
		G-4TEMEL	58
		G-4SEYIT	153+153
		G-4ALIDG	39+39
	- 300	G-4HAMIT	100+100+111
		G-4ADADG	39+39+43
		G-4GBZDG	39+39+42+39+39+42
		G-4TEMEL	58+58
		G-4SEYIT	153+153
		G-4ALIDG	39+39+42
	- 200	G-4HAMIT	100+100+111
		G-4ADADG	39+39+43
		G-4GBZDG	39+39+42+39+39+42
		G-4TEMEL	58+58
		G-4SEYIT	153+153
		G-4ALIDG	39+39+42
		G-4ISKEN	99
		G-4HAMIT	100+100+111
		G-4ADADG	39+39+43

Table 2.5.11. Energy transfer from North to South with Turkey

SCENARIO 5 SUMMER

Power System		NODE NAME	INCREASED FOR
Centrel	BASE INTERCHANGE	GABICK1	350
Centrel		LEVIC 1	150
Burstin		UMUKACH2	100
Burstin		UMUKACH1	400
		ISACCEA*	500
	Balance [MW]	NODE NAME	DECREASED FOR
Centrel	+ 1400	GABICK1	70
Centrel		LEVIC 1	30
Centrel	+ 1300	GABICK1	140
Centrel		LEVIC 1	60
Centrel	+ 1200	GABICK1	140
Centrel		LEVIC 1	60
Burstin		UMUKACH2	20
Burstin		UMUKACH1	80
Centrel	+ 1100	GABICK1	140
Centrel		LEVIC 1	60
Burstin		UMUKACH2	20
Burstin		UMUKACH1	80
		ISACCEA*	100
Centrel	+ 1000	GABICK1	210
Centrel		LEVIC 1	90
Burstin		UMUKACH2	20
Burstin		UMUKACH1	80
		ISACCEA*	100
Centrel	+ 900	GABICK1	210
Centrel		LEVIC 1	90
Burstin		UMUKACH2	20
Burstin		UMUKACH1	80
		ISACCEA*	200
Centrel	+ 800	GABICK1	210
Centrel		LEVIC 1	90
Burstin		UMUKACH2	40
Burstin		UMUKACH1	160
		ISACCEA*	200
Centrel	+700	GABICK1	210
Centrel		LEVIC 1	90
Burstin		UMUKACH2	40
Burstin		UMUKACH1	160
		ISACCEA*	300
Centrel	+ 600	GABICK1	280
Centrel		LEVIC 1	120
Burstin		UMUKACH2	40
Burstin		UMUKACH1	160
		ISACCEA*	300
Centrel	+ 500	GABICK1	280
Centrel		LEVIC 1	120
Burstin		UMUKACH2	60
Burstin		UMUKACH1	240
		ISACCEA*	300
Centrel	+ 400	GABICK1	280
Centrel		LEVIC 1	120
Burstin		UMUKACH2	60
Burstin		UMUKACH1	240
		ISACCEA*	400
Centrel	+ 300	GABICK1	350
Centrel		LEVIC 1	150
Burstin		UMUKACH2	60
Burstin		UMUKACH1	240
		ISACCEA*	400
Centrel	+ 200	GABICK1	350
Centrel		LEVIC 1	150
Burstin		UMUKACH2	80
Burstin		UMUKACH1	320

Power System		NODE NAME	DECREASED FOR
Turkey	BASE INTERCHANGE TUR -1000 GRE -500	G-4HAMIT	100+100+111
Turkey		G-4ADADG	39+39+43
Turkey		G-4GBZDG	39+39+42+39+39+42
Turkey		G-4SEYIT	153+153
Turkey		G-4ALIDG	39
Greece		KARACQOU-Italy DC	200
Greece		FLORINA	300
	Balance [MW]	NODE NAME	INCREASED FOR
Turkey	- 1400	G-4HAMIT	100
Turkey	- 1300	G-4HAMIT	100+100
Turkey	- 1200	G-4SEYIT	153+153
Turkey	- 1100	G-4SEYIT	153+153
Greece		KARACQOU-Italy DC	100
Turkey	- 1000	G-4HAMIT	100
Turkey		G-4SEYIT	153+153
Greece		KARACQOU-Italy DC	100
Turkey	-900	G-4HAMIT	100
Turkey		G-4SEYIT	153+153
Greece		KARACQOU-Italy DC	200
Turkey	-800	G-4HAMIT	100+100+111
Turkey		G-4ADADG	39+39+43
Turkey		G-4GBZDG	39+39
Greece		KARACQOU-Italy DC	200
Turkey	-700	G-4HAMIT	100+100+111
Turkey		G-4ADADG	39+39+43
Turkey		G-4GBZDG	39+39
Greece		KARACQOU-Italy DC	300
Turkey	-600	G-4HAMIT	100+111
Turkey		G-4ADADG	39+39+43
Turkey		G-4GBZDG	39+39+42
Turkey		G-4SEYIT	153
Greece		KARACQOU-Italy DC	300
Turkey	- 500	G-4HAMIT	100+100+111
Turkey		G-4ADADG	39+43
Turkey		G-4SEYIT	153+153
Greece		KARACQOU-Italy DC	300
Turkey	- 400	G-4HAMIT	100+100+111
Turkey		G-4ADADG	39+43
Turkey		G-4SEYIT	153+153
Greece		KARACQOU-Italy DC	400
Turkey	- 300	G-4HAMIT	100+111
Turkey		G-4ADADG	39+39+43
Turkey		G-4GBZDG	39+39+39+39
Turkey		G-4SEYIT	153+153
Greece		KARACQOU-Italy DC	400
Turkey	- 200	G-4HAMIT	100+100+111
Turkey		G-4ADADG	39+39+43
Turkey		G-4GBZDG	39+39+39+39
Turkey		G-4SEYIT	153+153
Greece		KARACQOU-Italy DC	400
Turkey	- 100	G-4HAMIT	100+100+111
Turkey		G-4ADADG	39+39+43
Turkey		G-4GBZDG	39+39+39+39
Turkey		G-4SEYIT	153+153
Greece		KARACQOU-Italy DC	200
Greece		FLORINA	300

6.2. Tables and Details from Chapter 3 of the Report

Table 3.1

Contingency schemes in the power system of Albania						
from bus			to bus			ID
number	name	voltage	number	name	voltage	
10004	FZ22	220	10005	KOM22	220	1
10004	FZ22	220	10007	BUR22	220	1
10004	FZ22	220	10008	TIR22	220	1
10005	KOM22	220	10006	VD22	220	1
10005	KOM22	220	10010	ELB222	220	1
10005	KOM22	220	10014	SHAR22	220	1
10006	VD22	220	10008	TIR22	220	1
10006	VD22	220	10008	TIR22	220	2
10007	BUR22	220	10009	ELB122	220	1
10008	TIR22	220	10009	ELB122	220	1
10008	TIR22	220	10009	ELB122	220	2
10008	TIR22	220	10017	RASHB22	220	1
10009	ELB122	220	10010	ELB222	220	1
10009	ELB122	220	10010	ELB222	220	2
10009	ELB122	220	10013	FIER22	220	1
10010	ELB222	220	10014	SHAR22	220	1
10013	FIER22	220	10017	RASHB22	220	1
10010	ELB222	220	10011	ELB2400	400	1

Table 3.2

Contingency schemes in the power system of Bosnia and Herzegovina						
from bus			to bus			ID
number	name	voltage	number	name	voltage	
14201	PRIJED2	220	16206	RP KAKAN	220	1
14201	PRIJED2	220	18202	JAJCE 2	220	1
14202	RP TREB	220	18203	MO-3	220	1
14402	UGLJEVI	400	16402	TS TUZL	400	1
14403	SA 20	400	16401	SA-10	400	1
14404	TE GACK	400	14405	RP TREB	400	1
14404	TE GACK	400	18401	MO-4	400	1
14406	VISEGRA	400	16402	TS TUZL	400	1
16203	GRADACAC	220	16209	TE TUZL	220	1
16204	SALAKOV	220	16206	RP KAKAN	220	1
16204	SALAKOV	220	18203	MO-3	220	1
16205	RP JABL	220	16206	RP KAKAN	220	1
16205	RP JABL	220	18200	HE RAMA	220	1
16205	RP JABL	220	18203	MO-3	220	1
16206	RP KAKAN	220	16208	KAKANJ5	220	1
16206	RP KAKAN	220	16211	TS TUZL	220	1
16208	KAKANJ5	220	16212	ZENICA2	220	1
16209	TE TUZL	220	16211	TS TUZL	220	1
16211	TS TUZL	220	16212	ZENICA2	220	1
16401	SA-10	400	16402	TS TUZL	400	1
16401	SA-10	400	18401	MO-4	400	1
18200	HE RAMA	220	18202	JAJCE 2	220	1
18200	HE RAMA	220	18204	MO-4	220	1
18203	MO-3	220	18204	MO-4	220	1
18203	MO-3	220	18206	EAL	220	1
18204	MO-4	220	18205	HE CAPLJ	220	1
18204	MO-4	220	18206	EAL	220	1
14202	RP TREB	220	14405	RP TREB	400	1
14204	SA 20	220	14403	SA 20	400	1
14205	VISEGRA	220	14406	VISEGRA	400	1
16211	TS TUZL	220	16402	TS TUZL	400	1
18204	MO-4	220	18401	MO-4	400	1

Table 3.3

Contingency schemes in the power system of Bulgaria						
from bus			to bus			ID
number	name	voltage	number	name	voltage	
12202	KAZICENE	220	12203	SOFIAJUG	220	1
12202	KAZICENE	220	12821	ALEKO	220	1
12202	KAZICENE	220	13204	STOLNIK2	220	1
12203	SOFIAJUG	220	13203	BOBOVDOL	220	1
12205	TECSOFIA	220	13203	BOBOVDOL	220	1
12205	TECSOFIA	220	13204	STOLNIK2	220	1
12401	METALURG	400	13401	STOLNIK4	400	1
12401	METALURG	400	13402	SOFIA_W4	400	1
12421	BOICH220	220	12422	AEC_220	220	1
12421	BOICH220	220	12921	MIZIA2	220	1
12422	AEC_220	220	12921	MIZIA2	220	1
12441	AEC_400	400	12941	MIZIA_40	400	1
12441	AEC_400	400	12941	MIZIA_40	400	3
12441	AEC_400	400	13402	SOFIA_W4	400	1
12441	AEC_400	400	13402	SOFIA_W4	400	2
12520	G_ORIAH	220	12521	BALKAN	220	1
12520	G_ORIAH	220	12529		220	1
12520	G_ORIAH	220	12622	MADARA	220	1
12520	G_ORIAH	220	12703	MI_2_220	220	1
12520	G_ORIAH	220	12924		220	1
12521	BALKAN	220	12828		220	1
12526	MI_3_220	220	12700	MI_220	220	1
12526	MI_3_220	220	12703	MI_2_220	220	1
12528		220	12621	DOBRUD2	220	1

Table 3.3 continued

12528		220	12703	MI_2_220	220	1
12529		220	12703	MI_2_220	220	1
12540	CAREVEC	400	12641	VARNA4	400	1
12540	CAREVEC	400	12941	MIZIA_40	400	1
12621	DOBRUD2	220	12622	MADARA	220	1
12621	DOBRUD2	220	12623	TECVARNA	220	1
12621	DOBRUD2	220	12623	TECVARNA	220	2
12641	VARNA4	400	12642	DOBRUD4	400	1
12641	VARNA4	400	12642	DOBRUD4	400	2
12641	VARNA4	400	12741	BURGAS	400	1
12700	MI_220	220	12703	MI_2_220	220	1
12700	MI_220	220	12703	MI_2_220	220	2
12700	MI_220	220	12721	MI1_220	220	1
12700	MI_220	220	12721	MI1_220	220	2
12700	MI_220	220	12826	PLOVDIV2	220	1
12700	MI_220	220	12826	PLOVDIV2	220	2
12741	BURGAS	400	12743	MI_2_400	400	1
12742	MI_3_400	400	12743	MI_2_400	400	1
12742	MI_3_400	400	12744	MI_400	400	1
12744	MI_400	400	13841	PLOVDIV4	400	1
12821	ALEKO	220	12826	PLOVDIV2	220	1
12821	ALEKO	220	12828		220	1
12921	MIZIA2	220	12924		220	1
12941	MIZIA_40	400	13401	STOLNIK4	400	1
13201	STOMANA	220	13203	BOBOVDOL	220	1
13201	STOMANA	220	13204	STOLNIK2	220	1
13401	STOLNIK4	400	13405	ZLATICA	400	1
13402	SOFIA_W4	400	13403	C_MOGILA	400	1
13403	C_MOGILA	400	13404	BLAGOEV	400	1
13403	C_MOGILA	400	13407	VETREN	400	1
13405	ZLATICA	400	13841	PLOVDIV4	400	1
13407	VETREN	400	13841	PLOVDIV4	400	1
12422	AEC_220	220	12441	AEC_400	400	1
12526	MI_3_220	220	12742	MI_3_400	400	1
12621	DOBRUD2	220	12642	DOBRUD4	400	1
12721	MI1_220	220	12744	MI_400	400	1
12921	MIZIA2	220	12941	MIZIA_40	400	1
13204	STOLNIK2	220	13401	STOLNIK4	400	1

Table 3.4

Contingency schemes in the power system of Croatia						
from bus			to bus			ID
number	name	voltage	number	name	voltage	
20005	BILIC220	220	20063	HEZAK220	220	1
20005	BILIC220	220	20077	KONJ220	220	1
20010	BRINJE	220	20059	HESEN220	220	1
20010	BRINJE	220	20077	KONJ220	220	1
20010	BRINJE	220	20103	MRACL220	220	1
20055	HEORLOVA	220	20077	KONJ220	220	1
20059	HESEN220	220	20096	MELIN220	220	1
20063	HEZAK220	220	20077	KONJ220	220	1
20078	KONJ400	400	20147	OBROV400	400	1
20094	MEDUR220	220	20168	TESIS220	220	1
20096	MELIN220	220	20126	PEHLIN22	220	1
20096	MELIN220	220	20165	TEPLO220	220	1
20096	MELIN220	220	20166	TERIJEKA	220	1
20097	MELIN400	400	20147	OBROV400	400	1
20097	MELIN400	400	20177	TUMBR400	400	1
20103	MRACL220	220	20168	TESIS220	220	1
20103	MRACL220	220	20202	ZERJA220	220	1
20126	PEHLIN22	220	20165	TEPLO220	220	1
20177	TUMBR400	400	20203	ZERJA400	400	1
20203	ZERJA400	400	20401	ERNES400	400	1
20077	KONJ220	220	20078	KONJ400	400	1
20096	MELIN220	220	20097	MELIN400	400	1
20202	ZERJA220	220	20203	ZERJA400	400	1

Table 3.5

Contingency schemes in the power system of Greece						
from bus			to bus			ID
number	name	voltage	number	name	voltage	
22241	QES.2	400	22294	AMUNTAIO	400	1
22241	QES.2	400	22845	QES/NIKH	400	1
22294	AMUNTAIO	400	22319	KARDIA K	400	1
22294	AMUNTAIO	400	22397	AHS_FLWR	400	1
22312	AG.DHMHT	400	22319	KARDIA K	400	1
22312	AG.DHMHT	400	22405	LARISA K	400	1
22312	AG.DHMHT	400	22845	QES/NIKH	400	1
22319	KARDIA K	400	22405	LARISA K	400	1
22319	KARDIA K	400	22837	K-TRIKAL	400	1
22405	LARISA K	400	22476	K_LARYMN	400	1
22405	LARISA K	400	22476	K_LARYMN	400	3
22476	K_LARYMN	400	22550	ACARNES	400	1
22476	K_LARYMN	400	22767	DISTOMO	400	1
22550	ACARNES	400	22568	KOUMOUN.	400	1
22550	ACARNES	400	22585	AG.STEF.	400	1
22568	KOUMOUN.	400	22767	DISTOMO	400	1
22585	AG.STEF.	400	22613	PALLHNH	400	1
22585	AG.STEF.	400	22613	PALLHNH	400	3
22613	PALLHNH	400	22635	ARGUR/LH	400	1
22613	PALLHNH	400	22682	LAURIO	400	1
22635	ARGUR/LH	400	22682	LAURIO	400	1
22767	DISTOMO	400	22772	ACELWOS	400	1
22767	DISTOMO	400	22837	K-TRIKAL	400	1
22772	ACELWOS	400	22875	KARACQOU	400	1
22837	K-TRIKAL	400	22875	KARACQOU	400	1
22183	FILIPPOI	400	22185	FILIPPOI	150	A1
22183	FILIPPOI	400	22185	FILIPPOI	150	A2
22208	THES2	150	22845	QES/NIKH	400	A4
22208	THES2	150	22845	QES/NIKH	400	A3
22207	QES/NIKH	150	22241	QES.2	400	A2
22207	QES/NIKH	150	22241	QES.2	400	A1
22319	KARDIA K	400	22326	KARDIA2	150	A2
22319	KARDIA K	400	22325	KARDIA1	150	A1
22397	AHS_FLWR	400	22398	AHS_FLW	150	A1
22405	LARISA K	400	22407	LARISA K	150	A3

Table 3.5 continued

22476	K_LARYMN	400	22586	AG.STEF.	400	1
22405	LARISA K	400	22407	LARISA K	150	A2
22405	LARISA K	400	22407	LARISA K	150	A1
22454	K-TRIKAL	150	22837	K-TRIKAL	400	A1
22476	K_LARYMN	400	22478	LARUMNA	150	A2
22476	K_LARYMN	400	22478	LARUMNA	150	A1
22547	KOUM_1	400	22570	KOUMOUN1	150	A1
22547	KOUM_1	400	22570	KOUMOUN1	150	A2
22548	KOUM_1	400	22571	KOUMOUN2	150	A3
22548	KOUM_1	400	22571	KOUMOUN2	150	A4
22549	KOUM_1	400	22572	KOUMOUN3	150	A5
22549	KOUM_1	400	22572	KOUMOUN3	150	A6
22550	ACARNES	400	22552	ACARNES2	150	A2
22550	ACARNES	400	22553	ACARNES1	150	A1
22585	AG.STEF.	400	22589	AG.STEF.	150	A2
22585	AG.STEF.	400	22590	AG.STEF.	150	A1
22613	PALLHNH	400	22615	PALLHNH	150	A2
22613	PALLHNH	400	22616	PALLHNH	150	A1
22635	ARGUR/LH	400	22637	ARGUR/LH	150	A2
22635	ARGUR/LH	400	22638	ARGUR/LH	150	A1
22682	LAURIO	400	22692	LAURIO T	150	A1
22767	DISTOMO	400	22793	DISTOMO	150	A2
22767	DISTOMO	400	22793	DISTOMO	150	A1
22772	ACELWOS	400	22778	ACELWOS	150	A2
22772	ACELWOS	400	22777	ACELWOS	150	A1
22794	KARACQOU	150	22875	KARACQOU	400	A2
22794	KARACQOU	150	22875	KARACQOU	400	A1

Table 3.6

Contingency schemes in the power system of Hungary						
from bus			to bus			ID
number	name	voltage	number	name	voltage	
24001	MGYOR 2	220	24037	MOROE 2	220	1
24002	MGYOR 4	400	24004	MLITR 4	400	1
24004	MLITR 4	400	24006	MMART 4	400	1
24004	MLITR 4	400	24012	MHEVI 4	400	1
24004	MLITR 4	400	24039	MPAKS 4	400	1
24005	MMART 21	220	24041	MDUME 22	220	1
24006	MMART 4	400	24017	MAISA 4	400	0
24006	MMART 4	400	24039	MPAKS 4	400	1
24007	MMART 22	220	24040	MDUME 21	220	2
24008	MDUJV 21	220	24040	MDUME 21	220	1
24009	MDUJV 22	220	24041	MDUME 22	220	2
24010	MTOPN 4	400	24012	MHEVI 4	400	1
24010	MTOPN 4	400	24039	MPAKS 4	400	1
24011	MPECS 4	400	24039	MPAKS 4	400	1
24014	MSZEG 2	220	24022	MSZOL 2	220	1
24016	MBEKO 4	400	24017	MAISA 4	400	1
24016	MBEKO 4	400	24020	MSAFA 4	400	1
24017	MAISA 4	400	24032	MGOD 4	400	1
24020	MSAFA 4	400	24039	MPAKS 4	400	1
24022	MSZOL 2	220	24043	MDETK 2	220	1
24022	MSZOL 2	220	24044	MSAJO 2	220	1
24023	MDEBR 21	220	24044	MSAJO 2	220	1
24024	MDEBR 22	220	24044	MSAJO 2	220	2
24025	MKISV 2	220	24044	MSAJO 2	220	1
24026	MFZSO 4	400	24027	MSAJI 4	400	1
24026	MFZSO 4	400	24046	MSAJO 4	400	1
24026	MFZSO 4	400	24046	MSAJO 4	400	2
24032	MGOD 4	400	24046	MSAJO 4	400	1
24033	MZUGL 2	220	24036	MOCSA 2	220	1
24033	MZUGL 2	220	24043	MDETK 2	220	1
24034	MALBF 21	220	24041	MDUME 22	220	1
24035	MALBF 22	220	24041	MDUME 22	220	2
24036	MOCSA 2	220	24038	MDUFI 2	220	1
24036	MOCSA 2	220	24040	MDUME 21	220	2
24037	MOROE 2	220	24041	MDUME 22	220	1
24038	MDUFI 2	220	24040	MDUME 21	220	1
24042	MTLOK 2	220	24044	MSAJO 2	220	1

Table 3.6 continued

24043	MDETK 2	220	24044	MSAJO 2	220	1
24000	MGYOR 11	120	24002	MGYOR 4	400	1
24002	MGYOR 4	400	24003	MGYOR 12	120	2
24005	MMART 21	220	24006	MMART 4	400	1
24006	MMART 4	400	24007	MMART 22	220	2
24019	MSAFA 11	120	24020	MSAFA 4	400	1
24020	MSAFA 4	400	24021	MSAFA 12	120	2
24044	MSAJO 2	220	24046	MSAJO 4	400	1

Table 3.7

Contingency schemes in the power system of Macedonia						
from bus			to bus			ID
number	name	voltage	number	name	voltage	
26005	BITOLA 2	400	26022	DUBROVO	400	1
26005	BITOLA 2	400	26064	SK 4	400	1
26022	DUBROVO	400	26064	SK 4	400	1
26022	DUBROVO	400	26112	STIP 1	400	1
26064	SK 4	400	26111	SK 1	400	1
26060	SK 1	220	26059	SK 1	110	1
26111	SK 1	400	26059	SK 1	110	1

Table 3.8

Contingency schemes in the power system of Romania						
from bus			to bus			ID
number	name	voltage	number	name	voltage	
28001	TANTAREN	400	28002	URECHEST	400	1
28001	TANTAREN	400	28007	SLATINA	400	1
28001	TANTAREN	400	28033	BRADU	400	1
28001	TANTAREN	400	28034	SIBIU	400	1
28002	URECHEST	400	28004	P.D.FE	400	1
28002	URECHEST	400	28010	DOMNESTI	400	1
28003	MINTIA	400	28008	ARAD	400	1
28003	MINTIA	400	28034	SIBIU	400	1
28004	P.D.FE	400	28007	SLATINA	400	1
28007	SLATINA	400	28011	BUC S	400	1
28008	ARAD	400	28096	ORADEA	400	1
28010	DOMNESTI	400	28011	BUC S	400	1
28010	DOMNESTI	400	28904	BRAZI	400	1
28011	BUC S	400	28015	PELICANU	400	1
28011	BUC S	400	28016	G. IALOM	400	1
28012	GUTINAS2	220	28080	MUNTENI	220	1
28015	PELICANU	400	28973	CERNAVOD	400	1
28016	G. IALOM	400	28021	L.SARAT	400	1
28016	G. IALOM	400	28973	CERNAVOD	400	1
28016	G. IALOM	400	28973	CERNAVOD	400	2
28017	CONSTAN	400	28019	TULCEA	400	1
28017	CONSTAN	400	28973	CERNAVOD	400	1
28019	TULCEA	400	28020	ISACCEA	400	1
28020	ISACCEA	400	28021	L.SARAT	400	1
28020	ISACCEA	400	28022	SMARDAN	400	1
28021	L.SARAT	400	28022	SMARDAN	400	1
28022	SMARDAN	400	28024	GUTINAS	400	1
28023	FOCSANI	220	28076	BARBOSI	220	1
28023	FOCSANI	220	28077	GUTINAS	220	1
28024	GUTINAS	400	28031	BRASOV	400	1
28025	BACAU	220	28077	GUTINAS	220	1
28025	BACAU	220	28950	ROMAN	220	1
28031	BRASOV	400	28032	DARSTE	400	1
28031	BRASOV	400	28033	BRADU	400	1
28031	BRASOV	400	28034	SIBIU	400	1

Table 3.8 continued

28032	DARSTE	400	28904	BRAZI	400	1
28034	SIBIU	400	28036	IERNUT	400	1
28036	IERNUT	400	28037	GADALIN	400	1
28037	GADALIN	400	28039	ROSIORI	400	1
28039	ROSIORI	400	28096	ORADEA	400	1
28041	AREFU	220	28042	RIURENI	220	1
28041	AREFU	220	28044	BRADU	220	1
28042	RIURENI	220	28043	STUPAREI	220	1
28043	STUPAREI	220	28044	BRADU	220	1
28044	BRADU	220	28910	TARG A	220	1
28044	BRADU	220	28911	TARG B	220	1
28045	URECHEST	220	28061	SARADAN	220	1
28045	URECHEST	220	28062	TGJIU	220	2
28046	P.D.FE B	220	28050	CETATE 1	220	1
28047	P.D.FE A	220	28050	CETATE 1	220	1
28047	P.D.FE A	220	28052	RESITA	220	1
28052	RESITA	220	28071	TIMIS	220	1
28055	SLATINA	220	28056	GRADISTE	220	1
28055	SLATINA	220	28057	CRAIOVAA	220	1
28055	SLATINA	220	28058	CRIOVAB	220	1
28055	SLATINA	220	28060	ISALNITA	220	1
28056	GRADISTE	220	28059	ISALNITB	220	1
28057	CRAIOVAA	220	28059	ISALNITB	220	1
28057	CRAIOVAA	220	28902	TR MAG	220	1
28058	CRIOVAB	220	28060	ISALNITA	220	1
28058	CRIOVAB	220	28061	SARADAN	220	1
28062	TGJIU	220	28063	PAROSENI	220	1
28063	PAROSENI	220	28064	BARU M	220	1
28064	BARU M	220	28065	HASD OT	220	1
28065	HASD OT	220	28066	PESTIS	220	1
28065	HASD OT	220	28068	MINTIAB	220	1
28066	PESTIS	220	28067	MINTIAA	220	1
28066	PESTIS	220	28068	MINTIAB	220	1
28067	MINTIAA	220	28071	TIMIS	220	1
28067	MINTIAA	220	28100	SIBIU	220	1
28068	MINTIAB	220	28069	ARAD	220	1
28068	MINTIAB	220	28097	A. IULIA	220	1
28069	ARAD	220	28070	SACALAZ	220	1
28069	ARAD	220	28071	TIMIS	220	1

Table 3.8 continued

28070	SACALAZ	220	28071	TIMIS	220	1
28072	BUC S A	220	28073	FUNDENI	220	1
28072	BUC S A	220	28079	BUC S B	220	1
28072	BUC S A	220	28901	GHIZDARU	220	1
28073	FUNDENI	220	28905	BRAZI A	220	1
28073	FUNDENI	220	29051	FUNDENI	220	1
28077	GUTINAS	220	28078	DUMBRAV	220	1
28077	GUTINAS	220	28080	MUNTENI	220	1
28077	GUTINAS	220	28081	FAI	220	1
28078	DUMBRAV	220	28083	STEJARU	220	1
28079	BUC S B	220	28935	RAC MOST	220	1
28079	BUC S B	220	29051	FUNDENI	220	1
28080	MUNTENI	220	28081	FAI	220	1
28081	FAI	220	28082	SUCEAVA	220	1
28082	SUCEAVA	220	28950	ROMAN	220	1
28083	STEJARU	220	28084	GHEORGH	220	1
28084	GHEORGH	220	28085	FANTAN	220	1
28086	UNGHENI	220	28087	IERNUT	220	1
28087	IERNUT	220	28088	CUPT C.T	220	1
28087	IERNUT	220	28093	BAIA M	220	1
28088	CUPT C.T	220	28089	CLUJ FL.	220	1
28089	CLUJ FL.	220	28091	TIHAU	220	1
28089	CLUJ FL.	220	28097	A. IULIA	220	1
28091	TIHAU	220	28093	BAIA M	220	1
28093	BAIA M	220	28094	ROSIORI	220	1
28901	GHIZDARU	220	28902	TR MAG	220	1
28901	GHIZDARU	220	28935	RAC MOST	220	1
28905	BRAZI A	220	28911	TARG B	220	1
28905	BRAZI A	220	29050	BRAZI B	220	1
28910	TARG A	220	29050	BRAZI B	220	1
29050	BRAZI B	220	29051	FUNDENI	220	1
28002	URECHEST	400	28045	URECHEST	220	1
28003	MINTIA	400	28067	MINTIAA	220	1
28003	MINTIA	400	28068	MINTIAB	220	1
28004	P.D.FE	400	28046	P.D.FE B	220	1
28004	P.D.FE	400	28047	P.D.FE A	220	2
28007	SLATINA	400	28055	SLATINA	220	1
28008	ARAD	400	28069	ARAD	220	1
28011	BUC S	400	28072	BUC S A	220	1

Table 3.8 continued

28011	BUC S	400	28079	BUC S B	220	1	
28012	GUTINAS2	220	28024	GUTINAS	400	1	
28021	L.SARAT	400	28074	L. SARAT	220	1	
28024	GUTINAS	400	28077	GUTINAS	220	1	
28034	SIBIU	400	28100	SIBIU	220	1	
28036	IERNUT	400	28087	IERNUT	220	1	
28039	ROSIORI	400	28094	ROSIORI	220	1	
28904	BRAZI	400	28905	BRAZI A	220	1	

Table 3.9

Contingency schemes in the power system of Slovenia						
from bus			to bus			ID
number	name	voltage	number	name	voltage	
30000	LDIVAC2	220	30001	LKLECE2	220	1
30001	LKLECE2	220	30002	LBERIC2	220	1
30002	LBERIC2	220	30003	LPODLO2	220	1
30003	LPODLO2	220	30004	LCIRKO2	220	1
30005	LDIVAC1	400	30006	LBERIC1	400	1
30006	LBERIC1	400	30007	LPODLO1	400	1
30007	LPODLO1	400	30008	LMARIB1	400	1
30008	LMARIB1	400	30009	LKRSKO1	400	1
30002	LBERIC2	220	30006	LBERIC1	400	1
30003	LPODLO2	220	30007	LPODLO1	400	1

Table 3.10

Contingency schemes in the power system of Yugoslavia						
from bus			to bus			ID
number	name	voltage	number	name	voltage	
34000	TENTB4	400	34001	RPMLAD	400	1
34001	RPMLAD	400	34003	NSA 34	400	1
34001	RPMLAD	400	34003	NSA 34	400	2
34001	RPMLAD	400	34005	OBR A4	400	1
34001	RPMLAD	400	34005	OBR A4	400	2
34001	RPMLAD	400	34056	SMIT24	400	1
34003	NSA 34	400	34004	SUB 34	400	1
34005	OBR A4	400	34010	BGD 84	400	1
34005	OBR A4	400	34058	KOLUB4	400	1
34006	OBR A2	220	34011	BGD 52	220	1
34006	OBR A2	220	34011	BGD 52	220	3
34006	OBR A2	220	34011	BGD 52	220	4
34006	OBR A2	220	34032	RPBBASTA	220	1
34006	OBR A2	220	34035	VALJ32	220	1
34006	OBR A2	220	34036	BGD32A	220	1
34006	OBR A2	220	34044	NSA 32	220	1
34010	BGD 84	400	34012	DRMNO	400	1
34010	BGD 84	400	34057	BGD204	400	1
34012	DRMNO	400	34013	DJERDA	400	1
34012	DRMNO	400	34015	PANC24	400	1
34013	DJERDA	400	34016	BOR 24	400	1
34015	PANC24	400	34057	BGD204	400	1
34016	BOR 24	400	34017	NIS 24	400	1
34017	NIS 24	400	34019	KOSOV4	400	1
34017	NIS 24	400	34053	SVET44	400	1
34018	KRAG24	400	34053	SVET44	400	1
34018	KRAG24	400	34058	KOLUB4	400	1
34019	KOSOV4	400	34059	PEC 34	400	1
34020	KOSOV2	220	34021	PRIS42	220	1
34020	KOSOV2	220	34021	PRIS42	220	2
34020	KOSOV2	220	34022	KRUS12	220	1
34020	KOSOV2	220	34046	TEKOS2	220	1
34020	KOSOV2	220	34046	TEKOS2	220	2
34020	KOSOV2	220	34047	GLOG22	220	1
34020	KOSOV2	220	34047	GLOG22	220	2

Table 3.10 continued

34022	KRUS12	220	34023	NIS 22	220	1
34022	KRUS12	220	34024	KRAL32	220	1
34024	KRAL32	220	34025	CACA32	220	1
34024	KRAL32	220	34026	POZEGA2	220	1
34025	CACA32	220	34026	POZEGA2	220	1
34032	RPBBASTA	220	34035	VALJ32	220	1
34032	RPBBASTA	220	34036	BGD32A	220	1
34032	RPBBASTA	220	34042	SMIT22	220	1
34036	BGD32A	220	34037	BGD 82	220	1
34036	BGD32A	220	34037	BGD 82	220	2
34037	BGD 82	220	34039	HIP	220	1
34039	HIP	220	34040	PANC22	220	1
34040	PANC22	220	34045	ZREN22	220	1
34042	SMIT22	220	34043	SRB 22	220	1
34043	SRB 22	220	34044	NSA 32	220	1
34044	NSA 32	220	34045	ZREN22	220	1
34047	GLOG22	220	34048	PRIZ22	220	1
36201	PLJEVLJA	220	36202	HEPIVA	220	1
36201	PLJEVLJA	220	36202	HEPIVA	220	2
36201	PLJEVLJA	220	36205	MOJKO(O)	220	1
36203	PODGORI1	220	36204	HEPERUCI	220	1
36203	PODGORI1	220	36205	MOJKO(O)	220	1
36401	PLEVLJA2	400	36402	RPRIBARE	400	1
36402	RPRIBARE	400	36403	PODGORI2	400	1
34003	NSA 34	400	34044	NSA 32	220	1
34005	OBR A4	400	34006	OBR A2	220	1
34010	BGD 84	400	34037	BGD 82	220	1
34015	PANC24	400	34040	PANC22	220	1
34019	KOSOV4	400	34020	KOSOV2	220	1
34042	SMIT22	220	34056	SMIT24	400	1
36201	PLJEVLJA	220	36401	PLEVLJA2	400	1

Table 3.11

Contingency schemes in the power system of Turkey						
from bus			to bus			ID
number	name	voltage	number	name	voltage	
32014	4ALIBEY	380	32065	4HAMIT	380	1
32014	4ALIBEY	380	32066	4IKITELL	380	1
32014	4ALIBEY	380	32101	4YILDIZ	380	1
32016	4AMBARLI	380	32066	4IKITELL	380	1
32019	4ATISALA	380	32064	4HABIPLR	380	1
32019	4ATISALA	380	32066	4IKITELL	380	1
32022	4BABAESK	380	32065	4HAMIT	380	1
32022	4BABAESK	380	32094	4UNIMRDG	380	1
32064	4HABIPLR	380	32094	4UNIMRDG	380	1
32065	4HAMIT	380	32094	4UNIMRDG	380	1
32066	4IKITELL	380	32094	4UNIMRDG	380	1
32004	4AGACC1	380	32005	4AGACC2	380	1
32006	4AGACC3	380	32007	4AGACC4	380	1
32008	4AKYAC1	380	32009	4AKYAC2	380	1
32010	4AKYAC3	380	32011	4AKYAC4	380	1
32020	4AVANOS	380	32030	4CAAVAN1	380	1
32020	4AVANOS	380	32031	4CAAVAN2	380	1
32021	4AVANOS2	380	32032	4CAAVAN3	380	1
32021	4AVANOS2	380	32033	4CAAVAN4	380	1
32056	4GOKCA1	380	32057	4GOKCA2	380	1
32058	4GOKCA3	380	32059	4GOKCA4	380	1
32014	4ALIBEY	380	32105	ALIBEY_A	154	1
32014	4ALIBEY	380	32106	ALIBEY_B	154	1
32016	4AMBARLI	380	32108	AMBAR_2A	154	1
32019	4ATISALA	380	32111	ATISALNA	154	1
32019	4ATISALA	380	32112	ATISALNB	154	1
32022	4BABAESK	380	32116	BABAESKI	154	1
32064	4HABIPLR	380	32131	HABIP_A	154	1
32064	4HABIPLR	380	32132	HABIP_B	154	1
32065	4HAMIT	380	32135	HAMIT	154	1
32066	4IKITELL	380	32138	IKITEL_A	154	1
32066	4IKITELL	380	32139	IKITEL_B	154	1
32101	4YILDIZ	380	32168	YILDIZ_A	154	1
32101	4YILDIZ	380	32169	YILDIZ_B	154	1

Table 3.12

Contingency schemes of tie- lines in the power pool						
from bus			to bus			ID
number	name	voltage	number	name	voltage	
10011	ELB2400	400	22319	KARDIA K	400	1
12441	AEC_400	400	28001	TANTAREN	400	1
12742	MI_3_400	400	32501	XHAMIT	400	1
12742	MI_3_400	400	32501	XHAMIT	400	2
13402	SOFIA_W4	400	34017	NIS 24	400	1
13404	BLAGOEV	400	22241	QES.2	400	1
14402	UGLJEVI	400	20401	ERNES400	400	1
14405	RP TREB	400	36403	PODGORI2	400	1
18401	MO-4	400	20078	KONJ400	400	1
20097	MELIN400	400	30005	LDIVAC1	400	1
20177	TUMBR400	400	30009	LKRSKO1	400	1
20203	ZERJA400	400	24012	MHEVI 4	400	1
20401	ERNES400	400	34056	SMIT24	400	1
22183	FILIPPOI	400	32500	XBABAESK	400	1
22397	AHS_FLWR	400	26005	BITOLA 2	400	1
22845	QES/NIKH	400	26022	DUBROVO	400	1
24002	MGYOR 4	400	45021	OWIEN_1	400	1
24020	MSAFA 4	400	28008	ARAD	400	1
24020	MSAFA 4	400	34004	SUB 34	400	1
26111	SK 1	400	34019	KOSOV4	400	1
28004	P.D.FE	400	34013	DJERDA	400	1
30005	LDIVAC1	400	55018	IRDPV111	400	1
30008	LMARIB1	400	45032	OKAINA1	400	1
34059	PEC 34	400	36402	RPRIBARE	400	1
10004	FZ22	220	34048	PRIZ22	220	1
10006	VD22	220	36203	PODGORI1	220	1
14201	PRIJED2	220	20094	MEDUR220	220	1
14201	PRIJED2	220	20103	MRACL220	220	1
14202	RP TREB	220	36204	HEPERUCI	220	1
14204	SA 20	220	36202	HEPIVA	220	1
14205	VISEGRA	220	34027	VARDIS	220	1
16203	GRADACAC	220	20024	DAKOV220	220	1
16209	TE TUZL	220	20024	DAKOV220	220	1
18200	HE RAMA	220	20063	HEZAK220	220	1
20126	PEHLIN22	220	30000	LDIVAC2	220	1

Table 3.12 continued

20202	ZERJA220	220	30004	LCIRKO2	220	1
24001	MGYOR 2	220	45010	OWIEN_2	220	1
24001	MGYOR 2	220	45047	ONEUSI2	220	1
26060	SK 1	220	34020	KOSOV2	220	1
30000	LDIVAC2	220	55015	IPDRV121	220	1
30003	LPODLO2	220	45003	OOBERS2	220	1
34026	POZEGA2	220	36201	PLJEVLJA	220	1
34032	RPBBASTA	220	36201	PLJEVLJA	220	1

6.3. Tables and Details from Chapter 4 of the Report

Table 4.1. Power flows: OHL 400kV Podgorica (YUG) - Elbasan (ALB)

No.	INTERCONNECTION LINE	POWER FLOWS																									
		WINTER																				SUMMER					
		Base case				Scenario 1		Scenario 2		Scenario 3		Scenario 4		Scenario 5		Scenario 6		Scenario 7		Scenario 8		Base case		Scenario 1		Scenario 5	
						UCTE >> TUR (W>>E)		TUR,GRE >> UCTE (E>>W)		UCTE >> BUL,GRE,ALB (W>>E)		BUL,GRE,ROM >> UCTE (E>>W)		CEN,UKR,ROM >> TUR,GRE (N>>S)		TUR,BUL >> CEN (S>>N)		CEN,UKR >> BUL,GRE,ALB (N>>S)		ROM,BUL,GRE >> CEN (S>>W)							
		With TUR		Without TUR		600		700		1000		700		1000		1500		1000		1500		With TUR		600		1200	
		MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%
1	OHL 400kV Kardia (GRE) - Elbasan (ALB)	100/18	8	108/16	8	43/23	4	181/18	13	108/14	8	184/16	14	13/27	2	216/19	16	116/19	9	237/21	18	104/19	8	41/23	3	-10/22	2
		67/-10	5	81/-13	6	-37/4	3	211/-11	16	-29/10	2	214/-13	16	-84/12	6	277/-7	21	-13/5	1	307/-4	23	94/-8	-3	-19/5	1	-101/16	8
2	OHL 400kV Tantareni (ROM) - Kozloduj (BUL) 1	110/-96	12	108/-94	11	168/-98	16	42/-94	8	206/-93	18	47/-88	8	220/-91	19	-78/-92	10	218/-94	19	27/-84	7	67/-74	8	143/-71	13	213/-69	18
		107/-96	12	106/-94	11	163/-98	15	44/-94	8	197/-94	17	49/-88	8	214/-91	19	-74/-92	9	209/-94	18	31/-85	7	66/-74	8	137/-71	12	204/-70	17
3	OHL 400kV Tantareni (ROM) - Kozloduj (BUL) 2	110/-96	12	108/-94	11	168/-98	16	42/-94	8	206/-93	18	47/-88	8	220/-91	19	-78/-92	10	218/-94	19	27/-84	7	67/-74	8	143/-71	13	213/-69	18
		107/-96	12	106/-94	11	163/-98	15	44/-94	8	197/-94	17	49/-88	8	214/-91	19	-74/-92	9	209/-94	18	31/-85	7	66/-74	8	137/-71	12	204/-70	17
4	OHL 400kV Nis (YUG) - Sofija west (BUL)	-47/-83	5	-27/-76	4	190/-110	12	-289/-58	16	163/-108	10	-266/-51	14	125/-102	9	-675/-17	36	148/-108	10	-468/-39	25	18/-33	2	196/-45	11	165/-44	9
		-58/-82	5	-34/-75	4	165/-107	10	-280/-58	15	126/-102	9	-258/-52	14	94/-98	7	-656/-18	35	114/-102	8	-449/-39	24	16/-33	2	182/-44	10	143/-43	8
5	OHL 400kV Thessaloniki (GRE) - Blagoevgrad (BUL)	-20/-36	3	26/-47	4	-63/-31	5	80/-44	7	-206/-12	16	102/-54	9	-212/-6	16	18/-36	3	-221/-9	17	148/-54	12	-69/-94	9	-89/-91	10	-282/-57	22
		-9/-37	3	37/-47	5	-36/-34	4	70/-42	6	-146/-22	11	89/-52	8	-179/-12	14	-3/-34	3	-165/-19	13	118/-52	10	-65/-93	9	-70/-94	9	-254/-63	20
6	OHL 400kV Ernestinovo (CRO) - Ugljevik (B&H)	-135/62	11	-138/62	11	-94/53	8	-189/64	15	-36/44	4	-189/64	15	-58/100	9	-258/57	20	-19/47	4	-254/58	20	-69/-8	5	-38/-11	3	8/-14	1
		-130/61	11	-134/62	11	-82/51	7	-194/65	16	-17/43	4	-194/65	16	-45/98	8	-266/59	21	-2/46	3	-264/60	21	-68/-9	5	-28/-13	2	24/-14	2
7	OHL 400kV Podgorica (YUG) - Trebinje (B&H)	-104/-15	8	-102/-16	8	-193/-4	15	-2/-25	2	-239/3	19	-2/-26	2	-177/0	14	65/-33	6	-206/-4	16	56/-32	5	-40/-61	6	-126/-49	11	-130/-52	11
		-127/-14	10	-121/-15	10	-248/2	20	18/-28	3	-331/12	26	18/-29	3	-242/7	19	106/-35	9	-294/3	23	104/-36	9	-47/-60	6	-169/-42	14	-194/-45	16
8	OHL 400kV Konjsko (CRO) - Mostar (B&H)	106/1	8	104/1	8	223/-15	17	-23/10	2	304/-26	23	-23/10	2	183/0	14	-74/13	6	237/-12	18	-69/13	5	99/1	8	217/-12	16	194/-6	15
		109/1	8	107/1	8	231/-16	18	-25/10	2	314/-27	24	-26/10	2	191/0	14	-80/13	6	247/-13	19	-76/13	6	100/1	8	224/-13	17	202/-7	15
9	OHL 400kV Divaca (SLO) - Meline (CRO)	-90/-4	7	-91/-4	7	14/-8	1	-205/16	16	71/-23	6	-205/16	16	-53/1	4	-195/23	15	-25/-5	2	-193/23	15	-98/-38	8	12/-33	3	-48/-33	4
		-89/-4	7	-90/-4	7	16/-8	1	-206/16	16	74/-23	6	-206/16	16	-50/1	4	-197/24	15	-23/-4	2	-196/23	15	-98/-38	8	16/-33	3	-46/-32	4
10	OHL 400kV Krsko (SLO) - Tumbri (CRO) 1	234/-66	18	234/-66	18	319/-74	25	152/-65	13	355/-67	27	152/-65	13	246/-65	19	191/-55	15	256/-68	20	191/-56	15	209/-57	16	294/-62	23	225/-57	18
		234/-66	18	234/-66	18	319/-74	25	152/-65	13	354/-67	27	152/-65	13	246/-65	19	191/-54	15	255/-68	20	191/-56	15	208/-57	16	295/-62	23	224/-56	18
11	OHL 400kV Krsko (SLO) - Tumbri (CRO) 2	234/-66	18	234/-66	18	319/-74	25	152/-65	13	355/-67	27	152/-65	13	246/-65	19	191/-55	15	256/-68	20	191/-56	15	209/-57	16	294/-62	23	225/-57	18
		234/-66	18	234/-66	18	319/-74	25	152/-65	13	354/-67	27	152/-65	13	246/-65	19	191/-54	15	255/-68	20	191/-56	15	208/-57	16	295/-62	23	224/-56	18
12	OHL 400kV Heviz (HUN) - Zerjavinec (CRO)	-143/-28	11	-145/-27	11	-164/-10	12	-155/-23	12	-116/-10	9	-153/-24	12	9/-35	3	-467/41	36	101/-48	8	-452/37	34	-81/-92	9	-97/-80	10	97/-105	11
		-140/-28	11	-143/-28	11	-157/-11	12	-157/-23	12	-104/-12	8	-156/-23	12	17/-36	3	-473/43	36	112/-49	9	-457/38	35	-80/-92	9	-91/-81	9	105/-105	11
13	OHL 400kV S.Mitrovica (YUG) - Ernestinovo (CRO)	116/-57	10	113/-57	10	19/-42	3	218/-57	17	-5/-33	3	218/-57	17	90/-22	7	266/-49	21	64/-47	6	259/-49	20	108/-70	10	-8/-50	4	58/-59	6
		121/-58	10	117/-58	10	32/-43	4	214/-57	17	17/-35	3	214/-57	17	105/-23	8	257/-49	20	85/-48	7	249/-49	19	110/-71	10	1/-51	4	76/-60	7
14	OHL 400kV Bitola (MKD) - Florina (GRE)	72/-4	6	57/-6	5	131/-13	12	-30/-1	3	270/-27	24	-35/-4	3	254/-23	22	-43/-4	4	269/-26	24	-103/-7	9	-19/-91	8	53/-104	10	206/-110	21
		60/-4	5	46/-6	4	102/-10	9	-19/-1	2	215/-20	19	-23/-5	2	219/-19	19	-21/-4	2	218/-20	19	-75/-7	7	-23/-91	8	29/-101	9	171/-104	18
15	OHL 400kV Dubrovo (MKD) - Thessaloniki (GRE)	90/-50	9	77/-41	8	144/-52	13	24/-48	5	127/-48	12	20/-38	4	142/-54	13	-15/-45	4	125/-47	12	-13/-40	4	139/11	12	202/9	18	211/-2	19
		85/-50	9	72/-42	7	132/-51	12	28/-48	5	104/-44	10	25/-39	4	128/-52	12	-6/-45	4	103/-44	10	-1/-40	4	138/11	12	192/10	17	197/1	17
16	OHL 400kV Arad (ROM) - Sandorfalva (HUN)	-57/26	5	-63/26	6	-197/44	17	104/8	9	-265/55	22	106/8	9	-189/47	16	360/-12	30	-311/64	26	437/-20	36	-7/-19	2	-151/0	12	-162/6	13
		-54/26	5	-60/26	5	-188/43	16	101/8	8	-248/53	21	103/8	9	-177/45	15	353/-11	29	-296/62	25	431/-19	36	-5/-19	2	-145/-1	12	-150/4	12
17	OHL 400kV Subotica (YUG) - Sandorfalva (HUN)	-89/-106	10	-86/-106	10	-224/-79	18	85/-136	12	-331/-57	25	83/-136	12	-323/-64	24	420/-182	34	-446/-35	33	368/-167	30	-94/16	7	-220/35	17	-361/52	27
		-88/-106	10	-86/-106	10	-222/-79	17	85/-136	12	-324/-59	24	83/-136	12	-319/-65	24	419/-182	34	-440/-37	33	366/-167	30	-94/16	7	-223/35	17	-358/52	27
18	OHL 400kV Kosovo B (YUG) - Skopje 1 (MKD)	153/-27	12	128/-20	10	254/-31	19	4/-16	1	368/-27	28	-5/-8	1	363/-30	27	-42/-12	3	366/-26	28	-95/1	7	109/-47	9	228/-50	18	376/-40	28
		138/-28	11	114/-20	9	216/-30	16	18/-19	2	295/-28	22	11/-11	1	317/-32	24	-13/-16	2	297/-28	22	-59/-5	4	104/-47	9	198/-49	15	329/-42	25
19	OHL 400kV Djerdap (YUG) - P.D.Fier (ROM)	-72/-56	7	-62/-56	6	-19/-56	4	-120/-61	10	-23/-62	5	-130/-66	11	-97/-69	9	-192/-74	15	-38/-63	6	-247/-86	20	-45/-16	4	42/-20	3	-52/-32	5
		-74/-56	7	-63/-56	6	-25/-56	5	-118/-60	10	-31/-61	5	-129/-66	11	-104/-69	9	-188/-73	15	-46/-62	6	-243/-85	19	-46/-16	4	34/-19	3	-63/-31	5
20	OHL 400kV Isaccea (ROM) - Varna (BUL)	-232/-58	15	-213/-40	14	-157/-69	11	-307/-42	20	-168/-47	11	-228/-36	15	53/-82	6	-392/-20	25	-161/-49	11	-233/-35	15	-172/-62	12	-92/-70	7	186/-76	13
		-234/-58	15	-214/-40	14	-161/-69	11	-305/-43	19	-173/-47	11	-227/-36	15	47/-82	6	-389/-21	25	-166/-48	11	-231/-36	15	-173/-62	12	-95/-70	7	180/-76	12
21	OHL 400kV Hamitabat (TUR) - Maritsa Istok 3 (BUL) 1	-316/60	21	/	/	-513/110	35	-136/33	9	/	/	/	/	-563/123	38	5/25	2	/	/	/	/	-313/45	21	-510/101	35	-607/116	41
		-314/60	21	/	/	-507/109	35	-139/33	10	/	/	/	/	-556/121	38	0/25	2	/	/	/	/	-313/45	21	-505/99	34	-599/113	41
22	OHL 400kV Hamitabat (TUR) - Maritsa Istok 3 (BUL) 2	-300/52	20	/	/	-486/100	33	-129/26	9	/	/	/	/	-534/112	36	4/19	1	/	/	/	/	-297/38	20	-483/90	33	-574/105	39
		-297/52	20	/	/	-480/98	33	-132/26	9	/	/	/	/	-526/109	36	0/19	1	/	/	/	/	-296/37	20	-478/88	32	-568/102	38
23	OHL 400kV Babaeski (TUR) - Filippi (GRE)	-81/-73	7	/	/	-294/-32	20	66/-84	7	/	/	/	/	-195/-53	13	293/-76	20	/	/	/	/	-87/21	6	-301/66	21	-210/38	14
		-86/-73	8	/	/	-306/-29	20	71/-85	7	/	/	/	/	-210/-51	14	302/-76	21	/	/	/	/	-89/20	6	-309/67	21	-223/40	15
		/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/
	OHL 400kV Podgorica (YUG) - Elbasan (ALB)	57/-4	4	47/-2	4	137/-10	10	-49/7	4	236/-13	18	-51/9	4	164/-12	12	-101/13	8	222/-11	17	-118/17	9	17/-4	1	102/-14	8	157/-15	12

without new line
with new line

% line load in % commpared to line thermal limit

Table 4.2. Power flows: OHL 400kV S.Mitrovica (YUG) - Ugljevik (B&H)

No.	INTERCONNECTION LINE	POWER FLOWS																									
		WINTER																				SUMMER					
		Base case				Scenario 1		Scenario 2		Scenario 3		Scenario 4		Scenario 5		Scenario 6		Scenario 7		Scenario 8		Base case		Scenario 1		Scenario 5	
						UCTE >> TUR (W>>E)		TUR,GRE >> UCTE (E>>W)		UCTE >> BUL,GRE,ALB (W>>E)		BUL,GRE,ROM >> UCTE (E>>W)		CEN,UKR,ROM >> TUR,GRE (N>>S)		TUR,BUL >> CEN (S>>N)		CEN,UKR >> BUL,GRE,ALB (N>>S)		ROM,BUL,GRE >> CEN (S>>W)				UCTE >> TUR (W>>E)		TUR,GRE >> UCTE (E>>W)	
		With TUR		Without TUR		600		700		1000		700		1000		1500		1000		1500		With TUR		600		1200	
		MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%
1	OHL 400kV Kardia (GRE) - Elbasan (ALB)	100/18	8	108/16	8	43/23	4	181/18	13	108/14	8	184/16	14	13/27	2	216/19	16	116/19	9	237/21	18	104/19	8	41/23	3	-10/22	2
		99/18	8	107/16	8	43/23	4	178/18	13	108/14	8	181/16	13	11/27	2	212/19	16	115/19	9	233/21	17	103/19	7	41/23	3	-10/22	2
2	OHL 400kV Tantareni (ROM) - Kozloduj (BUL) 1	110/-96	12	108/-94	11	168/-98	16	42/-94	8	206/-93	18	47/-88	8	220/-91	19	-78/-92	10	218/-94	19	27/-84	7	67/-74	8	143/-71	13	213/-69	18
		109/-96	12	107/-94	11	168/-98	16	41/-94	8	206/-93	18	46/-87	8	220/-91	19	-79/-92	10	218/-94	19	26/-84	7	67/-74	8	143/-71	13	212/-69	18
3	OHL 400kV Tantareni (ROM) - Kozloduj (BUL) 2	110/-96	12	108/-94	11	168/-98	16	42/-94	8	206/-93	18	47/-88	8	220/-91	19	-78/-92	10	218/-94	19	27/-84	7	67/-74	8	143/-71	13	213/-69	18
		109/-96	12	107/-94	11	168/-98	16	41/-94	8	206/-93	18	46/-87	8	220/-91	19	-79/-92	10	218/-94	19	26/-84	7	67/-74	8	143/-71	13	212/-69	18
4	OHL 400kV Nis (YUG) - Sofija west (BUL)	-47/-83	5	-27/-76	4	190/-110	12	-289/-58	16	163/-108	10	-266/-51	14	125/-102	9	-675/-17	36	148/-108	10	-468/-39	25	18/-33	2	196/-45	11	165/-44	9
		-48/-83	5	-28/-75	4	190/-110	12	-291/-57	16	163/-108	10	-268/-51	14	124/-102	9	-677/-17	36	148/-107	10	-469/-38	25	18/-33	2	197/-45	11	165/-44	9
5	OHL 400kV Thessaloniki (GRE) - Blagoevgrad (BUL)	-20/-36	3	26/-47	4	-63/-31	5	80/-44	7	-206/-12	16	102/-54	9	-212/-6	16	18/-36	3	-221/-9	17	148/-54	12	-69/-94	9	-89/-91	10	-282/-57	22
		-18/-37	3	27/-48	4	-63/-31	5	83/-44	7	-206/-12	16	106/-54	9	-210/-6	16	22/-36	3	-219/-9	17	153/-54	12	-68/-94	9	-89/-91	10	-282/-57	22
6	OHL 400kV Ernestinovo (CRO) - Ugljevik (B&H)	-135/62	11	-138/62	11	-94/53	8	-189/64	15	-36/44	4	-189/64	15	-58/100	9	-258/57	20	-19/47	4	-254/58	20	-69/-8	5	-38/-11	3	8/-14	1
		-176/54	14	-177/54	14	-90/36	7	-277/61	22	-27/24	3	-277/61	22	-96/74	9	-359/56	28	-50/35	5	-353/56	27	-100/9	8	-28/-3	2	-17/-1	1
7	OHL 400kV Podgorica (YUG) - Trebinje (B&H)	-104/-15	8	-102/-16	8	-193/-4	15	-2/-25	2	-239/3	19	-2/-26	2	-177/0	14	65/-33	6	-206/-4	16	56/-32	5	-40/-61	6	-126/-49	11	-130/-52	11
		-109/-16	9	-106/-16	9	-193/-5	15	-12/-25	2	-238/2	19	-12/-26	2	-181/-1	14	53/-32	5	-210/-5	17	45/-32	4	-43/-61	6	-126/-49	11	-132/-52	11
8	OHL 400kV Konjsko (CRO) - Mostar (B&H)	106/1	8	104/1	8	223/-15	17	-23/10	2	304/-26	23	-23/10	2	183/0	14	-74/13	6	237/-12	18	-69/13	5	99/1	8	217/-12	16	194/-6	15
		104/0	8	103/0	8	223/-16	17	-26/9	2	304/-27	23	-26/9	2	182/-1	14	-78/11	6	236/-13	18	-72/11	6	98/2	7	217/-12	16	193/-6	15
9	OHL 400kV Divaca (SLO) - Meline (CRO)	-90/-4	7	-91/-4	7	14/-8	1	-205/16	16	71/-23	6	-205/16	16	-53/1	4	-195/23	15	-25/-5	2	-193/23	15	-98/-38	8	12/-33	3	-48/-33	4
		-91/-6	7	-92/-5	7	14/-9	1	-207/14	16	72/-23	6	-207/15	16	-53/-1	4	-198/23	15	-26/-6	2	-196/22	15	-99/-38	8	12/-34	3	-49/-34	5
10	OHL 400kV Krsko (SLO) - Tumbri (CRO) 1	234/-66	18	234/-66	18	319/-74	25	152/-65	13	355/-67	27	152/-65	13	246/-65	19	191/-55	15	256/-68	20	191/-56	15	209/-57	16	294/-62	23	225/-57	18
		234/-67	18	234/-67	18	320/-75	25	151/-65	12	355/-69	27	151/-65	12	246/-66	19	190/-56	15	256/-69	20	190/-58	15	208/-57	16	294/-62	23	225/-57	18
11	OHL 400kV Krsko (SLO) - Tumbri (CRO) 2	234/-66	18	234/-66	18	319/-74	25	152/-65	13	355/-67	27	152/-65	13	246/-65	19	191/-55	15	256/-68	20	191/-56	15	209/-57	16	294/-62	23	225/-57	18
		234/-67	18	234/-67	18	320/-75	25	151/-65	12	355/-69	27	151/-65	12	246/-66	19	190/-56	15	256/-69	20	190/-58	15	208/-57	16	294/-62	23	225/-57	18
12	OHL 400kV Heviz (HUN) - Zerjavinec (CRO)	-143/-28	11	-145/-27	11	-164/-10	12	-155/-23	12	-116/-10	9	-153/-24	12	9/-35	3	-467/41	36	101/-48	8	-452/37	34	-81/-92	9	-97/-80	10	97/-105	11
		-149/-30	12	-151/-30	12	-163/-13	12	-168/-24	13	-114/-13	9	-166/-24	13	3/-38	3	-482/44	37	97/-51	8	-466/39	35	-84/-93	10	-96/-82	10	95/-106	11
13	OHL 400kV S.Mitrovica (YUG) - Ernestinovo (CRO)	116/-57	10	113/-57	10	19/-42	3	218/-57	17	-5/-33	3	218/-57	17	90/-22	7	266/-49	21	64/-47	6	259/-49	20	108/-70	10	-8/-50	4	58/-59	6
		80/-63	8	79/-63	8	23/-53	4	142/-64	12	2/-46	3	142/-64	12	56/-43	5	176/-57	14	37/-55	5	172/-57	14	78/-53	7	2/-39	3	35/-45	4
14	OHL 400kV Bitola (MKD) - Florina (GRE)	72/-4	6	57/-6	5	131/-13	12	-30/-1	3	270/-27	24	-35/-4	3	254/-23	22	-43/-4	4	269/-26	24	-103/-7	9	-19/-91	8	53/-104	10	206/-110	21
		72/-4	6	57/-6	5	131/-13	12	-29/-1	3	270/-27	24	-35/-4	3	255/-23	23	-42/-4	4	269/-26	24	-103/-7	9	-19/-91	8	53/-104	10	206/-110	21
15	OHL 400kV Dubrovo (MKD) - Thessaloniki (GRE)	90/-50	9	77/-41	8	144/-52	13	24/-48	5	127/-48	12	20/-38	4	142/-54	13	-15/-45	4	125/-47	12	-13/-40	4	139/11	12	202/9	18	211/-2	19
		90/-50	9	77/-41	8	144/-52	13	25/-48	5	127/-47	12	21/-38	4	142/-54	13	-14/-45	4	125/-47	12	-13/-39	4	140/11	12	202/9	18	212/-2	19
16	OHL 400kV Arad (ROM) - Sandorfalva (HUN)	-57/26	5	-63/26	6	-197/44	17	104/8	9	-265/55	22	106/8	9	-189/47	16	360/-12	30	-311/64	26	437/-20	36	-7/-19	2	-151/0	12	-162/6	13
		-58/26	5	-64/26	6	-197/44	17	103/7	9	-264/55	22	104/8	9	-189/47	16	358/-13	30	-311/64	26	436/-21	36	-7/-19	2	-151/-1	12	-162/5	13
17	OHL 400kV Subotica (YUG) - Sandorfalva (HUN)	-89/-106	10	-86/-106	10	-224/-79	18	85/-136	12	-331/-57	25	83/-136	12	-323/-64	24	420/-182	34	-446/-35	33	368/-167	30	-94/16	7	-220/35	17	-361/52	27
		-97/-104	11	-94/-104	10	-223/-78	17	68/-133	11	-329/-57	25	66/-133	11	-331/-63	25	401/-178	32	-452/-34	34	349/-164	29	-98/17	7	-219/36	16	-364/54	27
18	OHL 400kV Kosovo B (YUG) - Skopje 1 (MKD)	153/-27	12	128/-20	10	254/-31	19	4/-16	1	368/-27	28	-5/-8	1	363/-30	27	-42/-12	3	366/-26	28	-95/1	7	109/-47	9	228/-50	18	376/-40	28
		154/-27	12	128/-20	10	254/-30	19	5/-16	1	368/-27	28	-4/-8	1	364/-30	27	-40/-12	3	366/-26	28	-94/1	7	109/-47	9	228/-50	18	376/-40	28
19	OHL 400kV Djerdap (YUG) - P.D.Fier (ROM)	-72/-56	7	-62/-56	6	-19/-56	4	-120/-61	10	-23/-62	5	-130/-66	11	-97/-69	9	-192/-74	15	-38/-63	6	-247/-86	20	-45/-16	4	42/-20	3	-52/-32	5
		-74/-56	7	-64/-56	6	-19/-56	4	-124/-61	10	-23/-62	5	-134/-66	11	-99/-69	9	-197/-75	16	-40/-63	6	-252/-86	20	-46/-16	4	43/-19	4	-53/-32	5
20	OHL 400kV Isaccea (ROM) - Varna (BUL)	-232/-58	15	-213/-40	14	-157/-69	11	-307/-42	20	-168/-47	11	-228/-36	15	53/-82	6	-392/-20	25	-161/-49	11	-233/-35	15	-172/-62	12	-92/-70	7	186/-76	13
		-232/-58	15	-213/-40	14	-157/-69	11	-307/-42	20	-168/-48	11	-229/-36	15	52/-82	6	-393/-20	25	-162/-49	11	-233/-35	15	-172/-62	12	-92/-70	7	185/-76	13
21	OHL 400kV Hamitabat (TUR) - Maritsa Istok 3 (BUL) 1	-316/60	21	/	0	-513/110	35	-136/33	9	/	/	/	/	-563/123	38	5/25	2	/	/	/	/	-313/45	21	-510/101	35	-607/116	41
		-316/60	21	/	0	-513/110	35	-136/33	9	/	/	/	/	-563/123	38	5/25	2	/	/	/	/	-313/45	21	-510/101	35	-606/116	41
22	OHL 400kV Hamitabat (TUR) - Maritsa Istok 3 (BUL) 2	-300/52	20	/	0	-486/100	33	-129/26	9	/	/	/	/	-534/112	36	4/19	1	/	/	/	/	-297/38	20	-483/90	33	-574/105	39
		-299/52	20	/	0	-486/100	33	-129/26	9	/	/	/	/	-533/112	36	5/19	1	/	/	/	/	-297/38	20	-483/90	33	-574/105	39
23	OHL 400kV Babaeski (TUR) - Filippi (GRE)	-81/-73	7	/	0	-294/-32	20	66/-84	7	/	/	/	/	-195/-53	13	293/-76	20	/	/	/	/	-87/21	6	-301/66	21	-210/38	14
		-82/-72	7	/	0	-294/-32	20	65/-84	7	/	/	/	/	-195/-53	13	291/-77	20	/	/	/	/	-87/21	6	-301/65	21	-210/38	14
		/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/
	OHL 400kV S.Mitrovica (YUG) - Ugljevik (B&H)	64/-14	5	61/-14	5	-6/-1	0	135/-16	10	-12/6	1	135/-16	10	60/41	6	158/-9	12	48/-6	4	153/-9	12	45/-60	6	-14/-48	4	36/-54	5

without new line
with new line

% line load in % commpared to line thermal limit

Table 4.3. Power flows: OHL 400kV Nis (YUG) - Skopje 5 (MKD)

No.	INTERCONNECTION LINE	POWER FLOWS																									
		WINTER																				SUMMER					
		Base case				Scenario 1		Scenario 2		Scenario 3		Scenario 4		Scenario 5		Scenario 6		Scenario 7		Scenario 8		Base case		Scenario 1		Scenario 5	
						UCTE >> TUR (W>>E)		TUR,GRE >> UCTE (E>>W)		UCTE >> BUL,GRE,ALB (W>>E)		BUL,GRE,ROM >> UCTE (E>>W)		CEN,UKR,ROM >> TUR,GRE (N>>S)		TUR,BUL >> CEN (S>>N)		CEN,UKR >> BUL,GRE,ALB (N>>S)		ROM,BUL,GRE >> CEN (S>>W)							
		With TUR		Without TUR		600		700		1000		700		1000		1500		1000		1500		With TUR		600		1200	
		MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%
1	OHL 400kV Kardia (GRE) - Elbasan (ALB)	100/18	8	108/16	8	43/23	4	181/18	13	108/14	8	184/16	14	13/27	2	216/19	16	116/19	9	237/21	18	104/19	8	41/23	3	-10/22	2
		101/18	9	108/16	8	44/23	6	179/18	13	114/14	9	181/16	13	17/26	2	215/20	16	123/19	9	232/21	17	104/19	8	43/23	4	-2/21	2
2	OHL 400kV Tantareni (ROM) - Kozloduj (BUL) 1	110/-96	12	108/-94	11	168/-98	16	42/-94	8	206/-93	18	47/-88	8	220/-91	19	-78/-92	10	218/-94	19	27/-84	7	67/-74	8	143/-71	13	213/-69	18
		109/-98	12	107/-96	12	168/-99	16	42/-96	8	206/-95	18	47/-89	8	220/-92	19	-77/-94	10	218/-95	19	27/-85	7	67/-76	8	141/-73	13	208/-72	18
3	OHL 400kV Tantareni (ROM) - Kozloduj (BUL) 2	110/-96	12	108/-94	11	168/-98	16	42/-94	8	206/-93	18	47/-88	8	220/-91	19	-78/-92	10	218/-94	19	27/-84	7	67/-74	8	143/-71	13	213/-69	18
		109/-98	12	107/-96	12	168/-99	16	42/-96	8	206/-95	18	47/-89	8	220/-92	19	-77/-94	10	218/-95	19	27/-85	7	67/-76	8	141/-73	13	208/-72	18
4	OHL 400kV Nis (YUG) - Sofija west (BUL)	-47/-83	5	-27/-76	4	190/-110	12	-289/-58	16	163/-108	10	-266/-51	14	125/-102	9	-675/-17	36	148/-108	10	-468/-39	25	18/-33	2	196/-45	11	165/-44	9
		-49/-50	4	-22/-44	3	180/-76	10	-272/-26	14	124/-76	8	-249/-21	13	82/-69	6	-665/16	35	106/-75	7	-442/-10	23	19/-20	1	187/-32	10	126/-33	7
5	OHL 400kV Thessaloniki (GRE) - Blagoevgrad (BUL)	-20/-36	3	26/-47	4	-63/-31	5	80/-44	7	-206/-12	16	102/-54	9	-212/-6	16	18/-36	3	-221/-9	17	148/-54	12	-69/-94	9	-89/-91	10	-282/-57	22
		-18/-39	3	22/-50	4	-55/-35	5	67/-46	6	-166/-22	13	85/-55	8	-180/-15	14	11/-38	3	-178/-20	14	123/-56	10	-69/-93	9	-80/-92	9	-249/-64	20
6	OHL 400kV Ernestinovo (CRO) - Ugljevik (B&H)	-135/62	11	-138/62	11	-94/53	8	-189/64	15	-36/44	4	-189/64	15	-58/100	9	-258/57	20	-19/47	4	-254/58	20	-69/-8	5	-38/-11	3	8/-14	1
		-135/62	11	-138/62	11	-95/53	8	-188/64	15	-41/44	5	-187/64	15	-63/100	9	-257/57	20	-25/48	4	-251/58	20	-69/-9	5	-40/-12	3	2/-14	1
7	OHL 400kV Podgorica (YUG) - Trebinje (B&H)	-104/-15	8	-102/-16	8	-193/-4	15	-2/-25	2	-239/3	19	-2/-26	2	-177/0	14	65/-33	6	-206/-4	16	56/-32	5	-40/-61	6	-126/-49	11	-130/-52	11
		-104/-14	8	-102/-14	8	-192/-3	15	-4/-24	2	-234/4	19	-4/-24	2	-173/1	14	64/-31	6	-202/-3	16	53/-30	5	-40/-59	6	-125/-47	11	-125/-50	11
8	OHL 400kV Konjsko (CRO) - Mostar (B&H)	106/1	8	104/1	8	223/-15	17	-23/10	2	304/-26	23	-23/10	2	183/0	14	-74/13	6	237/-12	18	-69/13	5	99/1	8	217/-12	16	194/-6	15
		106/1	8	104/1	8	222/-15	17	-22/10	2	301/-26	23	-22/10	2	181/0	14	-74/13	6	234/-12	18	-67/12	5	99/1	8	216/-12	16	191/-7	15
9	OHL 400kV Divaca (SLO) - Meline (CRO)	-90/-4	7	-91/-4	7	14/-8	1	-205/16	16	71/-23	6	-205/16	16	-53/1	4	-195/23	15	-25/-5	2	-193/23	15	-98/-38	8	12/-33	3	-48/-33	4
		-91/-4	7	-91/-4	7	14/-8	1	-204/16	16	70/-23	6	-204/16	16	-53/1	4	-195/23	15	-26/-5	2	-193/23	15	-98/-38	8	12/-34	3	-50/-34	5
10	OHL 400kV Krsko (SLO) - Tumbri (CRO) 1	234/-66	18	234/-66	18	319/-74	25	152/-65	13	355/-67	27	152/-65	13	246/-65	19	191/-55	15	256/-68	20	191/-56	15	209/-57	16	294/-62	23	225/-57	18
		234/-66	18	234/-66	18	319/-74	25	152/-65	13	355/-67	27	152/-65	13	246/-65	19	191/-55	15	256/-68	20	191/-57	15	209/-57	16	294/-62	23	225/-57	18
11	OHL 400kV Krsko (SLO) - Tumbri (CRO) 2	234/-66	18	234/-66	18	319/-74	25	152/-65	13	355/-67	27	152/-65	13	246/-65	19	191/-55	15	256/-68	20	191/-56	15	209/-57	16	294/-62	23	225/-57	18
		234/-66	18	234/-66	18	319/-74	25	152/-65	13	355/-67	27	152/-65	13	246/-65	19	191/-55	15	256/-68	20	191/-57	15	209/-57	16	294/-62	23	225/-57	18
12	OHL 400kV Heviz (HUN) - Zerjavinec (CRO)	-143/-28	11	-145/-27	11	-164/-10	12	-155/-23	12	-116/-10	9	-153/-24	12	9/-35	3	-467/41	36	101/-48	8	-452/37	34	-81/-92	9	-97/-80	10	97/-105	11
		-143/-28	11	-145/-28	11	-164/-10	12	-154/-24	12	-119/-10	9	-152/-24	12	6/-35	3	-467/41	36	98/-48	8	-450/36	34	-81/-92	9	-98/-81	10	95/-105	11
13	OHL 400kV S.Mitrovica (YUG) - Ernestinovo (CRO)	116/-57	10	113/-57	10	19/-42	3	218/-57	17	-5/-33	3	218/-57	17	90/-22	7	266/-49	21	64/-47	6	259/-49	20	108/-70	10	-8/-50	4	58/-59	6
		115/-58	10	114/-57	10	18/-42	3	220/-57	17	-10/-32	3	220/-57	17	85/-21	7	267/-49	21	58/-47	6	262/-49	20	108/-71	10	-10/-51	4	51/-59	6
14	OHL 400kV Bitola (MKD) - Florina (GRE)	72/-4	6	57/-6	5	131/-13	12	-30/-1	3	270/-27	24	-35/-4	3	254/-23	22	-43/-4	4	269/-26	24	-103/-7	9	-19/-91	8	53/-104	10	206/-110	21
		73/7	6	54/5	5	138/-3	12	-42/11	4	296/-19	26	-47/8	4	283/-15	25	-50/6	4	298/-19	26	-121/5	11	-20/-70	6	61/-84	9	239/-92	23
15	OHL 400kV Dubrovo (MKD) - Thessaloniki (GRE)	90/-50	9	77/-41	8	144/-52	13	24/-48	5	127/-48	12	20/-38	4	142/-54	13	-15/-45	4	125/-47	12	-13/-40	4	139/11	12	202/9	18	211/-2	19
		91/-45	9	75/-36	7	150/-47	14	16/-42	4	147/-44	14	12/-32	3	163/-50	15	-20/-40	4	147/-43	13	-26/-33	4	140/22	12	209/20	18	236/9	21
16	OHL 400kV Arad (ROM) - Sandorfalva (HUN)	-57/26	5	-63/26	6	-197/44	17	104/8	9	-265/55	22	106/8	9	-189/47	16	360/-12	30	-311/64	26	437/-20	36	-7/-19	2	-151/0	12	-162/6	13
		-57/26	5	-63/26	6	-197/44	17	105/8	9	-267/55	22	106/8	9	-191/47	16	360/-12	30	-314/64	26	439/-20	36	-7/-19	2	-151/0	12	-162/6	13
17	OHL 400kV Subotica (YUG) - Sandorfalva (HUN)	-89/-106	10	-86/-106	10	-224/-79	18	85/-136	12	-331/-57	25	83/-136	12	-323/-64	24	420/-182	34	-446/-35	33	368/-167	30	-94/16	7	-220/35	17	-361/52	27
		-89/-106	10	-86/-106	10	-224/-78	18	86/-136	12	-332/-57	25	84/-136	12	-325/-63	25	421/-182	34	-448/-34	33	369/-167	30	-94/16	7	-221/35	17	-363/53	27
18	OHL 400kV Kosovo B (YUG) - Skopje 1 (MKD)	153/-27	12	128/-20	10	254/-31	19	4/-16	1	368/-27	28	-5/-8	1	363/-30	27	-42/-12	3	366/-26	28	-95/1	7	109/-47	9	228/-50	18	376/-40	28
		149/-37	12	135/-31	10	237/-39	18	30/-28	3	294/-34	22	27/-22	3	294/-38	22	-26/-22	3	285/-33	22	-47/-14	4	110/-68	10	205/-70	16	287/-61	22
19	OHL 400kV Djerdap (YUG) - P.D.Fier (ROM)	-72/-56	7	-62/-56	6	-19/-56	4	-120/-61	10	-23/-62	5	-130/-66	11	-97/-69	9	-192/-74	15	-38/-63	6	-247/-86	20	-45/-16	4	42/-20	3	-52/-32	5
		-73/-51	7	-62/-51	6	-21/-51	4	-119/-55	10	-27/-57	5	-130/-62	11	-102/-66	9	-192/-69	15	-42/-58	5	-246/-81	19	-46/-9	4	38/-13	3	-65/-27	5
20	OHL 400kV Isaccea (ROM) - Varna (BUL)	-232/-58	15	-213/-40	14	-157/-69	11	-307/-42	20	-168/-47	11	-228/-36	15	53/-82	6	-392/-20	25	-161/-49	11	-233/-35	15	-172/-62	12	-92/-70	7	186/-76	13
		-232/-58	15	-213/-41	14	-158/-69	11	-306/-43	20	-169/-48	11	-228/-37	15	51/-83	6	-392/-20	25	-162/-49	11	-233/-36	15	-172/-63	12	-93/-70	7	182/-76	12
21	OHL 400kV Hamitabat (TUR) - Maritsa Istok 3 (BUL) 1	-316/60	21	/	/	-513/110	35	-136/33	9	/	/	/	/	-563/123	38	5/25	2	/	/	/	/	-313/45	21	-510/101	35	-607/116	41
		-316/60	21	/	/	-511/109	35	-139/33	10	/	/	/	/	-556/120	38	3/25	2	/	/	/	/	-313/44	21	-508/99	35	-598/113	41
22	OHL 400kV Hamitabat (TUR) - Maritsa Istok 3 (BUL) 2	-300/52	20	/	/	-486/100	33	-129/26	9	/	/	/	/	-534/112	36	4/19	1	/	/	/	/	-297/38	20	-483/90	33	-574/105	39
		-299/52	20	/	/	-484/99	33	-132/26	9	/	/	/	/	-527/109	36	3/18	1	/	/	/	/	-297/37	20	-481/89	33	-567/102	38
23	OHL 400kV Babaeski (TUR) - Filippi (GRE)	-81/-73	7	/	/	-294/-32	20	66/-84	7	/	/	/	/	-195/-53	13	293/-76	20	/	/	/	/	-87/21	6	-301/66	21	-210/38	14
		-82/-74	7	/	/	-297/-32	20	72/-86	7	/	/	/	/	-209/-52	14	296/-77	20	/	/	/	/	-87/19	6	-305/65	21	-225/40	15
	OHL 400kV Nis (YUG) - Skopje 5 (MKD)	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/
		8/-65	5	-12/-62	5	32/-69	6	-49/-58	6	128/-74	11	-55/-56	6	128/-74	11	-29/-64	5	141/-75	12	-83/-53	7	-2/-36	3	41/-40	4	156/-41	12

without new line
with new line

% line load in % commpared to line thermal limit

Table 4.4. Power flows: OHL 400kV Sombor (YUG) – Pecs (HUN)

No.	INTERCONNECTION LINE	POWER FLOWS																											
		WINTER																				SUMMER							
		Base case				Scenario 1 UCTE >> TUR (W>>E)		Scenario 2 TUR,GRE >> UCTE (E>>W)		Scenario 3 UCTE >> BUL,GRE,ALB (W>>E)		Scenario 4 BUL,GRE,ROM >> UCTE (E>>W)		Scenario 5 CEN,UKR,ROM >> TUR,GRE (N>>S)		Scenario 6 TUR,BUL >> CEN (S>>N)		Scenario 7 CEN,UKR >> BUL,GRE,ALB (N>>S)		Scenario 8 ROM,BUL,GRE >> CEN (S>>W)		Base case		Scenario 1 UCTE >> TUR (W>>E)		Scenario 5 TUR,GRE >> UCTE (E>>W)	
		With TUR		Without TUR		600		700		1000		700		1000		1500		1000		1500		With TUR		600		1200	
		MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%
1	OHL 400kV Kardia (GRE) - Elbasan (ALB)	100/18	8	108/16	8	43/23	4	181/18	13	108/14	8	184/16	14	13/27	2	216/19	16	116/19	9	237/21	18	104/19	8	41/23	3	-10/22	2
		101/18	9	110/16	10	45/23	4	182/18	14	110/14	8	184/16	14	15/27	2	215/19	16	118/19	9	236/21	18	104/19	8	43/23	4	-8/22	2
2	OHL 400kV Tantareni (ROM) - Kozloduj (BUL) 1	110/-96	12	108/-94	11	168/-98	16	42/-94	8	206/-93	18	47/-88	8	220/-91	19	-78/-92	10	218/-94	19	27/-84	7	67/-74	8	143/-71	13	213/-69	18
		110/-96	12	108/-94	11	169/-98	16	42/-94	8	206/-93	18	47/-88	8	221/-91	19	-78/-92	10	219/-93	19	27/-84	7	68/-74	8	143/-71	13	213/-69	18
3	OHL 400kV Tantareni (ROM) - Kozloduj (BUL) 2	110/-96	12	108/-94	11	168/-98	16	42/-94	8	206/-93	18	47/-88	8	220/-91	19	-78/-92	10	218/-94	19	27/-84	7	67/-74	8	143/-71	13	213/-69	18
		110/-96	12	108/-94	11	169/-98	16	42/-94	8	206/-93	18	47/-88	8	221/-91	19	-78/-92	10	219/-93	19	27/-84	7	68/-74	8	143/-71	13	213/-69	18
4	OHL 400kV Nis (YUG) - Sofija west (BUL)	-47/-83	5	-27/-76	4	190/-110	12	-289/-58	16	163/-108	10	-266/-51	14	125/-102	9	-675/-17	36	148/-108	10	-468/-39	25	18/-33	2	196/-45	11	165/-44	9
		-46/-83	5	-26/-76	4	192/-111	12	-289/-57	16	166/-109	11	-266/-51	14	128/-103	9	-676/-17	36	151/-108	10	-469/-38	25	20/-33	2	198/-45	11	167/-44	9
5	OHL 400kV Thessaloniki (GRE) - Blagoevgrad (BUL)	-20/-36	3	26/-47	4	-63/-31	5	80/-44	7	-206/-12	16	102/-54	9	-212/-6	16	18/-36	3	-221/-9	17	148/-54	12	-69/-94	9	-89/-91	10	-282/-57	22
		-21/-36	3	24/-47	4	-65/-31	6	79/-44	7	-208/-12	16	101/-54	9	-214/-6	16	19/-36	3	-224/-8	17	149/-54	12	-70/-93	9	-90/-91	10	-284/-56	22
6	OHL 400kV Ernestinovo (CRO) - Ugljevik (B&H)	-135/62	11	-138/62	11	-94/53	8	-189/64	15	-36/44	4	-189/64	15	-58/100	9	-258/57	20	-19/47	4	-254/58	20	-69/-8	5	-38/-11	3	8/-14	1
		-136/62	11	-139/62	12	-95/54	8	-190/64	15	-37/46	4	-190/64	15	-59/101	9	-257/59	20	-20/49	4	-253/60	20	-68/-8	5	-37/-11	3	10/-13	1
7	OHL 400kV Podgorica (YUG) - Trebinje (B&H)	-104/-15	8	-102/-16	8	-193/-4	15	-2/-25	2	-239/3	19	-2/-26	2	-177/0	14	65/-33	6	-206/-4	16	56/-32	5	-40/-61	6	-126/-49	11	-130/-52	11
		-99/-16	8	-97/-16	8	-186/-6	15	0/-26	2	-229/1	18	0/-26	2	-169/-1	13	61/-33	6	-196/-6	16	52/-32	5	-38/-62	6	-121/-50	10	-123/-53	11
8	OHL 400kV Konjsko (CRO) - Mostar (B&H)	106/1	8	104/1	8	223/-15	17	-23/10	2	304/-26	23	-23/10	2	183/0	14	-74/13	6	237/-12	18	-69/13	5	99/1	8	217/-12	16	194/-6	15
		97/2	7	96/2	7	210/-13	16	-26/10	2	288/-24	22	-26/10	2	170/2	13	-69/13	5	220/-10	17	-63/12	5	96/2	7	207/-11	16	182/-5	14
9	OHL 400kV Divaca (SLO) - Meline (CRO)	-90/-4	7	-91/-4	7	14/-8	1	-205/16	16	71/-23	6	-205/16	16	-53/1	4	-195/23	15	-25/-5	2	-193/23	15	-98/-38	8	12/-33	3	-48/-33	4
		-95/-3	7	-95/-3	7	8/-8	1	-206/16	16	63/-21	5	-206/16	16	-59/1	4	-192/23	15	-33/-6	3	-191/22	15	-99/-38	8	6/-35	3	-55/-35	5
10	OHL 400kV Krsko (SLO) - Tumbri (CRO) 1	234/-66	18	234/-66	18	319/-74	25	152/-65	13	355/-67	27	152/-65	13	246/-65	19	191/-55	15	256/-68	20	191/-56	15	209/-57	16	294/-62	23	225/-57	18
		233/-66	18	233/-66	18	318/-73	25	152/-65	13	352/-68	27	151/-65	12	245/-65	19	192/-56	15	254/-68	20	192/-58	15	209/-57	16	292/-62	23	223/-57	17
11	OHL 400kV Krsko (SLO) - Tumbri (CRO) 2	234/-66	18	234/-66	18	319/-74	25	152/-65	13	355/-67	27	152/-65	13	246/-65	19	191/-55	15	256/-68	20	191/-56	15	209/-57	16	294/-62	23	225/-57	18
		233/-66	18	233/-66	18	318/-73	25	152/-65	13	352/-68	27	151/-65	12	245/-65	19	192/-56	15	254/-68	20	192/-58	15	209/-57	16	292/-62	23	223/-57	17
12	OHL 400kV Heviz (HUN) - Zerjavinec (CRO)	-143/-28	11	-145/-27	11	-164/-10	12	-155/-23	12	-116/-10	9	-153/-24	12	9/-35	3	-467/41	36	101/-48	8	-452/37	34	-81/-92	9	-97/-80	10	97/-105	11
		-166/-24	13	-169/-24	13	-200/-5	15	-163/-22	12	-160/-5	12	-161/-22	12	-30/-32	3	-452/36	34	52/-46	5	-437/32	33	-98/-90	10	-128/-77	11	61/-103	9
13	OHL 400kV S.Mitrovica (YUG) - Ernestinovo (CRO)	116/-57	10	113/-57	10	19/-42	3	218/-57	17	-5/-33	3	218/-57	17	90/-22	7	266/-49	21	64/-47	6	259/-49	20	108/-70	10	-8/-50	4	58/-59	6
		133/-58	11	131/-58	11	45/-45	5	225/-56	18	28/-37	4	225/-56	18	117/-24	9	254/-49	20	99/-51	8	248/-49	19	119/-71	11	17/-54	4	88/-63	8
14	OHL 400kV Bitola (MKD) - Florina (GRE)	72/-4	6	57/-6	5	131/-13	12	-30/-1	3	270/-27	24	-35/-4	3	254/-23	22	-43/-4	4	269/-26	24	-103/-7	9	-19/-91	8	53/-104	10	206/-110	21
		72/-4	6	57/-6	5	131/-13	12	-30/-1	3	270/-27	24	-35/-4	3	254/-23	22	-43/-4	4	269/-26	24	-103/-7	9	-19/-91	8	53/-104	10	206/-110	21
15	OHL 400kV Dubrovo (MKD) - Thessaloniki (GRE)	90/-50	9	77/-41	8	144/-52	13	24/-48	5	127/-48	12	20/-38	4	142/-54	13	-15/-45	4	125/-47	12	-13/-40	4	139/11	12	202/9	18	211/-2	19
		90/-50	9	77/-41	8	143/-52	13	24/-48	5	127/-47	12	20/-38	4	141/-54	13	-15/-45	4	125/-47	12	-13/-40	4	140/11	12	201/9	18	211/-2	19
16	OHL 400kV Arad (ROM) - Sandorfalva (HUN)	-57/26	5	-63/26	6	-197/44	17	104/8	9	-265/55	22	106/8	9	-189/47	16	360/-12	30	-311/64	26	437/-20	36	-7/-19	2	-151/0	12	-162/6	13
		-54/18	5	-60/18	5	-193/34	16	105/0	9	-259/42	22	106/1	9	-184/36	15	357/-23	30	-305/49	25	435/-31	36	-7/-25	2	-148/-8	12	-158/-3	13
17	OHL 400kV Subotica (YUG) - Sandorfalva (HUN)	-89/-106	10	-86/-106	10	-224/-79	18	85/-136	12	-331/-57	25	83/-136	12	-323/-64	24	420/-182	34	-446/-35	33	368/-167	30	-94/16	7	-220/35	17	-361/52	27
		59/-92	8	62/-92	8	-4/-78	6	143/-108	13	-63/-67	7	142/-108	13	-95/-68	9	337/-134	27	-161/-51	13	286/-120	23	5/30	2	-48/38	5	-163/49	13
18	OHL 400kV Kosovo B (YUG) - Skopje 1 (MKD)	153/-27	12	128/-20	10	254/-31	19	4/-16	1	368/-27	28	-5/-8	1	363/-30	27	-42/-12	3	366/-26	28	-95/1	7	109/-47	9	228/-50	18	376/-40	28
		153/-27	12	128/-20	10	253/-31	19	3/-16	1	367/-27	28	-5/-8	1	362/-30	27	-41/-12	3	365/-26	28	-95/1	7	109/-47	9	228/-50	18	375/-40	28
19	OHL 400kV Djerdap (YUG) - P.D.Fier (ROM)	-72/-56	7	-62/-56	6	-19/-56	4	-120/-61	10	-23/-62	5	-130/-66	11	-97/-69	9	-192/-74	15	-38/-63	6	-247/-86	20	-45/-16	4	42/-20	3	-52/-32	5
		-68/-56	7	-59/-56	6	-15/-56	4	-119/-60	10	-17/-62	5	-129/-66	11	-92/-69	9	-195/-74	16	-32/-63	5	-249/-86	20	-43/-16	3	46/-20	4	-48/-32	4
20	OHL 400kV Isaccea (ROM) - Varna (BUL)	-232/-58	15	-213/-40	14	-157/-69	11	-307/-42	20	-168/-47	11	-228/-36	15	53/-82	6	-392/-20	25	-161/-49	11	-233/-35	15	-172/-62	12	-92/-70	7	186/-76	13
		-232/-58	15	-213/-40	14	-157/-69	11	-307/-42	20	-168/-47	11	-228/-36	15	53/-82	6	-392/-20	25	-162/-49	11	-233/-35	15	-172/-62	12	-92/-70	7	185/-76	13
21	OHL 400kV Hamitabat (TUR) - Maritsa Istok 3 (BUL) 1	-316/60	21	/	/	-513/110	35	-136/33	9	/	/	/	/	-563/123	38	5/25	2	/	/	/	/	-313/45	21	-510/101	35	-607/116	41
		-317/60	22	/	/	-513/111	35	-137/33	9	/	/	/	/	-564/123	38	5/25	2	/	/	/	/	-314/45	21	-511/101	35	-607/116	41
22	OHL 400kV Hamitabat (TUR) - Maritsa Istok 3 (BUL) 2	-300/52	20	/	/	-486/100	33	-129/26	9	/	/	/	/	-534/112	36	4/19	1	/	/	/	/	-297/38	20	-483/90	33	-574/105	39
		-300/52	20	/	/	-486/100	33	-129/26	9	/	/	/	/	-534/112	36	5/19	1	/	/	/	/	-297/38	20	-484/90	33	-575/105	39
23	OHL 400kV Babaeski (TUR) - Filippi (GRE)	-81/-73	7	/	/	-294/-32	20	66/-84	7	/	/	/	/	-195/-53	13	293/-76	20	/	/	/	/	-87/21	6	-301/66	21	-210/38	14
		-81/-73	7	/	/	-293/-32	20	66/-84	7	/	/	/	/	-194/-53	13	292/-77	20	/	/	/	/	-87/20	6	-300/65	20	-209/38	14
	OHL 400kV Sombor (YUG) - Pec(HUN)	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/
		-182/-30	14	-183/-30	14	-273/-19	21	-70/-50	7	-333/-12	25	-71/-50	7	-284/-16	22	107/-101	11	-356/-12	27	104/-99	11	-131/-30	10	-217/-21	17	-251/-18	19

without new line
with new line

% line load in % commpared to line thermal limit

Table 4.5. Power flows: OHL 220kV Prizren (YUG) - Fierza (ALB) 2nd circuit

No.	INTERCONNECTION LINE	POWER FLOWS																							
		WINTER																				SUMMER					
		Base case				Scenario 1		Scenario 2		Scenario 3		Scenario 4		Scenario 5		Scenario 6		Scenario 7		Scenario 8		Base case		Scenario 1		Scenario 5	
						UCTE >> TUR (W>>E)		TUR,GRE >> UCTE (E>>W)		UCTE >> BUL,GRE,ALB (W>>E)		BUL,GRE,ROM >> UCTE (E>>W)		CEN,UKR,ROM >> TUR,GRE (N>>S)		TUR,BUL >> CEN (S>>N)		CEN,UKR >> BUL,GRE,ALB (N>>S)		ROM,BUL,GRE >> CEN (S>>W)				UCTE >> TUR (W>>E)		CENT >> TUR, GRE (E>>W)	
		With TUR		Without TUR		600		700		1000		700		1000		1500		1000		1500		With TUR		600		1200	
		MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%
1	OHL 400kV Kardia (GRE) - Elbasan (ALB)	100/18	9	108/16	10	43/23	5	183/18	13	107/20	8	184/16	13	12/27	7	220/20	16	133/18	10	237/21	17	104/19	7	41/23	3	-10/29	2
		100/17	9	108/15	10	46/22	6	190/18	14	108/21	8	184/16	13	19/26	7	227/20	16	132/18	10	244/22	18	108/18	8	45/23	3	-7/28	2
2	OHL 400kV Tantareni (ROM) - Kozloduj (BUL) 1	110/-96	10	108/-94	10	168/-98	14	42/-94	7	208/-93	16	46/-88	7	220/-91	18	-58/-89	7	200/-92	15	29/-85	6	67/-73	8	143/-71	12	213/-69	17
		108/-96	10	106/-94	10	168/-98	14	42/-94	7	207/-93	16	46/-88	7	221/-91	18	-58/-89	7	200/-92	15	28/-85	6	67/-73	8	143/-71	12	213/-69	17
3	OHL 400kV Tantareni (ROM) - Kozloduj (BUL) 2	110/-96	10	108/-94	10	168/-98	14	42/-94	7	208/-93	16	46/-88	7	220/-91	18	-58/-89	7	200/-92	15	29/-85	6	67/-73	8	143/-71	12	213/-69	17
		108/-96	10	106/-94	10	168/-98	14	42/-94	7	207/-93	16	46/-88	7	221/-91	18	-58/-89	7	200/-92	15	28/-85	6	67/-73	8	143/-71	12	213/-69	17
4	OHL 400kV Nis (YUG) - Sofija west (BUL)	-47/-83	5	-27/-76	4	190/-110	11	-294/-57	15	163/-108	10	-266/-52	14	123/-109	8	-679/-6	35	36/-91	5	-468/-39	24	18/-33	2	196/-45	10	165/-44	9
		-46/-82	5	-25/-75	2	193/-109	10	-292/-56	15	164/-107	10	-263/-51	14	126/-108	5	-677/-6	35	36/-90	5	-466/-39	24	19/-33	2	197/-44	10	165/-44	9
5	OHL 400kV Thessaloniki (GRE) - Blagoevgrad (BUL)	-20/-36	2	25/-47	2	-62/-31	5	79/-44	7	-208/-12	15	104/-55	9	-211/5	16	13/-29	2	-256/-2	19	148/-54	12	-69/-93	9	-89/-91	10	-282/-57	22
		-19/-37	2	27/-47	2	-64/-31	5	78/-44	7	-208/-12	15	102/-55	9	-213/-5	14	12/-29	2	-256/-2	19	146/-54	11	-69/-93	9	-90/-91	10	-283/-57	22
6	OHL 400kV Ernestinovo (CRO) - Ugljevik (B&H)	-135/62	12	-138/62	12	-94/53	9	-190/66	15	-34/44	4	-189/65	15	-67/54	7	-259/58	20	30/43	4	-254/58	20	-69/-8	5	-38/-12	3	7/-14	1
		-175/49	13	-177/-49	12	-94/53	9	-189/66	15	-34/44	4	-188/64	15	-66/54	7	-259/58	20	30/43	4	-254/58	20	-69/-8	5	-37/-12	3	9/-14	1
7	OHL 400kV Podgorica (YUG) - Trebinje (B&H)	-104/-15	8	-102/-16	8	-193/-4	15	1/-27	2	-240/3	19	-2/-26	2	-179/-8	14	65/-33	6	-164/-8	13	55/-32	5	-40/-61	6	-127/-48	11	-131/-52	11
		-104/-19	8	-102/-20	8	-191/4	15	3/-27	2	-239/3	19	0/-26	2	-179/-8	14	67/-33	6	-164/-8	13	57/-32	5	-39/-61	6	-126/-48	10	-130/-51	11
8	OHL 400kV Konjsko (CRO) - Mostar (B&H)	106/1	8	104/1	8	221/-14	17	-28/19	2	305/-26	23	-24/11	2	181/-6	14	-74/13	6	238/-13	18	-68/12	5	99/1	7	219/-12	16	195/-6	14
		86/4	8	84/4	8	221/14	17	-28/19	2	305/-26	23	-23/11	2	183/-6	14	-74/13	6	238/-13	18	-68/12	5	99/1	7	219/-12	13	195/-6	14
9	OHL 400kV Divaca (SLO) - Meline (CRO)	-90/-4	7	-91/-4	7	12/-8	1	-215/45	16	74/-24	6	-208/16	16	-55/-6	4	-194/23	15	-21/-4	2	-192/23	15	-98/-38	8	14/-33	3	-46/-33	4
		-93/-17	7	-94/-17	7	12/-8	1	-215/46	16	74/-24	6	-208/16	16	-53/-6	4	-194/23	15	-21/-4	2	-192/23	15	-98/-38	8	14/-33	3	-45/-33	4
10	OHL 400kV Krsko (SLO) - Tumbri (CRO) 1	234/-66	18	234/-66	18	318/-74	25	150/-63	12	356/-66	27	153/-63	12	245/-67	19	192/-55	15	256/-67	20	192/-56	15	208/-57	16	296/-62	22	226/-57	17
		242/-76	18	242/-76	18	318/-74	25	150/-63	12	356/-66	27	153/-63	12	246/-67	19	192/-55	15	256/-67	20	192/-56	15	208/-57	16	296/-62	22	226/-57	17
11	OHL 400kV Krsko (SLO) - Tumbri (CRO) 2	234/-66	18	234/-66	18	318/-74	25	150/-63	12	356/-66	27	153/-63	12	245/-67	19	192/-55	15	256/-67	20	192/-56	15	208/-57	16	296/-62	22	226/-57	17
		242/-76	18	242/-76	18	318/-74	25	150/-63	12	356/-66	27	153/-63	12	246/-67	19	192/-55	15	256/-67	20	192/-56	15	208/-57	16	296/-62	22	226/-57	17
12	OHL 400kV Heviz (HUN) - Zerjavinec (CRO)	-134/-28	11	-145/-27	11	-164/-10	13	-152/-32	12	-115/-10	9	-151/-25	11	6/-45	1	-469/42	36	127/-49	10	-451/36	34	-80/-92	9	-96/-80	9	98/-104	11
		-133/-48	11	-136/-47	11	-164/-10	13	-151/-32	12	-115/-10	9	-151/-25	11	7/-45	1	-469/42	36	127/-49	10	-451/36	34	-80/-92	9	-96/-80	9	98/-105	11
13	OHL 400kV S.Mitrovica (YUG) - Ernestinovo (CRO)	116/-57	9	113/-57	9	22/-43	2	223/-60	17	-6/-32	2	218/-57	17	87/-53	6	262/-49	20	114/-47	9	258/-49	20	108/-70	10	-11/-50	4	56/-59	6
		109/-76	9	107/-76	9	23/-43	2	224/-60	17	-6/-32	2	219/-57	17	84/-53	6	262/-49	20	114/-49	9	258/-49	20	108/-71	10	-10/-50	4	56/-59	6
14	OHL 400kV Bitola (MKD) - Florina (GRE)	72/-4	6	57/-6	5	132/-13	12	-32/-1	3	271/-27	23	-35/-4	3	254/-24	22	-51/-5	4	259/-24	22	-103/-7	9	-19/-91	8	53/-104	10	206/-110	20
		72/-4	6	57/-5	5	135/-12	12	-28/0	2	271/-26	23	-32/-3	3	257/-23	22	-48/-4	4	259/-23	22	-99/-6	8	-17/-90	8	55/-103	10	208/-109	20
15	OHL 400kV Dubrovo (MKD) - Thessaloniki (GRE)	90/-50	8	77/-41	7	144/-52	13	24/-48	5	128/-47	12	19/-38	4	141/-55	13	-22/-45	4	115/-45	11	-13/-40	4	139/10	12	202/9	17	212/-2	18
		90/-50	8	77/-41	7	146/-52	13	25/-48	5	128/-47	12	21/-38	4	143/-54	14	-20/-44	4	115/-44	11	-12/-39	3	140/11	12	203/9	17	212/-1	18
16	OHL 400kV Arad (ROM) - Sandorfalva (HUN)	-57/26	7	-63/26	7	-194/44	17	107/7	9	-267/55	22	105/8	8	-188/47	17	354/-11	29	-280/59	23	436/-20	36	-7/-19	2	-153/0	12	-163/6	13
		-52/25	7	-58/25	7	-195/44	17	107/7	9	-267/55	22	105/8	8	-190/47	17	354/-11	29	-280/59	23	436/-20	36	-7/-19	2	-152/0	12	-163/6	13
17	OHL 400kV Subotica (YUG) - Sandorfalva (HUN)	-89/-106	10	-87/-106	9	-219/-79	17	89/-137	12	-334/-56	25	82/-136	12	-319/-65	24	423/-182	35	-439/-39	33	366/-167	30	-94/15	7	-225/35	17	-365/53	27
		-76/-108	10	-74/-108	9	-219/-79	17	89/-137	12	-334/56	25	82/-136	12	-325/-64	25	424/-183	35	-439/-39	33	366/-167	30	-94/15	7	-225/35	17	-365/53	27
18	OHL 400kV Kosovo B (YUG) - Skopje 1 (MKD)	153/-27	13	128/-20	10	254/-31	19	1/-16	1	370/-26	27	-5/-8	1	362/-31	27	-55/-10	4	349/-25	25	-95/1	7	109/-47	9	228/-50	17	376/-39	28
		154/-27	13	128/-20	10	258/-30	19	5/-16	1	370/-26	27	-1/-8	1	366/-30	22	-52/-10	4	349/-25	25	-91/1	7	111/-46	9	231/-49	17	377/-39	28
19	OHL 400kV Djerdap (YUG) - P.D.Fier (ROM)	-72/-56	7	-62/-56	6	-18/-56	4	-121/-61	10	-22/-62	5	-130/-66	11	-96/-70	9	-172/-75	14	-60/-63	6	-245/-85	19	-45/-16	3	41/-20	3	-53/-32	4
		-70/-56	7	-60/-56	6	-18/-56	4	-121/-60	10	-22/-62	5	-130/-66	11	-97/-70	9	-171/-75	14	-60/-63	6	-245/-85	19	-45/-16	3	42/-19	3	-53/-32	4
20	OHL 400kV Varna (BUL) - Isaccea (ROM	232/-65	15	214/-83	14	158/-65	10	310/-64	19	169/-83	12	230/-84	15	-52/-63	4	411/-60	26	178/-84	12	236/-84	16	173/-75	11	92/-75	7	-185/-61	12
		234/-65	15	215/-83	14	158/-65	10	310/-64	19	169/-83	12	230/-84	15	-53/-62	3	411/-60	26	178/-84	12	236/-84	16	173/-75	11	92/-75	7	-185/-61	12
21	OHL 400kV Hamitabat (TUR) - Maritsa Istok 3 (BUL) 1	-316/60	22	/	/	-513/111	35	-134/33	9	/	/	/	/	-563/123	39	-3/30	2	/	/	/	/	-313/45	20	-510/100	32	-606/116	39
		-316/60	22	/	/	-513/111	35	-134/33	9	/	/	/	/	-564/124	38	-3/30	2	/	/	/	/	-313/45	20	-510/100	32	-606/116	39
22	OHL 400kV Hamitabat (TUR) - Maritsa Istok 3 (BUL) 2	-300/52	21	/	/	-489/100	33	-127/26	8	/	/	/	/	-533/112	37	-3/23	1	/	/	/	/	-297/38	19	-483/90	31	-575/105	37
		-300/52	21	/	/	-486/100	33	-127/26	8	/	/	/	/	-534/112	37	-3/23	1	/	/	/	/	-297/38	19	-483/90	31	-575/105	37
23	OHL 400kV Babaeski (TUR) - Filippi (GRE)	-81/-73	6	/	/	-294/-32	20	69/-85	7	/	/	/	/	-195/-53	13	307/-74	20	/	/	/	/	-87/20	6	-300/65	19	-210/39	13
		-82/-73	6	/	/	-293/-32	20	70/-85	7	/	/	/	/	-194/-53	13	308/-74	20	/	/	/	/	-87/20	6	-300/65	19	-209/38	13
	OHL 220kV Prizren (YUG) - Fierza (ALB)	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/
		-57/-23	18	-58/-23	18	-59/-22	18	-57/-24	18	-6/-32	9	-57/-24	18	-51/-24	17	-51/-26	17	0/-34	10	-58/-25	18	-32/-22	11	-32/-22	11	-22/-24	9

without new line
with new line

% line load in % commpared to line thermal limit

Table 4.6. Power flows: OHL 400kV Banja Luka (BiH) - Tumbri (CRO)

No.	INTERCONNECTION LINE	POWER FLOWS																									
		WINTER																				SUMMER					
		Base case				Scenario 1		Scenario 2		Scenario 3		Scenario 4		Scenario 5		Scenario 6		Scenario 7		Scenario 8		Base case		Scenario 1		Scenario 5	
						UCTE >> TUR (W>>E)		TUR,GRE >> UCTE (E>>W)		UCTE >> BUL,GRE,ALB (W>>E)		BUL,GRE,ROM >> UCTE (E>>W)		CEN,UKR,ROM >> TUR,GRE (N>>S)		TUR,BUL >> CEN (S>>N)		CEN,UKR >> BUL,GRE,ALB (N>>S)		ROM,BUL,GRE >> CEN (S>>W)				UCTE >> TUR (W>>E)		CENT >> TUR, GRE (E>>W)	
		With TUR		Without TUR		600		700		1000		700		1000		1500		1000		1500		With TUR		600		1200	
		MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%
1	OHL 400kV Kardia (GRE) - Elbasan (ALB)	100/18	9	108/16	10	43/23	7	183/18	13	107/20	8	184/16	13	12/27	7	220/20	16	133/18	10	237/21	17	104/19	7	41/23	3	-10/29	2
		100/17	9	108/15	10	42/23	7	183/18	13	106/20	8	184/16	13	11/27	6	221/19	16	131/17	9	237/21	17	103/18	7	40/23	3	-11/28	2
2	OHL 400kV Tantareni (ROM) - Kozloduj (BUL) 1	110/-96	10	108/-94	10	168/-98	14	42/-94	7	208/-93	16	46/-88	7	220/-91	18	-58/-89	7	200/-92	15	29/-85	6	67/-73	8	143/-71	12	213/-69	17
		108/-96	10	106/-94	10	165/-98	14	42/-94	7	204/-93	16	46/-88	7	218/-91	18	-57/-89	7	192/-92	15	29/-85	6	66/-74	8	141/-71	12	211/-69	17
3	OHL 400kV Tantareni (ROM) - Kozloduj (BUL) 2	110/-96	10	108/-94	10	168/-98	14	42/-94	7	208/-93	16	46/-88	7	220/-91	18	-58/-89	7	200/-92	15	29/-85	6	67/-73	8	143/-71	12	213/-69	17
		108/-96	10	106/-94	10	165/-98	14	42/-94	7	204/-93	16	46/-88	7	218/-91	18	-57/-89	7	192/-92	15	29/-85	6	66/-74	8	141/-71	12	211/-69	17
4	OHL 400kV Nis (YUG) - Sofija west (BUL)	-47/-83	5	-27/-76	4	190/-110	11	-294/-57	15	163/-108	10	-266/-52	14	123/-109	8	-679/-6	35	36/-91	5	-468/-39	24	18/-33	2	196/-45	10	165/-44	9
		-46/-82	5	-25/-75	2	194/-109	10	-295/-56	15	169/-107	10	-266/-51	14	126/-108	5	-681/-6	35	40/-90	5	-470/-38	24	19/-32	2	198/-44	10	167/-43	9
5	OHL 400kV Thessaloniki (GRE) - Blagoevgrad (BUL)	-20/-36	2	25/-47	2	-62/-31	5	79/-44	7	-208/-12	15	104/-55	9	-211/5	16	13/-29	2	-256/-2	19	148/-54	12	-69/-93	9	-89/-91	10	-282/-57	22
		-19/-37	2	27/-47	2	-61/-32	4	79/-44	7	-205/-13	15	103/-55	9	-209/-6	14	12/-29	2	-253/-3	19	147/-54	12	-68/-94	9	-87/-91	10	-281/-57	22
6	OHL 400kV Ernestinovo (CRO) - Ugljevik (B&H)	-135/62	12	-138/62	12	-94/53	9	-190/66	15	-34/44	4	-189/65	15	-67/54	7	-259/58	20	30/43	4	-254/58	20	-69/-8	5	-38/-12	3	7/-14	1
		-175/49	13	-177/-49	12	-173/48	9	-184/48	14	-139/44	11	-184/48	14	-131/44	7	-234/46	18	-55/36	6	-231/46	18	-99/-20	7	-111/-16	8	-53/-21	4
7	OHL 400kV Podgorica (YUG) - Trebinje (B&H)	-104/-15	8	-102/-16	8	-193/-4	15	1/-27	2	-240/3	19	-2/-26	2	-179/-8	14	65/-33	6	-164/-8	13	55/-32	5	-40/-61	6	-127/-48	11	-131/-52	11
		-104/-19	8	-102/-20	8	-193/-9	15	1/-30	2	-240/-1	19	-2/-29	2	-179/-12	14	66/-36	6	-164/-12	13	56/-34	5	-40/-65	6	-127/-54	11	-130/-57	11
8	OHL 400kV Konjsko (CRO) - Mostar (B&H)	106/1	8	104/1	8	221/-14	17	-28/19	2	305/-26	23	-24/11	2	181/-6	14	-74/13	6	238/-13	18	-68/12	5	99/1	7	219/-12	16	195/-6	4
		86/4	8	84/4	8	180/-8	17	-25/20	2	253/-19	19	-21/12	2	148/-1	14	-61/13	5	195/-7	14	-56/13	4	84/3	6	182/-7	13	164/-2	12
9	OHL 400kV Divaca (SLO) - Meline (CRO)	-90/-4	7	-91/-4	7	12/-8	1	-215/45	16	74/-24	6	-208/16	16	-55/-6	4	-194/23	15	-21/-4	2	-192/23	15	-98/-38	8	14/-33	3	-46/-33	4
		-93/-17	7	-94/-17	7	6/-22	1	-215/32	16	66/-25	5	-208/3	16	-60/-20	4	-190/15	15	-27/-19	3	-191/14	14	-100/-63	9	9/-61	5	-50/-59	6
10	OHL 400kV Krsko (SLO) - Tumbri (CRO) 1	234/-66	18	234/-66	18	318/-74	25	150/-63	12	356/-66	27	153/-63	12	245/-67	19	192/-55	15	256/-67	20	192/-56	15	208/-57	16	296/-62	22	226/-57	17
		242/-76	18	242/-76	18	333/-86	25	149/-79	12	275/-95	29	151/-72	12	257/-78	19	187/-66	15	272/-78	21	187/-66	15	214/-72	16	310/-78	23	238/-72	18
11	OHL 400kV Krsko (SLO) - Tumbri (CRO) 2	234/-66	18	234/-66	18	318/-74	25	150/-63	12	356/-66	27	153/-63	12	245/-67	19	192/-55	15	256/-67	20	192/-56	15	208/-57	16	296/-62	22	226/-57	17
		242/-76	18	242/-76	18	333/-86	25	149/-79	12	275/-95	29	151/-72	12	257/-78	19	187/-66	15	272/-78	21	187/-66	15	214/-72	16	310/-78	23	238/-72	18
12	OHL 400kV Heviz (HUN) - Zerjavinec (CRO)	-134/-28	11	-145/-27	11	-164/-10	13	-152/-32	12	-115/-10	9	-151/-25	11	6/-45	1	-469/42	36	127/-49	10	-451/36	34	-80/-92	9	-96/-80	9	98/-104	11
		-133/-48	11	-136/-47	11	-144/-35	13	-155/-49	12	-86/-28	7	-154/-42	12	23/-66	1	-478/30	36	151/-71	12	-460/24	35	-73/-112	10	-77/104	10	116/-125	13
13	OHL 400kV S.Mitrovica (YUG) - Ernestinovo (CRO)	116/-57	9	113/-57	9	22/-43	2	223/-60	17	-6/-32	2	218/-57	17	87/-53	6	262/-49	20	114/-47	9	258/-49	20	108/-70	10	-11/-50	4	56/-59	6
		109/-76	9	107/-76	9	8/-62	1	224/-78	18	-24/-49	4	220/-75	17	75/-72	6	266/-62	21	100/-70	9	262/-63	20	103/-90	10	-24/-70	5	45/-79	7
14	OHL 400kV Bitola (MKD) - Florina (GRE)	72/-4	6	57/-6	5	132/-13	12	-32/-1	3	271/-27	23	-35/-4	3	254/-24	22	-51/-5	4	259/-24	22	-103/-7	9	-19/-91	8	53/-104	10	206/-110	20
		72/-4	6	57/-5	5	132/-13	12	-32/0	3	272/-27	23	-36/-3	3	255/-23	25	-52/-5	4	260/-24	22	-103/-7	9	-18/-90	8	53/-103	10	207/-109	20
15	OHL 400kV Dubrovo (MKD) - Thessaloniki (GRE)	90/-50	8	77/-41	7	144/-52	13	24/-48	5	128/-47	12	19/-38	4	141/-55	13	-22/-45	4	115/-45	11	-13/-40	4	139/10	12	202/9	17	212/-2	18
		90/-50	8	77/-41	7	145/-52	13	24/-48	5	128/-47	12	19/-38	4	142/-55	14	-22/-44	4	116/-45	11	-13/-40	4	140/11	12	202/9	17	212/-2	18
16	OHL 400kV Arad (ROM) - Sandorfalva (HUN)	-57/26	7	-63/26	7	-194/44	17	107/7	9	-267/55	22	105/8	8	-188/47	17	354/-11	29	-280/59	23	436/-20	36	-7/-19	2	-153/0	12	-163/6	13
		-52/25	7	-58/25	7	-186/42	17	106/7	9	-253/52	21	103/8	8	-180/45	17	350/-11	29	-268/57	22	432/-20	35	-3/-20	2	-143/-2	12	-155/4	13
17	OHL 400kV Subotica (YUG) - Sandorfalva (HUN)	-89/-106	10	-87/-106	9	-219/-79	17	89/-137	12	-334/-56	25	82/-136	12	-319/-65	24	423/-182	35	-439/-39	33	366/-167	30	-94/15	7	-225/35	17	-365/53	27
		-76/-108	10	-74/-108	9	-193/-84	17	85/-136	12	-298/-63	22	79/-135	12	-298/-68	25	413/-181	34	-409/-44	30	357/-65	29	-84/15	6	-200/32	15	-343/51	26
18	OHL 400kV Kosovo B (YUG) - Skopje 1 (MKD)	153/-27	13	128/-20	10	254/-31	19	1/-16	1	370/-26	27	-5/-8	1	362/-31	27	-55/-10	4	349/-25	25	-95/1	7	109/-47	9	228/-50	17	376/-39	28
		154/-27	13	128/-20	10	255/-30	18	1/-16	1	371/-26	27	-5/-8	1	363/-31	22	-56/-10	4	350/-25	25	-95/1	7	109/-46	9	230/-49	17	377/-38	28
19	OHL 400kV Djerdap (YUG) - P.D.Fier (ROM)	-72/-56	7	-62/-56	6	-18/-56	4	-121/-61	10	-22/-62	5	-130/-66	11	-96/-70	9	-172/-75	14	-60/-63	6	-245/-85	19	-45/-16	3	41/-20	3	-53/-32	4
		-70/-56	7	-60/-56	6	-15/-56	4	-122/-60	10	-17/-62	5	-313/-66	11	-93/-70	9	-173/-75	14	-56/-62	6	-246/-85	19	-43/-15	3	45/-19	4	-49/-31	4
20	OHL 400kV Varna (BUL) - Isaccea (ROM	232/-65	15	214/-83	14	158/-65	10	310/-64	19	169/-83	12	230/-84	15	-52/-63	4	411/-60	26	178/-84	12	236/-84	16	173/-75	11	92/-75	7	-185/-61	12
		234/-65	15	215/-83	14	160/-65	10	310/-64	19	171/-83	12	230/-84	15	-51/-63	3	411/-60	26	180/-84	12	236/-84	16	173/-75	11	93/-75	7	-183/-61	12
21	OHL 400kV Hamitabat (TUR) - Maritsa Istok 3 (BUL) 1	-316/60	22	/	/	-513/111	35	-134/33	9	/	/	/	/	-563/123	39	-3/30	2	/	/	/	/	-313/45	20	-510/100	32	-606/116	39
		-316/60	22	/	/	-512/110	35	-134/33	9	/	/	/	/	-563/123	38	-3/30	2	/	/	/	/	-313/45	20	-509/100	32	-606/116	39
22	OHL 400kV Hamitabat (TUR) - Maritsa Istok 3 (BUL) 2	-300/52	21	/	/	-489/100	33	-127/26	8	/	/	/	/	-533/112	37	-3/23	1	/	/	/	/	-297/38	19	-483/90	31	-575/105	37
		-300/52	21	/	/	-485/100	33	-127/26	8	/	/	/	/	-533/112	36	-3/23	1	/	/	/	/	-297/38	19	-483/90	31	-575/105	37
23	OHL 400kV Babaeski (TUR) - Filippi (GRE)	-81/-73	6	/	/	-294/-32	20	69/-85	7	/	/	/	/	-195/-53	13	307/-74	20	/	/	/	/	-87/20	6	-300/65	19	-210/39	13
		-82/-73	6	/	/	-295/-31	20	70/-85	7	/	/	/	/	-196/-53	14	308/-74	20	/	/	/	/	-87/20	6	-301/65	19	-210/39	13
	OHL 400kV Banja Luka (BiH) - Tumbri (CRO)	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/
		-85/-61	6	-85/-61	2	-172/-43	12	15/-78	6	-228/-28	17	12/-73	5	-139/-53	10	57/-74	7	-185/-45	14	52/-74	7	-63/-50	6	-157/-36	12	-135/-42	10

without new line
with new line

% line load in % commpared to line thermal limit

Table 4.7. Power flows: OHL 2x400kV Ernestinovo (CRO) – Pecs (HUN)

No.	INTERCONNECTION LINE	POWER FLOWS																									
		WINTER																				SUMMER					
		Base case				Scenario 1 UCTE >> TUR (W>>E)		Scenario 2 TUR,GRE >> UCTE (E>>W)		Scenario 3 UCTE >> BUL,GRE,ALB (W>>E)		Scenario 4 BUL,GRE,ROM >> UCTE (E>>W)		Scenario 5 CEN,UKR,ROM >> TUR,GRE (N>>S)		Scenario 6 TUR,BUL >> CEN (S>>N)		Scenario 7 CEN,UKR >> BUL,GRE,ALB (N>>S)		Scenario 8 ROM,BUL,GRE >> CEN (S>>W)		Base case		Scenario 1 UCTE >> TUR (W>>E)		Scenario 5 TUR,GRE >> UCTE (E>>W)	
		With TUR		Without TUR		600		700		1000		700		1000		1500		1000		1500		With TUR		600		1200	
		MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%
1	OHL 400kV Kardia (GRE) - Elbasan (ALB)	99 / 75	9	108 / 73	10	42 / 82	7	181 / 71	14	108 / 77	10	182 / 69	15	12 / 86	7	215 / 70	17	116 / 76	10	235 / 70	18	103 / 77	9	41 / 83	7	-9 / 88	7
		99 / 75	9	107 / 73	10	41 / 82	7	182 / 71	14	105 / 77	10	184 / 69	15	9 / 86	6	222 / 70	17	110 / 76	10	240 / 70	19	102 / 77	9	39 / 83	7	-13 / 88	7
2	OHL 400kV Tantareni (ROM) - Kozloduj (BUL) 1	109 / -56	10	107 / -54	10	168 / -59	14	41 / -52	4	205 / -56	17	46 / -47	5	219 / -54	18	-61 / -47	6	218 / -57	17	27 / -43	4	67 / -34	6	142 / -33	12	212 / -34	17
		107 / -56	10	106 / -54	10	164 / -59	14	44 / -52	5	199 / -56	17	49 / -46	5	212 / -54	18	-48 / -45	5	208 / -57	17	38 / -41	4	65 / -34	6	138 / -33	11	205 / -34	17
3	OHL 400kV Tantareni (ROM) - Kozloduj (BUL) 2	109 / -56	10	107 / -54	10	168 / -59	14	41 / -52	4	205 / -56	17	46 / -47	5	219 / -54	18	-61 / -47	6	218 / -57	17	27 / -43	4	67 / -34	6	142 / -33	12	212 / -34	17
		107 / -56	10	106 / -54	10	164 / -59	14	44 / -52	5	199 / -56	17	49 / -46	5	212 / -54	18	-48 / -45	5	208 / -57	17	38 / -41	4	65 / -34	6	138 / -33	11	205 / -34	17
4	OHL 400kV Nis (YUG) - Sofija west (BUL)	-47 / -71	7	-27 / -64	6	189 / 100	18	-291 / -48	23	160 / -97	16	-266 / -43	23	121 / -98	13	-663 / -18	56	146 / -96	15	-467 / -35	39	18 / 1	2	194 / -15	16	163 / -13	14
		-46 / -71	7	-25 / -64	6	195 / 100	18	-295 / -47	25	171 / -97	17	-270 / -42	23	132 / -98	14	-684 / -18	58	165 / -97	16	-487 / -34	41	20 / 1	2	199 / -15	17	173 / -14	15
5	OHL 400kV Thessaloniki (GRE) - Blagoevgrad (BUL)	-19 / 13	2	25 / 2	2	-62 / 18	5	81 / 5	6	-204 / 29	16	102 / -6	8	-210 / 36	16	27 / 14	2	-220 / 32	17	150 / -8	11	-68 / -47	6	-89 / -45	8	-284 / -23	22
		-18 / 13	2	26 / 2	2	-60 / 17	5	79 / 5	6	-199 / 28	15	100 / -6	8	-206 / 36	16	19 / 15	2	-213 / 30	16	138 / -7	11	-67 / -47	6	-86 / -46	7	-278 / -24	21
6	OHL 400kV Ernestinovo (CRO) - Ugljevik (B&H)	-133 / 73	12	-138 / 74	12	-88 / 63	9	-193 / 75	17	-37 / 57	5	-189 / 75	15	-62 / 65	7	-263 / 66	20	-20 / 60	6	-254 / 68	20	-67 / 4	5	-32 / 0	2	13 / -1	1
		-124 / 102	12	-127 / 104	12	-51 / 95	8	-218 / 115	19	29 / 90	7	-213 / 115	18	11 / 89	7	-387 / 136	31	92 / 84	9	-370 / 135	30	-48 / 1	4	11 / -0	1	99 / -6	8
7	OHL 400kV Podgorica (YUG) - Trebinje (B&H)	-104 / 1	8	-102 / 1	8	-192 / 9	15	-2 / -7	1	-237 / 15	19	-2 / -7	1	-178 / 6	14	61 / -15	5	-204 / 10	16	55 / -14	5	-39 / -44	5	-125 / -32	10	-128 / -36	11
		-104 / -0	8	-103 / 0	8	-196 / 8	16	0 / -9	1	-244 / 13	19	0 / -9	1	-186 / 4	15	75 / -19	6	-217 / 8	17	66 / -17	5	-41 / -43	5	-127 / -33	10	-135 / -36	11
8	OHL 400kV Konjsko (CRO) - Mostar (B&H)	106 / 32	8	103 / 32	8	225 / 11	17	-27 / 43	4	300 / -3	23	-23 / 43	4	184 / 22	14	-77 / 44	7	233 / 14	17	-68 / 44	6	100 / 33	8	221 / 15	17	196 / 22	15
		101 / 32	8	101 / 32	8	215 / 12	16	-20 / 42	4	284 / -1	22	-17 / 42	3	164 / 25	13	-44 / 45	5	206 / 19	16	-37 / 44	4	94 / 34	8	205 / 18	16	169 / 27	13
9	OHL 400kV Divaca (SLO) - Meline (CRO)	-90 / 14	7	-91 / 15	7	14 / 11	1	-212 / 32	16	68 / -2	5	-209 / 33	16	-53 / 12	4	-195 / 40	15	-28 / 15	3	-191 / 39	15	-98 / -23	7	14 / -17	1	-47 / -18	4
		-94 / 11	7	-92 / 12	7	8 / 8	1	-207 / 27	16	57 / 0	4	-205 / 28	16	-66 / 9	5	-176 / 33	14	-43 / 10	3	-171 / 33	13	-101 / -22	8	3 / -19	1	-65 / -20	5
10	OHL 400kV Krsko (SLO) - Tumbri (CRO) 1	234 / -55	18	234 / -55	18	319 / -65	25	151 / -50	12	352 / -60	27	152 / -50	11	245 / -56	19	192 / -43	15	253 / -57	20	192 / -44	15	208 / -44	16	294 / -51	23	224 / -44	17
		231 / -57	18	233 / -57	18	316 / -67	25	153 / -53	12	347 / -69	27	154 / -53	12	238 / -58	19	200 / -50	16	247 / -59	19	201 / -50	16	206 / -44	16	289 / -51	22	216 / -44	17
11	OHL 400kV Krsko (SLO) - Tumbri (CRO) 2	234 / -55	18	234 / -55	18	319 / -65	25	151 / -50	12	352 / -60	27	152 / -50	11	245 / -56	19	192 / -43	15	253 / -57	20	192 / -44	15	208 / -44	16	294 / -51	23	224 / -44	17
		231 / -57	18	233 / -57	18	316 / -67	25	153 / -53	12	347 / -69	27	154 / -53	12	238 / -58	19	200 / -50	16	247 / -59	19	201 / -50	16	206 / -44	16	289 / -51	22	216 / -44	17
12	OHL 400kV Heviz (HUN) - Zerjavinec (CRO)	-143 / 18	11	-145 / 19	11	-166 / 35	13	-150 / 21	11	-116 / 37	9	-151 / 21	12	4 / 5	1	-468 / 53	36	101 / -0	6	-457 / 52	35	-81 / -42	7	-98 / -30	8	94 / -55	8
		-158 / 13	12	-159 / 13	12	-212 / 30	16	-120 / 8	9	-198 / 37	15	-122 / 9	9	-85 / 6	6	-317 / 24	24	-37 / 3	3	-313 / 24	24	-107 / -39	9	-159 / -26	12	-21 / -45	4
13	OHL 400kV S.Mitrovica (YUG) - Ernestinovo (CRO)	115 / -12	9	113 / -11	9	19 / 5	2	219 / -18	17	-3 / 14	1	217 / -17	17	84 / -6	6	262 / -13	20	66 / 0	5	256 / -12	19	107 / -59	9	-9 / -37	2	59 / -46	6
		107 / -36	9	101 / -35	8	-21 / -19	2	248 / -49	19	-75 / -10	6	245 / -49	19	4 / -24	2	401 / -60	31	-54 / -15	4	382 / -58	29	81 / -55	7	-68 / -35	6	-60 / -37	5
14	OHL 400kV Bitola (MKD) - Florina (GRE)	71 / 7	6	56 / 6	5	131 / -1	12	-31 / 11	3	268 / -17	24	-35 / 8	3	252 / -13	22	-46 / 7	4	267 / -16	23	-104 / 4	9	-18 / -79	7	52 / -92	9	205 / -99	20
		71 / 8	6	57 / 6	5	132 / -1	12	-31 / 11	3	269 / -17	24	-35 / 8	3	254 / -13	22	-49 / 7	4	270 / -17	24	-105 / 4	9	-18 / -79	7	53 / -92	9	208 / -100	20
15	OHL 400kV Dubrovo (MKD) - Thessaloniki (GRE)	89 / -18	8	76 / -9	7	143 / -22	13	23 / -15	2	126 / -17	11	20 / -6	2	140 / -24	13	-17 / -12	2	124 / -16	11	-13 / -7	1	139 / 39	13	200 / 35	18	210 / 24	19
		89 / -18	8	77 / -9	7	144 / -22	13	22 / -15	2	127 / -17	11	19 / -6	2	142 / -24	13	-21 / -12	2	126 / -16	11	-15 / -7	1	139 / 39	13	201 / 35	18	213 / 23	19
16	OHL 400kV Arad (ROM) - Sandorfalva (HUN)	-57 / 56	7	-63 / 57	7	-198 / 70	17	106 / 37	9	-263 / 77	23	105 / 37	9	-189 / 74	17	360 / 4	29	-311 / 83	25	433 / -10	36	-7 / 11	1	-153 / 27	13	-162 / 32	14
		-51 / 55	6	-58 / 56	7	-182 / 68	16	95 / 38	8	-235 / 73	20	94 / 38	8	-158 / 69	14	311 / 9	26	-266 / 76	23	385 / -4	32	1 / 9	1	-130 / 24	11	-122 / 26	10
17	OHL 400kV Subotica (YUG) - Sandorfalva (HUN)	-89 / -93	10	-86 / -93	9	-226 / -67	17	88 / -124	15	-327 / -50	25	82 / -124	11	-324 / -55	24	417 / -179	34	-445 / -32	31	367 / -162	30	-94 / 28	7	-226 / 46	17	-361 / 58	27
		-71 / -96	9	-74 / -95	9	-181 / -74	14	57 / -118	10	-248 / -62	19	53 / -118	10	-237 / -68	18	274 / -150	23	-317 / -51	24	227 / -136	20	-68 / 24	5	-158 / 37	12	-242 / 45	18
18	OHL 400kV Kosovo B (YUG) - Skopje 1 (MKD)	152 / -0	11	127 / 7	10	253 / -8	19	1 / 12	1	364 / -11	28	-4 / 20	2	359 / -15	27	-47 / 17	4	362 / -10	26	-96 / 29	8	108 / -19	8	227 / -26	17	373 / -26	28
		152 / -0	11	128 / 7	10	254 / -7	19	0 / 13	1	366 / -11	28	-5 / 21	2	362 / -15	27	-52 / 17	4	367 / -10	28	-98 / 29	8	109 / -19	8	228 / -26	17	378 / -26	28
19	OHL 400kV Djerdap (YUG) - P.D.Fier (ROM)	-71 / -55	7	-61 / -55	6	-19 / -55	4	-120 / -60	10	-22 / -61	5	-130 / -65	11	-96 / -69	9	-193 / -75	14	-38 / -62	5	-243 / -84	19	-45 / -15	4	40 / -19	3	-52 / -31	5
		-69 / -55	7	-59 / -55	6	-12 / -55	4	-125 / -60	10	-10 / -60	5	-135 / -65	11	-83 / -68	8	-217 / -76	17	-18 / -61	5	-265 / -86	21	-40 / -15	3	51 / -19	4	-32 / -31	3
20	OHL 400kV Isaccea (ROM) - Varna (BUL)	232 / -26	15	213 / -44	14	157 / -22	10	308 / -31	20	169 / -42	11	229 / -47	15	-52 / -16	4	432 / -37	27	162 / -41	11	236 / -47	15	172 / -31	11	91 / -28	6	-184 / -17	12
		233 / -26	15	214 / -44	14	159 / -22	10	307 / -31	20	173 / -42	11	227 / -47	15	-47 / -16	3	423 / -37	27	168 / -42	11	228 / -47	15	173 / -31	11	94 / -28	6	-179 / -18	11
21	OHL 400kV Hamitabat (TUR) - Maritsa Istok 3 (BUL) 1	-317 / 89	22	/	/	-516 / 115	35	-136 / 74	10	/	/	/	/	-567 / 120	39	-4 / 70	5	/	/	/	/	-314 / 76	22	-512 / 107	35	-611 / 105	41
		-317 / 89	22	/	/	-515 / 115	35	-136 / 74	10	/	/	/	/	-565 / 119	38	-6 / 70	5	/	/	/	/	-314 / 76	22	-511 / 107	35	-609 / 105	41
22	OHL 400kV Hamitabat (TUR) - Maritsa Istok 3 (BUL) 2	-300 / 85	21	/	/	-489 / 109	33	-129 / 70	10	/	/	/	/	-537 / 113	37	-3 / 66	4	/	/	/	/	-297 / 72	20	-485 / 102	33	-578 / 100	39
		-300 / 85	21	/	/	-488 / 109	33	-129 / 70	10	/	/	/	/	-536 / 113	37	-6 / 66	4	/	/	/	/	-297 / 72	20	-484 / 101	33	-577 / 100	39
23	OHL 400kV Babaeski (TUR) - Filippi (GRE)	-81 / 17	6	/	/	-294 / 42	20	65 / 6	4	/	/	/	/	-195 / 31	13	308 / -2	20	/	/	/	/	-87 / 109	9	-301 / 136	22	-209 / 118	16
		-81 / 17	6	/	/	-296 / 42	20	66 / 5	4	/	/	/	/	-198 / 31	13	313 / -2	21	/	/	/	/	-88 / 109	9	-303 / 136	22	-213 / 118	16
	OHL 2x400kV Ernestinovo (CRO) - Pecs(HUN)	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/
		- 34 / -66	3	- 34 / -68	3	- 122 / -64	5	84 / -92	5	216 / -64	9	80 / -92	5	- 240 / -42	9	408 / -150	17	-360 / -32	14	380 / -144	15	-70 / 10	3	-164 / 12	6	-318 / 34	12

without new line
with new line

% line load in % commpared to line thermal limit

Table 4.8. Power flows: OHL 400kV Bekescaba (HUN) - Oradea (ROM)

No.	INTERCONNECTION LINE	POWER FLOWS																									
		WINTER																				SUMMER					
		Base case				Scenario 1 UCTE >> TUR (W>>E)		Scenario 2 TUR,GRE >> UCTE (E>>W)		Scenario 3 UCTE >> BUL,GRE,ALB (W>>E)		Scenario 4 BUL,GRE,ROM >> UCTE (E>>W)		Scenario 5 CEN,UKR,ROM >> TUR,GRE (N>>S)		Scenario 6 TUR,BUL >> CEN (S>>N)		Scenario 7 CEN,UKR >> BUL,GRE,ALB (N>>S)		Scenario 8 ROM,BUL,GRE >> CEN (S>>W)		Base case		Scenario 1 UCTE >> TUR (W>>E)		Scenario 5 TUR,GRE >> UCTE (E>>W)	
		With TUR		Without TUR		600		700		1000		700		1000		1500		1000		1500		With TUR		600		1200	
		MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%
1	OHL 400kV Kardia (GRE) - Elbasan (ALB)	99 / 75	9	108 / 73	10	42 / 82	7	181 / 71	14	108 / 77	10	182 / 69	15	12 / 86	7	215 / 70	17	116 / 76	10	235 / 70	18	103 / 77	9	41 / 83	7	-9 / 88	7
		101 / 75	9	109 / 73	10	44 / 82	7	181 / 71	14	110 / 77	10	182 / 69	14	14 / 85	6	213 / 70	17	118 / 75	10	233 / 70	18	103 / 77	9	43 / 83	7	-7 / 87	7
2	OHL 400kV Tantareni (ROM) - Kozloduj (BUL) 1	109 / -56	10	107 / -54	10	168 / -59	14	41 / -52	4	205 / -56	17	46 / -47	5	219 / -54	18	-61 / -47	6	218 / -57	17	27 / -43	4	67 / -34	6	142 / -33	12	212 / -34	17
		112 / -56	10	110 / -53	10	174 / -59	15	41 / -52	5	214 / -56	18	46 / -47	5	226 / -54	19	-68 / -48	7	227 / -57	19	18 / -45	4	67 / -34	6	146 / -34	12	216 / -34	17
3	OHL 400kV Tantareni (ROM) - Kozloduj (BUL) 2	109 / -56	10	107 / -54	10	168 / -59	14	41 / -52	4	205 / -56	17	46 / -47	5	219 / -54	18	-61 / -47	6	218 / -57	17	27 / -43	4	67 / -34	6	142 / -33	12	212 / -34	17
		112 / -56	10	110 / -53	10	174 / -59	15	41 / -52	5	214 / -56	18	46 / -47	5	226 / -54	19	-68 / -48	7	227 / -57	19	18 / -45	4	67 / -34	6	146 / -34	12	216 / -34	17
4	OHL 400kV Nis (YUG) - Sofija west (BUL)	-47 / -71	7	-27 / -64	6	189 / 100	18	-291 / -48	23	160 / -97	16	-266 / -43	23	121 / -98	13	-663 / -18	56	146 / -96	15	-467 / -35	39	18 / 1	2	194 / -15	16	163 / -13	14
		-54 / -71	8	-34 / -64	6	176 / -98	17	-290 / -48	25	142 / -94	14	-265 / -43	23	106 / -96	12	-649 / -17	55	126 / -93	13	-449 / -35	38	16 / 1	1	188 / -14	16	155 / -12	13
5	OHL 400kV Thessaloniki (GRE) - Blagoevgrad (BUL)	-19 / 13	2	25 / 2	2	-62 / 18	5	81 / 5	6	-204 / 29	16	102 / -6	8	-210 / 36	16	27 / 14	2	-220 / 32	17	150 / -8	11	-68 / -47	6	-89 / -45	8	-284 / -23	22
		-21 / 13	2	23 / 2	2	-65 / 18	5	81 / 5	6	-209 / 30	16	102 / -6	8	-213 / 37	17	30 / 14	3	-227 / 32	18	155 / -9	12	-69 / -46	6	-92 / -45	8	-286 / -23	22
6	OHL 400kV Ernestinovo (CRO) - Ugljevik (B&H)	-133 / 73	12	-138 / 74	12	-88 / 63	9	-193 / 75	17	-37 / 57	5	-189 / 75	15	-62 / 65	7	-263 / 66	20	-20 / 60	6	-254 / 68	20	-67 / 4	5	-32 / 0	2	13 / -1	1
		-135 / 73	12	-139 / 74	12	-92 / 64	9	-192 / 75	16	-41 / 58	5	-189 / 76	15	-66 / 66	7	-260 / 67	20	-23 / 61	5	-250 / 69	20	-67 / 4	5	-34 / 0	3	11 / -1	1
7	OHL 400kV Podgorica (YUG) - Trebinje (B&H)	-104 / 1	8	-102 / 1	8	-192 / 9	15	-2 / -7	1	-237 / 15	19	-2 / -7	1	-178 / 6	14	61 / -15	5	-204 / 10	16	55 / -14	5	-39 / -44	5	-125 / -32	10	-128 / -36	11
		-101 / 1	8	-99 / 1	8	-188 / 9	15	-2 / -7	1	-232 / 14	18	-2 / -7	1	-173 / 5	14	57 / -14	5	-199 / 9	16	49 / -13	4	-39 / -44	5	-122 / -33	10	-125 / -36	10
8	OHL 400kV Konjsko (CRO) - Mostar (B&H)	106 / 32	8	103 / 32	8	225 / 11	17	-27 / 43	4	300 / -3	23	-23 / 43	4	184 / 22	14	-77 / 44	7	233 / 14	17	-68 / 44	6	100 / 33	8	221 / 15	17	196 / 22	15
		104 / 32	8	101 / 32	8	221 / 12	17	-26 / 43	4	294 / -2	22	-23 / 43	4	178 / 23	14	-72 / 44	6	228 / 15	17	-62 / 43	6	99 / 34	8	218 / 16	17	192 / 23	15
9	OHL 400kV Divaca (SLO) - Meline (CRO)	-90 / 14	7	-91 / 15	7	14 / 11	1	-212 / 32	16	68 / -2	5	-209 / 33	16	-53 / 12	4	-195 / 40	15	-28 / 15	3	-191 / 39	15	-98 / -23	7	14 / -17	1	-47 / -18	4
		-91 / 14	7	-92 / 15	7	12 / 11	1	-212 / 32	16	64 / -1	4	-209 / 32	16	-56 / 12	4	-194 / 39	15	-28 / 14	2	-188 / 39	15	-98 / -23	8	13 / -18	2	-49 / -18	4
10	OHL 400kV Krsko (SLO) - Tumbri (CRO) 1	234 / -55	18	234 / -55	18	319 / -65	25	151 / -50	12	352 / -60	27	152 / -50	11	245 / -56	19	192 / -43	15	253 / -57	20	192 / -44	15	208 / -44	16	294 / -51	23	224 / -44	17
		233 / -55	18	233 / -55	18	318 / -65	25	151 / -50	12	351 / -60	27	152 / -50	12	243 / -56	19	191 / -44	15	254 / -57	20	193 / -46	15	208 / -44	16	293 / -51	23	223 / -44	17
11	OHL 400kV Krsko (SLO) - Tumbri (CRO) 2	234 / -55	18	234 / -55	18	319 / -65	25	151 / -50	12	352 / -60	27	152 / -50	11	245 / -56	19	192 / -43	15	253 / -57	20	192 / -44	15	208 / -44	16	294 / -51	23	224 / -44	17
		233 / -55	18	233 / -55	18	318 / -65	25	151 / -50	12	351 / -60	27	152 / -50	12	243 / -56	19	191 / -44	15	254 / -57	20	193 / -46	15	208 / -44	16	293 / -51	23	223 / -44	17
12	OHL 400kV Heviz (HUN) - Zerjavinec (CRO)	-143 / 18	11	-145 / 19	11	-166 / 35	13	-150 / 21	11	-116 / 37	9	-151 / 21	12	4 / 5	1	-468 / 53	36	101 / -0	6	-457 / 52	35	-81 / -42	7	-98 / -30	8	94 / -55	8
		-149 / 19	11	-151 / 20	12	-177 / 36	14	-150 / 21	11	-130 / 38	10	-150 / 21	11	-7 / 6	1	-456 / 52	35	82 / 1	6	-443 / 50	34	-82 / -42	7	-106 / -30	8	85 / -54	8
13	OHL 400kV S.Mitrovica (YUG) - Ernestinovo (CRO)	115 / -12	9	113 / -11	9	19 / 5	2	219 / -18	17	-3 / 14	1	217 / -17	17	84 / -6	6	262 / -13	20	66 / 0	5	256 / -12	19	107 / -59	9	-9 / -37	2	59 / -46	6
		118 / -12	9	115 / -11	9	24 / 4	2	219 / -17	17	3 / 13	1	217 / -17	17	89 / -7	7	258 / -13	20	71 / -1	5	250 / -12	19	108 / -59	9	-6 / -37	3	64 / -47	6
14	OHL 400kV Bitola (MKD) - Florina (GRE)	71 / 7	6	56 / 6	5	131 / -1	12	-31 / 11	3	268 / -17	24	-35 / 8	3	252 / -13	22	-46 / 7	4	267 / -16	23	-104 / 4	9	-18 / -79	7	52 / -92	9	205 / -99	20
		71 / 7	6	56 / 6	5	130 / -1	12	-31 / 11	3	267 / -17	24	-35 / 8	3	251 / -13	22	-45 / 7	4	267 / -16	24	-102 / 4	9	-19 / -79	7	51 / -91	9	204 / -99	20
15	OHL 400kV Dubrovo (MKD) - Thessaloniki (GRE)	89 / -18	8	76 / -9	7	143 / -22	13	23 / -15	2	126 / -17	11	20 / -6	2	140 / -24	13	-17 / -12	2	124 / -16	11	-13 / -7	1	139 / 39	13	200 / 35	18	210 / 24	19
		89 / -18	8	76 / -9	7	142 / -22	13	23 / -15	2	125 / -16	11	20 / -6	2	139 / -24	13	-16 / -12	2	123 / -16	11	-12 / -7	1	138 / 39	13	199 / 35	18	209 / 24	19
16	OHL 400kV Arad (ROM) - Sandorfalva (HUN)	-57 / 56	7	-63 / 57	7	-198 / 70	17	106 / 37	9	-263 / 77	23	105 / 37	9	-189 / 74	17	360 / 4	29	-311 / 83	25	433 / -10	36	-7 / 11	1	-153 / 27	13	-162 / 32	14
		-2 / 50	4	-6 / 51	4	-91 / 62	9	98 / 34	8	-129 / 68	12	98 / 34	9	-73 / 62	8	245 / 6	20	-148 / 70	14	302 / -5	25	6 / 2	1	-85 / 15	7	-79 / 17	7
17	OHL 400kV Subotica (YUG) - Sandorfalva (HUN)	-89 / -93	10	-86 / -93	9	-226 / -67	17	88 / -124	15	-327 / -50	25	82 / -124	11	-324 / -55	24	417 / -179	34	-445 / -32	31	367 / -162	30	-94 / 28	7	-226 / 46	17	-361 / 58	27
		-80 / -100	9	-77 / -100	9	-209 / -76	16	87 / -130	12	-305 / -60	23	81 / -129	11	-305 / -64	23	402 / -183	33	-422 / -43	31	347 / -167	29	-92 / 22	7	-215 / 39	16	-348 / 51	26
18	OHL 400kV Kosovo B (YUG) - Skopje 1 (MKD)	152 / -0	11	127 / 7	10	253 / -8	19	1 / 12	1	364 / -11	28	-4 / 20	2	359 / -15	27	-47 / 17	4	362 / -10	26	-96 / 29	8	108 / -19	8	227 / -26	17	373 / -26	28
		151 / -0	11	127 / 7	10	251 / -7	19	2 / 12	1	362 / -11	28	-4 / 20	2	357 / -15	27	-44 / 17	4	361 / -10	28	-94 / 29	8	108 / -19	8	224 / -26	17	371 / -25	28
19	OHL 400kV Djerdap (YUG) - P.D.Fier (ROM)	-71 / -55	7	-61 / -55	6	-19 / -55	4	-120 / -60	10	-22 / -61	5	-130 / -65	11	-96 / -69	9	-193 / -75	14	-38 / -62	5	-243 / -84	19	-45 / -15	4	40 / -19	3	-52 / -31	5
		-79 / -56	7	-69 / -56	7	-34 / -56	5	-119 / -60	10	-42 / -62	6	-129 / -65	11	-113 / -71	10	-176 / -73	14	-61 / -63	7	-223 / -81	18	-47 / -15	4	29 / -19	3	-66 / -31	5
20	OHL 400kV Isaccea (ROM) - Varna (BUL)	232 / -26	15	213 / -44	14	157 / -22	10	308 / -31	20	169 / -42	11	229 / -47	15	-52 / -16	4	432 / -37	27	162 / -41	11	236 / -47	15	172 / -31	11	91 / -28	6	-184 / -17	12
		229 / -26	15	210 / -44	14	152 / -22	10	309 / -31	20	163 / -41	11	229 / -47	15	-58 / -15	4	438 / -37	28	154 / -40	10	242 / -47	16	171 / -31	11	88 / -28	6	-188 / -17	12
21	OHL 400kV Hamitabat (TUR) - Maritsa Istok 3 (BUL) 1	-317 / 89	22	/	/	-516 / 115	35	-136 / 74	10	/	/	/	/	-567 / 120	39	-4 / 70	5	/	/	/	/	-314 / 76	22	-512 / 107	35	-611 / 105	41
		-318 / 89	22	/	/	-517 / 115	35	-136 / 74	10	/	/	/	/	-568 / 120	38	-2 / 70	5	/	/	/	/	-314 / 76	22	-513 / 107	35	-612 / 106	41
22	OHL 400kV Hamitabat (TUR) - Maritsa Istok 3 (BUL) 2	-300 / 85	21	/	/	-489 / 109	33	-129 / 70	10	/	/	/	/	-537 / 113	37	-3 / 66	4	/	/	/	/	-297 / 72	20	-485 / 102	33	-578 / 100	39
		-301 / 85	21	/	/	-490 / 109	33	-128 / 70	10	/	/	/	/	-538 / 114	37	-2 / 66	4	/	/	/	/	-298 / 72	20	-486 / 102	33	-579 / 100	39
23	OHL 400kV Babaeski (TUR) - Filippi (GRE)	-81 / 17	6	/	/	-294 / 42	20	65 / 6	4	/	/	/	/	-195 / 31	13	308 / -2	20	/	/	/	/	-87 / 109	9	-301 / 136	22	-209 / 118	16
		-80 / 17	6	/	/	-292 / 42	20	65 / 6	4	/	/	/	/	-193 / 30	13	305 / -2	21	/	/	/	/	-86 / 109	9	-299 / 135	22	-208 / 117	16
	OHL 400kV Bekescaba (HUN) - Oradea (ROM)	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/
		71 / -41	8	74 / -41	8	140 / -44	6	-9 / -33	3	173 / -45	18	-8 / -33	3	150 / -48	16	-149 / -10	15	216 / -48	22	-169 / -5	17	17 / -43	5	89 / -49	10	110 / -52	12

without new line
with new line

% line load in % commpared to line thermal limit

Table 4.9. Power flows: OHL 400kV Heviz (HUN) - Cirkovce (SLO)

No.	INTERCONNECTION LINE	POWER FLOWS																									
		WINTER																				SUMMER					
		Base case				Scenario 1 UCTE >> TUR (W>>E)		Scenario 2 TUR,GRE >> UCTE (E>>W)		Scenario 3 UCTE >> BUL,GRE,ALB (W>>E)		Scenario 4 BUL,GRE,ROM >> UCTE (E>>W)		Scenario 5 CEN,UKR,ROM >> TUR,GRE (N>>S)		Scenario 6 TUR,BUL >> CEN (S>>N)		Scenario 7 CEN,UKR >> BUL,GRE,ALB (N>>S)		Scenario 8 ROM,BUL,GRE >> CEN (S>>W)		Base case		Scenario 1 UCTE >> TUR (W>>E)		Scenario 5 TUR,GRE >> UCTE (E>>W)	
		With TUR		Without TUR		600		700		1000		700		1000		1500		1000		1500		With TUR		600		1200	
		MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%
1	OHL 400kV Kardia (GRE) - Elbasan (ALB)	99 / 75	9	108 / 73	10	42 / 82	7	181 / 71	14	108 / 77	10	182 / 69	15	12 / 86	7	215 / 70	17	116 / 76	10	235 / 70	18	103 / 77	9	41 / 83	7	-9 / 88	7
		101 / 75	9	109 / 73	10	45 / 81	7	182 / 71	14	110 / 77	10	183 / 69	15	13 / 86	6	219 / 70	17	116 / 76	10	239 / 71	19	104 / 77	9	43 / 82	7	-9 / 88	7
2	OHL 400kV Tantareni (ROM) - Kozloduj (BUL) 1	109 / -56	10	107 / -54	10	168 / -59	14	41 / -52	4	205 / -56	17	46 / -47	5	219 / -54	18	-61 / -47	6	218 / -57	17	27 / -43	4	67 / -34	6	142 / -33	12	212 / -34	17
		111 / -56	10	109 / -54	10	171 / -59	14	43 / -52	5	208 / -57	17	48 / -47	5	220 / -54	18	-57 / -47	6	218 / -57	18	31 / -43	4	68 / -34	6	144 / -34	12	212 / -34	17
3	OHL 400kV Tantareni (ROM) - Kozloduj (BUL) 2	109 / -56	10	107 / -54	10	168 / -59	14	41 / -52	4	205 / -56	17	46 / -47	5	219 / -54	18	-61 / -47	6	218 / -57	17	27 / -43	4	67 / -34	6	142 / -33	12	212 / -34	17
		111 / -56	10	109 / -54	10	171 / -59	14	43 / -52	5	208 / -57	17	48 / -47	5	220 / -54	18	-57 / -47	6	218 / -57	18	31 / -43	4	68 / -34	6	144 / -34	12	212 / -34	17
4	OHL 400kV Nis (YUG) - Sofija west (BUL)	-47 / -71	7	-27 / -64	6	189 / 100	18	-291 / -48	23	160 / -97	16	-266 / -43	23	121 / -98	13	-663 / -18	56	146 / -96	15	-467 / -35	39	18 / 1	2	194 / -15	16	163 / -13	14
		-49 / -71	7	-29 / -64	6	185 / -99	18	-292 / -48	25	156 / -96	15	-268 / -43	23	120 / -98	13	-668 / -18	56	145 / -96	15	-473 / -35	40	17 / 1	2	192 / -14	17	163 / -13	14
5	OHL 400kV Thessaloniki (GRE) - Blagoevgrad (BUL)	-19 / 13	2	25 / 2	2	-62 / 18	5	81 / 5	6	-204 / 29	16	102 / -6	8	-210 / 36	16	27 / 14	2	-220 / 32	17	150 / -8	11	-68 / -47	6	-89 / -45	8	-284 / -23	22
		-21 / 14	2	23 / 2	2	-65 / 18	5	80 / 5	6	-207 / 30	15	100 / -6	8	-211 / 36	16	23 / 14	2	-220 / 32	17	144 / -8	11	-70 / -46	6	-91 / -45	7	-284 / -23	22
6	OHL 400kV Ernestinovo (CRO) - Ugljevik (B&H)	-133 / 73	12	-138 / 74	12	-88 / 63	9	-193 / 75	17	-37 / 57	5	-189 / 75	15	-62 / 65	7	-263 / 66	20	-20 / 60	6	-254 / 68	20	-67 / 4	5	-32 / 0	2	13 / -1	1
		-130 / 77	11	-134 / 78	12	-83 / 69	8	-191 / 79	16	-31 / 60	5	-187 / 80	15	-60 / 70	7	-257 / 71	20	-19 / 65	5	-247 / 73	20	-64 / 6	5	-27 / 2	2	14 / 0	1
7	OHL 400kV Podgorica (YUG) - Trebinje (B&H)	-104 / 1	8	-102 / 1	8	-192 / 9	15	-2 / -7	1	-237 / 15	19	-2 / -7	1	-178 / 6	14	61 / -15	5	-204 / 10	16	55 / -14	5	-39 / -44	5	-125 / -32	10	-128 / -36	11
		-98 / 0	8	-95 / 0	8	-183 / 7	15	1 / -9	1	-228 / 13	18	1 / -9	1	-175 / 5	14	74 / -17	6	-203 / 9	16	67 / -16	5	-36 / -45	5	-119 / -34	10	-128 / -37	11
8	OHL 400kV Konjsko (CRO) - Mostar (B&H)	106 / 32	8	103 / 32	8	225 / 11	17	-27 / 43	4	300 / -3	23	-23 / 43	4	184 / 22	14	-77 / 44	7	233 / 14	17	-68 / 44	6	100 / 33	8	221 / 15	17	196 / 22	15
		93 / 38	8	90 / 38	7	205 / 20	16	-35 / 48	5	281 / 4	21	-32 / 47	4	177 / 27	14	-105 / 48	9	230 / 19	18	-94 / 48	8	92 / 36	7	207 / 19	16	196 / 23	15
9	OHL 400kV Divaca (SLO) - Meline (CRO)	-90 / 14	7	-91 / 15	7	14 / 11	1	-212 / 32	16	68 / -2	5	-209 / 33	16	-53 / 12	4	-195 / 40	15	-28 / 15	3	-191 / 39	15	-98 / -23	7	14 / -17	1	-47 / -18	4
		-100 / 8	8	-101 / 9	8	-1 / 3	0	-218 / 27	17	52 / 2	4	-215 / 28	16	-58 / 6	4	-216 / 41	17	-30 / 9	2	-211 / 40	16	-104 / -29	8	2 / -27	2	-48 / -24	4
10	OHL 400kV Krsko (SLO) - Tumbri (CRO) 1	234 / -55	18	234 / -55	18	319 / -65	25	151 / -50	12	352 / -60	27	152 / -50	11	245 / -56	19	192 / -43	15	253 / -57	20	192 / -44	15	208 / -44	16	294 / -51	23	224 / -44	17
		189 / -41	15	188 / -41	15	251 / -49	19	123 / -36	10	285 / -54	22	124 / -36	10	222 / -43	17	102 / -32	8	244 / -44	19	104 / -33	8	180 / -42	14	244 / -47	19	222 / -43	17
11	OHL 400kV Krsko (SLO) - Tumbri (CRO) 2	234 / -55	18	234 / -55	18	319 / -65	25	151 / -50	12	352 / -60	27	152 / -50	11	245 / -56	19	192 / -43	15	253 / -57	20	192 / -44	15	208 / -44	16	294 / -51	23	224 / -44	17
		189 / -41	15	188 / -41	15	251 / -49	19	123 / -36	10	285 / -54	22	124 / -36	10	222 / -43	17	102 / -32	8	244 / -44	19	104 / -33	8	180 / -42	14	244 / -47	19	222 / -43	17
12	OHL 400kV Heviz (HUN) - Zerjavinec (CRO)	-143 / 18	11	-145 / 19	11	-166 / 35	13	-150 / 21	11	-116 / 37	9	-151 / 21	12	4 / 5	1	-468 / 53	36	101 / -0	6	-457 / 52	35	-81 / -42	7	-98 / -30	8	94 / -55	8
		-60 / 10	5	-61 / 10	5	-40 / 15	3	-100 / 16	8	8 / 20	2	-101 / 16	8	47 / 1	4	-303 / 38	23	118 / -2	9	-296 / 36	23	-29 / -31	3	-5 / -28	2	99 / -40	8
13	OHL 400kV S.Mitrovica (YUG) - Ernestinovo (CRO)	115 / -12	9	113 / -11	9	19 / 5	2	219 / -18	17	-3 / 14	1	217 / -17	17	84 / -6	6	262 / -13	20	66 / 0	5	256 / -12	19	107 / -59	9	-9 / -37	2	59 / -46	6
		127 / -18	10	124 / -17	9	36 / -3	3	227 / -23	17	14 / 8	1	225 / -22	17	89 / -11	7	287 / -18	22	68 / -4	5	280 / -18	21	116 / -64	10	4 / -44	3	59 / -50	6
14	OHL 400kV Bitola (MKD) - Florina (GRE)	71 / 7	6	56 / 6	5	131 / -1	12	-31 / 11	3	268 / -17	24	-35 / 8	3	252 / -13	22	-46 / 7	4	267 / -16	23	-104 / 4	9	-18 / -79	7	52 / -92	9	205 / -99	20
		71 / 8	6	56 / 6	5	130 / -1	12	-31 / 11	3	267 / -17	24	-35 / 8	3	252 / -13	22	-47 / 7	4	267 / -16	24	-104 / 4	9	-19 / -79	7	51 / -91	9	205 / -99	20
15	OHL 400kV Dubrovo (MKD) - Thessaloniki (GRE)	89 / -18	8	76 / -9	7	143 / -22	13	23 / -15	2	126 / -17	11	20 / -6	2	140 / -24	13	-17 / -12	2	124 / -16	11	-13 / -7	1	139 / 39	13	200 / 35	18	210 / 24	19
		89 / -18	8	76 / -9	7	142 / -22	13	22 / -15	2	125 / -16	11	19 / -6	2	140 / -24	13	-19 / -12	2	124 / -16	11	-14 / -7	1	138 / 39	13	200 / 35	18	210 / 24	19
16	OHL 400kV Arad (ROM) - Sandorfalva (HUN)	-57 / 56	7	-63 / 57	7	-198 / 70	17	106 / 37	9	-263 / 77	23	105 / 37	9	-189 / 74	17	360 / 4	29	-311 / 83	25	433 / -10	36	-7 / 11	1	-153 / 27	13	-162 / 32	14
		-65 / 57	7	-70 / 57	7	-209 / 71	18	101 / 37	9	-274 / 78	23	100 / 38	9	-193 / 74	17	346 / 5	29	-312 / 83	27	419 / -8	35	-11 / 11	1	-161 / 28	13	-162 / 32	14
17	OHL 400kV Subotica (YUG) - Sandorfalva (HUN)	-89 / -93	10	-86 / -93	9	-226 / -67	17	88 / -124	15	-327 / -50	25	82 / -124	11	-324 / -55	24	417 / -179	34	-445 / -32	31	367 / -162	30	-94 / 28	7	-226 / 46	17	-361 / 58	27
		-108 / -90	10	-105 / -90	10	-253 / -62	19	76 / -122	11	-354 / -45	26	70 / -121	10	-333 / -54	25	380 / -172	31	-448 / -31	33	330 / -156	27	-106 / 29	8	-247 / 48	19	-362 / 58	27
18	OHL 400kV Kosovo B (YUG) - Skopje 1 (MKD)	152 / -0	11	127 / 7	10	253 / -8	19	1 / 12	1	364 / -11	28	-4 / 20	2	359 / -15	27	-47 / 17	4	362 / -10	26	-96 / 29	8	108 / -19	8	227 / -26	17	373 / -26	28
		151 / -0	11	127 / 7	10	251 / -7	19	1 / 13	1	362 / -11	28	-4 / 20	2	359 / -15	27	-49 / 17	4	361 / -10	28	-97 / 29	8	107 / -19	8	225 / -26	17	373 / -25	28
19	OHL 400kV Djerdap (YUG) - P.D.Fier (ROM)	-71 / -55	7	-61 / -55	6	-19 / -55	4	-120 / -60	10	-22 / -61	5	-130 / -65	11	-96 / -69	9	-193 / -75	14	-38 / -62	5	-243 / -84	19	-45 / -15	4	40 / -19	3	-52 / -31	5
		-74 / -55	7	-64 / -56	6	-23 / -55	4	-121 / -60	10	-26 / -61	5	-132 / -65	11	-98 / -69	9	-198 / -75	16	-38 / -62	5	-248 / -84	20	-46 / -15	3	37 / -19	3	-52 / -31	5
20	OHL 400kV Isaccea (ROM) - Varna (BUL)	232 / -26	15	213 / -44	14	157 / -22	10	308 / -31	20	169 / -42	11	229 / -47	15	-52 / -16	4	432 / -37	27	162 / -41	11	236 / -47	15	172 / -31	11	91 / -28	6	-184 / -17	12
		231 / -26	15	212 / -44	14	155 / -22	10	307 / -31	20	168 / -42	11	228 / -47	15	-53 / -16	3	429 / -37	27	162 / -41	11	233 / -47	15	171 / -31	11	90 / -28	6	-184 / -17	11
21	OHL 400kV Hamitabat (TUR) - Maritsa Istok 3 (BUL) 1	-317 / 89	22	/	/	-516 / 115	35	-136 / 74	10	/	/	/	/	-567 / 120	39	-4 / 70	5	/	/	/	/	-314 / 76	22	-512 / 107	35	-611 / 105	41
		-318 / 89	22	/	/	-517 / 115	35	-136 / 74	10	/	/	/	/	-567 / 120	38	-5 / 70	5	/	/	/	/	-314 / 76	22	-513 / 107	35	-611 / 105	41
22	OHL 400kV Hamitabat (TUR) - Maritsa Istok 3 (BUL) 2	-300 / 85	21	/	/	-489 / 109	33	-129 / 70	10	/	/	/	/	-537 / 113	37	-3 / 66	4	/	/	/	/	-297 / 72	20	-485 / 102	33	-578 / 100	39
		-301 / 85	21	/	/	-489 / 109	33	-129 / 70	10	/	/	/	/	-537 / 114	37	-5 / 66	4	/	/	/	/	-298 / 72	20	-486 / 102	33	-578 / 100	39
23	OHL 400kV Babaeski (TUR) - Filippi (GRE)	-81 / 17	6	/	/	-294 / 42	20	65 / 6	4	/	/	/	/	-195 / 31	13	308 / -2	20	/	/	/	/	-87 / 109	9	-301 / 136	22	-209 / 118	16
		-80 / 17	6	/	/	-293 / 42	20	65 / 6	4	/	/	/	/	-195 / 31	13	310 / -2	21	/	/	/	/	-86 / 109	9	-300 / 135	22	-209 / 118	16
	OHL 400kV Heviz (HUN) - Cirkovce (SLO)	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/
		-145 / -29	11	-147 / -29	11	-220 / -7	17	-87 / -34	7	-218 / 6	17	88 / -34	7	-74 / -38	6	-286 / -6	22	-29 / -42	4	-281 / -7	21	-90 / -75	9	-163 / -61	13	-8 / -84	6

without new line
with new line

% line load in % commpared to line thermal limit

Table 4.10. Power flows: OHL 400kV Skopje (MKD) -Tirana (ALB)

No.	INTERCONNECTION LINE	POWER FLOWS																							
		WINTER																				SUMMER					
		Base case				Scenario 1		Scenario 2		Scenario 3		Scenario 4		Scenario 5		Scenario 6		Scenario 7		Scenario 8		Base case		Scenario 1		Scenario 5	
						UCTE >> TUR (W>>E)		TUR,GRE >> UCTE (E>>W)		UCTE >> BUL,GRE,ALB (W>>E)		BUL,GRE,ROM >> UCTE (E>>W)		CEN,UKR,ROM >> TUR,GRE (N>>S)		TUR,BUL >> CEN (S>>N)		CEN,UKR >> BUL,GRE,ALB (N>>S)		ROM,BUL,GRE >> CEN (S>>W)				UCTE >> TUR (W>>E)		TUR,GRE >> UCTE (E>>W)	
		With TUR		Without TUR		600		700		1000		700		1000		1500		1000		1500		With TUR		600		1200	
		MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%
1	OHL 400kV Kardia (GRE) - Elbasan (ALB)	56/18	4	108/16	8	43/23	4	181/19	13	107/129	12	184/17	14	12/27	2	216/20	16	117/21	9	236/22	18	104/19	8	42/23	4	-13/29	2
		56/-54	6	69/56	7	-29/-41	4	139/-54	11	-30/-39	4	181/-57	14	-78/-35	6	225/-53	17	-16/-18	2	259/-49	20	74/-50	7	-19/-37	3	-106/-25	8
2	OHL 400kV Tantareni (ROM) - Kozloduj (BUL) 1	109/-96	12	108/-94	11	168/-98	16	43/-94	8	207/-93	18	48/-88	8	221/-91	19	-78/-92	10	218/94	19	27/-85	7	67/-74	8	142/-71	13	214/-69	18
		108/-97	12	106/-95	11	162/-98	15	139/-54	8	197/-94	17	51/-69	7	213/-91	19	-71/-93	9	204/-74	17	34/-86	7	67/-75	8	137/-73	12	204/-72	17
3	OHL 400kV Tantareni (ROM) - Kozloduj (BUL) 2	109/-96	12	108/-94	11	168/-98	16	43/-94	8	207/-93	18	48/-88	8	221/-91	19	-78/-92	10	218/94	19	27/-85	7	67/-74	8	142/-71	13	214/-69	18
		108/-97	12	106/-95	11	162/-98	15	47/-95	8	197/-94	17	51/-69	7	213/-91	19	-71/-93	9	204/-74	17	34/-86	7	67/-75	8	137/-73	12	204/-72	17
4	OHL 400kV Nis (YUG) - Sofija west (BUL)	-47/-83	5	-62/-56	4	189/-110	12	-290/-58	16	164/-108	10	-267/-52	14	124/-109	9	-674/-18	36	147/108	10	-467/-39	25	18/-33	2	195/-45	11	168/-44	9
		-58/-76	5	-34/-69	4	164/-101	10	-281/-52	15	126/-97	8	-259/-46	14	92/-99	7	-655/-11	35	111/-97	8	-449/-33	24	16/-27	2	181/-38	10	145/-36	8
5	OHL 400kV Thessaloniki (GRE) - Blagoevgrad (BUL)	-20/-36	3	26/-47	4	-62/-31	5	80/-42	7	-208/-15	16	102/-52	9	-211/-6	16	19/-36	3	-219/-7	17	150/-52	12	-69/-94	9	-89/-91	10	-286/-56	22
		-9/-33	3	36/-44	4	-34/-31	4	-65/-37	6	-146/-22	11	86/-46	7	-177/-8	14	-6/-30	2	-163/-13	12	115/-46	9	-66/-89	8	-70/-90	9	-255/-59	20
6	OHL 400kV Ernestinovo (CRO) - Ugljevik (B&H)	-135/62	11	-138/62	11	-94/53	8	-189/64	15	34/-4	3	-190/64	15	-66/54	6	-258/57	20	-20/48	4	-255/59	20	-69/-8	5	-39/-11	3	8/-14	1
		-131/-58	11	-135/59	11	-81/49	7	-201/63	16	-15/40	3	-199/63	16	-51/50	5	-273/58	21	-3/43	3	-270/60	21	-70/-14	5	-27/-18	2	24/-20	2
7	OHL 400kV Podgorica (YUG) - Trebinje (B&H)	-104/-15	8	-102/-16	8	-193/-4	15	-2/-25	2	-240/3	19	-2/-26	2	-180/-8	14	65/-33	6	-205/-4	16	55/-32	5	-40/-61	6	-126/-49	11	-130/-51	11
		-124/19	10	-118/17	9	-250/36	20	38/5	3	-335/46	27	29/4	2	-249/31	20	120/-2	10	-291/38	23	115/-2	9	-42/-31	4	-169/-13	13	-195/-17	16
8	OHL 400kV Konjsko (CRO) - Mostar (B&H)	106/1	8	104/1	8	223/-15	17	-24/10	2	305/-26	23	-24/10	2	183/-6	14	-75/13	6	234/-12	18	-38/13	3	99/1	8	216/-12	16	195/-7	15
		109/-3	8	106/-3	8	231/-19	18	-32/7	2	316/-31	24	-30/7	2	192/-11	15	-83/10	6	244/-16	19	-76/9	6	99/-5	8	225/-19	17	204/-13	16
9	OHL 400kV Divaca (SLO) - Meline (CRO)	-90/-4	7	-91/-4	7	13/-8	1	-209/16	16	74/-24	6	-211/17	16	-53/-6	4	-195/23	15	-29/-5	2	-191/23	15	-98/-38	8	11/-34	3	-47/-38	5
		-89/-7	7	-90/-6	7	16/-9	1	-212/15	16	77/24	6	-213/15	16	-50/-8	4	-198/23	15	-27/-6	2	-193/22	15	-99/-44	8	16/-38	3	-45/-37	4
10	OHL 400kV Krsko (SLO) - Tumbri (CRO) 1	234/-66	18	234/-66	18	319/-74	25	152/-64	13	357/-66	28	152/-64	13	246/-67	19	191/-54	15	254/-68	20	194/-57	15	209/-57	16	294/-61	23	226/-57	18
		234/-67	18	234/-67	18	319/-74	25	152/-65	13	335/-67	26	151/-65	12	245/-68	19	191/-55	15	252/-68	20	194/-57	15	208/-58	16	295/-63	23	225/-57	18
11	OHL 400kV Krsko (SLO) - Tumbri (CRO) 2	234/-66	18	234/-66	18	319/-74	25	152/-64	13	357/-66	28	152/-64	13	246/-67	19	191/-54	15	254/-68	20	194/-57	15	209/-57	16	294/-61	23	226/-57	18
		234/-67	18	234/-67	18	319/-74	25	152/-65	25	335/-67	26	151/-65	12	245/-68	19	191/-55	15	252/-68	20	194/-57	15	208/-58	16	295/-63	23	225/-57	18
12	OHL 400kV Heviz (HUN) - Zerjavinec (CRO)	-143/-28	11	-145/-27	11	-164/-10	12	-150/-24	12	-115/-10	9	-152/-24	12	7/-45	3	-470/42	36	102/-49	9	-456/39	35	-81/-92	9	-97/-80	10	98/-105	11
		-141/-30	11	-144/-29	11	-156/-13	12	-158/-24	12	-103/-13	8	-158/-24	12	16/-47	4	-476/43	36	112/-51	9	-462/40	35	-81/-94	9	-90/-83	9	106/-107	11
13	OHL 400kV S.Mitrovica (YUG) - Ernestinovo (CRO)	116/-57	10	113/-57	10	20/-42	4	219/-57	17	-7/-32	3	220/-57	17	83/-53	7	267/-49	21	67/-47	6	257/-49	20	108/-70	10	-7/-51	4	56/59	6
		120/-60	10	116/-60	10	34/-46	4	207/-59	16	17/-36	3	211/-59	17	100/-56	9	249/-50	19	88/-51	8	238/-50	18	107/-75	10	1/-55	4	75/-64	7
14	OHL 400kV Bitola (MKD) - Florina (GRE)	72/-4	6	57/-6	5	131/-13	12	-30/-1	3	272/-25	24	-35/-4	3	254/-24	22	-43/-4	4	268/-28	24	-103/-7	9	-19/-91	8	52/-104	10	173/-119	18
		52/18	5	37/17	4	108/10	10	-69/22	6	217/0	19	-47/-18	4	225/0	20	-58/17	5	213/-3	19	-108/14	10	-37/-62	6	29/-73	7	137/-86	14
15	OHL 400kV Dubrovo (MKD) - Thessaloniki (GRE)	90/-50	9	77/-41	8	144/-52	13	24/-50	5	128/-46	12	20/-40	4	141/-55	13	-15/-45	4	124/-48	12	-14/-41	4	139/11	12	201/9	18	236/4	21
		81/-38	8	68/-29	7	136/-40	12	0/-36	3	105/-33	10	12/-28	3	132/-41	12	-27/-33	4	101/-34	9	-20/29	3	131/27	12	193/25	17	223/22	20
16	OHL 400kV Arad (ROM) - Sandorfalva (HUN)	-57/26	5	-63/26	6	-197/44	17	103/8	9	-267/55	22	106/8	9	-190/47	16	361/-12	30	-310/63	26	439/-20	36	-7/-19	2	-150/-1	12	-163/6	13
		-54/26	5	-61/26	5	-186/42	16	95/9	8	-250/53	21	101/8	8	-177/45	15	349/-11	29	-294/61	25	427/-19	35	-7/-19	2	-144/-1	12	-150/4	12
17	OHL 400kV Subotica (YUG) - Sandorfalva (HUN)	-88/-106	10	-86/-106	10	-223/-79	18	83/-136	12	-335/-56	25	86/-137	12	-235/-63	18	424/-183	34	-445/-35	33	376/-163	30	-94/16	7	-219/35	16	-364/59	27
		-88/-106	10	-86/-106	10	-219/-80	17	81/-136	12	-327/-58	25	84/-136	12	-320/-65	24	416/-182	34	-438/-38	33	366/-167	30	-94/16	7	-223/35	17	-360/52	27
18	OHL 400kV Kosovo B (YUG) - Skopje 1 (MKD)	153/-27	12	128/-20	10	254/-31	19	4/-18	1	370/-23	28	-5/-11	1	363/-31	27	-42/-12	3	364/-29	27	-95/-1	7	109/47	9	227/-50	17	368/-44	28
		149/-55	12	126/-48	10	208/-55	16	0/2	0	296/-48	23	44/-42	5	308/-58	24	37/-42	4	300/-56	23	-13/-35	3	123/-78	11	199/-79	16	320/-76	25
19	OHL 400kV Djerdap (YUG) - P.D.Fier (ROM)	-71/-56	7	-62/-56	6	-19/-56	4	-120/-60	10	-23/-62	5	-130/-66	11	-97/-70	9	-191/-74	15	-39/-63	6	-243/-84	19	-45/-16	4	42/-20	3	-52/-32	5
		-74/-55	7	-63/55	6	-26/-54	5	-117/-58	10	-32/-60	5	-127/-65	11	-105/-69	9	-187/-72	15	-47/-60	6	-239/-83	19	-46/-12	4	33/-15	3	-65/-27	5
20	OHL 400kV Isaccea (ROM) - Varna (BUL)	-232/-58	15	-213/-40	14	-157/-69	11	-307/-42	20	-168/-48	11	-229/-36	15	53/-82	6	-394/-20	25	-162/-49	11	-235/-35	15	-172/-62	12	-92/-70	7	186/-76	13
		-233/-58	15	-213/-40	14	-162/-69	11	0/2	19	-173/-47	11	-228/-37	15	47/-82	6	-390/-21	25	-166/-48	11	-232/-36	15	-172/-63	12	-96/-70	7	180/-76	12
21	OHL 400kV Hamitabat (TUR) - Maritsa Istok 3 (BUL) 1	-300/52	20	/	/	-486/100	33	-136/33	9	/	/	/	/	-534/112	36	5/19	1	/	/	/	/	-313/45	21	-510/100	35	-608/116	41
		-297/51	20	/	/	-479/98	33	-140/33	10	/	/	/	/	-525/109	36	-1/19	1	/	/	/	/	-312/44	21	-505/98	34	-599/113	41
22	OHL 400kV Hamitabat (TUR) - Maritsa Istok 3 (BUL) 2	-316/60	21	/	/	-513/110	35	-129/26	9	/	/	/	/	-563/123	38	5/25	2	/	/	/	/	-297/38	20	-483/90	33	-576/105	39
		-314/59	21	/	/	-506/108	34	-133/26	9	/	/	/	/	-555/120	38	-1/25	2	/	/	/	/	-296/37	20	-478/88	32	-568/102	38
23	OHL 400kV Babaeski (TUR) - Filippi (GRE)	-81/-72	7	/	/	-293/-32	20	66/-86	7	/	/	/	/	-195/-53	13	292/-77	20	/	/	/	/	-87/21	6	-300/65	20	-207/38	14
		-86/-76	8	/	/	-307/-32	21	73/-90	8	/	/	/	/	-211/-54	15	304/-79	21	/	/	/	/	-89/16	6	-310/63	21	-233/37	16
		/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/
	OHL 400kV Skopje(MKD) -Tirana (ALB)*	25/-63	5	27/-65	5	-19/-56	4	155/-17	12	-2/-52	4	74/-67	8	-20/-55	4	113/-65	10	10/-56	4	102/-66	9	43/-79	7	0/-74	6	-2/-73	6

*Simultaneously in operation with the line Elbasan-Tirana-Podgorica

without new line

with new line

% line load in % commpared to line thermal limit

Table 4.11. Power flows: OHL 400kV Chervena Mogila (BUL) - Stip (MKD)

No.	INTERCONNECTION LINE	POWER FLOWS																									
		WINTER																				SUMMER					
		Base case				Scenario 1 UCTE >> TUR (W>>E)		Scenario 2 TUR,GRE >> UCTE (E>>W)		Scenario 3 UCTE >> BUL,GRE,ALB (W>>E)		Scenario 4 BUL,GRE,ROM >> UCTE (E>>W)		Scenario 5 CEN,UKR,ROM >> TUR,GRE (N>>S)		Scenario 6 TUR,BUL >> CEN (S>>N)		Scenario 7 CEN,UKR >> BUL,GRE,ALB (N>>S)		Scenario 8 ROM,BUL,GRE >> CEN (S>>W)		Base case		Scenario 1 UCTE >> TUR (W>>E)		Scenario 5 TUR,GRE >> UCTE (E>>W)	
		With TUR		Without TUR		600		700		1000		700		1000		1500		1000		1500		With TUR		600		1200	
		MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%
1	OHL 400kV Kardia (GRE) - Elbasan (ALB)	100/18	8	108/16	8	43/23	4	181/19	13	107/129	12	184/17	14	12/27	2	216/20	16	117/21	9	236/22	18	104/19	8	42/23	4	-13/29	2
		101/18	8	108/16	8	44/24	4	180/19	13	115/18	9	181/18	13	19/26	2	218/20	16	126/21	9	232/23	17	104/20	8	42/24	4	-7/29	2
2	OHL 400kV Tantareni (ROM) - Kozloduj (BUL) 1	109/-96	12	108/-94	11	168/-98	16	43/-94	8	207/-93	18	48/-88	8	221/-91	19	-78/-92	10	218/94	19	27/-85	7	67/-74	8	142/-71	13	214/-69	18
		110/-98	12	107/-96	11	169/-99	16	180/19	8	211/-95	19	46/-89	8	225/-92	19	-77/-94	10	222/-96	19	26/-86	7	68/-77	8	142/-75	13	290/-73	24
3	OHL 400kV Tantareni (ROM) - Kozloduj (BUL) 2	109/-96	12	108/-94	11	168/-98	16	43/94	8	207/-93	18	48/-88	8	221/-91	19	-78/-92	10	218/94	19	27/-85	7	67/-74	8	142/-71	13	214/-69	18
		110/-98	12	107/-96	11	169/-99	16	42/-96	8	211/-95	19	46/-89	8	225/-92	19	-77/-94	10	222/-96	19	26/-86	7	68/-77	8	142/-75	13	290/-73	24
4	OHL 400kV Nis (YUG) - Sofija west (BUL)	-47/-83	5	-62/-56	4	189/-110	12	-290/-58	16	164/-108	10	-267/-52	14	124/-109	9	-674/-18	36	147/108	10	-467/-39	25	18/-33	2	195/-45	11	168/-44	9
		-42/-93	5	-31/-85	5	196/-120	12	-299/-66	16	214/-121	13	-283/-59	15	168/-122	11	-662/-27	35	200/-122	12	-491/-44	26	20/-37	2	194/-48	11	199/-48	11
5	OHL 400kV Thessaloniki (GRE) - Blagoevgrad (BUL)	-20/-36	3	26/-47	4	-62/-31	5	80/-42	7	-208/-15	16	102/-52	9	-211/-6	16	19/-36	3	-219/-7	17	150/-52	12	-69/-94	9	-89/-91	10	-286/-56	22
		-15/-42	3	20/-52	4	-55/-37	5	69/-46	6	-148/-30	12	83/-55	8	-162/-19	12	32/-42	4	-155/-23	12	121/-55	10	-65/-96	9	-91/-93	10	-236/-68	19
6	OHL 400kV Ernestinovo (CRO) - Ugljevik (B&H)	-135/62	11	-138/62	11	-94/53	8	-189/64	15	34/-4	3	-190/64	15	-66/54	6	-258/57	20	-20/48	4	-255/59	20	-69/-8	5	-39/-11	3	8/-14	1
		-135/62	11	-138/62	11	-95/53	8	-188/64	15	-39/44	4	-189/-64	15	-70/-54	7	-259/57	20	-25/48	4	-252/-58	20	-69/-8	5	-39/-12	3	4/-14	1
7	OHL 400kV Podgorica (YUG) - Trebinje (B&H)	-104/-15	8	-102/-16	8	-193/-4	15	-2/-25	2	-240/3	19	-2/-26	2	-180/-8	14	65/-33	6	-205/-4	16	55/-32	5	-40/-61	6	-126/-49	11	-130/-51	11
		-104/-14	8	-102/-15	8	-193/-4	15	-2/-25	2	-237/3	19	14/2	1	-178/-8	14	66/-32	6	-201/-4	16	53/-31	5	-40/-60	6	-126/-48	11	-127/-51	11
8	OHL 400kV Konjsko (CRO) - Mostar (B&H)	106/1	8	104/1	8	223/-15	17	-24/10	2	305/-26	23	-24/10	2	183/-6	14	-75/13	6	234/-12	18	-38/13	3	99/1	8	216/-12	16	195/-7	15
		106/1	8	104/1	8	222/-15	17	-24/10	2	303/-26	23	-24/10	2	181/-6	14	-76/13	6	231/-12	18	-65/12	5	99/1	8	216/-12	16	193/-7	15
9	OHL 400kV Divaca (SLO) - Meline (CRO)	-90/-4	7	-91/-4	7	13/-8	1	-209/16	16	74/-24	6	-211/17	16	-53/-6	4	-195/23	15	-29/-5	2	-191/23	15	-98/-38	8	11/-34	3	-47/-38	5
		-90/-4	7	-91/-4	7	13/-8	1	-209/16	16	73/-24	6	-210/17	16	-53/-6	4	-196/23	15	-30/-5	2	-190/22	15	-99/-38	8	11/-34	3	-47/-34	4
10	OHL 400kV Krsko (SLO) - Tumbri (CRO) 1	234/-66	18	234/-66	18	319/-74	25	152/-64	13	357/-66	28	152/-64	13	246/-67	19	191/-54	15	254/-68	20	194/-57	15	209/-57	16	294/-61	23	226/-57	18
		234/-66	18	234/-66	18	319/-74	25	152/-65	13	356/-66	27	152/-64	13	246/-67	19	191/-54	15	254/-68	20	194/-57	15	208/-57	16	294/-61	23	226/-57	18
11	OHL 400kV Krsko (SLO) - Tumbri (CRO) 2	234/-66	18	234/-66	18	319/-74	25	152/-64	13	357/-66	28	152/-64	13	246/-67	19	191/-54	15	254/-68	20	194/-57	15	209/-57	16	294/-61	23	226/-57	18
		234/-66	18	234/-66	18	319/-74	25	152/-65	25	356/-66	27	152/-64	13	246/-67	19	191/-54	15	254/-68	20	194/-57	15	208/-57	16	294/-61	23	226/-57	18
12	OHL 400kV Heviz (HUN) - Zerjavinec (CRO)	-143/-28	11	-145/-27	11	-164/-10	12	-150/-24	12	-115/-10	9	-152/-24	12	7/-45	3	-470/42	36	102/-49	9	-456/39	35	-81/-92	9	-97/-80	10	98/-105	11
		-143/-28	11	-145/-28	11	-164/-10	12	-150/-24	12	-117/-10	9	-152/-24	12	4/-44	3	-470/42	36	99/-49	8	-452/38	34	-81/-92	9	-97/-81	10	96/-105	11
13	OHL 400kV S.Mitrovica (YUG) - Ernestinovo (CRO)	116/-57	10	113/-57	10	20/-42	4	219/-57	17	-7/-32	3	220/-57	17	83/-53	7	267/-49	21	67/-47	6	257/-49	20	108/-70	10	-7/-51	4	56/59	6
		115/-57	10	113/-57	10	19/-42	4	220/-57	17	-10/-32	3	221/-57	17	80/-53	7	266/-49	21	63/-47	6	257/-50	20	-69/-8	5	-7/-51	4	52/-59	6
14	OHL 400kV Bitola (MKD) - Florina (GRE)	72/-4	6	57/-6	5	131/-13	12	-30/-1	3	272/-25	24	-35/-4	3	254/-24	22	-43/-4	4	268/-28	24	-103/-7	9	-19/-91	8	52/-104	10	173/-119	18
		75/13	7	54/12	5	135/4	12	-37/16	4	299/-8	26	-44/14	4	285/-9	25	35/11	3	297/-14	26	-116/-11	10	-18/-67	6	50/-79	8	204/-99	20
15	OHL 400kV Dubrovo (MKD) - Thessaloniki (GRE)	90/-50	9	77/-41	8	144/-52	13	24/-50	5	128/-46	12	20/-40	4	141/-55	13	-15/-45	4	124/-48	12	-14/-41	4	139/11	12	201/9	18	236/4	21
		95/-36	9	74/-27	7	151/-38	14	14/-35	3	169/-34	15	7/-25	2	186/-43	17	-3/-33	3	169/-37	15	-33/-25	4	143/33	13	200/-31	18	280/25	25
16	OHL 400kV Arad (ROM) - Sandorfalva (HUN)	-57/26	5	-63/26	6	-197/44	17	103/8	9	-267/55	22	106/8	9	-190/47	16	361/-12	30	-310/63	26	439/-20	36	-7/-19	2	-150/-1	12	-163/6	13
		-58/26	5	-63/26	6	-197/-44	17	104/8	9	-271/56	23	108/8	9	-193/-48	16	360/-12	30	-314/64	26	439/-20	36	-7/-19	2	-150/-1	12	-167/6	14
17	OHL 400kV Subotica (YUG) - Sandorfalva (HUN)	-88/-106	10	-86/-106	10	-223/-79	18	83/-136	12	-335/-56	25	86/-137	12	-235/-63	18	424/-183	34	-445/-35	33	376/-163	30	-94/16	7	-219/35	16	-364/59	27
		-89/-106	10	-86/-106	10	-223/-79	18	83/-136	12	-333/-56	25	86/-137	12	-325/-63	25	426/-183	34	-444/35	33	370/-167	30	-94/16	7	-219/35	16	-362/53	27
18	OHL 400kV Kosovo B (YUG) - Skopje 1 (MKD)	153/-27	12	128/-20	10	254/-31	19	4/-18	1	370/-23	28	-5/-11	1	363/-31	27	-42/-12	3	364/-29	27	-95/-1	7	109/47	9	227/-50	17	368/-44	28
		149/-36	12	132/-30	10	248/-39	19	12/-28	2	324/-33	24	10/-21	2	322/-40	24	-53/-20	4	314/-38	24	-73/-13	6	106/-60	9	229/-63	18	333/-58	25
19	OHL 400kV Djerdap (YUG) - P.D.Fier (ROM)	-71/-56	7	-62/-56	6	-19/-56	4	-120/-60	10	-23/-62	5	-130/-66	11	-97/-70	9	-191/-74	15	-39/-63	6	-243/-84	19	-45/-16	4	42/-20	3	-52/-32	5
		-71/-54	7	-62/-54	6	-19/-54	4	-121/-59	10	-17/-60	5	132/-65	11	-93/-69	9	-190/-72	15	33/-60	5	-247/-84	20	-45/-14	4	41/-18	3	-43/-30	4
20	OHL 400kV Isaccea (ROM) - Varna (BUL)	-232/-58	15	-213/-40	14	-157/-69	11	-307/-42	20	-168/-48	11	-229/-36	15	53/-82	6	-394/-20	25	-162/-49	11	-235/-35	15	-172/-62	12	-92/-70	7	186/-76	13
		-232/-59	15	-213/-41	14	-158/-70	11	12/-28	20	-166/-48	11	-230/-36	15	53/-83	6	-394/-20	25	-160/50	11	-236/-36	15	-172/-63	12	-92/-71	7	187/-77	13
21	OHL 400kV Hamitabat (TUR) - Maritsa Istok 3 (BUL) 1	-300/52	20	/	/	-486/100	33	-136/33	9	/	/	/	/	-534/112	36	5/19	1	/	/	/	/	-313/45	21	-510/100	35	-608/116	41
		-299/51	20	/	/	-484/98	33	-139/32	10	/	/	/	/	-524/108	36	7/18	1	/	/	/	/	-312/43	21	-510/99	35	-597/112	40
22	OHL 400kV Hamitabat (TUR) - Maritsa Istok 3 (BUL) 2	-316/60	21	/	/	-513/110	35	-129/26	9	/	/	/	/	-563/123	38	5/25	2	/	/	/	/	-297/38	20	-483/90	33	-576/0	38
		-315/59	21	/	/	-511/109	35	-131/26	9	/	/	/	/	-554/119	38	8/24	2	/	/	/	/	-296/36	20	-483/89	33	-566/101	38
23	OHL 400kV Babaeski (TUR) - Filippi (GRE)	-81/-72	7	/	/	-293/-32	20	66/-86	7	/	/	/	/	-195/-53	13	292/-77	20	/	/	/	/	-87/21	6	-300/65	20	-207/38	14
		-84/-75	7	/	/	-297/-33	20	71/-89	8	/	/	/	/	-214/-52	15	287/-80	20	/	/	/	/	-89/17	6	-300/62	20	-227/39	15
	OHL 400kV Chervena Mogila(BG) - Stip (MKD)	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/
		13/-52	4	-11/-48	4	18/-53	4	-27/-48	4	120/-57	10	-38/-45	4	120/-61	10	32/-54	5	129/-62	11	-56/-43	5	7/-31	2	-6/-30	2	115/-38	9

without new line
with new line

% line load in % commpared to line thermal limit

Table 4.12. Power flows: OHL 400kV Maritsa Iztok 3(BUL) - Filippi (GRE)

No.	INTERCONNECTION LINE	POWER FLOWS																									
		WINTER																				SUMMER					
		Base case				Scenario 1 UCTE >> TUR (W>>E)		Scenario 2 TUR,GRE >> UCTE (E>>W)		Scenario 3 UCTE >> BUL,GRE,ALB (W>>E)		Scenario 4 BUL,GRE,ROM >> UCTE (E>>W)		Scenario 5 CEN,UKR,ROM >> TUR,GRE (N>>S)		Scenario 6 TUR,BUL >> CEN (S>>N)		Scenario 7 CEN,UKR >> BUL,GRE,ALB (N>>S)		Scenario 8 ROM,BUL,GRE >> CEN (S>>W)		Base case		Scenario 1 UCTE >> TUR (W>>E)		Scenario 5 TUR,GRE >> UCTE (E>>W)	
		With TUR		Without TUR		600		700		1000		700		1000		1500		1000		1500		With TUR		600		1200	
		MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%	MW/Mvar	%
1	OHL 400kV Kardia (GRE) - Elbasan (ALB)	100/18	8	108/16	8	43/23	4	181/19	13	107/129	12	184/17	14	12/27	2	216/20	16	117/21	9	236/22	18	104/19	8	42/23	4	-13/29	2
		106/18	8	116/16	9	46/23	4	187/19	14	125/8	9	187/18	14	20/26	2	226/21	17	136/20	10	238/23	18	109/20	8	44/24	4	-5/29	2
2	OHL 400kV Tantareni (ROM) - Kozloduj (BUL) 1	109/-96	12	108/-94	11	168/-98	16	43/-94	8	207/-93	18	48/-88	8	221/-91	19	-78/-92	10	218/94	19	27/-85	7	67/-74	8	142/-71	13	214/-69	18
		110/-97	12	104/-95	11	169/-98	16	187/19	8	208/-95	18	48/-89	8	222/-92	19	-77/-93	10	219/-96	19	28/-86	7	69/-75	8	143/-72	13	216/-70	18
3	OHL 400kV Tantareni (ROM) - Kozloduj (BUL) 2	109/-96	12	108/-94	11	168/-98	16	43/-94	8	207/-93	18	48/-88	8	221/-91	19	-78/-92	10	218/94	19	27/-85	7	67/-74	8	142/-71	13	214/-69	18
		110/-97	12	104/-95	11	169/-98	16	43/-95	8	208/-95	18	48/-89	8	222/-92	19	-77/-93	10	219/-96	19	28/-86	7	69/-75	8	143/-72	13	216/-70	18
4	OHL 400kV Nis (YUG) - Sofija west (BUL)	-47/-83	5	-62/-56	4	189/-110	12	-290/-58	16	164/-108	10	-267/-52	14	124/-109	9	-674/-18	36	147/108	10	-467/-39	25	18/-33	2	195/-45	11	168/-44	9
		-30/-87	5	-4/-82	4	201/-113	12	-271/-62	15	221/-116	13	-257/-56	14	149/-113	10	-644/-25	34	205/-116	12	-463/-42	25	29/-35	2	200/-46	11	186/-45	10
5	OHL 400kV Thessaloniki (GRE) - Blagoevgrad (BUL)	-20/-36	3	26/-47	4	-62/-31	5	80/-42	7	-208/-15	16	102/-52	9	-211/-6	16	19/-36	3	-219/-7	17	150/-52	12	-69/-94	9	-89/-91	10	-286/-56	22
		13/-39	3	69/-50	6	-42/-32	4	115/-44	9	-100/-31	8	122/-51	10	-164/-13	13	77/-42	7	-108/-25	8	159/-51	13	-38/-89	7	-74/-85	9	-239/-57	19
6	OHL 400kV Ernestinovo (CRO) - Ugljevik (B&H)	-135/62	11	-138/62	11	-94/53	8	-189/64	15	34/-4	3	-190/64	15	-66/54	6	-258/57	20	-20/48	4	-255/59	20	-69/-8	5	-39/-11	3	8/-14	1
		-137/62	11	-141/63	12	-95/53	8	-191/65	15	-42/44	5	-191/65	15	-69/54	7	-262/58	20	-28/48	4	-255/59	20	-71/-8	5	-40/-11	3	5/-14	1
7	OHL 400kV Podgorica (YUG) - Trebinje (B&H)	-104/-15	8	-102/-16	8	-193/-4	15	-2/-25	2	-240/3	19	-2/-26	2	-180/-8	14	65/-33	6	-205/-4	16	55/-32	5	-40/-61	6	-126/-49	11	-130/-51	11
		-103/-15	8	-100/-16	8	-193/-4	15	0/-25	2	-236/3	19	-1/-26	2	-179/-8	14	67/-33	6	-200/-4	16	55/-32	5	-39/-61	6	-125/-49	11	-128/-51	11
8	OHL 400kV Konjsko (CRO) - Mostar (B&H)	106/1	8	104/1	8	223/-15	17	-24/10	2	305/-26	23	-24/10	2	183/-6	14	-75/13	6	234/-12	18	-38/13	3	99/1	8	216/-12	16	195/-7	15
		105/1	8	103/1	8	222/-15	17	-25/10	2	301/-26	23	-25/10	2	181/-6	14	-78/13	6	229/-12	17	-68/13	5	98/2	7	215/-12	16	193/-7	15
9	OHL 400kV Divaca (SLO) - Meline (CRO)	-90/-4	7	-91/-4	7	13/-8	1	-209/16	16	74/-24	6	-211/17	16	-53/-6	4	-195/23	15	-29/-5	2	-191/23	15	-98/-38	8	11/-34	3	-47/-38	5
		-91/-4	7	-92/-4	7	14/-8	1	-210/16	16	73/-23	6	-211/17	16	-53/-6	4	-196/24	15	-31/-5	2	-191/23	15	-99/-38	8	11/-34	3	-47/-34	4
10	OHL 400kV Krsko (SLO) - Tumbri (CRO) 1	234/-66	18	234/-66	18	319/-74	25	152/-64	13	357/-66	28	152/-64	13	246/-67	19	191/-54	15	254/-68	20	194/-57	15	209/-57	16	294/-61	23	226/-57	18
		234/-66	18	234/-66	18	319/74	25	152/-64	13	356/-66	27	152/-64	13	246/-67	19	191/-54	15	253/-68	20	194/-57	15	208/-57	16	293/-61	23	226/-57	18
11	OHL 400kV Krsko (SLO) - Tumbri (CRO) 2	234/-66	18	234/-66	18	319/-74	25	152/-64	13	357/-66	28	152/-64	13	246/-67	19	191/-54	15	254/-68	20	194/-57	15	209/-57	16	294/-61	23	226/-57	18
		234/-66	18	234/-66	18	319/74	25	152/-64	25	356/-66	27	152/-64	13	246/-67	19	191/-54	15	253/-68	20	194/-57	15	208/-57	16	293/-61	23	226/-57	18
12	OHL 400kV Heviz (HUN) - Zerjavinec (CRO)	-143/-28	11	-145/-27	11	-164/-10	12	-150/-24	12	-115/-10	9	-152/-24	12	7/-45	3	-470/42	36	102/-49	9	-456/39	35	-81/-92	9	-97/-80	10	98/-105	11
		-144/-28	11	-147/-27	11	-165/-10	13	-152/-24	12	-120/-10	9	-153/-24	12	5/-44	3	-472/42	36	96/-49	8	-457/39	35	-82/-92	9	-98/-81	10	96/-105	11
13	OHL 400kV S.Mitrovica (YUG) - Ernestinovo (CRO)	116/-57	10	113/-57	10	20/-42	4	219/-57	17	-7/-32	3	220/-57	17	83/-53	7	267/-49	21	67/-47	6	257/-49	20	108/-70	10	-7/-51	4	56/59	6
		114/-57	10	111/-57	9	18/-42	3	217/-57	17	-12/-32	3	219/-57	17	80/-53	7	264/-49	20	61/-47	6	256/-49	20	106/-70	10	-8/-51	4	53/-59	6
14	OHL 400kV Bitola (MKD) - Florina (GRE)	72/-4	6	57/-6	5	131/-13	12	-30/-1	3	272/-25	24	-35/-4	3	254/-24	22	-43/-4	4	268/-28	24	-103/-7	9	-19/-91	8	52/-104	10	173/-119	18
		61/-3	5	43/-4	4	125/-12	11	-41/-1	4	297/-18	26	-42/-4	4	239/-21	21	-62/-4	5	232/-22	21	-105/-7	9	-28/-88	8	48/-101	10	159/-114	17
15	OHL 400kV Dubrovo (MKD) - Thessaloniki (GRE)	90/-50	9	77/-41	8	144/-52	13	24/-50	5	128/-46	12	20/-40	4	141/-55	13	-15/-45	4	124/-48	12	-14/-41	4	139/11	12	201/9	18	236/4	21
		81/51	8	65/-43	7	138/-53	13	14/-50	5	48/-45	6	15/-42	4	129/-5	11	-31/-46	5	94/-47	9	-16/-43	4	132/5	12	198/2	17	225/-1	20
16	OHL 400kV Arad (ROM) - Sandorfalva (HUN)	-57/26	5	-63/26	6	-197/44	17	103/8	9	-267/55	22	106/8	9	-190/47	16	361/-12	30	-310/63	26	439/-20	36	-7/-19	2	-150/-1	12	-163/6	13
		-60/26	5	-67/27	6	-199/44	17	100/8	8	-276/55	23	104/8	9	-194/47	16	356/-11	29	-320/64	27	438/-19	36	-10/-19	2	-151/-1	12	-168/6	14
17	OHL 400kV Subotica (YUG) - Sandorfalva (HUN)	-88/-106	10	-86/-106	10	-223/-79	18	83/-136	12	-335/-56	25	86/-137	12	-235/-63	18	424/-183	34	-445/-35	33	376/-163	30	-94/16	7	-219/35	16	-364/59	27
		-88/106	10	-85/-106	10	-223/-78	18	84/-136	12	-331/-56	25	86/-137	12	-234/-63	18	426/-183	34	-441/-35	33	377/-168	31	-92/15	7	-218/34	16	-362/53	27
18	OHL 400kV Kosovo B (YUG) - Skopje 1 (MKD)	153/-27	12	128/-20	10	254/-31	19	4/-18	1	370/-23	28	-5/-11	1	363/-31	27	-42/-12	3	364/-29	27	-95/-1	7	109/47	9	227/-50	17	368/-44	28
		135/27	10	105/-20	8	243/-32	18	-15/-17	2	311/-24	23	-15/-13	2	337/-33	25	-74/-8	6	303/-32	23	-100/-2	8	94/-51	8	220/-55	17	345/-50	26
19	OHL 400kV Djerdap (YUG) - P.D.Fier (ROM)	-71/-56	7	-62/-56	6	-19/-56	4	-120/-60	10	-23/-62	5	-130/-66	11	-97/-70	9	-191/-74	15	-39/-63	6	-243/-84	19	-45/-16	4	42/-20	3	-52/-32	5
		-67/-55	7	-55/-55	6	-16/-56	4	-115/-60	10	-7/-60	5	-121/-65	10	-90/-69	8	-182/-73	15	-21/-60	5	-242/-84	19	-39/-15	3	45/-19	4	-42/-30	4
20	OHL 400kV Isaccea (ROM) - Varna (BUL)	-232/-58	15	-213/-40	14	-157/-69	11	-307/-42	20	-168/-48	11	-229/-36	15	53/-82	6	-394/-20	25	-162/-49	11	-235/-35	15	-172/-62	12	-92/-70	7	186/-76	13
		-225/62	15	-204/-45	13	-153/-72	11	-15/-17	19	-146/-65	10	-226/-40	15	63/-85	7	-383/-26	24	-139/-56	9	-234/-38	15	-166/-64	11	-89/-71	7	196/-76	13
21	OHL 400kV Hamitabat (TUR) - Maritsa Istok 3 (BUL) 1	-300/52	20	/	/	-486/100	33	-136/33	9	/	/	/	/	-534/112	36	5/19	1	/	/	/	/	-313/45	21	-510/100	35	-608/116	41
		-268/-28	18	/	/	-466/78	31	-100/8	7	/	/	/	/	-489/83	33	63/-3	4	/	/	/	/	-282/38	19	-492/95	33	-559/105	38
22	OHL 400kV Hamitabat (TUR) - Maritsa Istok 3 (BUL) 2	-316/60	21	/	/	-513/110	35	-129/26	9	/	/	/	/	-563/123	38	5/25	2	/	/	/	/	-297/38	20	-483/90	33	-576/105	39
		-283/35	19	/	/	-492/87	33	-95/3	6	/	/	/	/	-516/93	35	66/2	4	/	/	/	/	-267/31	18	-466/85	32	-529/94	36
23	OHL 400kV Babaeski (TUR) - Filippi (GRE)	-81/-72	7	/	/	-293/-32	20	66/-86	7	/	/	/	/	-195/-53	13	292/-77	20	/	/	/	/	-87/21	6	-300/65	20	-207/38	14
		-147/-72	11	/	/	-334/-32	22	-5/-88	6	/	/	/	/	-288/-44	19	173/-86	13	/	/	/	/	-148/-10	10	-335/33	22	-303/22	20
	OHL 400kV Maritsa Iztok 3(BG) - Filippi (GR)	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/
		125/-103	12	76/94	9	78/-98	9	134/-49	11	192/90	16	36/-73	6	178/-103	16	224/-103	19	200/-95	17	16/-92	7	112/48	9	60/55	6	176/41	14

without new line
with new line

% line load in % commpared to line thermal limit

Table 4.14. Active power losses: OHL 400kV Podgorica (YUG) - Elbasan (ALB)

	ACTIVE POWER LOSSES												
	WINTER										SUMMER		
	Base case		Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6	Scenario 7	Scenario 8	Base case	Scenario 1	Scenario 5
			UCTE >> TUR (W>>E)	TUR,GRE >> UCTE (E>>W)	UCTE >> BUL,GRE,ALB (W>>E)	BUL,GRE,ROM >> UCTE (E>>W)	CEN,UKR,ROM >> TUR,GRE (N>>S)	TUR,BUL >> CEN (S>>N)	CEN,UKR >> BUL,GRE,ALB (N>>S)	ROM,BUL,GRE >> CEN (S>>W)		UCTE >> TUR (W>>E)	TUR,GRE >> UCTE (E>>W)
AREA	With TUR	Without TUR	600	700	1000	700	1000	1500	1000	1500	With TUR	600	1200
ALB	25.7	25.5	27.8	24.3	24.7	24.3	29.2	24.4	24.3	24.2	21.8	23.4	25.4
	24.7	24.6	26.0	24.7	21.7	24.7	27.1	25.8	21.4	25.8	21.4	22.1	23.8
	-3.89	-3.53	-6.47	1.65	-12.15	1.65	-7.19	5.74	-11.93	6.61	-1.83	-5.56	-6.30
BUL	67.5	68.2	74.5	69.4	69.7	69.9	75.2	85.9	70.1	73.2	25.0	32.6	37.6
	67.4	68.2	73.9	69.3	68.6	69.8	74.1	85.4	69.0	72.8	25.0	32.1	36.3
	-0.15	0.00	-0.81	-0.14	-1.58	-0.14	-1.46	-0.58	-1.57	-0.55	0.00	-1.53	-3.46
BIH	13.5	13.6	14.4	16.4	17.6	16.4	13.7	20.8	15.7	20.3	5.2	7.2	7.4
	13.5	13.5	14.5	16.5	17.8	16.6	13.8	21.3	15.8	20.8	5.2	7.4	7.8
	0.00	-0.74	0.69	0.61	1.14	1.22	0.73	2.40	0.64	2.46	0.00	2.78	5.41
UCTE	87.9	87.9	109.3	111.6	111.4	109.8	86.0	102.4	85.8	101.6	51.8	72.2	51.3
	87.8	87.9	109.2	111.6	110.5	109.8	86.2	102.8	86.2	102.1	51.8	72.7	51.1
	-0.11	0.00	-0.09	0.00	-0.81	0.00	0.23	0.39	0.47	0.49	0.00	0.69	-0.39
CRO	8.8	8.8	14.5	10.1	20.1	10.0	10.1	18.5	12.8	17.6	5.4	10.7	8.3
	8.8	8.8	14.6	10.1	20.2	10.1	10.2	18.8	13.0	17.9	5.4	11.0	8.5
	0.00	0.00	0.69	0.00	0.50	1.00	0.99	1.62	1.56	1.70	0.00	2.80	2.41
HUN	37.7	37.7	40.1	44.7	45.4	44.6	49.8	74.9	62.5	75.9	17.2	19.0	26.7
	37.5	37.7	39.8	44.6	44.5	44.5	49.6	74.8	62.0	76.0	17.2	18.9	26.5
	-0.53	0.00	-0.75	-0.22	-1.98	-0.22	-0.40	-0.13	-0.80	0.13	0.00	-0.53	-0.75
GRE	239.2	239.6	241.7	239.8	244.3	244.7	240.8	243.1	244.7	240.3	321.8	326.3	325.3
	238.8	239.3	241.6	239.8	243.0	244.6	240.5	243.9	243.3	241.5	321.4	326.4	325.3
	-0.17	-0.13	-0.04	0.00	-0.53	-0.04	-0.12	0.33	-0.57	0.50	-0.12	0.03	0.00
MKD	1.9	1.9	2.2	2.6	2.8	2.7	2.9	3.1	2.8	3.9	1.3	2.1	3.6
	1.9	2.0	2.1	2.5	2.2	2.5	2.4	2.8	2.2	3.3	1.3	1.9	2.9
	0.00	5.26	-4.55	-3.85	-21.43	-7.41	-17.24	-9.68	-21.43	-15.38	0.00	-9.52	-19.44
UKR	0.8	0.8	0.8	0.8	0.8	0.8	3.8	0.7	5.2	0.7	0.7	0.7	3.8
	0.8	0.8	0.8	0.8	0.8	0.8	3.8	0.7	5.2	0.7	0.7	0.7	3.8
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ROM	140.0	141.2	141.9	144.2	140.4	141.3	127.8	164.5	140.2	157.9	100.9	106.7	95.3
	139.9	141.2	141.6	144.1	139.8	141.2	127.4	163.9	139.5	157.4	100.9	106.2	94.6
	-0.07	0.00	-0.21	-0.07	-0.43	-0.07	-0.31	-0.36	-0.50	-0.32	0.00	-0.47	-0.73
SLO	5.0	5.0	6.7	6.1	8.4	6.2	5.1	5.7	5.3	5.7	3.4	4.8	3.6
	5.0	5.0	6.7	6.2	8.4	6.2	5.1	5.7	5.3	5.7	3.4	4.9	3.6
	0.00	0.00	0.00	1.64	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.08	0.00
TUR	185.9	/	180.5	194.9	/	/	186.2	213.9	/	/	136.8	149.0	146.4
	185.8	/	180.4	194.9	/	/	186.1	214.0	/	/	136.8	148.9	146.2
	-0.05	/	-0.06	0.00	/	/	-0.05	0.05	/	/	0.00	-0.07	-0.14
YUG	99.8	99.7	102.4	108.3	112.5	108.7	104.0	137.9	111.0	134.1	41.1	42.7	47.8
	99.7	99.6	100.8	107.8	106.4	108.1	102.1	135.6	105.7	131.7	41.2	41.8	46.2
	-0.10	-0.10	-1.56	-0.46	-5.42	-0.55	-1.83	-1.67	-4.77	-1.79	0.24	-2.11	-3.35
CENT	0.2	0.2	0.2	0.2	0.2	0.2	0.6	3.8	1.5	3.8	0.4	0.4	1.1
	0.2	0.2	0.2	0.2	0.2	0.2	0.6	3.8	1.5	3.8	0.4	0.4	1.1
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL	913.8	730.2	957.1	973.3	798.3	779.4	935.3	1099.6	781.8	859.2	732.8	797.8	783.6
	911.8	728.8	952.2	973.0	784.3	779.1	928.9	1099.3	770.1	859.5	732.0	795.2	777.7
	-0.22	-0.19	-0.51	-0.03	-1.75	-0.04	-0.68	-0.03	-1.50	0.03	-0.11	-0.33	-0.75

active power loses in MW without new line
active power loses in MW with new line
active power loses in %

Table 4.15. Active power losses: OHL 400kV S.Mitrovica (YUG) - Ugljevik (B&H)

	ACTIVE POWER LOSSES												
	WINTER										SUMMER		
	Base case		Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6	Scenario 7	Scenario 8	Base case	Scenario 1	Scenario 5
			UCTE >> TUR (W>>E)	TUR,GRE >> UCTE (E>>W)	UCTE >> BUL,GRE,ALB (W>>E)	BUL,GRE,ROM >> UCTE (E>>W)	CEN,UKR,ROM >> TUR,GRE (N>>S)	TUR,BUL >> CEN (S>>N)	CEN,UKR >> BUL,GRE,ALB (N>>S)	ROM,BUL,GRE >> CEN (S>>W)		UCTE >> TUR (W>>E)	TUR,GRE >> UCTE (E>>W)
AREA	With TUR	Without TUR	600	700	1000	700	1000	1500	1000	1500	With TUR	600	1200
ALB	25.7	25.5	27.8	24.3	24.7	24.3	29.2	24.4	24.3	24.2	21.8	23.4	25.4
	25.7	25.5	27.8	24.3	24.7	24.2	29.3	24.3	24.4	24.2	21.8	23.3	25.4
	0.00	0.00	0.00	0.00	0.00	-0.41	0.34	-0.41	0.41	0.00	0.00	-0.43	0.00
BUL	67.5	68.2	74.5	69.4	69.7	69.9	75.2	85.9	70.1	73.2	25.0	32.6	37.6
	67.5	68.2	74.5	69.4	69.7	69.9	75.2	85.9	70.1	73.0	25.0	32.6	37.6
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.27	0.00	0.00	0.00
BIH	13.5	13.6	14.4	16.4	17.6	16.4	13.7	20.8	15.7	20.3	5.2	7.2	7.4
	13.4	13.5	14.4	16.1	17.6	16.1	13.7	20.4	15.7	19.9	5.2	7.2	7.5
	-0.74	-0.74	0.00	-1.83	0.00	-1.83	0.00	-1.92	0.00	-1.97	0.00	0.00	1.35
UCTE	87.9	87.9	109.3	111.6	111.4	109.8	86.0	102.4	85.8	101.6	51.8	72.2	51.3
	87.9	88.0	109.3	111.7	111.3	109.9	86.1	103.1	85.7	102.3	51.8	72.2	51.3
	0.00	0.11	0.00	0.09	-0.09	0.09	0.12	0.68	-0.12	0.69	0.00	0.00	0.00
CRO	8.8	8.8	14.5	10.1	20.1	10.0	10.1	18.5	12.8	17.6	5.4	10.7	8.3
	8.8	8.8	14.5	10.0	20.1	10.0	10.0	18.8	12.6	17.8	5.3	10.7	8.2
	0.00	0.00	0.00	-0.99	0.00	0.00	-0.99	1.62	-1.56	1.14	-1.85	0.00	-1.20
HUN	37.7	37.7	40.1	44.7	45.4	44.6	49.8	74.9	62.5	75.9	17.2	19.0	26.7
	37.8	37.8	40.0	44.5	45.3	44.4	49.9	74.6	62.6	75.7	17.2	19.0	26.7
	0.27	0.27	-0.25	-0.45	-0.22	-0.45	0.20	-0.40	0.16	-0.26	0.00	0.00	0.00
GRE	239.2	239.6	241.7	239.8	244.3	244.7	240.8	243.1	244.7	240.3	321.8	326.3	325.3
	239.2	239.6	241.7	239.8	244.3	244.7	240.8	243.1	244.7	241.2	321.7	326.3	325.3
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.37	-0.03	0.00	0.00
MKD	1.9	1.9	2.2	2.6	2.8	2.7	2.9	3.1	2.8	3.9	1.3	2.1	3.6
	1.9	1.9	2.2	2.6	2.8	2.7	2.9	3.1	2.8	3.8	1.3	2.1	3.6
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-2.56	0.00	0.00	0.00
UKR	0.8	0.8	0.8	0.8	0.8	0.8	3.8	0.7	5.2	0.7	0.7	0.7	3.8
	0.8	0.8	0.8	0.8	0.8	0.8	3.8	0.7	5.2	0.7	0.7	0.7	3.8
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ROM	139.9	141.2	141.9	144.2	140.4	141.3	127.8	164.5	140.2	157.9	100.9	106.7	95.3
	139.8	141.1	141.9	144.0	140.4	141.1	127.7	164.3	140.1	157.7	100.9	106.8	95.3
	-0.07	-0.07	0.00	-0.14	0.00	-0.14	-0.08	-0.12	-0.07	-0.13	0.00	0.09	0.00
SLO	5.0	5.0	6.7	6.1	8.4	6.2	5.1	5.7	5.3	5.7	3.4	4.8	3.6
	5.0	5.0	6.7	6.2	8.4	6.2	5.1	5.8	5.3	5.7	3.4	4.8	3.6
	0.00	0.00	0.00	1.64	0.00	0.00	0.00	1.75	0.00	0.00	0.00	0.00	0.00
TUR	185.9	/	180.5	194.9	/	/	186.2	213.9	/	/	136.8	149.0	146.4
	185.9	/	180.7	194.9	/	/	186.2	213.8	/	/	136.8	149.0	146.4
	0.00	/	0.11	0.00	/	/	0.00	-0.05	/	/	0.00	0.00	0.00
YUG	99.8	99.7	102.4	108.3	112.5	108.7	104.0	137.9	111.0	134.1	41.1	42.7	47.8
	99.9	99.8	102.3	108.5	112.4	108.8	104.1	137.9	111.1	134.1	41.2	42.7	47.8
	0.10	0.10	-0.10	0.18	-0.09	0.09	0.10	0.00	0.09	0.00	0.24	0.00	0.00
CENT	0.2	0.2	0.2	0.2	0.2	0.2	0.6	3.8	1.5	3.8	0.4	0.4	1.1
	0.2	0.2	0.2	0.2	0.2	0.2	0.6	3.8	1.5	3.8	0.4	0.4	1.1
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL	913.8	730.2	957.1	973.3	798.3	779.4	935.3	1099.6	781.8	859.2	732.8	797.8	783.6
	913.8	730.2	957.0	972.8	798.0	779.0	935.2	1099.5	781.7	859.9	732.7	797.7	783.5
	0.00	0.00	-0.01	-0.05	-0.04	-0.05	-0.01	-0.01	-0.01	0.08	-0.01	-0.01	-0.01

active power loses in MW without new line
active power loses in MW with new line
active power loses in %

Table 4.16. Active power losses: OHL 400kV Nis (YUG) - Skopje 5 (MKD)

	ACTIVE POWER LOSSES													
	WINTER										SUMMER			
	Base case		Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6	Scenario 7	Scenario 8	Base case	Scenario 1	Scenario 5	
			UCTE >> TUR (W>>E)	TUR,GRE >> UCTE (E>>W)	UCTE >> BUL,GRE,ALB (W>>E)	BUL,GRE,ROM >> UCTE (E>>W)	CEN,UKR,ROM >> TUR,GRE (N>>S)	TUR,BUL >> CEN (S>>N)	CEN,UKR >> BUL,GRE,ALB (N>>S)	ROM,BUL,GRE >> CEN (S>>W)		UCTE >> TUR (W>>E)	TUR,GRE >> UCTE (E>>W)	
AREA	With TUR	Without TUR	600	700	1000	700	1000	1500	1000	1500	With TUR	600	1200	
ALB	25.7	25.5	27.8	24.3	24.7	24.3	29.2	24.4	24.3	24.2	21.8	23.4	25.4	
	25.7	25.5	27.8	24.3	24.4	24.3	28.9	24.4	23.9	24.2	21.7	23.3	25.0	
	0.00	0.00	0.00	0.00	-1.21	0.00	-1.03	0.00	-1.65	0.00	-0.46	-0.43	-1.57	
BUL	67.5	68.2	74.5	69.4	69.7	70.5	75.2	85.9	70.1	73.2	25.0	32.6	37.6	
	67.4	68.1	74.2	69.2	68.9	70.4	74.2	85.5	69.3	72.9	25.0	32.4	36.2	
	-0.15	-0.15	-0.40	-0.29	-1.15	-0.14	-1.33	-0.47	-1.14	-0.41	0.00	-0.61	-3.72	
BIH	13.5	13.6	14.4	16.4	17.6	17.1	13.7	20.8	15.7	20.3	5.2	7.2	7.4	
	13.6	13.6	14.4	16.3	17.5	17.0	13.7	20.7	15.5	20.1	5.2	7.1	7.2	
	0.74	0.00	0.00	-0.61	-0.57	-0.58	0.00	-0.48	-1.27	-0.99	0.00	-1.39	-2.70	
UCTE	87.9	87.9	109.3	111.6	111.4	121.7	86.0	102.4	85.8	101.6	51.8	72.2	51.3	
	87.9	87.9	109.3	111.6	111.3	121.8	86.0	102.4	85.7	101.6	52.4	72.2	51.2	
	0.00	0.00	0.00	0.00	0.09	0.08	0.00	0.00	-0.12	0.00	1.16	0.00	-0.19	
CRO	8.8	8.8	14.5	10.1	20.1	10.8	10.1	18.5	12.8	17.6	5.4	10.7	8.3	
	8.8	8.8	14.5	10.0	20.0	10.8	10.1	18.4	12.7	17.5	5.4	10.7	8.2	
	0.00	0.00	0.00	-0.99	-0.50	0.00	0.00	-0.54	-0.78	-0.57	0.00	0.00	-1.20	
HUN	37.7	37.7	40.1	44.7	45.4	46.8	49.8	74.9	62.5	75.9	17.2	19.0	26.7	
	37.7	37.7	40.1	44.7	45.5	46.8	49.9	74.9	62.6	76.0	17.1	19.0	26.7	
	0.00	0.00	0.00	0.00	-0.22	0.00	-0.20	0.00	0.16	-0.13	-0.58	0.00	0.00	
GRE	239.2	239.6	241.7	239.8	244.3	244.6	240.8	243.1	244.7	240.3	321.8	326.3	325.3	
	239.1	239.5	241.7	239.6	244.2	244.3	241.0	243.1	244.6	239.9	321.3	326.1	325.2	
	-0.04	-0.04	0.00	-0.08	-0.04	-0.12	0.08	0.00	-0.04	-0.17	-0.16	-0.06	-0.03	
MKD	1.9	1.9	2.2	2.6	2.8	2.7	2.9	3.1	2.8	3.9	1.3	2.1	3.6	
	1.9	1.9	2.2	2.7	2.8	2.8	2.9	3.2	2.8	4.2	1.3	2.0	3.5	
	0.00	0.00	0.00	3.85	0.00	3.70	0.00	3.23	0.00	7.69	0.00	-4.76	-2.78	
UKR	0.8	0.8	0.8	0.8	0.8	0.8	3.8	0.7	5.2	0.7	0.7	0.7	3.8	
	0.8	0.8	0.8	0.8	0.8	0.8	3.8	0.7	5.2	0.7	0.7	0.7	3.8	
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
ROM	140.0	141.2	141.9	144.2	140.4	143.3	127.8	164.5	140.2	157.9	100.9	106.7	95.3	
	139.8	141.1	141.8	144.3	140.1	143.3	127.4	164.5	140.0	158.0	100.8	106.5	94.8	
	-0.14	-0.07	-0.07	0.07	-0.21	0.00	-0.31	0.00	-0.14	0.06	-0.10	-0.19	-0.52	
SLO	5.0	5.0	6.7	6.1	8.4	6.6	5.1	5.7	5.3	5.7	3.4	4.8	3.6	
	5.0	5.0	6.7	6.1	8.4	6.6	5.1	5.7	5.3	5.7	3.4	4.8	3.6	
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
TUR	185.9	/	180.5	194.9	/	/	186.2	213.9	111.0	/	136.8	149.0	146.4	
	185.9	/	180.6	194.9	/	/	186.1	213.9	110.5	/	136.9	149.0	146.2	
	0.00	/	0.06	0.00	/	/	-0.05	0.00	-0.45	/	0.07	0.00	-0.14	
YUG	99.8	99.7	102.4	108.3	112.5	111.3	104.0	137.9	1.5	134.1	41.1	42.7	47.8	
	99.6	99.5	102.3	107.9	112.2	110.9	104.0	137.5	1.5	133.4	41.0	42.8	47.9	
	-0.20	-0.20	-0.10	-0.37	-0.27	-0.36	0.00	-0.29	0.00	-0.52	-0.24	0.23	0.21	
CENT	0.2	0.2	0.2	0.2	0.2	0.2	0.6	3.8		3.8	0.4	0.4	1.1	
	0.2	0.2	0.2	0.2	0.2	0.2	0.6	3.8		3.8	0.4	0.4	1.1	
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	
TOTAL	913.8	730.2	957.1	973.3	798.3	800.7	935.3	1099.6	781.8	859.2	732.8	797.8	783.6	
	913.2	729.7	956.6	972.6	796.2	800.0	933.5	1098.8	779.7	858.0	732.6	796.9	780.9	
	-0.07	-0.07	-0.05	-0.07	-0.26	-0.09	-0.19	-0.07	-0.27	-0.14	-0.03	-0.11	-0.34	

active power loses in MW without new line
active power loses in MW with new line
active power loses in %

Table 4.17. Active power losses: OHL 400kV Sombor (YUG) – Pecs (HUN)

	ACTIVE POWER LOSSES													
	WINTER										SUMMER			
	Base case		Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6	Scenario 7	Scenario 8	Base case	Scenario 1	Scenario 5	
			UCTE >> TUR (W>>E)	TUR,GRE >> UCTE (E>>W)	UCTE >> BUL,GRE,ALB (W>>E)	BUL,GRE,ROM >> UCTE (E>>W)	CEN,UKR,ROM >> TUR,GRE (N>>S)	TUR,BUL >> CEN (S>>N)	CEN,UKR >> BUL,GRE,ALB (N>>S)	ROM,BUL,GRE >> CEN (S>>W)		UCTE >> TUR (W>>E)	TUR,GRE >> UCTE (E>>W)	
AREA	With TUR	Without TUR	600	700	1000	700	1000	1500	1000	1500	With TUR	600	1200	
ALB	25.7	25.5	27.8	24.3	24.7	24.3	29.2	24.4	24.3	24.2	21.8	23.4	25.4	
	25.7	25.5	27.7	24.3	24.6	24.3	29.1	24.4	24.2	24.2	21.8	23.3	25.4	
	0.00	0.00	-0.36	0.00	-0.40	0.00	-0.34	0.00	-0.41	0.00	0.00	-0.43	0.00	
BUL	67.5	68.2	74.5	69.4	69.7	70.5	75.2	85.9	70.1	73.2	25.0	32.6	37.6	
	67.5	68.3	74.6	69.4	69.8	70.5	75.3	85.9	70.2	73.2	25.0	32.7	37.7	
	0.00	0.15	0.13	0.00	0.14	0.00	0.13	0.00	0.14	0.00	0.00	0.31	0.27	
BIH	13.5	13.6	14.4	16.4	17.6	17.1	13.7	20.8	15.7	20.3	5.2	7.2	7.4	
	13.6	13.6	14.2	16.5	17.0	17.2	13.5	20.5	15.2	20.0	5.1	6.9	7.1	
	0.74	0.00	-1.39	0.61	-3.41	0.58	-1.46	-1.44	-3.18	-1.48	-1.92	-4.17	-4.05	
UCTE	87.9	87.9	109.3	111.6	111.4	121.7	86.0	102.4	85.8	101.6	51.8	72.2	51.3	
	88.2	88.3	109.8	111.7	111.3	121.9	86.2	101.9	85.8	101.1	52.5	72.3	51.1	
	0.34	0.46	0.46	0.09	-0.09	0.16	0.23	-0.49	0.00	-0.49	1.35	0.14	-0.39	
CRO	8.8	8.8	14.5	10.1	20.1	10.8	10.1	18.5	12.8	17.6	5.4	10.7	8.3	
	8.9	9.0	14.0	10.3	18.8	11.0	9.6	17.7	11.6	16.9	5.4	10.1	7.5	
	1.14	2.27	-3.45	1.98	-6.47	1.85	-4.95	-4.32	-9.38	-3.98	0.00	-5.61	-9.64	
HUN	37.7	37.7	40.1	44.7	45.4	46.8	49.8	74.9	62.5	75.9	17.2	19.0	26.7	
	35.7	35.7	35.9	44.2	39.5	46.5	45.0	74.7	55.0	75.7	16.1	16.6	23.2	
	-5.31	-5.31	-10.47	-1.12	-13.00	-0.64	-9.64	-0.27	-12.00	-0.26	-6.40	-12.63	-13.11	
GRE	239.2	239.6	241.7	239.8	244.3	244.6	240.8	243.1	244.7	240.3	321.8	326.3	325.3	
	239.2	239.6	241.7	239.8	244.3	244.6	240.8	243.1	244.7	240.3	321.7	326.3	325.3	
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.03	0.00	0.00	
MKD	1.9	1.9	2.2	2.6	2.8	2.7	2.9	3.1	2.8	3.9	1.3	2.1	3.6	
	1.9	1.9	2.2	2.6	2.8	2.7	2.9	3.1	2.8	3.9	1.3	2.1	3.6	
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
UKR	0.8	0.8	0.8	0.8	0.8	0.8	3.8	0.7	5.2	0.7	0.7	0.7	3.8	
	0.8	0.8	0.8	0.8	0.8	0.8	3.8	0.7	5.2	0.7	0.7	0.7	3.8	
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
ROM	140.0	141.2	141.9	144.2	140.4	143.3	127.8	164.5	140.2	157.9	100.9	106.7	95.3	
	140.0	141.4	142.1	144.2	140.5	143.3	127.9	164.0	140.2	157.4	100.9	106.8	95.3	
	0.00	0.14	0.14	0.00	0.07	0.00	0.08	-0.30	0.00	-0.32	0.00	0.09	0.00	
SLO	5.0	5.0	6.7	6.1	8.4	6.6	5.1	5.7	5.3	5.7	3.4	4.8	3.6	
	5.0	5.0	6.6	6.2	8.2	6.6	5.1	5.7	5.2	5.6	3.4	4.7	3.6	
	0.00	0.00	-1.49	1.64	-2.38	0.00	0.00	0.00	-1.89	-1.75	0.00	-2.08	0.00	
TUR	185.9	/	180.5	194.9	/	/	186.2	213.9	/	/	136.8	149.0	146.4	
	185.9	/	180.7	194.9	/	/	186.2	213.9	/	/	136.9	149.0	146.4	
	0.00	/	0.11	0.00	/	/	0.00	0.00	/	/	0.07	0.00	0.00	
YUG	99.8	99.7	102.4	108.3	112.5	111.3	104.0	137.9	111.0	134.1	41.1	42.7	47.8	
	98.6	98.5	101.1	107.7	111.6	110.8	103.1	139.1	110.5	135.3	40.7	42.5	48.0	
	-1.20	-1.20	-1.27	-0.55	-0.80	-0.45	-0.87	0.87	-0.45	0.89	-0.97	-0.47	0.42	
CENT	0.2	0.2	0.2	0.2	0.2	0.2	0.6	3.8	1.5	3.8	0.4	0.4	1.1	
	0.2	0.2	0.2	0.2	0.2	0.2	0.6	3.8	1.5	3.8	0.4	0.4	1.1	
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
TOTAL	913.8	730.2	957.1	973.3	798.3	800.7	935.3	1099.6	781.8	859.2	732.8	797.8	783.6	
	911.2	727.6	951.6	972.7	789.3	800.3	929.1	1098.5	772.1	858.2	731.9	794.2	779.0	
	-0.28	-0.36	-0.57	-0.06	-1.13	-0.05	-0.66	-0.10	-1.24	-0.12	-0.12	-0.45	-0.59	

active power loses in MW without new line
active power loses in MW with new line
active power loses in %

Table 4.18. Active power losses: OHL 220kV Prizren (YUG) - Fierza (ALB)

	ACTIVE POWER LOSSES												
	WINTER										SUMMER		
	Base case		Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6	Scenario 7	Scenario 8	Base case	Scenario 1	Scenario 5
			UCTE >> TUR (W>>E)	TUR,GRE >> UCTE (E>>W)	UCTE >> BUL,GRE,ALB (W>>E)	BUL,GRE,ROM >> UCTE (E>>W)	CEN,UKR,ROM >> TUR,GRE (N>>S)	TUR,BUL >> CEN (S>>N)	CEN,UKR >> BUL,GRE,ALB (N>>S)	ROM,BUL,GRE >> CEN (S>>W)		UCTE >> TUR (W>>E)	TUR,GRE >> UCTE (E>>W)
AREA	With TUR	Without TUR	600	700	1000	700	1000	1500	1000	1500	With TUR	600	1200
ALB	25.7	25.5	27.8	24.2	24.8	24.3	29.2	24.4	23.4	24.2	21.8	23.4	25.5
	25.2	25.0	27.3	23.7	24.8	23.7	28.7	23.9	23.4	23.7	21.5	23.1	25.3
	-1.95	-1.96	-1.80	-2.07	0.00	-2.47	-1.71	-2.05	0.00	-2.07	-1.38	-1.28	-0.78
BUL	67.5	68.2	74.5	69.5	69.7	70.1	75.2	85.9	71.0	73.2	25.0	32.6	37.6
	67.5	68.2	74.6	69.5	69.6	70.1	75.3	85.8	71.0	73.2	25.0	32.6	37.6
	0.00	0.00	0.10	0.00	-0.14	0.00	0.13	-0.12	0.00	0.00	0.00	0.00	0.00
BIH	13.5	13.6	14.4	16.5	17.7	16.4	13.7	20.7	15.2	20.3	5.2	7.2	7.4
	13.5	13.6	14.4	16.4	17.7	16.4	13.7	20.7	15.2	20.2	5.2	7.2	7.4
	0.00	0.00	0.00	-0.61	0.00	0.00	0.00	0.00	0.00	-0.49	0.00	0.00	0.00
UCTE	87.9	87.9	109.4	113.7	112.1	109.9	86.6	102.0	85.9	101.8	51.8	73.0	51.8
	87.9	87.9	109.4	113.7	112.1	110.0	86.0	102.0	85.9	101.8	51.8	73.0	51.8
	0.00	0.00	0.00	0.00	0.00	0.09	-0.69	0.00	0.00	0.00	0.00	0.00	0.00
CRO	8.8	8.8	14.3	10.2	20.3	10.0	10.0	18.4	13.8	17.6	5.4	10.9	8.4
	8.8	8.8	14.3	10.2	20.3	10.0	10.1	18.3	13.7	17.6	5.4	10.9	8.4
	0.00	0.00	0.00	0.00	0.00	0.00	1.00	-0.54	-0.72	0.00	0.00	0.00	0.00
HUN	37.7	37.7	40.2	45.0	45.6	44.3	49.8	73.1	63.7	76.1	17.2	19.2	26.7
	37.5	37.5	39.9	45.0	45.6	44.4	49.8	73.2	63.7	76.1	17.2	19.2	26.7
	0.00	0.00	-0.70	0.00	0.00	0.23	0.00	0.14	0.00	0.00	0.00	0.00	0.00
GRE	239.2	239.6	241.7	237.4	244.6	245.2	240.8	243.1	244.9	240.4	321.8	326.3	325.4
	239.2	239.7	241.7	237.4	244.6	245.2	240.8	243.2	244.9	240.4	321.7	326.3	325.4
	0.00	-0.04	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.00	-0.03	0.00	0.00
MKD	1.9	1.9	2.2	2.6	2.9	2.7	2.9	3.1	2.6	3.9	1.3	2.1	3.6
	1.9	1.9	2.3	2.6	2.9	2.6	2.9	3.1	2.6	3.9	1.3	2.1	3.6
	0.00	0.00	4.50	0.00	0.00	-3.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00
UKR	0.8	0.8	0.8	0.8	0.8	0.8	3.8	0.7	7.7	0.7	0.7	0.7	3.8
	0.8	0.8	0.8	0.8	0.8	0.8	3.8	0.7	7.7	0.7	0.7	0.7	3.8
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ROM	140.0	141.2	142.0	144.3	140.4	241.6	127.8	164.6	138.3	157.8	100.9	106.7	95.3
	139.9	141.2	142.0	144.4	140.4	241.6	127.8	164.6	138.3	157.9	100.9	106.7	95.3
	-0.14	-0.07	0.00	0.07	0.00	0.00	0.00	0.00	0.00	0.06	0.00	0.00	0.00
SLO	5.0	5.0	6.7	6.1	8.5	6.1	5.1	5.7	5.4	5.7	3.4	4.9	3.6
	5.0	5.0	6.7	6.1	8.5	6.1	5.1	5.7	5.4	5.7	3.4	4.9	3.6
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TUR	185.9	/	180.7	195.1	/	/	183.9	213.8	/	/	136.8	148.8	146.5
	185.9	/	180.7	195.2	/	/	183.9	213.9	/	/	136.9	148.8	146.5
	0.00	/	0.00	0.05	/	/	0.00	0.05	/	/	0.07	0.00	0.00
YUG	99.8	99.7	102.5	108.7	112.7	108.6	104.1	137.9	107.1	134.0	41.1	42.6	47.7
	99.6	99.5	102.3	108.5	112.6	108.4	103.8	137.7	107.0	133.9	41.1	42.6	47.7
	-0.20	-0.20	-0.20	-0.18	-0.09	-0.18	-0.29	-0.15	-0.09	-0.07	0.00	0.00	0.00
CENT	0.2	0.2	0.2	0.2	0.2	0.2	0.6	3.7	1.5	3.8	0.4	0.4	1.1
	0.2	0.2	0.2	0.2	0.2	0.2	0.6	3.7	1.5	3.8	0.4	0.4	1.1
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL	913.8	729.9	957.4	974.3	800.2	780.1	933.5	1097.2	780.5	859.6	732.8	798.7	784.5
	912.9	729.3	956.6	973.6	800.1	779.5	932.3	1096.6	780.4	858.9	732.5	798.5	784.4
	-0.08	-0.08	-0.08	-0.07	-0.01	-0.08	-0.13	-0.05	-0.01	-0.08	-0.04	-0.03	-0.01

active power loses in MW without new line
active power loses in MW with new line
active power loses in %

Table 4.19. Active power losses: OHL 400kV Banja Luka (BiH) – Tumbri CRO)

	ACTIVE POWER LOSSES												
	WINTER										SUMMER		
	Base case		Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6	Scenario 7	Scenario 8	Base case	Scenario 1	Scenario 5
			UCTE >> TUR (W>>E)	TUR,GRE >> UCTE (E>>W)	UCTE >> BUL,GRE,ALB (W>>E)	BUL,GRE,ROM >> UCTE (E>>W)	CEN,UKR,ROM >> TUR,GRE (N>>S)	TUR,BUL >> CEN (S>>N)	CEN,UKR >> BUL,GRE,ALB (N>>S)	ROM,BUL,GRE >> CEN (S>>W)		UCTE >> TUR (W>>E)	TUR,GRE >> UCTE (E>>W)
AREA	With TUR	Without TUR	600	700	1000	700	1000	1500	1000	1500	With TUR	600	1200
ALB	25.7	25.5	27.8	24.2	24.8	24.3	29.2	24.4	23.4	24.2	21.8	23.4	25.5
	25.7	25.5	27.3	24.2	24.9	24.2	28.7	24.4	23.5	24.2	21.8	23.4	25.5
	0.00	0.00	-1.80	0.00	0.40	-0.41	-1.71	0.00	0.43	0.00	0.00	0.00	0.00
BUL	67.5	68.2	74.5	69.5	69.7	70.1	75.2	85.9	71.0	73.2	25.0	32.6	37.6
	67.4	68.1	74.6	69.5	69.6	70.1	75.3	85.8	70.9	73.2	25.0	32.6	37.5
	-0.15	-0.15	0.10	0.00	-0.14	0.00	0.13	-0.12	-0.14	0.00	0.00	0.00	-0.27
BIH	13.5	13.6	14.4	16.5	17.7	16.4	13.7	20.7	15.2	20.3	5.2	7.2	7.4
	13.6	13.6	14.4	16.5	16.6	16.4	13.7	21.3	13.9	20.7	5.0	7.0	7.3
	0.74	0.00	0.00	0.00	-6.21	0.00	0.00	2.90	-8.55	1.97	-3.85	-2.78	-1.35
UCTE	87.9	87.9	109.4	113.7	112.1	109.9	86.6	102.0	85.9	101.8	51.8	73.0	51.8
	87.9	87.9	109.4	113.9	110.5	110.1	86.0	102.4	86.1	102.2	51.7	72.2	51.8
	0.00	0.00	0.00	0.18	-1.43	0.18	-0.69	0.39	0.23	0.39	-0.19	-1.10	0.00
CRO	8.8	8.8	14.3	10.2	20.3	10.0	10.0	18.4	13.8	17.6	5.4	10.9	8.4
	8.8	8.8	14.3	10.0	16.0	9.9	10.1	17.6	11.3	17.0	5.2	8.8	7.2
	0.00	0.00	0.00	-1.96	-21.18	-1.00	1.00	-4.35	-18.12	-3.41	-3.70	-19.27	-14.29
HUN	37.7	37.7	40.2	45.0	45.6	44.3	49.8	73.1	63.7	76.1	17.2	19.2	26.7
	37.7	37.7	39.9	44.9	43.9	44.3	49.8	72.7	63.1	75.6	17.2	18.6	26.5
	0.00	0.00	-0.70	-0.22	-3.73	0.00	0.00	-0.55	-0.94	-0.66	0.00	-3.12	-0.75
GRE	239.2	239.6	241.7	237.4	244.6	245.2	240.8	243.1	244.9	240.4	321.8	326.3	325.4
	239.1	239.5	241.7	237.3	244.6	245.1	240.8	243.1	244.8	240.4	321.7	326.4	325.4
	-0.04	-0.04	0.00	-0.04	0.00	-0.04	0.00	0.00	-0.04	0.00	-0.03	0.03	0.00
MKD	1.9	1.9	2.2	2.6	2.9	2.7	2.9	3.1	2.6	3.9	1.3	2.1	3.6
	1.9	1.9	2.3	2.6	2.9	2.7	2.9	3.1	2.6	3.9	1.3	2.1	3.6
	0.00	0.00	4.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
UKR	0.8	0.8	0.8	0.8	0.8	0.8	3.8	0.7	7.7	0.7	0.7	0.7	3.8
	0.8	0.8	0.8	0.8	0.8	0.8	3.8	0.7	7.7	0.7	0.7	0.7	3.8
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ROM	140.0	141.2	142.0	144.3	140.4	241.6	127.8	164.6	138.3	157.8	100.9	106.7	95.3
	139.8	141.1	142.0	144.2	140.5	241.5	127.8	164.0	138.4	157.4	101.0	106.7	95.3
	-0.14	-0.07	0.00	-0.07	0.07	-0.04	0.00	-0.36	0.07	-0.25	0.10	0.00	0.00
SLO	5.0	5.0	6.7	6.1	8.5	6.1	5.1	5.7	5.4	5.7	3.4	4.9	3.6
	5.0	5.0	6.7	5.9	8.5	6.0	5.1	5.6	5.2	5.6	3.4	4.8	3.6
	0.00	0.00	0.00	-3.28	0.00	-1.64	0.00	-1.75	-3.70	-1.75	0.00	-2.04	0.00
TUR	185.9	/	180.7	195.1	/	/	183.9	213.8	/	/	136.8	148.8	146.5
	185.9	/	180.7	195.1	/	/	183.9	213.9	/	/	136.8	148.8	146.5
	0.00	/	0.00	0.00	/	/	0.00	0.05	/	/	0.00	0.00	0.00
YUG	99.8	99.7	102.5	108.7	112.7	108.6	104.1	137.9	107.1	134.0	41.1	42.6	47.7
	99.6	99.5	102.3	108.5	113.8	108.5	103.8	137.3	107.4	133.5	41.3	43.0	47.8
	-0.20	-0.20	-0.20	-0.18	0.98	-0.09	-0.29	-0.44	0.28	-0.37	0.49	0.94	0.21
CENT	0.2	0.2	0.2	0.2	0.2	0.2	0.6	3.7	1.5	3.8	0.4	0.4	1.1
	0.2	0.2	0.2	0.2	0.2	0.2	0.6	3.7	1.5	3.8	0.4	0.4	1.1
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL	913.8	730.2	957.4	974.3	800.2	780.1	933.5	1097.2	780.5	859.6	732.8	798.7	784.5
	913.2	729.7	956.6	973.8	792.6	779.6	932.3	1095.8	776.5	858.3	732.8	795.6	782.8
	-0.07	-0.07	-0.08	-0.05	-0.95	-0.06	-0.13	-0.13	-0.51	-0.15	0.00	-0.39	-0.22

active power loses in MW without new line
active power loses in MW with new line
active power loses in %

Table 4.20. Active power losses: OHL 2x400kV Ernestinovo (CRO) - Pecs (HUN)

	ACTIVE POWER LOSSES												
	WINTER										SUMMER		
	Base case		Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6	Scenario 7	Scenario 8	Base case	Scenario 1	Scenario 5
			UCTE >> TUR (W>>E)	TUR,GRE >> UCTE (E>>W)	UCTE >> BUL,GRE,ALB (W>>E)	BUL,GRE,ROM >> UCTE (E>>W)	CEN,UKR,ROM >> TUR,GRE (N>>S)	TUR,BUL >> CEN (S>>N)	CEN,UKR >> BUL,GRE,ALB (N>>S)	ROM,BUL,GRE >> CEN (S>>W)		UCTE >> TUR (W>>E)	TUR,GRE >> UCTE (E>>W)
AREA	With TUR	Without TUR	600	700	1000	700	1000	1500	1000	1500	With TUR	600	1200
ALB	25.7	25.5	27.8	24.2	24.7	24.3	29.2	24.4	24.3	24.2	21.8	23.3	25.5
	25.7	25.5	27.9	24.2	24.9	24.2	29.4	24.5	24.6	24.3	21.8	23.4	25.6
	0.00	0.00	0.36	0.00	0.81	-0.41	0.68	0.41	1.23	0.41	0.00	0.43	0.39
BUL	67.5	68.2	74.5	69.4	69.6	70.1	75.2	83.8	70.0	73.2	25.0	32.6	37.6
	67.5	68.2	74.5	69.4	69.4	70.1	74.9	83.9	69.8	73.3	25.0	32.5	37.3
	0.00	0.00	0.00	0.00	-0.29	0.00	-0.40	0.12	-0.29	0.14	0.00	-0.31	-0.80
BIH	13.6	13.6	14.6	16.3	17.6	16.4	13.9	20.3	15.6	20.3	5.1	7.1	7.3
	13.5	13.5	14.2	16.5	17.2	16.6	13.5	22.4	15.4	22.0	5.1	7.0	7.6
	-0.74	-0.74	-2.74	1.23	-2.27	1.22	-2.88	10.34	-1.28	8.37	0.00	-1.41	4.11
UCTE	87.9	87.9	109.4	111.6	110.4	110.5	86.4	101.9	86.6	101.6	51.8	72.8	51.1
	88.6	88.1	110.0	111.3	111.1	110.2	87.1	97.8	86.0	97.4	52.0	72.5	51.0
	0.80	0.23	0.55	-0.27	0.63	-0.27	0.81	-4.02	-0.69	-4.13	0.39	-0.41	-0.20
CRO	8.8	8.8	14.4	10.3	19.8	10.0	10.0	18.6	12.6	17.6	5.4	10.9	8.3
	8.8	8.8	13.7	10.0	17.8	9.7	8.7	15.4	9.8	14.6	5.3	9.7	6.3
	0.00	0.00	-4.86	-2.91	-10.10	-3.00	-13.00	-17.20	-22.22	-17.05	-1.85	-11.01	-24.10
HUN	37.5	37.5	40.1	44.7	45.1	44.5	49.9	74.8	64.8	75.7	17.1	19.1	26.6
	37.1	37.0	38.5	45.9	42.3	45.6	45.9	79.0	57.6	79.2	16.5	17.5	22.6
	-1.07	-1.33	-3.99	2.68	-6.21	2.47	-8.02	5.61	-11.11	4.62	-3.51	-8.38	-15.04
GRE	239.2	239.6	241.7	236.1	244.0	243.9	240.6	243.1	244.4	240.3	321.8	326.3	325.4
	239.1	239.6	241.7	236.1	244.0	243.9	240.6	243.3	244.6	240.4	321.8	326.3	325.5
	-0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.08	0.04	0.00	0.00	0.03
MKD	1.9	1.9	2.2	2.6	2.8	2.7	2.8	3.0	2.8	3.9	1.3	2.1	3.6
	1.9	1.9	2.3	2.6	2.8	2.7	2.9	3.1	2.8	3.9	1.3	2.1	3.7
	0.00	0.00	4.55	0.00	0.00	0.00	3.57	3.33	0.00	0.00	0.00	0.00	2.78
UKR	0.8	0.8	0.8	0.8	0.8	0.8	3.8	0.7	7.8	0.7	0.7	0.7	3.8
	0.8	0.8	0.8	0.8	0.8	0.8	3.8	0.7	7.7	0.7	0.7	0.7	3.8
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-1.28	0.00	0.00	0.00	0.00
ROM	139.9	141.2	141.9	144.3	140.3	141.6	127.7	164.2	140.1	157.9	100.9	106.7	95.3
	140.2	141.4	142.3	143.5	140.8	140.8	128.5	157.7	140.6	152.3	101.1	106.7	95.2
	0.21	0.14	0.28	-0.55	0.36	-0.56	0.63	-3.96	0.36	-3.55	0.20	0.00	-0.10
SLO	5.0	5.0	6.7	6.2	8.3	6.1	5.1	5.7	5.3	5.7	3.4	4.8	3.6
	4.9	5.0	6.5	6.0	8.0	6.0	5.0	5.4	5.1	5.4	3.4	4.6	3.5
	-2.00	0.00	-2.99	-3.23	-3.61	-1.64	-1.96	-5.26	-3.77	-5.26	0.00	-4.17	-2.78
TUR	185.9	/	180.7	194.5	/	/	184.3	213.9	/	/	136.9	148.8	146.4
	185.9	/	180.7	194.5	/	/	184.3	213.9	/	/	136.8	148.7	146.4
	0.00	/	0.00	0.00	/	/	0.00	0.00	/	/	-0.07	-0.07	0.00
YUG	99.7	99.7	102.3	108.6	112.3	108.7	103.9	137.8	110.7	134.1	41.1	42.6	47.7
	100.1	99.8	103.2	108.0	113.9	108.1	105.1	134.8	112.5	131.0	41.3	43.2	47.9
	0.40	0.10	0.88	-0.55	1.42	-0.55	1.15	-2.18	1.63	-2.31	0.49	1.41	0.42
CENT	0.2	0.2	0.2	0.2	0.2	0.2	0.6	3.8	1.5	3.8	0.4	0.4	1.1
	0.2	0.2	0.2	0.2	0.2	0.2	0.6	3.8	1.5	3.8	0.4	0.4	1.1
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL	913.6	730.0	957.3	969.8	796.0	779.6	933.3	1096.1	786.3	859.0	732.8	798.1	783.4
	914.3	729.9	956.5	969.2	793.7	779.0	930.6	1087.2	779.2	849.5	732.6	795.6	778.4
	0.08	-0.01	-0.08	-0.06	-0.29	-0.08	-0.29	-0.81	-0.90	-1.11	-0.03	-0.31	-0.64

active power loses in MW without new line
active power loses in MW with new line
active power loses in %

Table 4.21. Active power losses: OHL 400kV Bekescaba (HUN) - Oradea (ROM)

	ACTIVE POWER LOSSES													
	WINTER										SUMMER			
	Base case		Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6	Scenario 7	Scenario 8	Base case	Scenario 1	Scenario 5	
			UCTE >> TUR (W>>E)	TUR,GRE >> UCTE (E>>W)	UCTE >> BUL,GRE,ALB (W>>E)	BUL,GRE,ROM >> UCTE (E>>W)	CEN,UKR,ROM >> TUR,GRE (N>>S)	TUR,BUL >> CEN (S>>N)	CEN,UKR >> BUL,GRE,ALB (N>>S)	ROM,BUL,GRE >> CEN (S>>W)		UCTE >> TUR (W>>E)	TUR,GRE >> UCTE (E>>W)	
AREA	With TUR	Without TUR	600	700	1000	700	1000	1500	1000	1500	With TUR	600	1200	
ALB	25.7	25.5	27.8	24.2	24.7	24.3	29.2	24.4	24.3	24.2	21.8	23.3	25.5	
	25.7	25.5	27.7	24.2	24.6	24.3	29.0	24.4	24.1	24.2	21.8	23.3	25.4	
	0.00	0.00	-0.36	0.00	-0.40	0.00	-0.68	0.00	-0.82	0.00	0.00	0.00	-0.39	
BUL	67.5	68.2	74.5	69.4	69.6	70.1	75.2	83.8	70.0	73.2	25.0	32.6	37.6	
	67.5	68.2	74.6	69.4	69.7	70.1	75.4	83.8	70.2	73.1	25.0	32.6	37.8	
	0.00	0.00	0.13	0.00	0.14	0.00	0.27	0.00	0.29	-0.14	0.00	0.00	0.53	
BIH	13.6	13.6	14.6	16.3	17.6	16.4	13.9	20.3	15.6	20.3	5.1	7.1	7.3	
	13.7	13.6	14.5	16.3	17.3	16.4	13.8	20.0	15.4	19.9	5.1	7.0	7.2	
	0.74	0.00	-0.68	0.00	-1.70	0.00	-0.72	-1.48	-1.28	-1.97	0.00	-1.41	-1.37	
UCTE	87.9	87.9	109.4	111.6	110.4	110.5	86.4	101.9	86.6	101.6	51.8	72.8	51.1	
	88.0	88.0	109.6	111.5	110.4	110.5	86.6	101.8	85.7	101.1	51.8	72.8	51.1	
	0.11	0.11	0.18	-0.09	0.00	0.00	0.23	-0.10	-1.04	-0.49	0.00	0.00	0.00	
CRO	8.8	8.8	14.4	10.3	19.8	10.0	10.0	18.6	12.6	17.6	5.4	10.9	8.3	
	8.9	8.9	14.2	10.3	19.3	10.0	9.8	18.1	12.3	16.9	5.4	10.7	8.1	
	1.14	1.14	-1.39	0.00	-2.53	0.00	-2.00	-2.69	-2.38	-3.98	0.00	-1.83	-2.41	
HUN	37.5	37.5	40.1	44.7	45.1	44.5	49.9	74.8	64.8	75.7	17.1	19.1	26.6	
	37.7	37.7	40.3	44.7	45.0	44.5	49.5	73.4	63.2	73.5	17.0	19.0	26.1	
	0.53	0.53	0.50	0.00	-0.22	0.00	-0.80	-1.87	-2.47	-2.91	-0.58	-0.52	-1.88	
GRE	239.2	239.6	241.7	236.1	244.0	243.9	240.6	243.1	244.4	240.3	321.8	326.3	325.4	
	239.2	239.6	241.6	236.1	244.1	243.9	240.6	243.1	244.7	240.3	321.7	326.2	325.4	
	0.00	0.00	-0.04	0.00	0.04	0.00	0.00	0.00	0.12	0.00	-0.03	-0.03	0.00	
MKD	1.9	1.9	2.2	2.6	2.8	2.7	2.8	3.0	2.8	3.9	1.3	2.1	3.6	
	1.9	1.9	2.2	2.6	2.8	2.7	2.8	3.0	2.8	3.8	1.3	2.0	3.5	
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-2.56	0.00	-4.76	-2.78	
UKR	0.8	0.8	0.8	0.8	0.8	0.8	3.8	0.7	7.8	0.7	0.7	0.7	3.8	
	0.8	0.8	0.8	0.8	0.8	0.8	3.8	0.7	7.7	0.7	0.7	0.7	3.8	
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-1.28	0.00	0.00	0.00	0.00	
ROM	139.9	141.2	141.9	144.3	140.3	141.6	127.7	164.2	140.1	157.9	100.9	106.7	95.3	
	138.1	139.4	138.9	144.5	136.7	141.8	124.7	169.3	136.1	162.7	100.7	105.9	94.6	
	-1.29	-1.27	-2.11	0.14	-2.57	0.14	-2.35	3.11	-2.86	3.04	-0.20	-0.75	-0.73	
SLO	5.0	5.0	6.7	6.2	8.3	6.1	5.1	5.7	5.3	5.7	3.4	4.8	3.6	
	5.0	5.0	6.6	6.2	8.2	6.1	5.0	5.7	5.3	5.6	3.4	4.8	3.6	
	0.00	0.00	-1.49	0.00	-1.20	0.00	-1.96	0.00	0.00	-1.75	0.00	0.00	0.00	
TUR	185.9	/	180.7	194.5	/	/	184.3	213.9	/	/	136.9	148.8	146.4	
	185.9	/	180.7	194.5	/	/	184.4	213.8	/	/	136.9	148.8	146.5	
	0.00	/	0.00	0.00	/	/	0.05	-0.05	/	/	0.00	0.00	0.07	
YUG	99.7	99.7	102.3	108.6	112.3	108.7	103.9	137.8	110.7	134.1	41.1	42.6	47.7	
	100.1	100.0	102.4	108.4	112.0	108.6	103.9	135.4	110.5	131.4	41.2	42.5	47.5	
	0.40	0.30	0.10	-0.18	-0.27	-0.09	0.00	-1.74	-0.18	-2.01	0.24	-0.23	-0.42	
CENT	0.2	0.2	0.2	0.2	0.2	0.2	0.6	3.8	1.5	3.8	0.4	0.4	1.1	
	0.2	0.2	0.2	0.2	0.2	0.2	0.6	3.8	1.5	3.8	0.4	0.4	1.1	
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
TOTAL	913.6	730.0	957.3	969.8	796.0	779.6	933.3	1096.1	786.3	859.0	732.8	798.1	783.4	
	912.6	728.9	954.6	969.8	791.6	779.7	930.3	1096.7	780.3	857.7	732.5	796.9	781.8	
	-0.11	-0.15	-0.28	0.00	-0.55	0.01	-0.32	0.05	-0.76	-0.15	-0.04	-0.15	-0.20	

active power loses in MW without new line
active power loses in MW with new line
active power loses in %

Table 4.22. Active power losses: OHL 400kV Heviz (HUN) - Cirkovce (SLO)

	ACTIVE POWER LOSSES												
	WINTER										SUMMER		
	Base case		Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6	Scenario 7	Scenario 8	Base case	Scenario 1	Scenario 5
			UCTE >> TUR (W>>E)	TUR,GRE >> UCTE (E>>W)	UCTE >> BUL,GRE,ALB (W>>E)	BUL,GRE,ROM >> UCTE (E>>W)	CEN,UKR,ROM >> TUR,GRE (N>>S)	TUR,BUL >> CEN (S>>N)	CEN,UKR >> BUL,GRE,ALB (N>>S)	ROM,BUL,GRE >> CEN (S>>W)		UCTE >> TUR (W>>E)	TUR,GRE >> UCTE (E>>W)
AREA	With TUR	Without TUR	600	700	1000	700	1000	1500	1000	1500	With TUR	600	1200
ALB	25.7	25.5	27.8	24.2	24.7	24.3	29.2	24.4	24.3	24.2	21.8	23.3	25.5
	25.7	25.5	27.7	24.2	24.6	24.3	29.1	24.4	24.2	24.3	21.8	23.3	25.5
	0.00	0.00	-0.36	0.00	-0.40	0.00	-0.34	0.00	-0.41	0.41	0.00	0.00	0.00
BUL	67.5	68.2	74.5	69.4	69.6	70.1	75.2	83.8	70.0	73.2	25.0	32.6	37.6
	67.6	68.3	74.6	69.4	69.7	70.1	75.2	83.8	70.0	73.2	25.0	32.7	37.6
	0.15	0.15	0.13	0.00	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.31	0.00
BIH	13.6	13.6	14.6	16.3	17.6	16.4	13.9	20.3	15.6	20.3	5.1	7.1	7.3
	13.6	13.5	14.2	16.4	16.9	16.5	13.8	20.9	15.5	20.9	5.1	6.8	7.3
	0.00	-0.74	-2.74	0.61	-3.98	0.61	-0.72	2.96	-0.64	2.96	0.00	-4.23	0.00
UCTE	87.9	87.9	109.4	111.6	110.4	110.5	86.4	101.9	86.6	101.6	51.8	72.8	51.1
	86.9	86.9	107.0	111.1	107.7	110.0	86.2	96.4	86.6	96.0	51.4	71.4	51.1
	-1.14	-1.14	-2.19	-0.45	-2.45	-0.45	-0.23	-5.40	0.00	-5.51	-0.77	-1.92	0.00
CRO	8.8	8.8	14.4	10.3	19.8	10.0	10.0	18.6	12.6	17.6	5.4	10.9	8.3
	7.8	7.8	11.4	10.2	16.4	9.9	9.4	17.1	12.2	16.0	5.0	9.1	8.3
	-11.36	-11.36	-20.83	-0.97	-17.17	-1.00	-6.00	-8.06	-3.17	-9.09	-7.41	-16.51	0.00
HUN	37.5	37.5	40.1	44.7	45.1	44.5	49.9	74.8	64.8	75.7	17.1	19.1	26.6
	38.2	38.0	40.8	44.9	45.7	44.7	50.2	75.0	64.9	75.6	17.3	19.5	26.7
	1.87	1.33	1.75	0.45	1.33	0.45	0.60	0.27	0.15	-0.13	1.17	2.09	0.38
GRE	239.2	239.6	241.7	236.1	244.0	243.9	240.6	243.1	244.4	240.3	321.8	326.3	325.4
	239.2	239.6	241.6	236.1	244.1	243.9	240.6	243.2	244.4	240.3	321.7	326.2	325.4
	0.00	0.00	-0.04	0.00	0.04	0.00	0.00	0.04	0.00	0.00	-0.03	-0.03	0.00
MKD	1.9	1.9	2.2	2.6	2.8	2.7	2.8	3.0	2.8	3.9	1.3	2.1	3.6
	1.9	1.9	2.2	2.6	2.8	2.7	2.8	3.1	2.8	3.9	1.3	2.0	3.6
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.33	0.00	0.00	0.00	-4.76	0.00
UKR	0.8	0.8	0.8	0.8	0.8	0.8	3.8	0.7	7.8	0.7	0.7	0.7	3.8
	0.8	0.8	0.8	0.8	0.8	0.8	3.8	0.7	7.8	0.7	0.7	0.7	3.8
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ROM	139.9	141.2	141.9	144.3	140.3	141.6	127.7	164.2	140.1	157.9	100.9	106.7	95.3
	139.5	140.8	141.7	144.0	140.3	141.2	127.7	162.3	140.1	156.1	100.8	106.8	95.3
	-0.29	-0.28	-0.14	-0.21	0.00	-0.28	0.00	-1.16	0.00	-1.14	-0.10	0.09	0.00
SLO	5.0	5.0	6.7	6.2	8.3	6.1	5.1	5.7	5.3	5.7	3.4	4.8	3.6
	4.9	4.9	6.2	6.2	7.6	6.2	4.9	6.4	5.1	6.3	3.4	4.5	3.6
	-2.00	-2.00	-7.46	0.00	-8.43	1.64	-3.92	12.28	-3.77	10.53	0.00	-6.25	0.00
TUR	185.9	/	180.7	194.5	/	/	184.3	213.9	/	/	136.9	148.8	146.4
	185.9	/	180.7	194.5	/	/	184.3	213.9	/	/	136.9	148.8	146.4
	0.00	/	0.00	0.00	/	/	0.00	0.00	/	/	0.00	0.00	0.00
YUG	99.7	99.7	102.3	108.6	112.3	108.7	103.9	137.8	110.7	134.1	41.1	42.6	47.7
	99.3	99.2	101.6	108.3	111.7	108.4	103.7	136.4	110.7	132.8	41.1	42.5	47.7
	-0.40	-0.50	-0.68	-0.28	-0.53	-0.28	-0.19	-1.02	0.00	-0.97	0.00	-0.23	0.00
CENT	0.2	0.2	0.2	0.2	0.2	0.2	0.6	3.8	1.5	3.8	0.4	0.4	1.1
	0.2	0.2	0.2	0.2	0.2	0.2	0.6	3.8	1.5	3.8	0.4	0.4	1.1
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL	913.6	730.0	957.3	969.8	796.0	779.6	933.3	1096.1	786.3	859.0	732.8	798.1	783.4
	911.7	728.0	952.1	969.1	789.9	778.9	932.6	1089.9	785.9	852.2	732.1	795.3	783.5
	-0.21	-0.27	-0.54	-0.07	-0.77	-0.09	-0.08	-0.57	-0.05	-0.79	-0.10	-0.35	0.01

active power loses in MW without new line
active power loses in MW with new line
active power loses in %

Table 4.23. Active power losses: OHL 400kV Skopje (MKD) -Tirana (ALB)

	ACTIVE POWER LOSSES													
	WINTER										SUMMER			
	Base case		Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6	Scenario 7	Scenario 8	Base case	Scenario 1	Scenario 5	
			UCTE >> TUR (W>>E)	TUR,GRE >> UCTE (E>>W)	UCTE >> BUL,GRE,ALB (W>>E)	BUL,GRE,ROM >> UCTE (E>>W)	CEN,UKR,ROM >> TUR,GRE (N>>S)	TUR,BUL >> CEN (S>>N)	CEN,UKR >> BUL,GRE,ALB (N>>S)	ROM,BUL,GRE >> CEN (S>>W)		UCTE >> TUR (W>>E)	TUR,GRE >> UCTE (E>>W)	
AREA	With TUR	Without TUR	600	700	1000	700	1000	1500	1000	1500	With TUR	600	1200	
ALB	25.7	25.5	27.8	24.3	24.9	24.2	29.2	24.4	24.2	24.2	21.8	23.3	25.7	
	24.0	23.9	25.1	23.6	19.6	23.6	25.9	23.9	19.3	24.0	20.7	21.4	22.7	
	-6.61	-6.27	-9.71	-2.88	-21.29	-2.48	-11.30	-2.05	-20.25	-0.83	-5.05	-8.15	-11.67	
BUL	67.5	68.2	74.5	69.4	69.7	69.9	75.2	82.9	70.1	73.1	25.0	32.6	37.8	
	67.4	68.2	73.8	69.3	68.6	69.8	74.0	82.4	69.0	72.9	25.0	32.0	36.3	
	-0.15	0.00	-0.94	-0.14	-1.58	-0.14	-1.60	-0.60	-1.57	-0.27	0.00	-1.84	-3.97	
BIH	13.5	13.6	14.4	16.4	17.7	16.5	13.7	20.7	15.6	20.3	5.2	7.1	7.4	
	13.6	13.7	14.6	16.8	18.0	16.9	14.0	21.6	15.8	21.1	5.2	7.4	7.8	
	0.74	0.74	1.39	2.44	1.69	2.42	2.19	4.35	1.28	3.94	0.00	4.23	5.41	
UCTE	87.9	87.9	109.4	108.3	112.4	112.8	86.0	102.5	86.6	101.5	51.8	71.9	51.7	
	87.8	87.9	109.2	108.6	111.4	113.1	86.2	102.8	87.1	101.6	51.7	72.7	51.4	
	-0.11	0.00	-0.18	0.28	-0.89	0.27	0.23	0.29	0.58	0.10	-0.19	1.11	-0.58	
CRO	8.8	8.8	14.5	10.0	20.4	10.1	10.1	18.5	12.6	17.7	5.4	10.7	8.4	
	8.8	8.8	14.5	10.1	20.4	10.2	10.2	18.8	12.7	17.9	5.4	11.0	8.6	
	0.00	0.00	0.00	1.00	0.00	0.99	0.99	1.62	0.79	1.13	0.00	2.80	2.38	
HUN	37.5	37.7	40.0	44.4	45.9	45.1	49.8	75.3	64.9	74.4	17.2	19.0	26.7	
	37.5	37.7	39.7	44.3	44.9	45.0	49.6	74.7	64.4	73.8	17.2	19.0	26.5	
	0.00	0.00	-0.75	-0.23	-2.18	-0.22	-0.40	-0.80	-0.77	-0.81	0.00	0.00	-0.75	
GRE	239.2	239.6	241.7	239.2	255.1	244.2	241.5	242.7	243.1	240.4	321.8	326.0	352.1	
	238.2	238.7	241.1	238.4	253.0	243.3	240.6	242.3	241.1	239.7	320.2	325.3	350.3	
	-0.42	-0.38	-0.25	-0.33	-0.82	-0.37	-0.37	-0.16	-0.82	-0.29	-0.50	-0.21	-0.51	
MKD	1.9	1.9	2.2	2.6	2.9	2.7	2.9	3.0	2.8	3.8	1.3	2.1	3.7	
	1.9	2.0	2.0	2.7	2.1	2.8	2.3	3.1	2.1	3.8	1.4	1.8	2.9	
	0.00	5.26	-9.09	3.85	-27.59	3.70	-20.69	3.33	-25.00	0.00	7.69	-14.29	-21.62	
UKR	0.8	0.8	0.8	0.8	0.8	0.8	3.8	0.7	7.8	0.7	0.7	0.7	3.8	
	0.8	0.8	0.8	0.8	0.8	0.8	3.8	0.7	7.8	0.7	0.7	0.7	3.8	
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
ROM	139.9	141.2	141.9	144.1	140.4	141.7	127.8	165.8	140.1	158.3	100.9	106.7	95.4	
	139.8	141.2	141.6	143.9	139.8	141.4	127.4	164.5	139.5	157.1	100.8	106.2	94.5	
	-0.07	0.00	-0.21	-0.14	-0.43	-0.21	-0.31	-0.78	-0.43	-0.76	-0.10	-0.47	-0.94	
SLO	5.0	5.0	6.7	6.1	8.5	6.2	5.1	5.7	5.3	5.7	3.4	4.8	3.6	
	5.0	5.0	6.7	6.2	8.5	6.2	5.1	5.7	5.3	5.7	3.4	4.9	3.6	
	0.00	0.00	0.00	1.64	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.08	0.00	
TUR	185.9		180.7	194.9			184.4	213.7			136.8	148.8	146.5	
	185.8		180.6	194.9			184.2	213.8			136.8	148.7	146.3	
	-0.05		-0.06	0.00			-0.11	0.05			0.00	-0.07	-0.14	
YUG	99.8	99.7	102.4	108.3	112.8	108.8	104.0	138.2	110.7	134.6	41.1	42.7	47.7	
	99.7	99.6	100.6	107.3	106.1	107.8	101.8	134.6	105.2	130.8	41.2	41.8	45.8	
	-0.10	-0.10	-1.76	-0.92	-5.94	-0.92	-2.12	-2.60	-4.97	-2.82	0.24	-2.11	-3.98	
CENT	0.2	0.2	0.2	0.2	0.2	0.2	0.6	3.8	1.5	3.8	0.4	0.4	1.1	
	0.2	0.2	0.2	0.2	0.2	0.2	0.6	3.8	1.5	3.8	0.4	0.4	1.1	
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
TOTAL	913.5	730.2	957.2	969.1	811.5	783.0	934.1	1098.0	785.2	858.4	732.8	796.9	811.4	
	910.9	727.8	951.2	967.6	795.6	781.5	926.7	1093.9	772.6	854.0	730.3	793.7	802.8	
	-0.28	-0.33	-0.63	-0.15	-1.96	-0.19	-0.79	-0.37	-1.60	-0.51	-0.34	-0.40	-1.06	

active power loses in MW without new line
active power loses in MW with new line
active power loses in %

Table 4.24. Active power losses: OHL 400kV Chervena Mogila (BUL) - Stip (MKD)

	ACTIVE POWER LOSSES													
	WINTER										SUMMER			
	Base case		Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6	Scenario 7	Scenario 8	Base case	Scenario 1	Scenario 5	
			UCTE >> TUR (W>>E)	TUR,GRE >> UCTE (E>>W)	UCTE >> BUL,GRE,ALB (W>>E)	BUL,GRE,ROM >> UCTE (E>>W)	CEN,UKR,ROM >> TUR,GRE (N>>S)	TUR,BUL >> CEN (S>>N)	CEN,UKR >> BUL,GRE,ALB (N>>S)	ROM,BUL,GRE >> CEN (S>>W)		UCTE >> TUR (W>>E)	TUR,GRE >> UCTE (E>>W)	
AREA	With TUR	Without TUR	600	700	1000	700	1000	1500	1000	1500	With TUR	600	1200	
ALB	25.7	25.5	27.8	24.3	24.9	24.2	29.2	24.4	24.2	24.2	21.8	23.3	25.7	
	25.7	25.5	27.8	24.3	24.4	24.3	28.9	24.4	23.8	24.2	21.8	23.3	25.4	
	0.00	0.00	0.00	0.00	-2.01	0.41	-1.03	0.00	-1.65	0.00	0.00	0.00	-1.17	
BUL	67.5	68.2	74.5	69.4	69.7	69.9	75.2	82.9	70.1	73.1	25.0	32.6	37.8	
	67.5	68.2	74.3	69.3	69.4	69.8	74.5	82.9	69.6	73.0	24.9	32.5	37.3	
	0.00	0.00	-0.27	-0.14	-0.43	-0.14	-0.93	0.00	-0.71	-0.14	-0.40	-0.31	-1.32	
BIH	13.5	13.6	14.4	16.4	17.7	16.5	13.7	20.7	15.6	20.3	5.2	7.1	7.4	
	13.6	13.6	14.4	16.4	17.6	16.4	13.7	20.8	15.4	20.1	5.2	7.1	7.3	
	0.74	0.00	0.00	0.00	-0.56	-0.61	0.00	0.48	-1.28	-0.99	0.00	0.00	-1.35	
UCTE	87.9	87.9	109.4	108.3	112.4	112.8	86.0	102.5	86.6	101.5	51.8	71.9	51.7	
	87.9	87.9	109.4	108.3	112.3	112.8	86.0	102.6	86.6	101.2	51.8	71.8	51.6	
	0.00	0.00	0.00	0.00	-0.09	0.00	0.00	0.10	0.00	-0.30	0.00	-0.14	-0.19	
CRO	8.8	8.8	14.5	10.0	20.4	10.1	10.1	18.5	12.6	17.7	5.4	10.7	8.4	
	8.8	8.8	14.5	10.0	20.2	10.1	10.1	18.5	12.4	17.5	5.4	10.7	8.3	
	0.00	0.00	0.00	0.00	-0.98	0.00	0.00	0.00	-1.59	-1.13	0.00	0.00	-1.19	
HUN	37.5	37.7	40.0	44.4	45.9	45.1	49.8	75.3	64.9	74.4	17.2	19.0	26.7	
	37.5	37.7	40.1	44.4	46.0	45.1	49.8	75.3	64.9	74.3	17.2	19.0	26.7	
	0.00	0.00	0.25	0.00	0.22	0.00	0.00	0.00	0.00	-0.13	0.00	0.00	0.00	
GRE	239.2	239.6	241.7	239.2	255.1	244.2	241.5	242.7	243.1	240.4	321.8	326.0	352.1	
	239.0	239.4	241.6	239.0	254.8	243.8	241.6	242.4	242.9	240.0	321.1	325.5	351.6	
	-0.08	-0.08	-0.04	-0.08	-0.12	-0.16	0.04	-0.12	-0.08	-0.17	-0.22	-0.15	-0.14	
MKD	1.9	1.9	2.2	2.6	2.9	2.7	2.9	3.0	2.8	3.8	1.3	2.1	3.7	
	1.8	1.9	2.1	2.6	2.7	2.7	2.7	2.9	2.6	3.9	1.3	2.0	3.2	
	-5.26	0.00	-4.55	0.00	-6.90	0.00	-6.90	-3.33	-7.14	2.63	0.00	-4.76	-13.51	
UKR	0.8	0.8	0.8	0.8	0.8	0.8	3.8	0.7	7.8	0.7	0.7	0.7	3.8	
	0.8	0.8	0.8	0.8	0.8	0.8	3.8	0.7	7.8	0.7	0.7	0.7	3.8	
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
ROM	139.9	141.2	141.9	144.1	140.4	141.7	127.8	165.8	140.1	158.3	100.9	106.7	95.4	
	139.8	141.1	141.9	144.1	140.7	141.6	127.8	165.6	140.5	158.1	100.9	106.6	95.8	
	-0.07	-0.07	0.00	0.00	0.21	-0.07	0.00	-0.12	0.29	-0.13	0.00	-0.09	0.42	
SLO	5.0	5.0	6.7	6.1	8.5	6.2	5.1	5.7	5.3	5.7	3.4	4.8	3.6	
	5.0	5.0	6.7	6.1	8.5	6.2	5.1	5.7	5.3	5.6	3.4	4.8	3.6	
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-1.75	0.00	0.00	0.00	
TUR	185.9	/	180.7	194.9	/	/	184.4	213.7	/	/	136.8	148.8	146.5	
	185.9	/	180.6	194.9	/	/	184.1	213.6	/	/	136.8	148.7	146.2	
	0.00	/	-0.06	0.00	/	/	-0.16	-0.05	/	/	0.00	-0.07	-0.20	
YUG	99.8	99.7	102.4	108.3	112.8	108.8	104.0	138.2	110.7	134.6	41.1	42.7	47.7	
	99.7	99.6	102.3	108.2	112.0	108.7	103.6	138.1	109.8	134.0	41.1	42.7	47.1	
	-0.10	-0.10	-0.10	-0.09	-0.71	-0.09	-0.38	-0.07	-0.81	-0.45	0.00	0.00	-1.26	
CENT	0.2	0.2	0.2	0.2	0.2	0.2	0.6	3.8	1.5	3.8	0.4	0.4	1.1	
	0.2	0.2	0.2	0.2	0.2	0.2	0.6	3.8	1.5	3.8	0.4	0.4	1.1	
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
TOTAL	913.5	730.2	957.2	969.1	811.5	783.0	934.1	1098.0	785.2	858.4	732.8	796.9	811.4	
	913.1	729.7	956.6	968.6	809.4	782.4	932.4	1097.5	783.2	856.4	732.0	795.9	809.0	
	-0.04	-0.07	-0.06	-0.05	-0.26	-0.08	-0.18	-0.05	-0.25	-0.23	-0.11	-0.13	-0.30	

active power loses in MW without new line
active power loses in MW with new line
active power loses in %

Table 4.25. Active power losses: OHL 400kV Maritsa Iztok 3(BUL) - Filippi (GRE)

	ACTIVE POWER LOSSES													
	WINTER										SUMMER			
	Base case		Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6	Scenario 7	Scenario 8	Base case	Scenario 1	Scenario 5	
			UCTE >> TUR (W>>E)	TUR,GRE >> UCTE (E>>W)	UCTE >> BUL,GRE,ALB (W>>E)	BUL,GRE,ROM >> UCTE (E>>W)	CEN,UKR,ROM >> TUR,GRE (N>>S)	TUR,BUL >> CEN (S>>N)	CEN,UKR >> BUL,GRE,ALB (N>>S)	ROM,BUL,GRE >> CEN (S>>W)		UCTE >> TUR (W>>E)	TUR,GRE >> UCTE (E>>W)	
AREA	With TUR	Without TUR	600	700	1000	700	1000	1500	1000	1500	With TUR	600	1200	
ALB	25.7	25.5	27.8	24.7	24.9	24.2	29.2	24.4	24.2	24.2	21.8	23.3	25.7	
	25.5	25.3	27.7	24.8	24.0	24.2	28.8	24.4	23.3	24.2	21.7	23.2	25.3	
	-0.78	-0.78	-0.36	0.40	-3.61	0.00	-1.37	0.00	-3.72	0.00	-0.46	-0.43	-1.56	
BUL	67.5	68.2	74.5	78.5	69.7	69.9	75.2	82.9	70.1	73.1	25.0	32.6	37.8	
	66.5	67.2	74.2	76.7	66.9	69.2	74.3	79.3	67.0	72.6	24.3	32.4	37.1	
	-1.48	-1.47	-0.40	-2.29	-4.02	-1.00	-1.20	-4.34	-4.42	-0.68	-2.80	-0.61	-1.85	
BIH	13.5	13.6	14.4	25.0	17.7	16.5	13.7	20.7	15.6	20.3	5.2	7.1	7.4	
	13.6	13.6	14.4	25.2	17.4	16.5	13.7	21.0	15.3	20.3	5.2	7.1	7.3	
	0.74	0.00	0.00	0.80	-1.69	0.00	0.00	1.45	-1.92	0.00	0.00	0.00	-1.35	
UCTE	87.9	87.9	109.4	105.1	112.4	112.8	86.0	102.5	86.6	101.5	51.8	71.9	51.7	
	87.9	87.9	109.3	105.2	112.3	112.8	86.0	102.7	86.7	101.5	51.8	71.8	51.6	
	0.00	0.00	-0.09	0.10	-0.09	0.00	0.00	0.20	0.12	0.00	0.00	-0.14	-0.19	
CRO	8.8	8.8	14.5	24.9	20.4	10.1	10.1	18.5	12.6	17.7	5.4	10.7	8.4	
	8.8	8.8	14.5	24.9	20.2	10.1	10.1	18.6	12.4	17.7	5.4	10.6	8.3	
	0.00	0.00	0.00	0.00	-0.98	0.00	0.00	0.54	-1.59	0.00	0.00	-0.93	-1.19	
HUN	37.5	37.7	40.0	50.6	45.9	45.1	49.8	75.3	64.9	74.4	17.2	19.0	26.7	
	37.5	37.8	40.1	50.5	46.1	45.0	49.9	75.3	65.0	74.4	17.2	19.0	26.7	
	0.00	0.27	0.25	-0.20	0.44	-0.22	0.20	0.00	0.15	0.00	0.00	0.00	0.00	
GRE	239.2	239.6	241.7	242.4	255.1	244.2	241.5	242.7	243.1	240.4	321.8	326.0	352.1	
	239.4	239.9	241.7	243.1	255.6	244.4	241.6	243.6	243.8	240.4	320.7	324.9	350.4	
	0.08	0.13	0.00	0.29	0.20	0.08	0.04	0.37	0.29	0.00	-0.34	-0.34	-0.48	
MKD	1.9	1.9	2.2	4.9	2.9	2.7	2.9	3.0	2.8	3.8	1.3	2.1	3.7	
	1.9	2.0	2.2	5.2	2.2	2.8	2.6	3.3	2.1	3.9	1.3	2.0	3.3	
	0.00	5.26	0.00	6.12	-24.14	3.70	-10.34	10.00	-25.00	2.63	0.00	-4.76	-10.81	
UKR	0.8	0.8	0.8	0.8	0.8	0.8	3.8	0.7	7.8	0.7	0.7	0.7	3.8	
	0.8	0.8	0.8	0.8	0.8	0.8	3.8	0.7	7.8	0.7	0.7	0.7	3.8	
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
ROM	139.9	141.2	141.9	151.8	140.4	141.7	127.8	165.8	140.1	158.3	100.9	106.7	95.4	
	140.3	141.8	142.3	151.9	142.4	141.8	128.5	165.8	142.3	158.3	101.3	107.0	96.1	
	0.29	0.42	0.28	0.07	1.42	0.07	0.55	0.00	1.57	0.00	0.40	0.28	0.73	
SLO	5.0	5.0	6.7	12.1	8.5	6.2	5.1	5.7	5.3	5.7	3.4	4.8	3.6	
	5.0	5.0	6.7	12.1	8.5	6.2	5.1	5.7	5.3	5.7	3.4	4.8	3.6	
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
TUR	185.9	/	180.7	212.4	/	/	184.4	213.7	/	/	136.8	148.8	146.5	
	185.4	/	180.3	212.1	/	/	183.4	212.6	/	/	136.4	148.4	145.4	
	-0.27	/	-0.22	-0.14	/	/	-0.54	-0.51	/	/	-0.29	-0.27	-0.75	
YUG	99.8	99.7	102.4	128.5	112.8	108.8	104.0	138.2	110.7	134.6	41.1	42.7	47.7	
	99.7	99.7	102.3	128.6	111.1	108.8	103.5	138.3	108.9	134.6	41.1	42.6	47.1	
	-0.10	0.00	-0.10	0.08	-1.51	0.00	-0.48	0.07	-1.63	0.00	0.00	-0.23	-1.26	
CENT	0.2	0.2	0.2	0.2	0.2	0.2	0.6	3.8	1.5	3.8	0.4	0.4	1.1	
	0.2	0.2	0.2	0.2	0.2	0.2	0.6	3.8	1.5	3.8	0.4	0.4	1.1	
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
TOTAL	913.5	730.2	957.2	1061.8	811.5	783.0	934.1	1098.0	785.2	858.4	732.8	796.9	811.4	
	912.8	730.0	956.8	1061.4	808.3	782.9	932.3	1096.2	782.2	858.2	731.1	795.1	807.8	
	-0.08	-0.03	-0.04	-0.04	-0.39	-0.01	-0.19	-0.16	-0.38	-0.02	-0.23	-0.23	-0.44	

active power loses in MW without new line
active power loses in MW with new line
active power loses in %

7. APPENDIX B

This appendix contains tables with all computational results and is given in electronic form only.

8. REFERENCE

List of participating electric power companies and institutes in the project:

CMS Energy, USA

Electric Power Company of Macedonia – ESM, Skopje, Macedonia
"A.D. Elektrostopanstvo na Makedonija"

Electricity Coordinating Center – EKC, Belgrade, Serbia, Yugoslavia
"Elektroenergetski Koordinacioni Centar"

Electric Power Industry of Serbia – EPS, Belgrade, Serbia, Yugoslavia
"Elektroprivreda Srbije"

Electric Power Company of Montenegro – EPCG, Niksic, Montenegro, Yugoslavia
"Elektroprivreda Crne Gore"

Electric Power Company of Croatia – HEP, Zagreb, Croatia
"Hrvatska Elektroprivreda D.D."

Energy Institute Hrvoje Pozar – EIHP, Zagreb, Croatia
"Energetski Institut Hrvoje Pozar"

Joint Power Coordination Centre B&H – ZEKC, Sarajevo, Bosnia and Herzegovina
"Zajednicki Elektroenergetski Koordinacijski Centar BiH"

Electric Power Utility of B&H – EP BiH, Sarajevo, Bosnia and Herzegovina
"Elektroprivreda BiH"

Electric Power Utility of Republic of Srpska – ERS, Trebinje, Republic of Srpska
"Elektroprivreda Republike Srpske"

Electric Power Utility of Croatian Community of HB – EP HZHB, Mostar, Croatian Community of Herzeg-Bosnia
"Elektroprivreda Hrvatske Zajednice Herceg-Bosne"

National Electric Company of Bulgaria – NEK-EAD, Sofia, Bulgaria
"Natsionalna Elektricheska Kompania EAD"

National Power Grid Company – TEL, Bucharest, Romania
"TRANSELECTRICA – S.A."

Hellenic Transmission System Operator – HTSO, Athens, Greece

Albanian Electric Power Company – KESH, Tirana, Albania
"Korporata Elektro-energjetike Shqiptare"

Electric Power Utility of Hungary – MVM Rt, Budapest, Hungary
”Magyar Villamos Müvek”

Turkish Electricity Transmission Corporation – TEIAŞ, Ankara, Turkey
”Türkey Elektrik Iletim A.Ş.”

Electric Power Company of Slovenia – ELES, Ljubljana, Slovenia
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