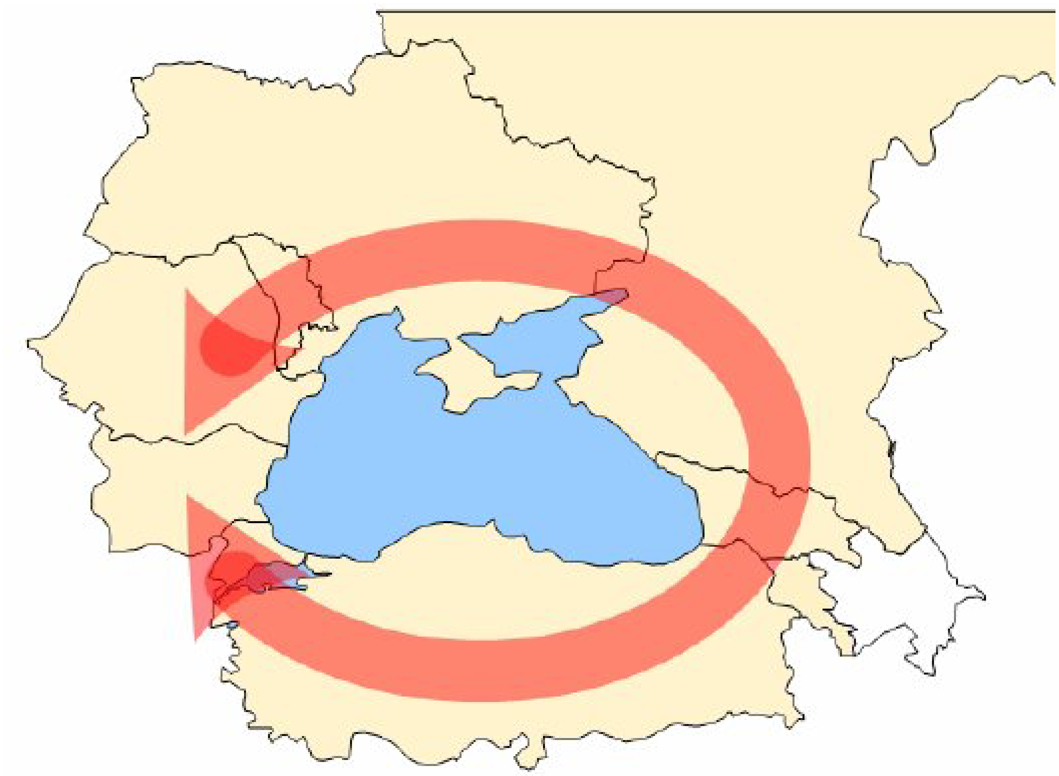
Black Sea Regional Transmission Planning Project

Regional Model Construction Report



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Contents

1. INTRODUCTION

The initial meeting of the Black Sea Regional Transmission Planning Project was conducted in Sofia, Bulgaria February 18-20, 2004. At the meeting representatives of the Black Sea IPS/UPS TSOs and the Southeast Europe Black Sea TSOs, together with the US Agency for International Development, the US Energy Association and the Black Sea Regional Energy Centre, developed and agreed to a set of Project organizing principles.

The project is supporting the following goals:

- Preparation of national inputs and the development of a regional transmission model
- Power transmission system analysis
- Promotion of regional cooperation on transmission planning among Black Sea region TSOs
- Analyze the regional transmission system to identify the existing potential for electric power trade in the region
- Identify potential transmission investment projects to expand electric power trade respecting reliability requirements
- Promote the results of the analysis to a wide audience of policy and regulatory authorities
- Enhancement of the trade of electric power in the Black Sea region
- Elaboration and dissemination of the project report

A Steering Committee was established in order to advise the project. The members if Steering Committee are representatives of:

- Black Sea Regional Energy Centre
- Georgian State Electrosystem
- Moldelectrica
- National Electric Company (Bulgaria)
- National Electric Company Ukrenergo
- System Operator-Central Dispatch Administration of the Unified Energy System of Russia
- Transelectrica (Romania)
- Turkish Electricity Transmission Corporation
- Electricity coordinating Center
- United States Agency for International Development
- United States Energy Association

The Steering Committee reviewed work plans, assessed objectives and plans, and review reports and recommendations on investment priorities.

Also, the Regional Working Group was formed in order to analyze possibilities of increasing electricity trade level between Black Sea region and West Europe and to identify bottle-necks and make proposition of network reinforcement. For the utilities from the Black Sea countries, which are undergoing different degrees of structural and functional change in a political environment, developing a regional transmission planning organization with the necessary tools and procedures suitable for the changing market is a significant need.

The following project objectives have been agreed to:

(1) convert existing national transmission planning data into a common regional PSS/E format
(2) establishing of regional transmission planning model for the Black Sea region
(3) perform certain regional transmission planning studies as defined by the BS Steering Committee

A Regional Working Group was consisted from each participating country and Electricity Coordinating Center-EKC, which act as the regional model integrator.
A work plan and schedule was developed by the Regional Working Group to frame the activities of the project.
Based on the regional transmission network model, the Regional Working Group was elaborated a set of supply/demand and load flow scenarios and performed analysis to identify the weak points in the system and test potential reinforcements to improve the safety in operation of the power systems and provide opportunities for expanded electricity trade.

National transmission network models in PSS/E format were developed by the specialists from Black Sea countries. In the process of elaboration the national models the participants agreed the expected exchange program for target year i.e. export/import balance and load & generation forecast for 2010 was approved by all members.
The regional model integrator EKC has taken the following obligations:

- Review all collected data to check that they conform to the agreed numbering systems for areas, zones and busses
- Merge all model data in order to form one model for each regime and representing the year 2010
- Test the operation and accuracy of the regional model
- EKC is responsible for the integrated model

Turkey is responsible for integrating the Turkey and Georgia systems in PSS/E program as sub-integrator.

In Scope of Work was necessary to identify winter and summer load regimes. Regional Transmission Network Model for the year 2010 winter peak and summer light data from Bulgaria, Georgia, Moldova, Romania, Russia, Turkey and Ukraine are established.

The Black Sea Regional Transmission Planning Project (BSTP) model used more detailed generation unit representation, i.e. each unit is represented separately and included lower voltage levels and the step-up transformers. Regional Model is updated with most recent information. (P, Q, new planed: branches, generator units, compensators, phase shift transformers, shunts, etc). In the model, whole 750, 500, 400, 330, 220, 150 kV network are included.

Each country gave table for total of generation, consumption, exchange program, long term contract for importing or exporting if any, for 2010. One base scenario and some exchange scenarios will be analyzed with assumptions that the region is synchronously interconnected to UCTE. That means that one of the basic prerequisite is that the UCTE zone will be connected to the main IPS/UPS Interconnection through existing interconnectivity lines. The UCTE interconnection is modeled with adequate equivalents in the border region with Black Sea Region.

The goal of this Report is to review all necessary technical data for all Black Sea countries and the region as a whole used in regional transmission planning project.

Figure 1.1 – Interconnection lines in Black Sea Region

In Figure 1.1, scheme of interconnected network of Black Sea Countries (only border lines) is presented.

A power systems data for all analyzed countries is shown in Chapter two of this Report.

Model development, model characteristics and base case scenarios are presented in Chapter three of this Report with title REGIONAL MODEL.

In Chapter four are presented Analyses results in following subchapters: MODEL SUMMARY-Summary report for each TSO in the region, AREA INTERCHANGE - Base case exchanges and border flows for each TSO in the region, LOAD FLOWS ANALISES-report on major lines and interfaces with graphical presentation of load flows for each TSO and region as whole, NETWORK LOADING ANALYSES - Report on elements that are overloaded or highly loaded and may represent network constraint, VOLTAGE PROFILE ANALISES taking into account agreed maximum and minimum voltage values for normal and emergency operation condition, CONTINGENCY ANALISES respect to (n-1) security criterion, BORDER CAPACITIES ANALYSES – report on maximum transfer capabilities of the network for each country, and some market realistic scenarios.

List of NEW PLANED LINES AND SUBSTATIONS was reviewed and revised as the most probable projects for consideration, and shown in Chapter five of this Report. In that table, the projects that will be in operation in 2010 are indicated.

Overall FINDINGS are presented in final Chapter six of this document.

2. POWER SYSTEMS DATA

2.1. BULGARIA

The power transmission network of Bulgaria consists of 750 kV, 400 kV, 220 kV and 110 kV lines. Figure 2.1 shows the map of Bulgarian network and Table 2.1 shows main data about Bulgarian transmission network.

The installed generation capacity comprises about 5400 MW of thermal units, 2880 MW of nuclear units, and 2600 MW of hydro units. Thermal power plants produce about 47 % of the total energy, and nuclear units produce about 42 % of the total energy. Hydro units cover 11 % of the total energy.

Table 2.1 – Bulgaria - network overview

lines		transformers	
Voltage level	Length of the overhead lines and cables	Voltage level	Installed capacities
(kV)	(km)	(kV/kV)	(MVA)
400	2356	400/x	-
220	2692	220/x	-
110	9562	110/x	-
total	14610		16817

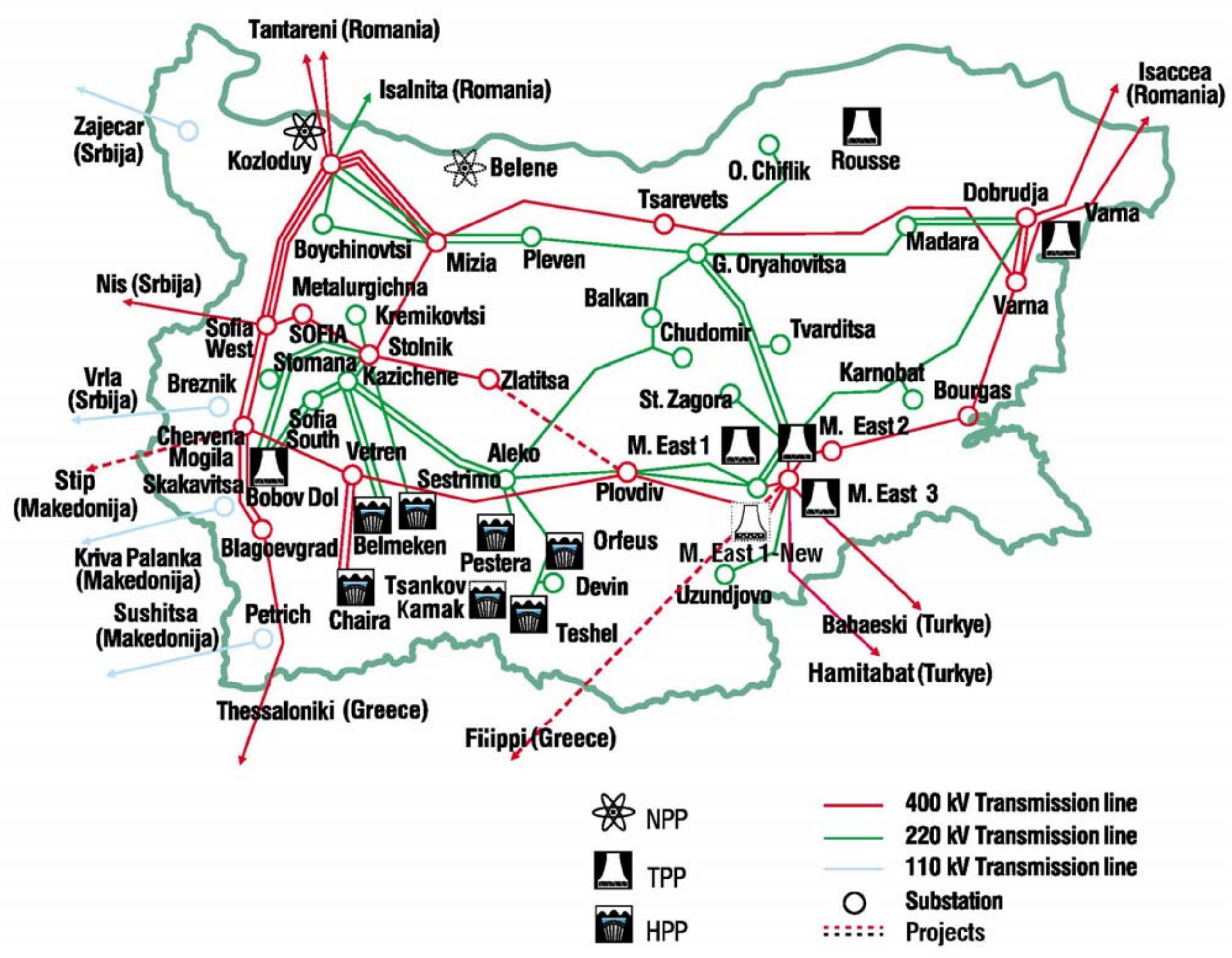


Figure 2.1 – Bulgaria - network map

NEK EAD is the owner of the high-voltage power transmission network in the country. Its total length is 14 610 km. The interconnection lines between the Bulgarian EPS and neighboring countries are shown in Table 2.2 and grid operation data for 2005 – in Table 2.3.

Table 2.2 – Bulgaria – interconnection lines

Interconnection Lines between the Republic of Bulgaria and Neighbour Countries

Country	Substation	Voltage кV	Number of lines	Length km	Cross Section mm^2
Romania	NPP Kozloduy (BG) - Tantareni (RO)	400	2	115.7 (14)	2ACO 500
Romania	NPP Kozloduy (BG) - Isalnita (RO)	220	1	98.1 (18.6)	ACO 500
Romania	Varna (BG) - Isaccea (RO)	400	1	235.4 (85)	5ACO 300
Romania	Dobrudja (BG) - Isaccea (RO)	400	1	230.6 (80.3)	3ACO 400
Turkey	TPP Maritsa East 3 (BG) - Babaeski (TR)	400	1	136.6 (59.5)	2ACO 500
Turkey	TPP Maritsa East 3 (BG) - GPP Hamitabat (TR)	400	1	150 (59)	3ACO 400
Greece	Blagoevgrad (BG) - Thessaloniki (GR)	400	1	174.7 (72.7)	2AC 500
Macedonia	Petrich (BG) - Sushitsa (MK)	110	1	49.3 (21.5)	ACO 400
Macedonia	Skakavitsa (BG) - Kriva Palanka (MK)	110	1	12.7 (5.3)	ACO 400
Macedonia	Chervena Mogila (BG) - Stip (MK)	400	under construction		
Serbia	Sofia West (BG) - Nis (SER)	400	1	122.6 (37)	2ACO 500
Serbia	Breznik (BG) - Vurla (SER)	110	1	64.1 (41.1)	AC 185
Serbia	Kula (BG) - Zajecar (SER)	110	1	21 (11.8)	AC 185

(...) - On the territory of the Republic of Bulgaria

Table 2.3 – Bulgaria - grid operation data for 2005

GRID OPERATION DATA FOR 2005

		Value	date/day/hour
Absolute maximum load	MW	6502	09/02/2005, Wed, 20 hrs
Absolute minimum load	MW	2577	24/05/2005, Hol, 5 hrs
Range of load fluctuation	MW	3925	
Utilization of the absolute maximum load	h	5551	
Electricity demand per resident	kWh	4580	
Seasonal factor		0.60366	
Maximum density factor - workday in February		0.889	
Minimum density factor - average Saturday in October		0.786	

Planned network reinforcements

Table 2.4 shows planed network reinforcements in forthcoming period.

Table 2.4 – Bulgaria - Planned network reinforcements

TYPE	SUBSTATION1		SUBSTATION2		VOLTAGE LEVEL kV/kV	Number Of Circuits /units	CAPACITY A or MVA	CAPACITY limited A or MVA	MATERIAL OR TRANSFORMER TYPE	CROSS mm2	LENGTH BR1 km	LENGTH BR2 km	LENGTH TOTAL km	DATE OF COMMISSIONING	STATUS
1	2	3	2	3	4	5	6	7	8	9	10	11	12	13	14
OHL	BG	C.Mogila	MK	Stip	400	1	1890	-	ACSR	2X500	80	70	150	2008	construction
OHL	BG	M.East	GR	Nea Santa	400	1	1890	-	ACSR	2X500	-	-	-	-	Feasibility study
OHL	BG	Zlatitsa	BG	Plovdiv	400	1	1890	-	ACSR	2X500	-	-	140	2007	Feasibility study

1 Type of project (OHL - overhead line, K - cable, SK - submarine cable, SS - substation, BB - back to back system...)
2 Country (ISO code)
3 Substation name
4 Installed voltage (for lines nominal voltage, for transformers ratio in voltages)
5 number of circuits/units
6 Conventional transmission capacity of elements for OHL in Amps, for transformers in MVA
7 Conventional transmission capacity limited by transformers or substations
8 Type of conductor or transformer (ACSR - Aluminum Cross-section Steel Reinforced, or code of conductor, PS - phase shift transformer...)
9 Cross-section (number of ropes in bundle x cross-section/cross-section of reinforcement rope)
10 Length till border of first state
11 Length till border of second state
12 Total length
13 Date of commissioning (estimate)
14 Status of project (Idea, Feasibility study, Construction, Damaged, out of service, Decommissioned...)

Table 2.5 – Bulgaria - Planned new generation units

TYPE	SUBSTATION1		VOLTAGE LEVEL kV	VOLTAGE LEVEL kV	CAPACITY MW	CAPACITY MVA	DATE OF COMMISSIONING year	STATUS
1	2	3	4	5	6	7	8	9
NPP	BG	Belene	?	400	2x1000	2x1111	2012	construction

1 Type of plant (HPP - Hydropower plant, TPP - Thermal power plant, PSHPP - Pump Storage Hydro Power Plant, CCHP - Combined Cycle Heating Plant...)
2 Country
3 Substation name
4 Generator voltage level
5 Network voltage level
6 Installed active power
7 Installed apparent power
8 Date of commissioning (estimate)
9 Status of the project (Idea, Feasibility study, Construction...)

2.2. GEORGIA

Figure 2.2 and Figure 2.3 shows the transmission system of Georgia. As it can be seen, 500 kV East-West line represents a backbone of Georgia's high voltage network. Together with 220 kV lines in parallel, 110kV and 35 kV in radial (spurs) operation, it forms Georgian transmission system.

Figure 2.2 – Georgia - network map

Figure 2.3 – Georgia - single line diagram

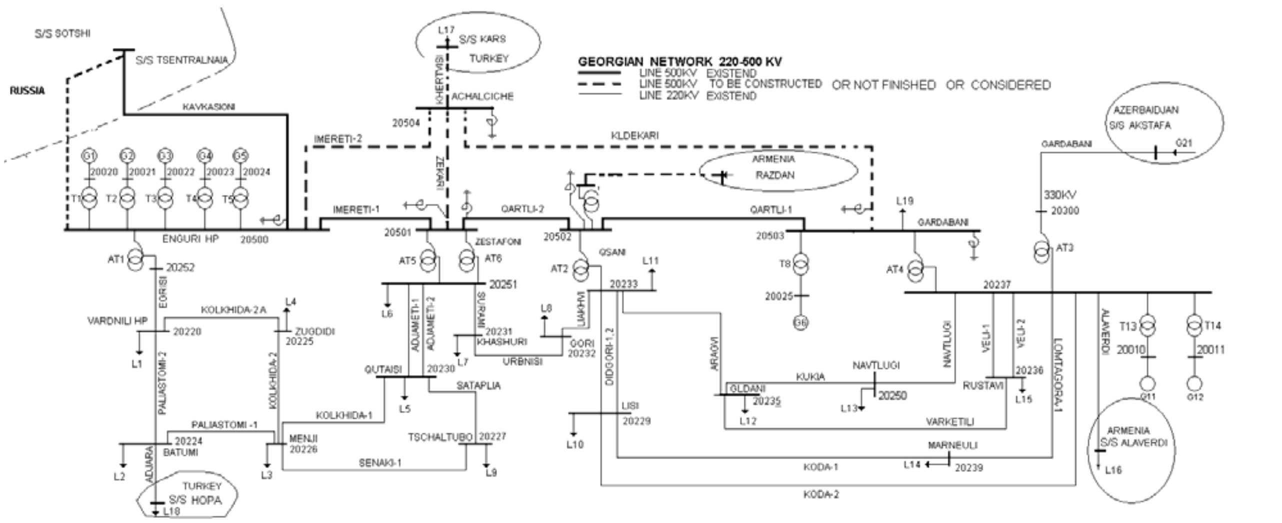


Table 2.6 shows main characteristics of the Georgian network.

Table 2.6 – Georgia - network overview

lines		transformers	
Voltage level	Length of the overhead lines and cables	Voltage level	Installed capacities
(kV)	(km)	(kV/kV)	(MVA)
500	576	500/220	2800
330	21	330/x	400
220	1690	220/x	-
110	3911	110/x	-
total	6198		3200

Planned network reinforcements

At present, official and documented system expansion plan does not exist, but there are general guidelines and ideas how to reinforce Georgian transmission network. The main guideline is to reinforce Georgia-Russia-Azerbaijan loop, and close 500 kV loop internally and to build new connection to Turkey in order to increase transfer capacity.

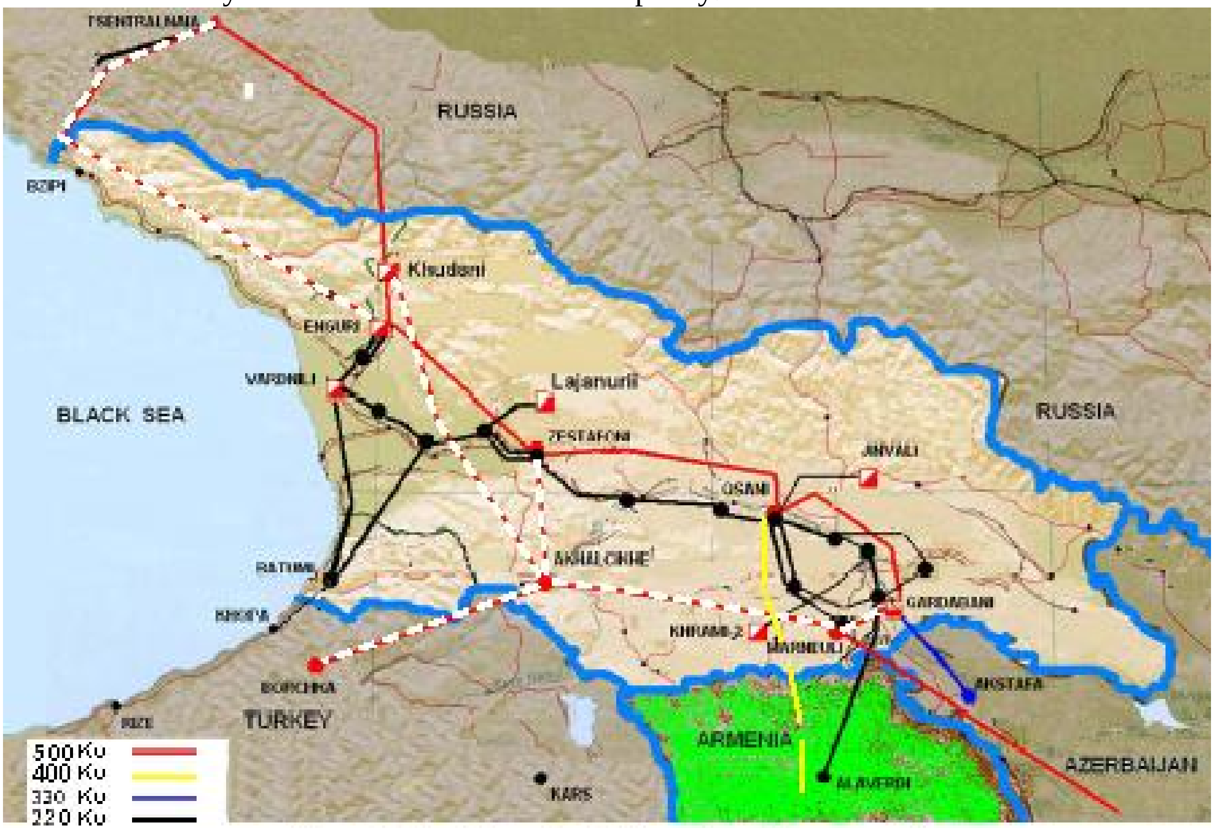


Figure 2.4 – Georgia – Network reinforcements

Table 2.7 – Georgia - Planned network reinforcements

TYPE	SUBSTATION1		SUBSTATION2		VOLTAGE LEVEL	number of circuits /units	CAPACITY		MATERIAL OR TRANSFORMER TYPE	CROSSECTION	LENGTH			DATE OF COMMISSION	STATUS
					kV/kV		A or MVA	limited A or MVA		mm2	BR1 km	BR2 km	TOTAL km		
1	2	3	2	3	4	5	6	7	8	9	10	11	12	13	14
SS	GE	Qsani			500/400	1	3X267		LTC					2009	Feasibility study
OHL	GE	Qsani	AM	TPP Hrazdan	400	1	1100	1400	ACSR	2x300	80	90	170	2009	Feasibility study
OHL	GE	Mukharani	AZ	AZ TPP	330	1							283		
SS	GE	Akhaltske			500/400	1									
BB	GE	Akhaltske			400	1									
OHL	GE	Akhaltske		Marneuli	500	1									
OHL	GE	Marneuli		Gardabani	500	1									
OHL	GE	Akhaltske		Menji	500	1									
OHL	GE	Menji		Kudoni	500	1									
OHL	GE	Akhaltske		Zestaponi	500	1							71		
OHL	GE	Akhaltske	TR	Borcka	400	1							130		
OHL	GE	Gardabani	AR	Atarbeksan	330	1									
OHL	GE	Enguri	RU	Centralna(Sochi)	500	1							450		

1 Type of project (OHL - overhead line, K - cable, SK - submarine cable, SS - substation, BB - back to back system...)
2 Country (ISO code)
3 Substation name
4 Installed voltage (for lines nominal voltage, for transformers ratio in voltages)
5 number of circuits/units
6 Conventional transmission capacity of elements for OHL in Amps, for transformers in MVA
7 Conventional transmission capacity limited by transformers or substations
8 Type of conductor or transformer (ACSR - Aluminum Cross-section Steel Reinforced, or code of conductor, PS - phase shift transformer...)
9 Cross-section (number of ropes in bundle x cross-section/cross-section of reinforcement rope)
10 Length till border of first state
11 Length till border of second state
12 Total length
13 Date of commissioning (estimate)
14 Status of project (Idea, Feasibility study, Construction, Damaged, out of service, Decommissioned...)

2.3. MOLDOVA

Backbone of Moldovan network is 330 kV system that crosses whole country from north to south. Together with 110 kV system that operates in parallel with 330 kV network it forms the national grid. In Figure 2.5, transmission grid of Moldova is presented.

Figure 2.5 – Moldova - network map

Table 2.8 – Moldova – overview of tie-lines

Table 2.9 shows main characteristics of the Moldovan network.

Table 2.9 – Moldova - network overview

lines		transformers	
Voltage level	Length of the overhead lines and cables	Voltage level	Installed capacities
(kV)	(km)	(kV/kV)	(MVA)
400	214	400/330	500
330	532.4	330/x	2525
110	5231.1	110/x	3687
total	5977.5		6712

At present, Moldavia operates in parallel operation with Ukrainian main grid and it is highly integrated to it, while 110 kV connections to Romania are operated only in island mode, and 400 kV line to Bulgaria is rerouted to Romania and usually out of operation. Due to configuration of the high voltage network, Ukraine has large influence on system operation of Moldavian network.

Planned network reinforcements

Moldavia has not so ambitious network development plan. The main issues are rehabilitation of present network, and building of two new interconnection lines (Table 2.10).

Table 2.10 – Moldova - Planned network reinforcements

TYPE	SUBSTATION1		SUBSTATION2		VOLTAGE LEVEL kV/kV	Number Of Circuits /units	CAPACITY A or MVA	CAPACITY limited A or MVA	MATERIAL OR TRANSFORMER TYPE	CROSSECTION mm2	LENGTH BR1 km	LENGTH BR2 km	LENGTH TOTAL km	DATE OF COMMISSIONING
1	2	3	2	3	4	5	6	7	8	9	10	11	12	13
SS	MD	Balti			400/330	1								
OHL	MD	Balti	RO	Suceava	400	1								
SS	MD	Chisinau			400/330	1								
OHL	MD	Chisinau	RO	Iasi	400	1								
OHL	MD	Balti	UA	Dnestrovska HPP	330	1								
OHL	MD	Balti	MD	Straseni	330	1								
OHL	MD	Straseni	MD	Chisinau	330	1								
OHL	MD	Balti	MD	Ribnita	330	1								
SS	MD	Balti			400/330	1			IPC					
SS	MD	Moldovskaya			400/330	1			IPC					

1 Type of project (OHL - overhead line, K - cable, SK - submarine cable, SS - substation, BB - back to back system...)
2 Country (ISO code)
3 Substation name
4 Installed voltage (for lines nominal voltage, for transformers ratio in voltages)
5 number of circuits/units
6 Conventional transmission capacity of elements for OHL in Amps, for transformers in MVA
7 Conventional transmission capacity limited by transformers or substations
8 Type of conductor or transformer (ACSR - Aluminum Cross-section Steel Reinforced, or code of conductor, PS - phase shift transformer...)
9 Cross-section (number of ropes in bundle x cross-section/cross-section of reinforcement rope)
10 Length till border of first state
11 Length till border of second state
12 Total length
13 Date of commissioning (estimate)
14 Status of project (Idea, Feasibility study, Construction, Damaged, out of service, Decommissioned...)

Table 2.11 – Moldova - Planned new generation units

TYPE	SUBSTATION1		VOLTAGE LEVEL kV	kV	CAPACITY MW	MVA	DATE OF COMMISSIONING year	STATUS	COMMENT
1	2	3	4	5	6	7	8	9	10
CCHP	MD	Balti	15.75	400	3x150	3x176	2010		2x150MW gas,1x150MW steam,300MW belongs to RO
CCHP	MD	Vulkanesti	15.75	400	3x150	3x176	2010		2x150MW gas,1x150MW steam,300MW belongs to RO

1 Type of plant (HPP - Hydropower plant, TPP - Thermal power plant, PSHPP - Pump Storage Hydro Power Plant, CCHP - Combined Cycle Heating Plant...)
2 Country
3 Substation name
4 Generator voltage level
5 Network voltage level
6 Installed active power
7 Installed apparent power
8 Date of commissioning (estimate)
9 Status of the project (Idea, Feasibility study, Construction...)

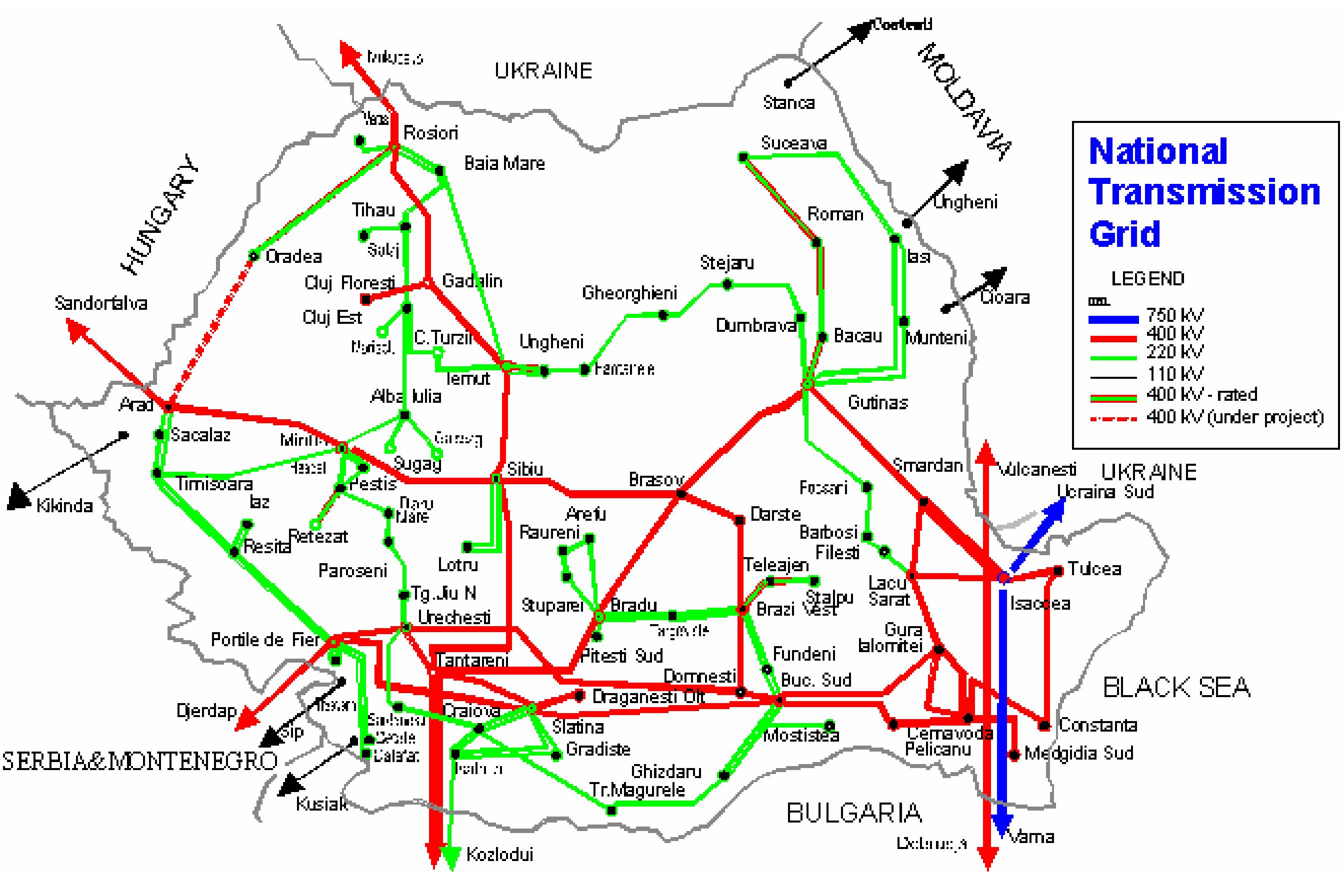
2.4. ROMANIA

The transmission network of Romania is quite strong with a mesh of 400, 220 and 110 kV lines. From the regional system point of view, the Romanian transmission system has a strong configuration with multiple internal loops at 400 kV. There are however few interconnections with surrounding countries. Main characteristics of Romanian network are presented in Table 2.12 below.

Table 2.12 – Romania - network overview

lines		transformers	
Voltage level	Length of the overhead lines and cables	Voltage level	Installed capacities
(kV)	(km)	(kV/kV)	(MVA)
750	154.5	750/400	2500
400	4599	400/x	13000
220	4892.5	220/x	18990
110	6473.5	110/x	14580
total	16119.5		49070

Figure 2.6 – Romania - network map



Planned network reinforcements

The present development plan is to increase border lines capacities by diverting Dobrudja (Bulgaria)-Vulkanesti (Moldova) line to Isaccea (Romania) substation, rehabilitation of existing 750 kV line Isaccea (Romania)-Pivdenoukrainskaya (Ukraine) with installation of Back-to-Back system, building 400 kV lines Oradea (Romania) - Becescaba (Hungary) and Suceava (Romania)-Balti (Moldova) and to upgrade parts of Romanian network from 220 kV to 400 kV. These lines are already built for 400 kV but presently operated at 220 kV level. The construction of the new 400 kV lines will increase transmission and reserve capacity of the network.

Table 2.13 – Romania – Planned network reinforcements

TYPE	SUBSTATION1		SUBSTATION2		VOLTAGE LEVEL kV/kV	Number Of Circuits /units	CAPACITY A or MVA	CAPACITY limited A or MVA	MATERIAL OR TRANSFORMER TYPE	CROSS mm2	LENGTH BR1 km	LENGTH BR2 km	LENGTH TOTAL km	DATE OF COMMISSION	STATUS	COMMENT
1	2	3	2	3	4	5	6	7	8	9	10	11	12	13	14	13
SS	RO	Portile de Fier II			220/110	2	2*200		2 windings					2008		
OHL	RO	Portile de Fier II	RO	Cetate	220	1	875		Ol-Al	450			80	2008		
OHL	RO	Portile de Fier II	RO	Portile de Fier I	220	1	875		Ol-Al	450			71	2008		
CSS	RO	Nadab		-	400											
OHL	RO	Oradea	RO	Nadab	400	1	1997		Ol-Al	3*300			75			
OHL	RO	Arad	RO	Nadab	400	1	1997		Ol-Al	3*300			35			
OHL	RO	Nadab	HU	Bekescsaba Border	400	1	1750		Ol-Al	3*300			23	2008		
OHL	HU	Bekescsaba Border	HU	Bekescsaba	400	1	1750		Ol-Al	2*500			37	2010		
SS	RO	Suceava			400/110	2	250		2 windings					2010		
OHL	RO	Suceava	MD	Balti	400	1	1750		Ol-Al	3*300			95	2014		
SS	RO	Bacau			400/220	1	400		2 windings					2014		
SS	RO	Roman			400/220	1	400		2 windings					2014		
OHL	RO	Suceava	RO	Roman	400	1	1700		Ol-Al	3*300			100	2014		upgrade from 220 kV
OHL	RO	Roman	RO	Bacau	400	1	1700		Ol-Al	3*300			58.8	2014		upgrade from 220 kV
OHL	RO	Bacau	RO	Gutinas	400	1	1700		Ol-Al	3*300			55.3	2014		upgrade from 220 kV
SS	RO	Iasi			400/220									2010		
OHL	RO	Iasi	MD	Chisinau	400	1								2010		
SS	RO	Resita			400/220	1	400		2 windings					2014		
SS	RO	Resita			400/110	1	250		2 windings					2014		
OHL	RO	Portile de Fier I	RO	Resita	400	1	1997		Ol-Al	3*300			117	2014		new 400kV OHL
SS	RO	Timisoara			400/220	1	400		2 windings					2014		
OHL	RO	Timisoara	RO	Resita	400	1	1997		Ol-Al	3*300			73	2014		upgrade from 220 kV
OHL	RO	Timisoara	RO	Arad	400	1	1997		Ol-Al	3*300			55	2014		upgrade from 220 kV
OHL	RO	Timisoara	CS	Vrsac	400	1	1750		Ol-Al	3*300			100	2014		
DC	RO	Constanta			400		600							?		DC Converter station
SK	RO	Constanta	TR	Pasakoy	400	1	600				200	200	400	?		
OHL	RO	Constanta	RO	Medgidia	400	1	1800		Ol-Al	3*300			21	2010-2014		new 400kV OHL

1 Type of project (OHL - overhead line, K - cable, SK - submarine cable, SS - substation, BB - back to back system...)

2 Country (ISO code)
3 Substation name
4 Installed voltage (for lines nominal voltage, for transformers ratio in voltages)
5 number of circuits/units
6 Conventional transmission capacity of elements for OHL in Amps, for transformers in MVA
7 Conventional transmission capacity limited by transformers or substations
8 Type of conductor or transformer (ACSR - Aluminum Cross-section Steel Reinforced, or code of conductor, PS - phase shift transformer...)
9 Cross-section (number of ropes in bundle x cross-section/cross-section of reinforcement rope)
10 Length till border of first state
11 Length till border of second state
12 Total length
13 Date of commissioning (estimate)
14 Status of project (Idea, Feasibility study, Construction, Damaged, out of service, Decommissioned...)

Table 2.14 – Romania – Planned new generation units

TYPE	SUBSTATION1		VOLTAGE LEVEL		CAPACITY		DATE OF COMMISSIONING	STATUS	COMMENT
			kV	kV	MW	MVA	year		
1	2	3	4	5	6	7	8	9	10
NPP	RO	Cernavoda	24	400	2x700	740	2010- 2014	construction	

1 Type of plant (HPP - Hydropower plant, TPP - Thermal power plant, PSHPP - Pump Storage Hydro Power Plant, CCHP - Combined Cycle Heating Plant...)
2 Country
3 Substation name
4 Generator voltage level
5 Network voltage level
6 Installed active power
7 Installed apparent power
8 Date of commissioning (estimate)
9 Status of the project (Idea, Feasibility study, Construction...)

2.5. RUSSIA

The power industry in Russia developed stepwise, by incorporating regional power systems, working in parallel, and forming interregional electric power pools, which merged to form a single Power Grid, operated from center in Moscow.

Figure 2.7 – Russia – network map (western part)

Table 2.15 – Russia - network overview

lines		transformers	
Voltage level	Length of the overhead lines and cables	Voltage level	Installed capacities
(kV)	(km)	(kV/kV)	(MVA)
750	3074	750/x	16089
500	38852	500/x	123996
330	10612	330/x	32140
220	99936	220/x	203674
110	298668	110/x	302251
total	451142		678150

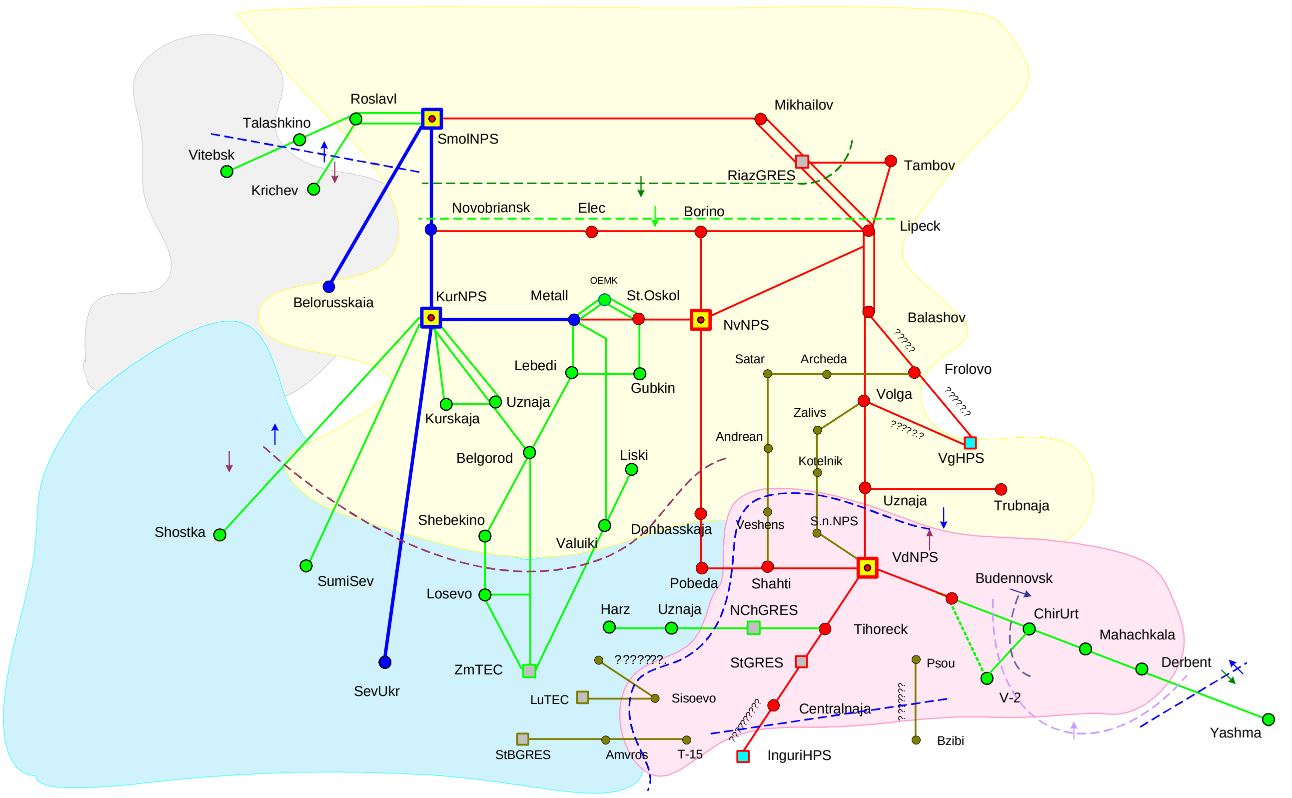


Figure 2.8 – Russia – network map (modeled part in Black Sea regional model)

Only part of Russian network is modeled, the one that has largest influence on the region. Also, central and northern part of Russia are modeled in detail to analyze eventual influence of large exports to Western Europe over Ukraine network.

Planned network reinforcements

In following Table 2.16 planned network reinforcements for Russian system are presented, but only for region of interest (Northern-Caucasus region).

Table 2.16 – Russia – Network reinforcements (Northern Caucasus region)

TYPE	SUBSTATION1		SUBSTATION2		VOLTAGE LEVEL kV/kV	number of circuits /units	CAPACITY A or MVA	CAPACITY limited A or MVA	MATERIAL OR TRANSFORMER TYPE	CROSS mm2	LENGTH BR1 km	LENGTH BR2 km	LENGTH TOTAL km	DATE OF COMMISSION	STATUS	COMMENT
1	2	3	2	3	4	5	6	7	8	9	10	11	12	13	14	15
OHL	RU	Sotchi	GE	Enguri	500	1							450			
SS	RU	Rostov			500	2										
OHL	RU	Rostov		Sahti 30	500	1										
OHL	RU	Rostov		Frolovskaya	500	1										
OHL	RU	Rostov		R 20	220	1										
SS	RU	Krimskaya II			500	2										
OHL	RU	Krimskaya II		Tihoreck	500	1										
SS	RU	Senaya		Senaya	220	1										
OHL	RU	Krimskaya II		Senaya	220	1										
OHL	RU	Krimskaya II		Slavyansk	220	1										
OHL	RU	Slavyansk		Senaya	220	1										
SS	RU	Nevinomysk			500	1										
OHL	RU	Nevinomysk		Volgodonskaya	500	1										
SS	RU	Mozdok			500	2										
OHL	RU	Nevinomysk		Mozdok	500	1										
SS	RU	Alagir			330	2										
OHL	RU	Nalcik		Alagir	330	1										
OHL	RU	V2		Alagir	330	1										
SS	RU	Kizljar			330	2										on 330 kV Budenovsk-Chirjurt
SS	RU	Grozniy			330	2										on 330 kV V2-Chirjurt
SS	RU	Artem			330	2										on 330 kV Mahachkala-Chirjurt
OHL	RU	Mozdok		Artem	330	1										
OHL	RU	HP Irganskaya		Artem	330	1										
OHL	RU	Derbent		Artem	330	1										
OHL	RU	Derbent	AZ	Apsheron	330	1										

1 Type of project (OHL - overhead line, K - cable, SK - submarine cable, SS - substation, BB - back to back system...)
2 Country (ISO code)
3 Substation name
4 Installed voltage (for lines nominal voltage, for transformers ratio in voltages)
5 number of circuits/units
6 Conventional transmission capacity of elements for OHL in Amps, for transformers in MVA
7 Conventional transmission capacity limited by transformers or substations
8 Type of conductor or transformer (ACSR - Aluminum Cross-section Steel Reinforced, or code of conductor, PS - phase shift transformer...)

9 Cross-section (number of ropes in bundle x cross-section/cross-section of reinforcement rope)
10 Length till border of first state
11 Length till border of second state
12 Total length
13 Date of commissioning (estimate)
14 Status of project (Idea, Feasibility study, Construction, Damaged, out of service, Decommissioned...)

Alternative evolution of the Power System of Northern Caucasus

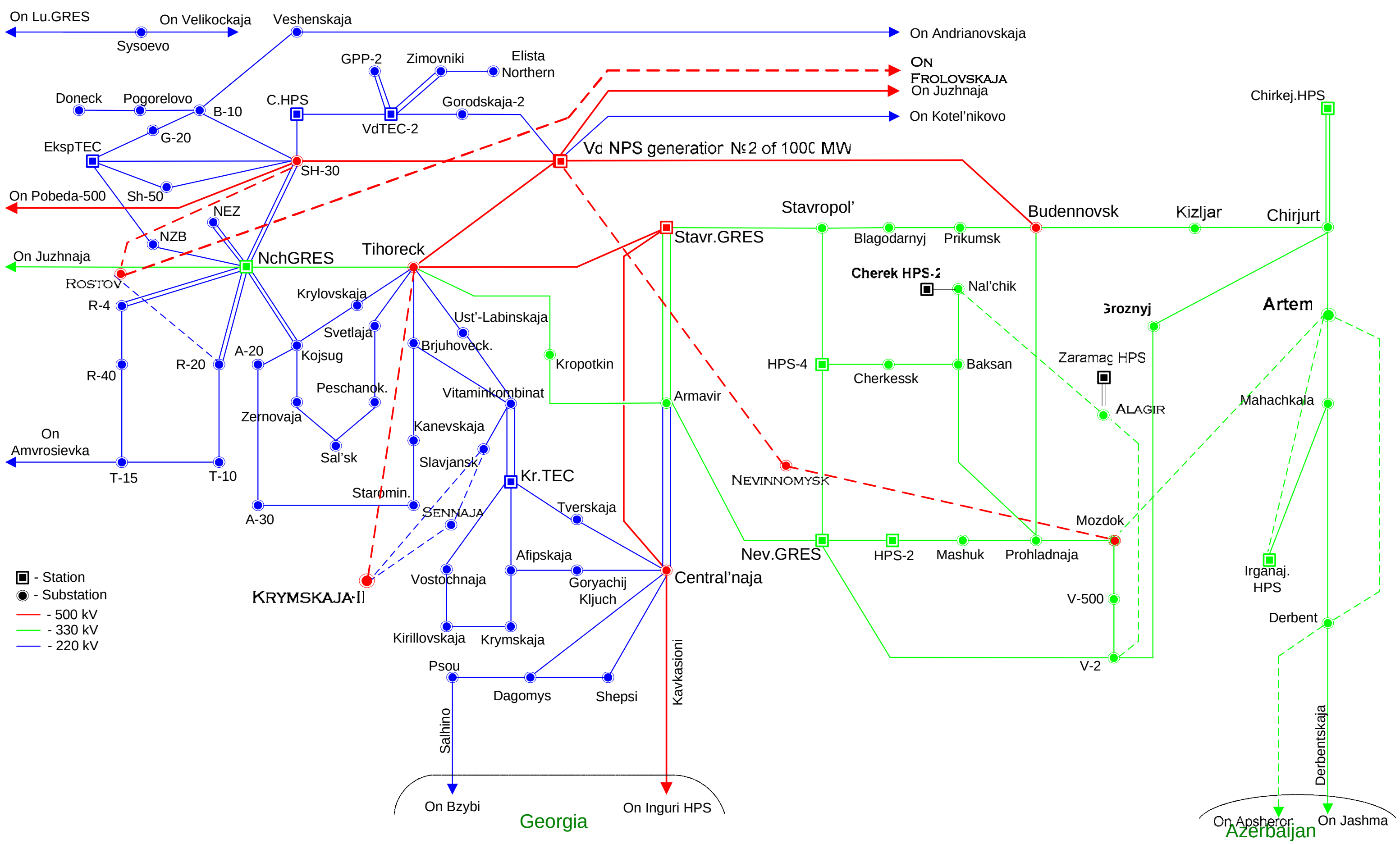


Figure 2.9 – Russia – Network reinforcements (Northern Caucasus region)

Table 2.17 – Russia - New production units (Northern Caucasus region)

TYPE	SUBSTATION1		VOLTAGE LEVEL kV	kV	CAPACITY MW	MVA	DATE OF COMMISSIONING year	STATUS	COMMENT
1	2	3	4	5	6	7	8	9	10
HPP	RU	Zaramagskaya		330			2010		
HPP	RU	Cherkeskaya II		330			2010		
NPP	RU	Volgodonskaya	20	500	1000	1111	2010		unit 2

1 Type of plant (HPP - Hydropower plant, TPP - Thermal power plant, PSHPP - Pump Storage Hydro Power Plant, CCHP - Combined Cycle Heating Plant...)
2 Country
3 Substation name
4 Generator voltage level
5 Network voltage level
6 Installed active power
7 Installed apparent power
8 Date of commissioning (estimate)
9 Status of the project (Idea, Feasibility study, Construction...)

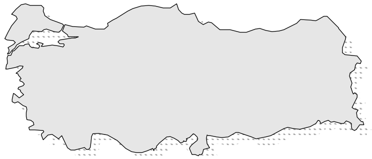
2.6. TURKEY

The Turkish Power Grid consists of the lines of 400, 220, 150, 66 kV, the Table 2.15 shows total length of transmission lines by voltage levels. Network of the 400 kV system is shown in Figure 2.10. Table 2.18 shows total length of transmission lines by voltage levels.

The power system of Turkey has quality of service and reliability in keeping with the west European standards. Hydro potential and lignite are important primary energy resources of the country. Large loads are concentrated in the areas of Istanbul, İzmir and Ankara. Most of the hydro resources and a large lignite field are located in Eastern Turkey, so power has to be transmitted across the country via the 400 kV lines.

Table 2.18 – Turkey – network overview

lines		transformers	
Voltage level	Length of the overhead lines and cables	Voltage level	Installed capacities
(kV)	(km)	(kV/kV)	(MVA)
400	13 958	400/x	24240
220	84.6	220/x	300
150	31 522	154/x	46979
66	718.9	66/x	678
total	46 283.5		72197



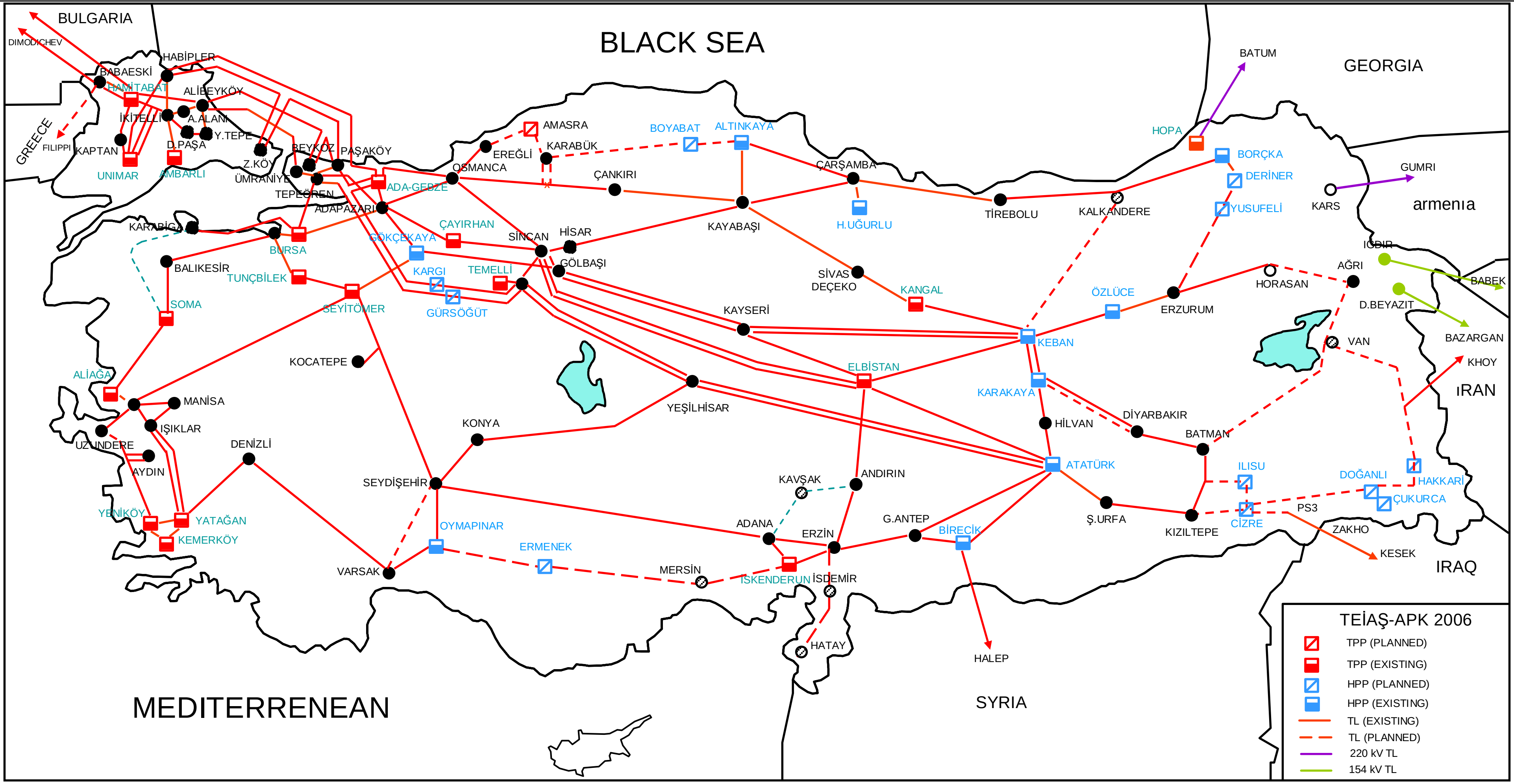


Figure 2.10 – Turkey – Map of 400 kV transmission network

Planed network reinforcements

The geographical location of primary energy resources of Turkey has brought to the construction of an important number of HPPs and of two lignite fired TPPs in the East of the country. On the other hand, large lignite fired TPPs and most of the natural gas combined cycle thermal power plants (NGCCTPPs) are located in the west of the country.

Location of generation and the long distances involved are liable to challenge the transmission grid during operation with the maximum hydroelectric dispatch, when most of the power produced by the large HPPs in the East has to be transferred to the North-West regions and also partly to the South-West regions that are the areas where the energy consumption is higher. Consequently, the planned lines connecting the Western and the Eastern areas of country has necessary power carrying capacity and stability margins.

In the eastern Black Sea region, the group of large HPPs planned for commissioning in 2005-2007, has an aggregate capacity of 2010 MW, they are Borçka HPP (300 MW), Deriner HPP (670 MW), Muratlı HPP (115 MW), Artvin HPP (332 MW) and Yusufeli HPP (540 MW). Borçka and Muratlı HPPs have been already commissioned recently.

The construction of the new HPPs allowed the extension of the 400 kV grid close to the border with Georgia and Armenia. Also a 400/154 kV, 300 MVA autotransformer bank has been installed recently at Borçka thereby reinforcing the power supply of the Eastern Black Sea Region of Turkey.

Table 2.19 – Turkey – Planned network reinforcements

TYPE	SUBSTATION1		SUBSTATION2		VOLTAGE LEVEL kV/kV	Number of circuits /units	CAPACITY A or MVA	CAPACITY limited A or MVA	MATERIAL OR TRANSFORMER TYPE	CROSS mm2	LENGTH BR1 km	LENGTH BR2 km	LENGTH TOTAL km	DATE OF COMMISSION	STATUS	COMMENT
1	2	3	2	3	4	5	6	7	8	9	10	11	12	13	14	15
SS	TR	Afyon	-	-	400/150		250							2006	construction	
SS	TR	Agri	-	-	400/150		250+150							2006	construction	
OHL	TR	Aliağa		Manisa	400	1			ACSR	3Bx1272				2006	completed	
SS	TR	Baglum	-	-	400/150		2x250							2006	construction	
SS	TR	Beykoz GIS	-	-	400/33		2x125							2006	construction	
SS	TR	Davutpaşa GIS	-	-	400/150		250							2006	construction	
SS	TR	Davutpaşa GIS	-	-	400/33		125							2006	construction	
SS	TR	Erzurum	-	-	400/150		250							2006	construction	capacity addition
OHL	TR	Erzurum		Horasan	400	1			ACSR	3Bx954				2006	construction	
SS	TR	Germencik	-	-	400/150		2x250							2006	construction	
SS	TR	Hilvan	-	-	400/150		250							2006	construction	
SS	TR	Hilvan	-	-	400/33		125							2006	construction	
OHL	TR	Horasan		Agri	400	1			ACSR	3Bx954				2006	construction	
OHL	TR	HPP Borçka-Deriner		HPP Yusufeli	400	1			ACSR	3Bx954				2006	construction	
OHL	TR	HPP Oymapinar		Varsak	400	1			ACSR	3Bx954				2006	construction	second line
OHL	TR	HPP Yusufeli		Erzurum	400	1			ACSR	3Bx954				2006	construction	
SS	TR	Ikiteli	-	-	400/33		2x125							2005	completed	capacity addition
K	TR	Ikitelli		Davutpasa	400	1				2000 mm2				2006	completed	
OHL	TR	Isiklar		Manisa	400	1			ACSR	3Bx1272				2006	completed	
OHL	TR	Iyidere		HPP Borçka	400	1			ACSR	3Bx1272				2006	completed	
OHL	TR	Karabiga-Çan		TPP Soma	400	1			ACSR	3Bx954				2006	construction	
OHL	TR	Karakya-Ataturk		Hilvan	400	1			ACSR	3Bx954				2006	completed	
SS	TR	Manisa	-	-	400/150		2x250							2006	construction	
OHL	TR	Tirebolu		Iyidere	400	1			ACSR	3Bx1272				2006	completed	
SS	TR	TPP Iskenderun	-	-	400/150		250							2006	construction	capacity addition, autotransformer
OHL	TR	TPP Unimar		Babaeski	400	1			ACSR	3Bx954				2006	construction	
OHL	TR	Yeniköy-Uzundere		Aydin	400	2			ACSR	3Bx954				2006	completed	
K	TR	Yildiztepe		Davutpasa	400	2				2000 mm2				2006	construction	
SS	TR	Zekeriyakoy GIS	-	-	400/150		250							2006	construction	
SS	TR	Zekeriyakoy GIS	-	-	400/33		125							2006	construction	
SS	TR	Hatay	-	-	400/150		250							2007	construction	
SS	TR	Hatay	-	-	400/33		125							2007	construction	
OHL	TR	Hatay		Erzin	400	1			ACSR	3Bx954				2007	construction	
SS	TR	Mersin	-	-	400/150		250							2007	construction	
SS	TR	Mersin	-	-	400/33		125							2007	construction	
OHL	TR	Mersin		TPP Iskenderun	400	1			ACSR	3Bx954				2007	construction	
OHL	TR	Seydişehir		HPP Oymapinar	400	1			ACSR	3Bx954				2007	construction	
SS	TR	Umraniye	-	-	400/150		2x250							2007	construction	Transformer change
SS	TR	Borçka	-	-	400/150		250							?		
OHL	TR	Borcka	GE	Akhaltske	400	1							130			

OHL	TR	Babaeski	GR	N.Santa	400	1			ACSR	3Bx954	64			2010	F.study	
DC	TR	Pasakoy			400		600 MW								Idea	DC Converter station
SK	TR	Pasakoy	RO	Constanta	400	1	600 MW				200	200	400		Idea	

1 Type of project (OHL - overhead line, K - cable, SK - submarine cable, SS - substation, BB - back to back system...)
2 Country (ISO code)
3 Substation name
4 Installed voltage (for lines nominal voltage, for transformers ratio in voltages)
5 number of circuits/units
6 Conventional transmission capacity of elements for OHL in Amps, for transformers in MVA
7 Conventional transmission capacity limited by transformers or substations
8 Type of conductor or transformer (ACSR - Aluminum Cross-section Steel Reinforced, or code of conductor, PS - phase shift transformer...)
9 Cross-section (number of ropes in bundle x cross-section/cross-section of reinforcement rope)
10 Length till border of first state
11 Length till border of second state
12 Total length
13 Date of commissioning (estimate)
14 Status of project (Idea, Feasibility study, Construction, Damaged, out of service, Decommissioned...)

Table 2.20 – Turkey – Planned generation units

TYPE	SUBSTATION1		VOLTAGE LEVEL kV	kV	CAPACITY MW	MVA	DATE OF COMMISSIONING year	STATUS	COMMENT
1	2	3	4	5	6	7	8	9	10
HPP	TR	Ermenek		400	320		-2010		
HPP	TR	Kargı		400	214		-2010		
HPP	TR	Borçka		400	300		-2010		
HPP	TR	Deriner		400	670		-2010		

1 Type of plant (HPP - Hydropower plant, TPP - Thermal power plant, PSHPP - Pump Storage Hydro Power Plant, CCHP - Combined Cycle Heating Plant...)
2 Country
3 Substation name
4 Generator voltage level
5 Network voltage level
6 Installed active power
7 Installed apparent power
8 Date of commissioning (estimate)
9 Status of the project (Idea, Feasibility study, Construction...)

2.7. UKRAINE

Ukraine's transmission system consists of an 800 kV DC line; a basic infrastructure of 750 kV, single circuit AC system that overlay an extensive 330 kV (single and double circuit) network, feeding into 220 kV and 110 kV systems, but also 500 kV and 400 kV AC systems in some parts of the country. Figure 2.11 shows transmission network of Ukraine and Table 2.21 shows overview of Ukrainian transmission network.

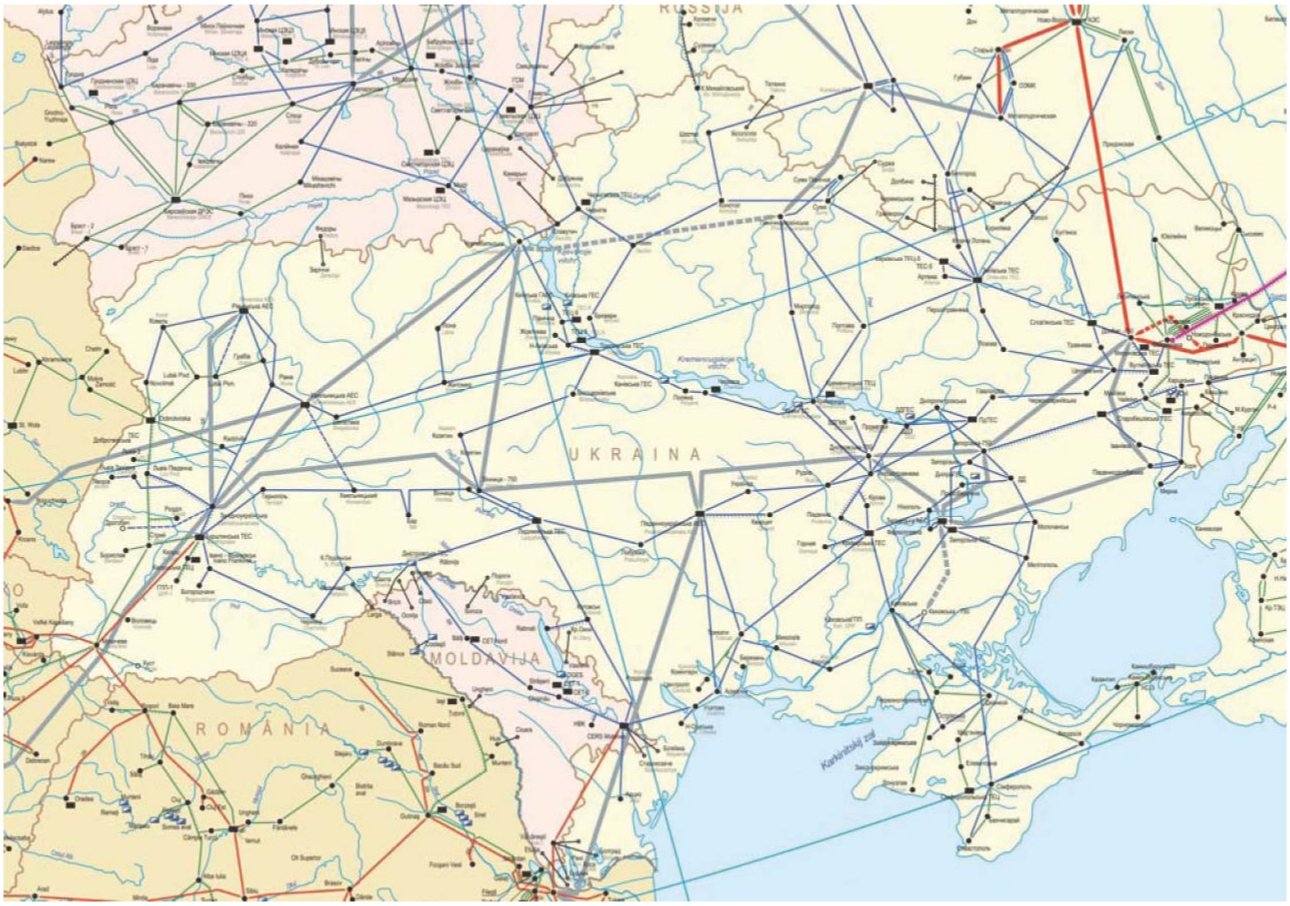


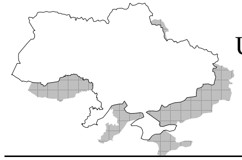
Figure 2.11 – Ukraine – network map

Table 2.21 – Ukraine – Overview of electricity transmission and distribution lines in km, year 2002

	Transmission	**Distribution**	**Total**
	110-750 kV	**0.4-35 kV**	**0.4-750 kV**
Overhead Lines	70,302	821,053	891,355
Underground Cables	51.5	67,275	67,326.5
Total	**70,353.5**	**888,328**	**958,681.5**

Source: Ministry of Fuel and Energy

At present, southwestern part of Ukrainian system called Burstyn island, including Burstinskaya TPP, part of 220 kV network connected to it and the Mukachevo substation, is separated from the main Ukrainian system and operates in synchronous and parallel mode with UCTE main grid. This was done in order to realize export from Ukraine to Western Europe.



Planned network reinforcements

High voltage transmission grid needed to increase the supply of electricity to power deficient regions of the country, optimize system interflows and increase the reliability of supply and to connect to European markets.

Table 2.22 – Ukraine – Network reinforcements till 2010

TYPE		SUBSTATION1		SUBSTATION2	VOLTAGE LEVEL kV/kV	number of circuits /units	CAPACITY A or MVA	CAPACITY limited A or MVA	MATERIAL OR TRANSFORMER TYPE	CROSS mm2	LENGTH BR1 km	LENGTH BR2 km	LENGTH TOTAL km	DATE OF COMMISSIONING	STATUS	COMMENT
1	2	3	2	3	4	5	6	7	8	9	10	11	12	13	14	15
OHL	UA	Pivdenoukrainskaya	RO	Isaccea	750	1	4000 A	-	ACSR	400*5	406	3	409	2015	Feasibility study	Restoration. Voltage level to be defined
SS	UA	Kyivska			750/330	1	1000 MVA	-	PST	-	-	-	-	2008	Construction	
OHL	UA	Rivnenska NPP	UA	Kyivska	750	1	4000 A	-	ACSR	400*5	370	0	370	2008	Construction	
OHL	UA	Zahidnoukrainska	UA	Bogorodchani	330	1	1670 A	-	ACSR	400*2	111	0	111	2010	Construction	
OHL	UA	Dnistrovska PSHPP	UA	Bar	330	1	1670 A	-	ACSR	400*2	95	0	95	2007	Construction	
OHL	UA	Novoodeska	UA	Artsyz	330	1	1670 A	-	ACSR	400*2	140	0	140	2007	Feasibility study	
OHL	UA	Adgalyk	UA	Usatovo	330	1	1670 A	-	ACSR	400*2	124	0	124	2007	Feasibility study	second line
OHL	UA	Zarya	UA	Mirna	330	1	1380 A	-	ACSR	300*2	14	0	14	2008	Construction	second line
OHL	UA	Simferopol	UA	Sevastopol	330	1	1670 A	-	ACSR	400*2	70	0	70	2007	Feasibility study	upgrade from 220kV
OHL	UA	Dgankoj	UA	Melitopol–Simferopol	330	1	1380 A	-	ACSR	400*2	16	0	16	2006	Construction	Connectors of Dgankoj SS to OHL Melitopol–Simferopol
OHL	UA	Pivnichnoukrainska	UA	Kyivska	750	1	4000 A	-	ACSR	400*5	292	0	292	2015	Feasibility study	
OHL	UA	Zaporizka NPP	UA	Kahovska	750	1	4000 A	-	ACSR	400*5	190	0	190	2015	Feasibility study	
OHL	UA	Lutsk Pivnichna	UA	Ternopil	330	1	1670 A	-	ACSR	400*2	180	0	180	2010	Feasibility study	
OHL	UA	K.Podolska	UA	Ternopil	330	1	1670 A	-	ACSR	400*2	150	0	150	2012	Feasibility study	
OHL	UA	HPP Dnistrovska	MD	Balti	330	1	1670 A	-	ACSR	400*2	120	0	120	2012	Idea	second line

1 Type of project (OHL - overhead line, K - cable, SK - submarine cable, SS - substation, BB - back to back system...)
2 Country (ISO code)
3 Substation name
4 Installed voltage (for lines nominal voltage, for transformers ratio in voltages)
5 number of circuits/units
6 Conventional transmission capacity of elements for OHL in Amps, for transformers in MVA
7 Conventional transmission capacity limited by transformers or substations
8 Type of conductor or transformer (ACSR - Aluminum Cross-section Steel Reinforced, or code of conductor, PS - phase shift transformer...)
9 Cross-section (number of ropes in bundle x cross-section/cross-section of reinforcement rope)
10 Length till border of first state
11 Length till border of second state
12 Total length
13 Date of commissioning (estimate)
14 Status of project (Idea, Feasibility study, Construction, Damaged, out of service, Decommissioned...)

Figure 2.12 – Ukraine – Network reinforcements till 2010

Table 2.23 – Ukraine – New production units

TYPE	SUBSTATION1		VOLTAGE LEVEL		CAPACITY		DATE OF COMMISSIONING	STATUS	COMMENT
			kV	kV	MW	MVA	year		
1	2	3	4	5	6	7	8	9	10
PSHPP	UA	Dnistrovska	15.75	330	324/416	360	2008	Construction	
CCHP	UA	Kyivska 6	20	330	250	353	2008	Construction	
PSHPP	UA	Tashlykska	15.75	330	2x146/2x211	307	2006	Construction	units 1 and 2(211PUMP/146GENERATION)
PSHPP	UA	Tashlykska	15.75	330	2x146/2x211	307	2008	Construction	units 3 and 4(211PUMP/146GENERATION)

1 Type of plant (HPP - Hydropower plant, TPP - Thermal power plant, PSHPP - Pump Storage Hydro Power Plant, CCHP - Combined Cycle Heating Plant...)
2 Country
3 Substation name

4 Generator voltage level
5 Network voltage level
6 Installed active power
7 Installed apparent power
8 Date of commissioning (estimate)
9 Status of the project (Idea, Feasibility study, Construction...)

2.8. ARMENIA

The power transmission network of Armenia consists of 220 kV and 110 kV lines. Figure 2.13 shows the map of Armenian network and Table 2.24 shows main data about Armenian transmission network.

Table 2.24 – Armenia - network overview

Lines		Transformers	
Voltage level	Length of the overhead lines and cables	Voltage level	Installed capacities
(kV)	(km)	(kV/kV)	(MVA)
220	1323	220/x	2715
110	3169	110/x	5400
total	4492		8115

Armenia is connected through interconnection lines with all neighboring countries:

Table 2.25 – Armenia – interconnection lines

State	Name and Type of Interconnection	Condition
Georgia	Alaverdi 220 kV	Operational
Turkey	Kars 220 kV	Out of operation
Iran	Megri 220 kV	Operational
Azerbaijan	Atarbekiar 330 kV	Out of operation
Georgia	Ashotzk 110 kV	Operational (radial)
Georgia	Lalvar 110 kV	Operational (radial)

Installed generation capacity in Armenia exceeds consumption, and Armenia is capable of exporting large quantities of energy.

Armenian NPP	815(440) MW
Hrazdan TPP	1100 MW
Yerevan TPP	550 MW
Sevan-Hrazdan cascade of HPPs	550 MW
Vorotan cascade of HPPs	400 MW
Small HPPs	80 MW

Figure 2.13 – Armenia - network map

Planned network reinforcements

Table 2.26 shows planed network reinforcements in forthcoming period.

Table 2.26 – Armenia - Planned network reinforcements

TYPE	SUBSTATION1		SUBSTATION2		VOLTAGE LEVEL	number of circuits /units	CAPACITY		MATERIAL OR TRANSFORMER TYPE	CROS SECTION	LENGTH			DATE OF COMMISSION	STATUS
								limited			BR1	BR2	TOTAL		
					kV/kV		A or MVA	A or MVA		mm2	km	km	km		
1	2	3	2	3	4	5	6	7	8	9	10	11	12	13	14
SS	AM	Hrazdan TPP			400/220	10	2x5x200	2x5x220						2009	Feasibility study
OHL	AM	Hrazdan TPP	IR	Tavriz	400	2	2x1800	2x1900	ACSR	2x(2x500)	332	100	432	2010	Feasibility study
OHL	AM	Hrazdan TPP	GE	Ksani	400	1	1100	1400	ACSR	2x300	90	80	170	2009	Feasibility study

1 Type of project (OHL - overhead line, K - cable, SK - submarine cable, SS - substation, BB - back to back system...)
2 Country (ISO code)
3 Substation name
4 Installed voltage (for lines nominal voltage, for transformers ratio in voltages)
5 number of circuits/units
6 Conventional transmission capacity of elements for OHL in Amps, for transformers in MVA
7 Conventional transmission capacity limited by transformers or substations
8 Type of conductor or transformer (ACSR - Aluminum Cross-section Steel Reinforced, or code of conductor, PS - phase shift transformer...)
9 Cross-section (number of ropes in bundle x cross-section/cross-section of reinforcement rope)
10 Length till border of first state
11 Length till border of second state
12 Total length
13 Date of commissioning (estimate)
14 Status of project (Idea, Feasibility study, Construction, Damaged, out of service, Decommissioned...)

Table 2.27 – Armenia - Planned new generation units

TYPE	SUBSTATION1		VOLTAGE LEVEL		CAPACITY		DATE OF COMMISSIONING	STATUS
			kV	kV	MW	MVA	year	
1	2	3	4	5	6	7	8	9
CCHP	AM	Yerevan TPP new unit	18	110	208	240	2009	Tendering
TPP	AM	Hrarzdan TPP unit 5	15.75	220	440	510	2009	Partly Constructed

1 Type of plant (HPP - Hydropower plant, TPP - Thermal power plant, PSHPP - Pump Storage Hydro Power Plant, CCHP - Combined Cycle Heating Plant...)
2 Country
3 Substation name
4 Generator voltage level
5 Network voltage level
6 Installed active power
7 Installed apparent power
8 Date of commissioning (estimate)
9 Status of the project (Idea, Feasibility study, Construction...)

3. REGIONAL MODEL

3.1. Model development

Every project participant made model of his system in PSS/E. Model integrator (EKC) has connected all models into one regional model. Also, model integrator had following obligations:

- homologize data for interconnection lines
- developing of adequate external equivalent (equivalenting Western, Central and Southern Europe's network)
- checking of all models and regional one
- testing of model accuracy

3.2. Model characteristics

For forecast horizon it was decided to model two regimes in 2010, with following assumptions:

- All power systems in parallel operation
- Hydrological conditions: average for whole region

It was decided to model two yearly characteristic regimes for whole region:

- ❑ minimum load regime
- ❑ peak load regime

Table 3.1 – Peak load and low load hours in Black Sea countries

	BG	GE	MD	RO	RU	TR	UA
time zone*	+1:00	+3:00	+2:00	+2:00	+3:00	+2:00	+2:00
Low hour**	**05:00**	**04:00**	**03:00**	**03:00**	**04:00**	**03:00**	**03:00**
Peak hour**	**20:00**	**21:00**	**18:00**	**19:00**	**19:00**	**19:00**	**19:00**

*time shift to GMT time zone
** local time

It was agreed to use these time for respective model regimes

- ❑ Winter peak load (16:00 GMT)
- ❑ Summer minimum load (01:00 GMT)

Agreed base case scenarios

Winter regime

		1	2	3	4	5	6	7	8	9	10
		from									
		BG	GE	MD	RO	RU	TR	UA	AM	EXT*	**
to	BG	*****			0		0			0	
	GE		*****			200	0		0	0	
	MD			*****	-750			450		0	
	RO	0		750	*****			0		-800	
	RU		-200			*****		-200		-1150	1800
	TR	0	0				*****		150	0	
	UA			-450	0	200		*****		-1000	1000
	AM		0				-150		*****	-1250	
	EXT*	0	0	0	800	1150	0	1000	1250	*****	
	TOTAL	**0**	**-200**	**300**	**50**	**1550**	**-150**	**1250**	**1400**	**-4200**	**2800**

*countries outside BSR

** remaining capabilities

Summer regime

		1	2	3	4	5	6	7	8	9	10
		from									
		BG	GE	MD	RO	RU	TR	UA	AM	EXT*	**
to	BG	*****			0		0			0	
	GE		*****			200	-500		0	100	
	MD			*****	-350			350		0	
	RO	0		350	*****			0		-350	
	RU		-200			*****		-200		-1150	1800
	TR	0	500				*****		150	0	
	UA			-350	0	200		*****		-1000	1000
	AM		0				-150		*****	-1250	
	EXT*	0	-100	0	350	1150	0	1000	1250	*****	
	TOTAL	**0**	**200**	**0**	**0**	**1550**	**-650**	**1150**	**1400**	**-3650**	**2800**

*countries outside BSR

** remaining capabilities

All systems are modeled in “parallel” operation and connected to main UCTE grid. At present they do not operate like this. Main goal of this approach is to investigate operational conditions and electric energy trade capabilities after eventual connection of the whole region to UCTE main grid.

For this purpose, high voltage network-transmission network of all countries in the region was modeled:

- Voltage levels
  - 750kV
  - 500kV
  - 400kV
  - 330kV
  - 220kV
  - 150kV
  - 110kV

Main generator units are modeled at their nominal voltage level with corresponding step-up transformers. All new substations and lines that are expected to be operational till 2010 (according to the long term development plans) are modeled too. Table 3.2 shows main model characteristics, like number of elements modeled (Buses, Plants, Machines, Loads, Lines, Transformers).

Table 3.2 – Model characteristics

	BULGARIA			GEORGIA			MOLDOVA			ROMANIA			ROSSIA		
AREA	1			2			3			4			5		
ELEMENT TYPE	#	W	S	#	W	S	#	W	S	#	W	S	#	W	S
BUSES	**651**	608	596	**59**	54	49	**469**	476	476	**1078**	1016	973	**609**	609	574
PLANTS	**84**	58	32	**22**	16	11	**42**	32	32	**238**	184	138	**123**	107	69
MACHINES	**112**	69	35	**26**	20	11	**48**	36	34	**238**	178	94	**139**	121	75
LOADS	**569**	569	554	**27**	26	26	**253**	253	253	**739**	719	681	**433**	432	424
LINES	**747**	713	727	**52**	43	43	**552**	486	486	**1315**	1144	1146	**657**	640	641
750										**1**			**6**		
500				**8**									**44**		
400	**40**			**2**			**5**			**58**					
330				**1**			**17**						**76**		
220	**56**			**38**						**117**			**207**		
150															
110	**651**			**3**			**530**			**1139**			**324**		
TRANSFORMERS	**161**	120	92	**31**	24	18	**62**	42	42	**307**	210	167	**418**	415	380
STEP UP	**96**			**23**			**35**			**151**			**107**		
NETWORK	**65**			**8**			**27**			**156**			**311**		

	TURKEY			UKRAINA			ARMENIA			EXT			**TOTAL**		
AREA	6			7			8								
ELEMENT TYPE	#	W	S	#	W	S	#	W	S	#	W	S	**#**	**W**	**S**
BUSES	**1307**	1102	1034	**652**	628	585	**108**	108	100	**170**	161	162	**5103**	**4762**	**4549**
PLANTS	**299**	298	233	**141**	108	58	**45**	45	37	**13**	13	12	**1007**	**861**	**622**
MACHINES	**683**	621	421	**142**	109	58	**48**	39	39	**13**	13	12	**1449**	**1206**	**779**
LOADS	**633**	633	595	**540**	508	446	**31**	31	31	**77**	75	73	**3302**	**3246**	**3083**
LINES	**1244**	1300	1294	**650**	646	647	**90**	86	86	**77**	125	130	**5384**	**5183**	**5200**
750				**21**									**28**		
500				**4**						**1**			**57**		
400	**172**			**4**			**2**			**50**			**333**		
330				**190**						**20**			**304**		
220	**2**			**75**			**42**			**6**			**543**		
150	**1070**			**75**									**1145**		
110				**281**			**46**						**2974**		
TRANSFORMERS	**715**	711	503	**342**	305	262	**74**	74	66	**6**	6	5	**2116**	**1907**	**1535**
STEP UP	**535**			**124**			**47**			**0**			**1118**		
NETWORK	**180**			**218**			**27**			**6**			**998**		

#	total number of elements
W	number of elements in operation in Winter maximum
S	number of elements in operation in Summer minimum

3.3. Methodology for transfer capacities calculations

Transfer capacities (TTC. NTC, ATC) are important indicators for market participants to anticipate and plan their cross-border transactions and for the TSOs to manage these international exchanges of electricity. But also can give indications about week points of transmission network and can be used to evaluate influence of network development plans and new planed network reinforcements.

General definitions of transfer capacities and the procedures for their calculation/assessment are given by ETSO (European Transmission System Operators), in the following documents:

[1] ETSO, Definitions of Transfer Capacities in liberalized Electricity Markets, Final Report April 2001
[2] ETSO, Procedures for cross-border transmission capacity assessments, October 2001
[3] ETSO, Net Transfer Capacities (NTC) and Available Transfer Capacities(ATC) in the Internal Market of Electricity in Europe (IEM)
[4] UCTE, Technical guidelines for Net Transfer Capacity determination

Methodology used in performing this study is based on these prerequisites, and detailed approach will be explained in following chapters.

3.3.1. DEFINITIONS OF TRANSFER CAPACITIES

According to ETSO, the definitions that refer to program values are presented below. As explained in the Introduction, these definitions are related to the classical calculation of transfer capacities – between the neighbouring systems/areas, linked with the tie-line(s).

Also, it is important to note that the TTC, NTC, BCE, AAC, ATC are the <u>EXCHANGE PROGRAM</u> values; <u>these are not the physical flows</u>, and generally differ from the physical flows at the interconnection lines (except in particular cases of radial operation).

The evaluation of TTC between two electrical areas requires:

- To make a choice of local power system scenario
- To define a base case, which involves the sharing of full information amongst TSOs to build up the global (merged) load flow model
- To apply an agreed procedure for carrying out the calculations

Total Transfer Capacity (TTC)**,** is the maximum feasible <u>exchange program</u> between two areas compatible with operational security standards, calculated according to the pre-assumption that the future network conditions are well known.

TTC is always related to a given power system scenario, i.e.: generation schedule and pattern, consumption pattern and available network state that constitute the data allowing to build up a mathematical model of the power system (load flow equations). The solution of this model leads to the knowledge of the voltages at the network nodes and the power flows in the network elements which are the parameters being monitored by a TSO to assess system security.

The solution of this model is the so-called **base case** and is the starting point for TTC computation. This base case will already contain exchange programs between TSOs and control areas. These are the various transactions likely to exist -according to what has been observed in the past - in the forecasted situation.

For a given pair of neighbouring control areas, A and B, for which capacities are to be computed, in the base case there exists a global exchange program called **Base Case Exchange (BCE)**. Sometimes it is hard to determine the Base Case Exchanges for a given base case network model, even for the classical calculation of transfer capacities (between the neighbouring areas). It is easy to determine the load-flows at the tie-lines by running the load-flow on the base case model and recording the active power flows at the tie-lines (this value is called the Notified Transmission Flow - NTF), but since the BCEs are the program (contractual) values, related to the base case model, theoretically there can be an infinite number of sets of BCEs which give the same exchange totals of all modelled systems. That is why the BCE should be agreed by the consensus among the calculation parties. Since the final TTC values highly depend on the agreed value of BCE, it is recommended that realistic BCEs are agreed (base case load flows on interconnection lines - NTFs can give some indication of the BCEs which are resulted from).

As the result of this procedure, TTC equals the maximum exchange programme between the two areas being considered, if the generation and load pattern in these areas and in other areas strongly interconnected to these two would exactly correspond to the assumptions made in the evaluation steps, namely the ones implicit in the base case.

The maximum additional program exchange (over the BCE) that copes with the security standards is marked with **ΔEmax**.

The Total Transfer Capacity (TTC) is the maximum exchange program between two areas, compatible with operational security standards* applicable at each system**, if future network conditions, generation and load patterns were perfectly known in advance***.

$$\mathbf{TTC = BCE + \Delta Emax}$$

* *the most important, and usually checked is n-1 security criterion*

** *in highly meshed networks, usually not only the two concerned systems are observed, but also the “third” systems, if they are significantly influenced by the transfers between the two concerned systems*

*** *the last part of the sentence indicates that no model and/or forecasting imperfections are taken into account within TTC (they are evaluated within the TRM, see below)*

The uncertainties associated to the forecast of the power system state, for a given time period in the future, may decrease according to the selected time frame. Therefore the TTC value may vary (i.e. may increase or decrease) when approaching the time of programme execution as a result of a more accurate knowledge of generating unit schedules, load pattern, network topology and tie-lines availability.

Transmission Reliability Margin (TRM)

is a security margin that copes with uncertainties on the computed TTC values arising from:

- Unintended deviations of physical flows during operation due to the physical functioning of load-frequency control (LFC)
- Emergency exchanges between TSOs to cope with unexpected unbalanced situations in real time
- Inaccuracies, e. g. in data collection and measurements

TRM is then associated to the real-time operation and its value is determined by each TSO, in order to guarantee the operation security of its own power system. TRM may vary seasonally or may be updated according to possible modifications occurred in the power system.

Typical values of TRM used in SEE area are 50-100 MW, which somehow corresponds to the size of the SEE systems and typical electricity transfers. However, if the calculated transfer capacities will be used in real electricity market (as a constraints for some of the transmission capacity allocation methods based on NTC), the particular TRM for each border and in each direction should be carefully assessed among the TSOs.

Net Transfer Capacity (NTC) is defined as:

NTC = TTC-TRM

NTC is the maximum exchange program between two areas compatible with security standards applicable in both areas and taking into account the technical uncertainties on future network conditions.

Figure 1 gives the graphical explanation of defined program values, presented on the example of calculating the transfer capacities between areas A and B, with already existing Base Case Exchange from A towards B.

Direction A→B

$$TTC^{A\to B} = BCE^{A\to B} + \Delta E^{A\to B}_{max}$$

$$NTC^{A\to B} = TTC^{A\to B} - TRM^{A\to B}$$

Direction B→A

$$TTC^{B\to A} = BCE^{B\to A} + \Delta E^{B\to A}_{max}$$

$$NTC^{B\to A} = TTC^{B\to A} - TRM^{A\to B}$$

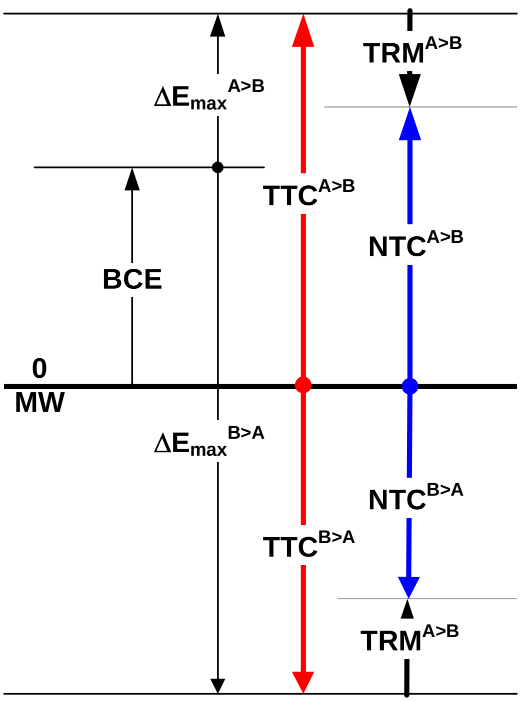


Figure 3.1 - Graphical and presentation of transfer capacities and their analytical relations

NTC may be allocated in different time frames to match the need for securing longer term trading and to provide room for shorter term trading. One may distinguish, as the result of the allocation procedures in each allocation time frame, two notions:

Already Allocated Capacity (AAC), that is the total amount of allocated transmission rights (at some of the possible previous allocation rounds), depending on the allocation method.

The Available Transmission Capacity (ATC), is the part of NTC that remains available, after each phase of the allocation procedure, for further commercial activity. ATC is given by the following equation:

ATC = NTC- AAC

AAC and ATC are thus a result of each stage of the allocation procedure.

In ETSO definitions of transfer capacities the clear distinction is made between the program (contractual, scheduled) values, and the physical active power flows related to these program values, i.e. originated by them, and recorder in AC load flow model.

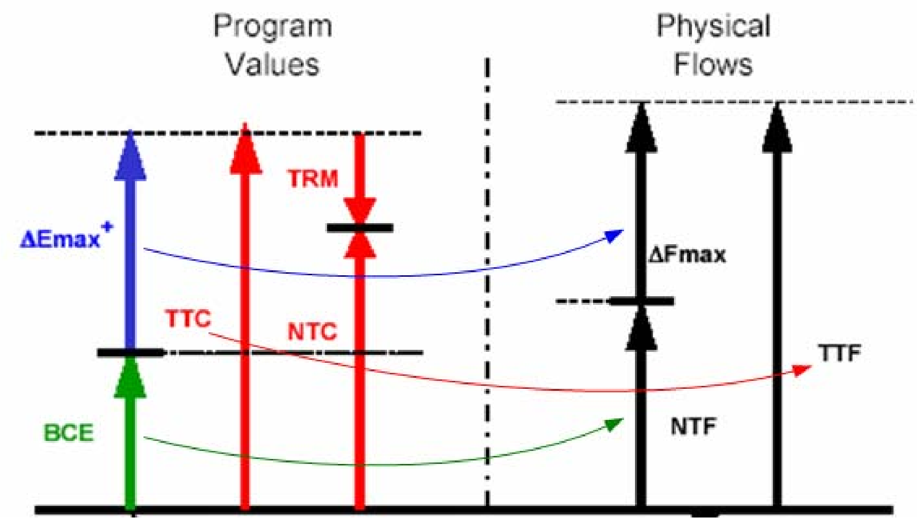


Figure 3.2 - Program and physical values

Since the definitions of the program values are related to the border between the two TSOs, the definitions of physical values are also related to the sum of the individual tie-line flows at the observed border.

Notified Transmission Flow (NTF) is the physical flow over the tie-lines between the considered areas observed in the base case model prior to any generation shift between the areas. It results from the Base Case Exchanges (BCE).

The additional physical flow ΔFmax is the physical flow over the tie lines between the two concerned areas, induced by the maximum generation shift **ΔEmax**.

Total transfer Flow (TTF)[1] is the net physical flow across the border associated with a program exchange of magnitude TTC, provided that no other exchanges have been modified from the base case (except the one between the two areas between which the TTC is calculated).

$$\mathbf{TTF = NTF + \Delta Fmax}$$

3.3.2. CALCULATION OF TTC

Algorithm of TTC calculation

The concept of TTC calculation based on ETSO documents will be explained on an example of calculating the TTCs between areas A and B, where BCE from A towards B already exist in base case.

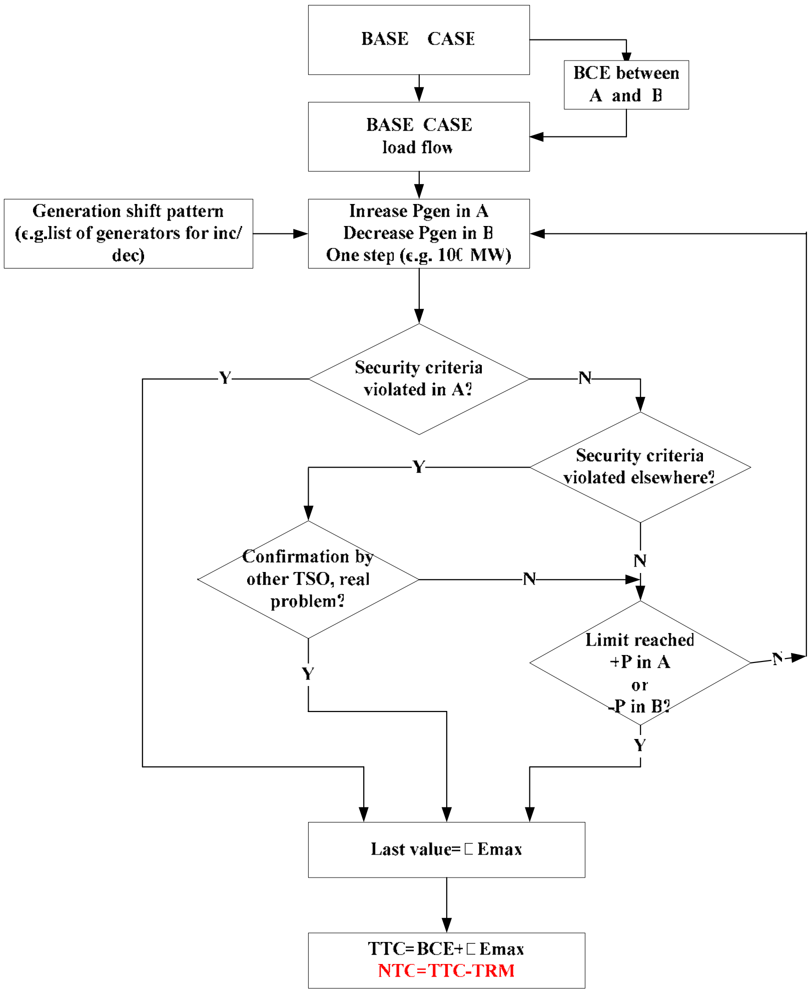


Figure 3.3 - Process of TTC calculation

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[1] In flow-based methods for the allocation of the transmission capacity, the TTF is usually used as a constraint, like physical maximum of the cross-border flow compatible with security standards. In most of these methods it is then called Border Capacity (BC). One of such methods is Coordinated explicit flow-based Auction, proposed by ETSO, and currently investigated among the TSO of SEE Europe.

When computing TTC from area A to area B, generation is stepwise increased in control area A and decreased in control area B giving rise to a power flow from area A to area B. The shifts of generation are named as ΔE^{+} and ΔE^{-} for the increase and the decrease respectively. This process is carried out up to the point, where security rules (in systems A, B, or in some of the neighbouring systems highly dependent on the transaction among A and B) are breached ($\Delta Emax^{+}$ / $\Delta Emax^{-}$). The maximum exchange from A to B compatible with security rules without taking into account uncertainties and inaccuracies is actually the TTC from A to B, and it is calculated as:

$$\mathbf{TTC = BCE + \Delta Emax^{+}}$$

This procedure is reversed - decrease of generation in system A and increase of generation in system B - when computing TTC from area B to area A leading to a maximum increase of generation of $\Delta Emax^{-}$ and thus to a maximum exchange from B to A of $\Delta Emax^{-}$ - BCE.

For planning purposes (evaluation of development plans) and for long term transfer capabilities evaluations, after reaching the exchange in which first critical contingency occurs, calculations should be continued, to confirm this identified bottleneck, till the next identified critical contingency.

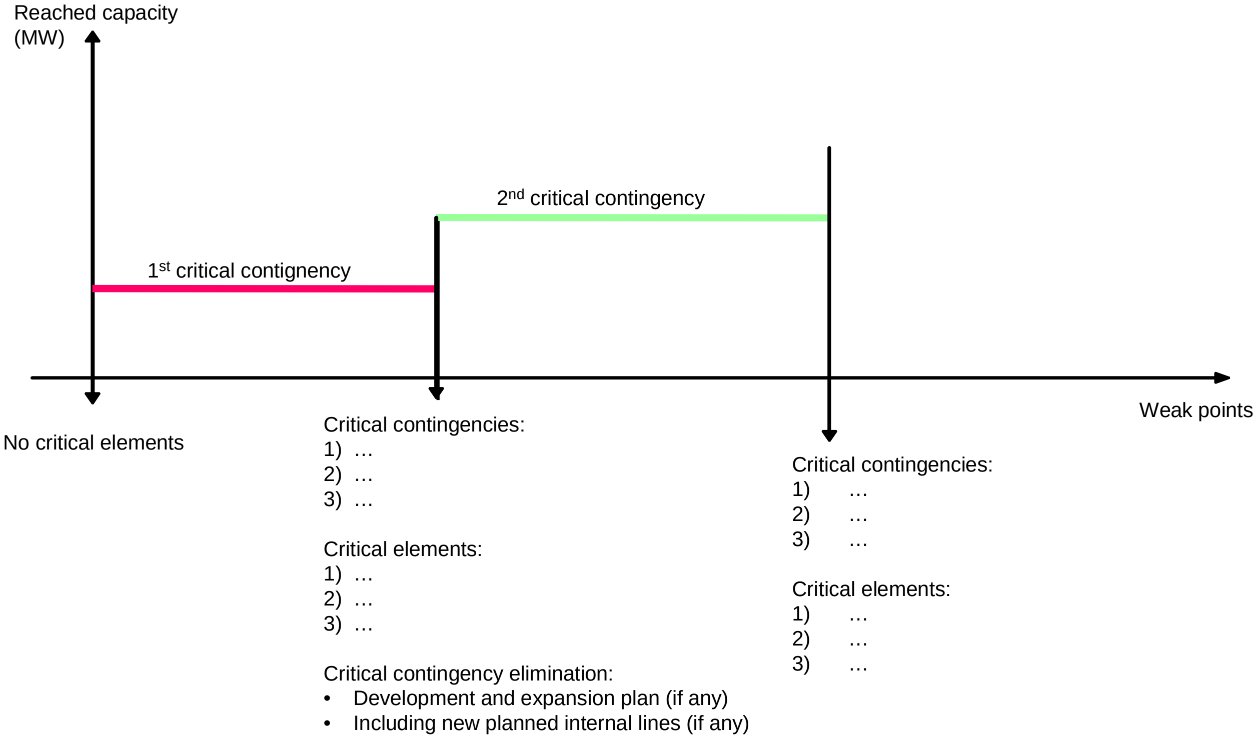


Figure 3.4

This way identified bottleneck is confirmed, or even next one identified, allowing experts to identify whole problematic parts of network (not just one critical element and contingency), giving better and wider view how this limitations can be remedied and which new investment are best in sense of transfer capabilities increase. Also, with additional analyses, influence of new elements according to the development plans can be evaluated (Figure 4).

The calculations are performed on the merged data sets, so cold “base models” and their significant maintenance (topology) scenarios, considering the approved exchange scenarios. Before starting calculations, corresponding base models have to be checked for security, respecting the N-1 criterion. If any bottlenecks are found, they have to be carefully analyzed and corresponding measures have to be taken to avoid them. Concerning that, base models overloads are to be neglected during the further transfer capacities calculations.

Except for EPS of Turkey, for all other EPSs, represented with models in the base cases, the existing long term contracts are modelled as base case exchanges. An internal exchange pattern of zero exchanges between southeast European countries and Turkey is assumed. If, from the findings of this analysis, some critically loaded lines are found, the combined influence of internal and external exchanges will be evaluated for a realistic (limited) number of cases.

Generation shift

In order to determine the cross-border transmission limit between two neighbouring countries or zones, cross-border exchanges are gradually increased while maintaining the loads in the whole system unchanged until security limits are reached.

Starting from the common base case exchanges, the additional exchange is performed through an increase of generation on the exporting side and an equivalent decrease of generation on the importing side. This generation shift is to be made stepwise until a network constraint is violated. Typical step for the generation shift during the TTC assessment is 50, or 100 MW.

The generation increase/decrease has to be performed according to some predefined criteria. The main concepts of the distribution the generation increase/decrease in some area over the different generating sets are:

1. Proportionally to the engagement of the production units in base case

This is wide used generation shift concept, suitable for fast calculations, because it does not require any additional information except the base case Load flow model. Commonly used principle is that the factor which distributes the generation increase/decrease in a given area over the different generators in this area is the ratio of base case engagement of each generator to the total of internal generation scheduled and involved in the shift.

$$P_{new}^{inc} = P_i + \Delta E \cdot \frac{P_i}{\sum_n (P_i)}; \quad P_{new}^{dec} = P_i - \Delta E \cdot \frac{P_i}{\sum_n (P_i)}$$

P_i - active power generation of respective production unit

P_{new}^{inc} - new increased generation

P_{new}^{dec} - new decreased generation

ΔE - step of the generation shift

This concept of generation shift often lead to non-feasible generation patterns, because of the principle that the generators already highly engaged in base case are favoured during the shift, often above their real possibilities. On the other hand, some generators which are not engaged in base case will not be engaged in generation shift process too.

2. *Proportionally to the active power reserve in respective production units*

This concept respects the real production possibilities of the generators, and requires additional information about the Pmin and Pmax of those generators which will participate in generation shift. Then, in each step the amount of the shift will be shared among the engaged generators according to their remaining production “reserve” (UCTE method A).

$$P_{new}^{inc} = P_i + \Delta E \cdot \frac{P_i^{\max} - P_i}{\sum_n (P_i^{\max} - P_i)} \; ; \quad P_{new}^{dec} = P_i - \Delta E \cdot \frac{P_i^{\min} - P_i}{\sum_n (P_i^{\min} - P_i)}$$

P_i - active power generation of respective production unit

P_{new}^{inc} - new increased generation

P_{new}^{dec} - new decreased generation

ΔE - step of the generation shift

$P_i^{\min}$ - minimum permissible generation (for the generators participating in decreasing)

$P_i^{\max}$ - maximum permissible generation (for the generators participating in increasing)

In case of using the generation shift proportionally to the reserve, the information about actual Pmin [MW] and Pmax [MW] for modelled power plants should be comprised in corresponding format for the network model. These Pmin and Pmax should be not related to the theoretical minimum and maximum generation of the respective power-plant, but to their available limits, which correspond to the observed regime.

Thus, the power reserve for some power plant can be calculated:

$$\Delta P_{\text{increase}} = P_{\max} - P_{\text{base case}}$$

$$\Delta P_{\text{decrease}} = P_{\text{base case}} - P_{\max}$$

3. *According to the priority list of the production units (order& active generation shift)*

Within this concept, the priority lists of the generators for the participation in generation shift are known, with an order of the engagement and the active power for the increasing/decreasing (so-called “Generation merit order” - UCTE method C). Then, generation is shifted simultaneously - increased/ decreased according to the shifting lists. This list corresponds to the common operational practice of increasing of the amount of the power exchanges, and thus corresponds to the realistic scenarios or it can be made according to the economic dispatch, or even market prices. It has to be said that this is most realistic approach, since generator units are engaged as they are in reality.

This pattern of generation shift is very frequently used in TTC calculation among the SEE countries, and requires additional information in a form of generation shift list.

In case of using the generation shift according to the priority list, an additional data should be exchanged along with ach base case model, comprising the information of the shifting order (1,2,3…) and the available amount of generation shift.

<u>Example</u>

Priority list for increase within one system containing three modelled power plants can be:

Table 3.3 – Example of Generation shifting list

Node	Order	$P_{basecase}$	ΔP+	IF STEP=	STEP 1	STEP 2
		[MW]	[MW]		[MW]	[MW]
JDJERD11	1	700	120	100 MW	100	20
JBASTA21	2	70	50		/	50
JBASTA22	3	90	30		/	30
				sum:	**100**	**100**

Thus, if the generation shift step is e.g. 100 MW:

1. in first step the JDJERD11 will be shifted for 100 MW, and its engagement will be 800 MW.

2. In second step JDJERD11 will be increased for 20 MW (and thus spend its possibility for the increase) and its engagement will be 820 MW. Additionally, JBASTA21 will be increased for 50 MW, and JBASTA22 will be increased for 30 MW.

100 MW is the recommended step for increasing/decreasing the generation to calculate TTC. For all generation nodes that are to be considered for the transfer capacities determination, the minimal and maximal output power must be indicated. Generators out of operation in the base case must also be included, with their corresponding limits, so they could be switched on if necessary during TTC determination.

When calculating MTC, two methods for shift of generation are recommended:

- According merit order (method 3);
- Proportionally to the remaining available capacity (method 2).

Second method will be used in cases where Generation shifting list is not available.

Security criteria

As it has been shown in Figure 3.3 and Figure 3.4, the calculation of the TTC is stopped if:

1) Maximum export possibility in exporting system is reached, or maximum import possibility in importing system is reached. In cases of reaching the Pmax of export or import, the last ΔE is considered as ΔEmax.

2) Critical contingencies are discovered. If the critical contingency is reached, the calculation is stopped, and the generation shift ΔE from the previous step is considered as an ΔEmax. TTC is then calculated as:

$$\mathbf{TTC = BCE + \Delta Emax}$$

The **base case model should be checked** from the point of view of respecting the security criteria. If some contingencies are determined in base case, their relevancy concerning the transfer capacity which is to be calculated should be evaluated, and the calculation of TTC should be continued depending on the conclusion (i.e. some contingencies from the base case can be irrelevant for the observed transfer, and in such case the TTC calculation can be performed).

Security assessment comprises the checking of the **n-1 security criteria** for the outages of:

- interconnection and internal lines of extra-high voltage, without radial lines
- transformers 750/x, 500/x and 400/x …

The **n-2 security criteria** for the simultaneous outages of double circuit lines can be checked for the agreed specific cases of outages known from practice.

Bus bar outages *are not considered, because the opinion is, that the severity of possible consequences are usually loss of stability endangering overall system security and that bus bar failures and the subsequent tripping of all transformers within a substation may lead to temporary supply interruptions within complete regional high voltage network.*

Outages of generation units *should not be taken into account within the TTC assessment, since they should be covered with TRM.*

The breaching of security rules may happen internally in any of observed systems or on the tie lines between them. Under the critical contingencies, the loading of the network elements equal or greater than above values is presumed:

- 100% of Imax [A] for transmission lines
- 100% of Snom [MVA] for the transformers

The Imax (lines) and Snom (transformers) should be defined within the base case model. Imax should comprise the typical operational current limit for the transmission lines known by the system operators, whether thermal limit, or the protection setting.

Due to the uncertainty of reactive power forecast, **voltage violations** are considered only for each internal network by the corresponding system operator, usually to check that corrective measures are available.

Also, some critical contingencies can be detected in TTC calculation, but can be neglected in case:

- if the reason for the detected critical contingency is not the real critical operational regime, but the **imperfection of the used network model** (like not modelled lower voltage network in one area, which actually mitigates the effect of the observed outage)
- if reasonable **preventive & fast post-event measures** can be made, under the competences of the system operator of the network affected by the considered contingency meshing of lower voltage network, maintenance rescheduling, generation restrictions and re-dispatching
- if critical contingency is caused by the outage of the element which is shown as very stabile in sense of **failure probability from the practical experience** (like element operating few years without any unplanned outage)

3.3.3. HARMONIZATION OF THE VALUES

The same TTC and NTC value is usually calculated by the two neighbouring TSOs (and for both directions), and then it is subject of harmonization. The values of calculated transfer capacities should be compared, along with the comprehensive results of calculation (like lists of observed outages and detected critical contingencies).

Since each TSO is responsible for the operation of its network, it also has the final word in harmonization of the transfer capacities, in cases where the critical contingencies appear at the elements of its network.

Also, as described in previous chapter, the TSOs can notify each other about the practical sense of some detected contingencies (is it realistic or not, are the post-event measures possible...)

In case if the agreement between the two TSOs, the lower between the two values for the corresponding border and direction is taken as valid.

3.3.4. SIMULTANEOUSLY FEASIBLE (COMPOSITE) TRANSFER CAPACITIES

The TTC values are currently the basis for applied mechanisms for allocation of the transmission capacity at almost all European borders[2]. Nevertheless, the strong interdependence between some of the borders within the highly meshed European grid can seriously compromise the usage of classically calculated TTCs as bilaterally agreed values. The effect of parallel flows, i.e. the physical flows containing the natural flows and the loop flows originated by the scheduled transactions at some "third" borders, often endanger the operational security of the transmission grid, even if all the calculated NTCs are respected.

A simple example can show the main side of this problem:
If TTC (or NTC) is calculated for the export of system A towards system C, the generation is increased in A and decreased in C until the security limits are breached. Thus the value TTC A→C is obtained. In this case the generation in system B remains as in the base case. If then the TTC (B→C) is calculated, the base case model is again the starting point, and the generation is increased in B and decreased in C, while the generation in B is as in the base case.

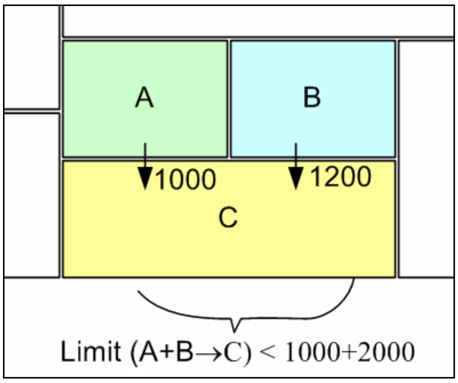


Figure 3.5

If the two bilaterally agreed values TTC (A→C) and TTC (B→C) are offered to the market, the final operational regime can be dangerous from the security point of view (although both TTCs are "correctly" calculated), sine the borders A→C and B→C are interdependent.

The values TTC (A→C) and TTC (B→C) are not cumulative, i.e. the value TTC (A→C) + TTC (B→C) cannot be offered to the market.

One of the possible ways to mitigate this problem is the calculation of so-called "composite", or "bundled" TTC, which can be treated as simultaneously feasible. First the highly interdependent borders or regional cross-sections should be detected (can comprise two or more bilateral borders).
In the above example, the composite TTC can be calculated by the simultaneous generation increase in systems A+B (according to the predefined generation shift scenario), and decrease in system C. Thus the joint TTC for the border (A+B)→C is calculated. If necessary, it can later on be fractioned per the bilateral borders A→C and B→C (e.g. in proportion to the physical power flows, "TTFs" at these borders).

[2] Methods that use NTC: first come-first served, pro-rata rationing, explicit and implicit auctions, market splitting

The principle of simultaneous generation shift in more than one exporting (or importing) area can also be used in case of calculation the TTCs over the third, transit systems. If this system (figure 6) is typically the transit system for the electricity exchanges between A and C, the calculation of TTC by increasing the generation only in B would lead to unrealistically small capacity. Therefore the generation can be increased in (A+B) simultaneously and lead to more accurate transfer capabilities results.

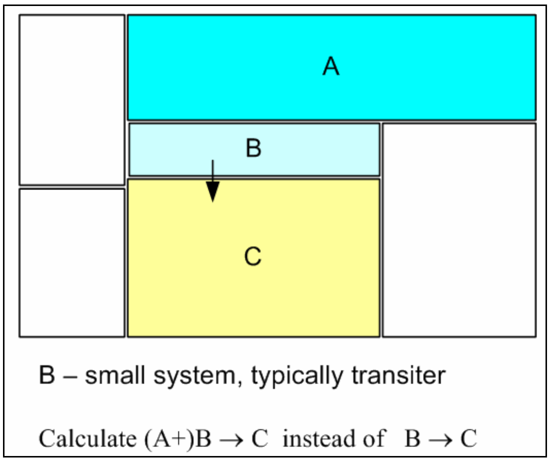


Figure 3.6

3.3.5. TRANSFER CAPACITIES BETWEEN NON-NEIGHBOURING SYSTEMS

As already explained, ETSO definitions for the transfer capacities are always related to the neighbouring systems, i.e. to the border between the neighbouring systems, containing at least one interconnection line. However, the principles used in TTC calculation (simultaneous increase/decrease of generation in exporting/importing system) can be generalized with a goal of determination the maximum secure exchange scenarios between also non-neighbouring systems also.

The calculation procedure for TTC can be applied for this purpose, but under assumptions:

- Arbitrary assessment of BCE; It is sometimes is hard to determine BCE even for the classical TTC (for the bilateral border). Since in calculation of transfer capacities among distant systems there is no longer a bilateral border, the Base Case Exchanges among the concerned systems should be determined on the level of all TSOs involved
- Consequently to the above, the physical values typically related to the respective border (NTF, ΔFmax, TTF) cannot be determined. Luckily, their assessment is not absolutely necessary in TTC assessment

The list of observed outages, as well as the list of detected contingencies should comprise the elements within all affected systems (source, sink, and systems in the middle).

3.4. Generation shifting lists

BULGARIA

Increasing the generation should start from the top of the list, and decreasing should start from the bottom of the list. Maximum and minimum generation should be set according to this list.

Table 3.4 – Bulgaria – Generation shifting list

Price	**Bus No**	**Name**	**Pmax**	**Pmin**
1	13310	VHCH34G 19.000	428	0
2	13404	VNKOZ_G9 24.000	1015.8	0
3	13602	VTVARNG3 15.750	224	0
3	13603	VTVARNG4 15.750	210	0
3	13604	VTVARNG5 15.750	210	0
3	13605	VTVARNG6 15.750	210	0

GEORGIA

Table 3.5 – Georgia - Generation shifting list Winter

Price	**Bus No**	**Name**	**Pmax**	**Pmin**
1	20104	6HENGUG4	240	25
1	20105	6HENGUG5	240	25

Table 3.6 – Georgia - Generation shifting list Summer

Price	**Bus No**	**Name**	**Pmax**	**Pmin**
1	20104	6HENGUG4	240	25
1	20105	6HENGUG5	240	25
1	20103	6HENGUG3	240	25

MOLDOVA

Increasing the generation in Moldova should start from the top of the list, and decreasing should start from the bottom of the list. Maximum and minimum generation should be set according to this list.

Table 3.7 – Moldova - Generation shifting list

bus	Machine name	ID	Status	BC P	Pmax	Pmin
38016	5KOHPPG 10.500	1	1	16	16	0
38010	5DHPP1G 10.500	3	1	6	12	0
38010	5DHPP1G 10.500	4	1	6	12	0
38011	5DHPP2G 10.500	1	1	6	12	0
38011	5DHPP2G 10.500	2	1	6	12	0
38001	5KSPP2G1 10.500	2	1	70	80	0
38002	5KSPP2G2 10.500	1	1	72	80	0
38003	5KSPP2G3 10.500	3	1	68	80	0
38004	5KSPP2G4 10.500	4	1	68	70	0
30103	5MGRESG3 15.750	3	0	0	0	0
30104	5MGRESG4 15.750	4	0	0	150	0
30105	5MGRESG5 15.750	5	0	0	180	0
30106	5MGRESG6 15.750	6	0	0	0	0
30107	5MGRESG7 15.750	7	1	150	190	0
30108	5MGRESG8 15.750	8	0	0	170	0

30109	5MGRESG9 15.750	9	1	150	200	0
30111	5MGRESGA 15.750	10	0	0	200	0
30140	5MGRESGB 15.750	11	1	195.81	210	0
30141	5MGRESGC 15.750	12	0	0	210	0
30150	5MGRESG1 15.750	1	0	0	80	0
30151	5MGRESG2 15.750	2	0	0	0	0
30197	5MGRE3G2 10.500	2G	0	0	27	0
30198	5MGRE3G1 10.500	1G	1	30	27	0
38005	5KSPP1G5 6.3000	5	1	10	25	0
38006	5KSPP1G6 6.3000	1	1	9	12	0
38006	5KSPP1G6 6.3000	2	1	9	12	0
38006	5KSPP1G6 6.3000	4	1	9	10	0
38006	5KSPP1G6 6.3000	6	1	2	5	0
38012	5BSPP1G 10.500	4	1	6	8.4	0
38013	5BSPP2G 6.3000	3	1	9	12	0
38022	5BALTSG1 15.750	1	1	150	150	0
38023	5BALTSG2 15.750	3	1	150	150	0
38024	5BALTSG3 15.750	2	1	150	150	0
36056	5BURLAG 15.750	1	1	50	150	0
31008	5DONDU5 110.00	1	1	6	6	0
31009	5DROKI5 110.00	1	1	6	6	0
31010	5EDINE5 110.00	1	1	12	12	0
32018	5REZIN5 110.00	1	1	6	6	0
32027	5FALES5 110.00	1	1	6	6	0
32028	5FLORE5 110.00	1	1	9	9	0
33090	5RIBNT52 110.00	1	0	0	12	0
34017	5NANEN5 110.00	1	1	15	16	0
34022	5ORHEI5 110.00	1	1	20	20	0
34056	5SHTEF5 110.00	1	1	6	6	0
34057	5KISHI5 110.00	1	1	30	30	0
36028	5TARAK51 110.00	1	1	6	6	0
38018	5GORBOG 6.3000	1	1	4	6	0
38018	5GORBOG 6.3000	2	0	0	6	0

ROMANIA

Machines are in ascending rank related to delivery price of energy - Regulatory Authority Decision, published in Romanian Official Journal

Table 3.8 – Romania – Generation shifting list

Price	Bus No	Name	Pmax	Pmin
1	49189	RP.D.FG1	190	80
1	49190	RP.D.FG2	190	80
1	49191	RP.D.FG3	190	80
1	49192	RP.D.FG4	190	80
1	49193	RP.D.FG5	190	80
1	49250	RP.D.FG6	190	80
1	49194	RGRUIAG2	60	5.5
1	49195	RGRUIAG4	60	5.5
1	49196	RGRUIAG8	60	5.5
1	49199	RGRUIAG6	60	5.5
1	49232	RLOTRUG1	170	20
1	49233	RLOTRUG2	152	20
1	49234	RLOTRUG3	152	20
2	49218	RCERNAG1	690	555

2	49332	RCERNAG2	690	555
2	49470	RCERNAG3	690	555
3	49119	RROVING5	287	185
3	49120	RROVING6	277	185
3	49121	RROVING3	277	185
4	49110	RTURCEG1	284	174
4	49112	RTURCEG3	285	174
4	49113	RTURCEG4	291	175
4	49114	RTURCEG5	280	174
4	49116	RTURCEG6	280	174
4	49117	RTURCEG7	280	190
5	49198	RCRAI G2	118	70
5	49200	RCRAI G1	118	70
5	49184	RISALNG7	277	130
5	49185	RISALNG8	290	130
6	49167	RMINTIG1	185	140
6	49168	RMINTIG2	185	140
6	49169	RMINTIG5	185	140
7	49221	RBARBOG5	99.8	57.1
7	49224	RBARBOG3	100	57.1
7	49225	RSMARDG6	99.8	57.1
7	49310	RSMARDG4	52.6	33.4
8	49136	RBUC.SG5	100	60
8	49137	RBUC.SG6	100	60
8	49138	RBUC.SG3	100	50
8	49139	RBUC.SG1	50	30
8	49317	RBUC.SG2	50	30
8	49318	RBUC.SG4	100	50
9	49201	RBORZEG7	182.4	145.9
9	49202	RBORZEG8	173.3	145.9
9	49203	RBORZEG6	60	37
9	49205	RBORZEG4	50	37
9	49206	RBORZEG5	50	37
9	49219	RBRAILG1	212	110
9	49220	RBRAILG2	188	110
9	49299	RBRAILG3	180	110
9	49269	RPAROSG1	29	12
9	49270	RPAROSG2	34.8	12
9	49271	RPAROSG3	29	12
9	49263	RPAROSG4	150	77
9	49301	RDOICEG8	160	90
9	49302	RDOICEG7	160	90

Obs. Increasing power in Romania machines has to be done from price 1 to price 9 (start from the top of the list),
Decreasing power in Romania machines, has to be done from price 9 to price 1 (start from the bottom of the list),

RUSSIA

Increasing power in Russian machines has to be done from price 1 to price 4 (start from the top of the list).
Decreasing power in Russian machines has to be done from price 4 to price 1 (start from the bottom of the list).

Table 3.9 – Russia – Generation shifting list

Price	Bus No	Name	Pmax	Pmin
1	51420	4VGGESG7 13.800	115	3
1	51421	4VGGESG8 13.800	115	3
1	51422	4VGGESG9 13.800	115	3
1	51423	4VGGESG0 13.800	115	3
1	51424	4VGGESGA 13.800	115	3
1	51425	4VGGESGB 13.800	115	3
1	51426	4VGGESGG 13.800	115	3
1	51427	4VGGESGH 13.800	115	3
1	51428	4VGGESGI 13.800	115	3
1	51429	4VGGESGJ 13.800	115	3
1	51430	4VGGESGK 13.800	115	3
1	51431	4VGGESGL 13.800	115	3
1	51432	4VGG34G 13.800	115	3
1	51432	4VGG34G 13.800	115	3
1	51433	4VGG56G 13.800	115	3
1	51433	4VGG56G 13.800	115	3
1	51434	4VGG13G 13.800	115	3
1	51434	4VGG13G 13.800	115	3
1	51435	4VGG15G 13.800	115	3
1	51435	4VGG15G 13.800	115	3
1	58744	4CHGESG3	250	50
1	58745	4CHGESG1	250	50
1	58746	4CHGESG2	250	50
1	58747	4CHGESG4	250	50
2	58311	4NEVGRG1	150	80
2	58387	4NEVGRG2	150	80
2	58388	4NEVGRG3	150	80
2	58389	4NEVGRG4	150	80
2	58314	4NEVGRG5	100	70
2	58385	4NEVGRG6	150	80
2	58386	4NEVGRG7	150	80
2	58390	4NEVGRG8	150	130
2	51462	4KAES2G3 20.000	500	300
2	51463	4KAES2G4 20.000	500	300
3	58301	4STGRSG1	300	150
3	58380	4STGRSG2	300	150
3	58381	4STGRSG3	300	150
3	58382	4STGRSG4	300	150
3	58383	4STGRSG5	300	150
3	58384	4STGRSG6	300	150
3	58358	4STGRSG7	300	150
3	58359	4STGRSG8	300	150

3	51400	4RGRESG4 20.000	300	150
3	51401	4RGRESG5 24.000	800	400
3	51402	4RGRESG6 24.000	800	400
3	51403	4RGRESG7 20.000	300	150
3	51404	4RGRESG1 20.000	300	150
3	51405	4RGRESG2 20.000	300	150
3	51406	4RGRESG3 20.000	300	150
4	58149	4NCHGRG1	264	200
4	58183	4NCHGRG2	264	225
4	58184	4NCHGRG3	264	200
4	58185	4NCHGRG4	264	225
4	58186	4NCHGRG5	264	225
4	58187	4NCHGRG6	264	225
4	58195	4NCHGRG7	264	225
4	58196	4NCHGRG8	264	225

TURKEY

The shift list prepared for 1200 MW energy transfer in both directions according to the imp./exp.scenario of Turkey for 2010.

Table 3.10 – Turkey – Generation shifting list for RO to TR

	EXPORT		
Summer			
Bus Number	**Bus name**	**Shift**	**ID**
60801	G-4HAMIT	100	1
60801	G-4HAMIT	100	2
60801	G-4HAMIT	111,5	3
60843	G-4AMBR	138,8	1
60843	G-4AMBR	138,8	2
60844	G-4AMBR	172,8	1
60903	G-4TUNC	159,8	1
60908	G-TUNC B	159,8	1
60909	G-TUNC A	65,6	1
60929	G-4SOMA	165	1
60929	G-4SOMA	165	2
	TOTAL:	**1477,1**	**MW**
Winter			
Bus Number	**Bus name**	**Shift**	**ID**
60805	G-4HAMIT	100	7
60805	G-4HAMIT	100	8
60805	G-4HAMIT	111,5	9
60848	G-4AMBR	138,8	1
60848	G-4AMBR	138,8	2
60849	G-4AMBR	172,8	1
60935	G-4SOMA	165	6
60945	G-4YATAG	210	3
60913	G-SEYITO	159,8	1
60931	G-ALIDG	36	1
60931	G-ALIDG	36	2
60931	G-ALIDG	31	3
	TOTAL:	**1399,7**	**MW**

Table 3.11 - Turkey – Generation shifting list for TR to RO

IMPORT			
Summer			
Bus Number	**Bus name**	**Shift**	**ID**
60801	G-4HAMIT	-100,3	6
60801	G-4HAMIT	-111,5	A
60847	G-AMB2B	-124,9	1
60848	G-AMB2B	-155,5	1
60922	G-4ALIB	-221,1	1
60922	G-4ALIB	-221,1	2
60923	G-4ALIB	-240,2	1
60852	G-AMBFO	-150	1
	TOTAL:	**-1324,6**	**MW**
Winter			
Bus Number	**Bus name**	**Shift**	**ID**
60805	G-4HAMIT	-90	1
60805	G-4HAMIT	-90	2
60805	G-4HAMIT	-100,3	3
60850	G-4HABIP	-143	1
60850	G-4HABIP	-143	2
60850	G-4HABIP	-155	3
60851	G-4AMB2A	-124,9	1
60851	G-4AMB2A	-124,9	2
60852	G-4AMB2A	-155,5	1
60909	G-4TUNC	-143,8	1
60914	G-TUNC B	-143,8	1
	TOTAL:	**-1414,2**	**MW**

The shift list prepared for 1200 MW energy transfer in both directions according to the imp./exp.scenario of Turkey for 2010.

Table 3.12 - Turkey – Generation shifting list for TR to UCTE

EXPORT			
Summer			
Bus Number	**Bus name**	**Shift**	**ID**
60801	G-4HAMIT	100	1
60801	G-4HAMIT	100	2
60801	G-4HAMIT	111,5	3
60843	G-4AMBR	138,8	1
60843	G-4AMBR	138,8	2
60844	G-4AMBR	172,8	1
60903	G-4TUNC	159,8	1
60908	G-TUNC B	159,8	1
60909	G-TUNC A	65,6	1
60929	G-4SOMA	165	1
60929	G-4SOMA	165	2
	TOTAL:	**1477,1**	**MW**
Winter			
Bus Number	**Bus name**	**Shift**	**ID**
60805	G-4HAMIT	100	7
60805	G-4HAMIT	100	8
60805	G-4HAMIT	111,5	9

60848	G-4AMBR	138,8	1
60848	G-4AMBR	138,8	2
60849	G-4AMBR	172,8	1
60935	G-4SOMA	165	6
60945	G-4YATAG	210	3
60913	G-SEYITO	159,8	1
60931	G-ALIDG	36	1
60931	G-ALIDG	36	2
60931	G-ALIDG	31	3
	TOTAL:	**1399,7**	**MW**

Table 3.13 - Turkey – Generation shifting list for UCTE to TR

IMPORT			
Summer			
Bus Number	**Bus name**	**Shift**	**ID**
60801	G-4HAMIT	-100,3	6
60801	G-4HAMIT	-111,5	A
60847	G-AMB2B	-124,9	1
60848	G-AMB2B	-155,5	1
60922	G-4ALIB	-221,1	1
60922	G-4ALIB	-221,1	2
60923	G-4ALIB	-240,2	1
60852	G-AMBFO	-150	1
	TOTAL:	**-1324,6**	**MW**
Winter			
Bus Number	**Bus name**	**Shift**	**ID**
60805	G-4HAMIT	-90	1
60805	G-4HAMIT	-90	2
60805	G-4HAMIT	-100,3	3
60850	G-4HABIP	-143	1
60850	G-4HABIP	-143	2
60850	G-4HABIP	-155	3
60851	G-4AMB2A	-124,9	1
60851	G-4AMB2A	-124,9	2
60852	G-4AMB2A	-155,5	1
60909	G-4TUNC	-143,8	1
60914	G-TUNC B	-143,8	1
	TOTAL:	**-1414,2**	**MW**

The shift list prepared for 650 MW energy transfer in both directions according to the imp./exp.scenario of Turkey for 2010.

Table 3.14 - Turkey – Generation shifting list for TR to RU

EXPORT			
Summer			
Bus Number	**Bus name**	**Shift**	**ID**
61036	G-4BORCK	138	2
61037	G-4DERIN	167,4	2
61037	G-4DERIN	167,4	3
61038	G-4MURATL	58,8	1
61038	G-4MURATL	58,8	2
61057	G-4KEBAN	157,5	4
	TOTAL:	**747,9**	**MW**
Winter			

Bus Number	Bus name	Shift	ID
61062	G-4KARAK	300	5
61062	G-4KARAK	300	6
61059	G-4ATATU	300	4
	TOTAL:	**900**	**MW**

Table 3.15 - Turkey – Generation shifting list for RU to TR

	IMPORT		
Summer			
Bus Number	**Bus name**	**Shift**	**ID**
61036	G-4BORCK	-138	1
61062	G-4KARAK	-270	3
61062	G-4KARAK	-270	4
61044	G-4ATATU	-270	4
	TOTAL:	**-948**	**MW**
Winter			
Bus Number	**Bus name**	**Shift**	**ID**
61050	G-4BORCK	-138	1
61050	G-4BORCK	-138	2
61062	G-4KARAK	-270	3
61072	G-4KEBAN	-162,9	7
	TOTAL:	**-708,9**	**MW**

UKRAINE

Table 3.16 - Ukraine – Generation shifting list for UA to CE Winter

Node	Order	$P_{basecase}$	DP+
		[MW]	[MW]
79918	1	81	110
79917	2	130	15
79916	3	130	30
79915	4	130	15
79914	5	130	5
79909	6	130	15
79926	7	140	10
79919	8	0	160
79913	9	0	190
79911	10	0	190
79904	11	210	10
79927	12	0	150
79826	13	0	240
79903	14	210	10
79827	15	0	240
79902	16	210	10
79823	17	0	240
79901	18	210	10
70806	19	117	100
70805	20	260	200
79700	21	108	2
79701	22	108	2
79707	23	245	10
79719	24	240	16
79722	25	250	10
79723	26	250	10
79720	27	140	150

79724	28	140	150
79725	29	140	150
79726	30	240	60
79727	31	230	70
79728	32	230	70
79321	33	0	300
79345	34	217	50
TOTAL			3000

Table 3.17 - Ukraine – Generation shifting list for CE to UA Winter

Node	Order	$P_{basecase}$	DP+
		[MW]	[MW]
79908	1	200	-200
79909	2	130	-130
79914	3	130	-130
79915	4	130	-130
79916	5	130	-130
79917	6	130	-130
79900	7	116	-10
79927	8	140	-140
79900	9	1000	-1000
79808	10	1000	-1000
TOTAL			-3000

Table 3.18 - Ukraine – Generation shifting list for UA to CE Summer

Node	Order	$P_{basecase}$	DP+
		[MW]	[MW]
79009	1	0	290
79180	2	280	10
79010	3	0	290
79181	4	0	290
79133	5	80	70
79134	6	0	150
79135	7	0	150
79136	8	0	150
79137	9	0	150
79174	10	0	750
79170	11	212.5	50
79171	12	212.5	50
79172	13	212.5	50
79173	14	212.5	50
79159	15	0	500
TOTAL			3000

Table 3.19 - Ukraine – Generation shifting list for CE to UA Summer

Node	Order	$P_{basecase}$	DP+
		[MW]	[MW]
79101	1	170	-170
79102	2	170	-30
79130(4)	3	150	-150
79130(5)	4	150	-150
79170	5	212.5	-12.5
79171	6	212.5	-12.5
79172	7	212.5	-212.5
79173	8	212.5	-212.5
79179	9	800	-800
79009	10	0	250

79140	11	200	-200
79143	12	200	-200
79144	13	200	-200
79309	14	800	-800
79338	15	700	-100
TOTAL			-3000

Table 3.20 - Ukraine – Generation shifting list for UA to SEE Winter

Node	Order	$P_{basecase}$	DP+
		[MW]	[MW]
79908	1	0	200
79910	2	0	200
79912	3	0	200
79911	4	0	190
79913	5	0	190
79909	6	130	10
79915	7	130	10
79918	8	61	100
79919	9	0	150
79926	10	0	150
79927	11	0	150
79900	12	0	1000
79808	13	950	50
79825	14	0	250
79826	15	0	150
TOTAL			3000

Table 3.21 - Ukraine – Generation shifting list for SEE to UA Winter

Node	Order	$P_{basecase}$	DP+
		[MW]	[MW]
79914	1	130	-130
79915	2	130	-130
79916	3	130	-130
79917	4	130	-10
79985	5	1000	-1000
79808	6	1000	-1000
79719	7	200	-200
79599	8	1000	-200
79520	9	1000	-200
TOTAL			-3000

Table 3.22 - Ukraine – Generation shifting list for UA to SEE Summer

Node	Order	$P_{basecase}$	DP+
		[MW]	[MW]
79009	1	230	50
79010	2	230	50
79180	3	0	250
79181	4	0	250
79172	5	0	250
79173	6	0	250
79141	7	0	200
79142	8	0	200
79144	9	0	200
79132	10	0	150
79133	11	0	150
79134	12	0	150
79135	13	0	150

79136	14	0	150
79103	15	0	150
79104	16	0	150
79105	17	0	150
79106	18	0	100
TOTAL			3000

Table 3.23 - Ukraine – Generation shifting list for SEE to UA Summer

Node	Order	$P_{basecase}$	DP+
		[MW]	[MW]
79313	1	1000	-1000
79599	2	1000	-1000
79808	3	1000	-1000
TOTAL			-3000

EQUIVALENT

For the purpose of modeling additional exchanges, folowing loads are added to the BSR model

Table 3.24

BUS#	BUS NAME	VOLT.	ID	AREA	AREA NAME
80001	ZRZE421	400	EQ	12	PL
80004	ZZAM212	220	EQ	12	PL
80054	QVKAP_1	400	EQ	11	SK
80109	JRPMLA1	400	EQ	13	CS
80113	JTKOSB1	400	EQ	13	CS
80151	MAISA 1	400	EQ	15	HU
80154	MGOD 1	400	EQ	15	HU
80255	GAGDHM1	400	EQ	17	GR
80256	GKADIA1	400	EQ	17	GR

Table 3.25

FROM UCTE TO TURKEY

BUS#	BUS NAME	VOLT.	ID	AREA	AREA NAME	%
80001	ZRZE421	400	EQ	12	PL	20%
80054	QVKAP_1	400	EQ	11	SK	20%
80113	JTKOSB1	400	EQ	13	CS	60%

FROM UKRAIN AND RUSSIA TO SEE AND VS

BUS#	BUS NAME	VOLT.	ID	AREA	AREA NAME	%
80001	ZRZE421	400	EQ	12	PL	15%
80151	MAISA 1	400	EQ	15	HU	10%
80255	GAGDHM1	400	EQ	17	GR	40%
80256	GKADIA1	400	EQ	17	GR	35%

FROM UKRAIN AND RUSSIA TO WEST EUROPE AND VS

BUS#	BUS NAME	VOLT.	ID	AREA	AREA NAME	%
80001	ZRZE421	400	EQ	12	PL	40%
80004	ZZAM212	220	EQ	12	PL	5%
80054	QVKAP_1	400	EQ	11	SK	10%
80113	JTKOSB1	400	EQ	13	CS	15%
80151	MAISA 1	400	EQ	15	HU	30%

%-percentage of total additional exchange
to be modeled in marked bus as load

4. ANALISES RESULTS

4.1. Model summary

BLACK SEA REGIONAL MODEL
WINTER MAXIMUM LOAD 2010

AREA TOTALS
IN MW/MVAR

X-- AREA --X	FROM GENERATION	TO LOAD	TO BUS SHUNT	TO LINE SHUNT	FROM CHARGING	TO NET INT	LOSSES	DESIRED NET INT
1	8023.0	7854.0	0.0	14.3	0.0	0.0	154.7	0.0
BG	2800.6	2791.1	0.0	119.6	2275.2	89.1	2076.0	
2	2006.0	2057.0	0.0	106.6	0.0	-200.0	42.4	-200.0
GE	428.8	1038.0	0.0	-106.6	847.5	-85.9	430.8	
3	1523.4	1188.1	0.0	0.0	0.0	300.0	35.4	300.0
MD	329.7	503.1	0.0	0.0	509.7	77.3	259.0	
4	9868.9	9534.1	0.0	86.0	0.0	50.0	198.7	50.0
RO	3207.4	3574.7	1259.5	274.9	4496.3	263.9	2330.7	
5	19199.3	16903.7	21.5	15.9	0.0	1550.0	708.2	1550.0
RU	15961.4	16218.9	4101.2	122.4	11626.2	416.5	6728.7	
6	33598.5	33209.2	0.1	0.0	0.0	-150.0	539.2	-150.0
TR	6329.6	5452.0	1663.7	0.0	8947.0	-206.2	8367.1	
7	32610.2	30515.5	9.8	70.6	0.0	1250.1	764.2	1250.0
UA	10992.8	10050.9	7876.2	703.3	16307.6	-698.3	9368.3	
8	2390.8	930.6	0.0	0.0	0.0	1400.0	60.2	1400.0
AM	316.4	309.5	0.0	0.0	658.7	182.5	483.1	
9	0.0	217.2	0.0	0.0	0.0	-220.0	2.8	-220.0
AZ	0.0	30.0	0.0	0.0	36.6	-10.1	16.7	
10	6009.7	6961.3	9.5	0.5	0.0	-1000.0	38.4	-1000.0
BY	1551.6	1626.4	597.6	2.1	1099.9	86.5	338.8	
11	6.7	277.0	0.0	0.0	0.0	-280.0	9.7	-280.0
SK	144.0	-22.0	0.0	0.0	396.2	458.8	103.4	
12	-187.7	-358.3	0.0	0.0	0.0	159.9	10.8	160.0
PL	-404.7	251.6	0.0	2.3	626.4	-174.6	142.4	
13	1.3	494.8	0.0	0.0	0.0	-530.0	36.4	-530.0
CS	-9.8	777.6	0.0	0.0	867.2	-343.4	423.2	
15	1578.7	2287.6	0.0	0.0	0.0	-730.0	21.1	-730.0
HU	-27.4	801.4	573.2	2.6	1568.7	-135.1	299.1	
16	2.5	100.5	0.0	0.0	0.0	-100.0	2.0	-100.0
MK	-51.7	299.3	0.0	0.0	302.5	-70.7	22.2	
17	-5.7	286.2	0.0	0.0	0.0	-300.0	8.1	-300.0
GR	93.8	750.0	0.0	0.0	933.3	192.3	84.7	
18	12.5	1200.0	0.0	0.2	0.0	-1200.0	12.3	-1200.0
IR	-42.2	45.2	0.0	0.5	122.8	-42.7	77.5	
TOTALS	**116638.2**	**113658.5**	**41.0**	**294.1**	**0.0**	**0.0**	**2644.6**	**0.0**
	41620.2	**44497.9**	**16071.4**	**1121.1**	**51621.8**	**0.0**	**31551.6**	

BLACKSEA REGIONAL MODEL **AREA TOTALS**
SUMMER MINIMUM LOAD 2010 **IN MW/MVAR**

X-- AREA --X	FROM GENERATION	TO LOAD	TO BUS SHUNT	TO LINE SHUNT	FROM CHARGING	TO NET INT	LOSSES	DESIRED NET INT
1	3020.4	2958.1	0.0	12.4	0.0	0.0	49.9	0.0
BG	507.7	1096.8	903.6	91.2	2345.0	62.1	698.9	
2	1063.9	713.0	0.0	127.9	0.0	200.3	22.7	200.0
GE	139.3	497.0	529.6	-127.9	865.8	-118.5	224.8	
3	1203.3	888.0	0.0	0.0	0.0	300.0	15.4	300.0
MD	27.7	375.3	0.0	0.0	553.2	75.5	130.1	
4	4126.2	3936.2	0.0	80.9	0.0	49.9	59.2	50.0
RO	595.9	1944.6	2108.3	247.3	4526.1	3.3	818.6	
5	13430.7	11601.7	22.6	15.3	0.0	1550.0	241.1	1550.0
RU	1732.6	5478.2	5443.1	101.7	12175.3	260.0	2624.8	
6	18695.7	19114.0	-3.2	0.0	0.0	-649.6	234.6	-650.0
TR	1571.3	2725.1	3807.5	0.0	8881.4	-205.4	4125.6	
7	16928.2	15366.6	9.1	68.8	0.0	1149.5	334.1	1150.0
UA	4937.3	7406.6	8832.5	645.9	16595.4	-345.0	4992.7	
8	1937.2	480.6	0.0	0.0	0.0	1400.1	56.5	1400.0
AM	339.2	357.5	0.0	0.0	641.6	192.7	430.6	
9	0.0	65.0	0.0	0.0	0.0	-65.2	0.2	0.0
AZ	0.0	30.0	0.0	0.0	46.7	15.6	1.2	
10	6010.1	6961.3	9.5	0.5	0.0	-1000.0	38.7	-1000.0
BY	1408.5	1626.4	598.4	2.1	1167.1	26.5	322.1	
11	2.8	477.0	0.0	0.0	0.0	-480.2	6.0	-480.0
SK	148.0	238.0	0.0	0.0	411.7	257.7	64.0	
12	-249.4	-301.7	0.0	0.0	0.0	45.2	7.1	-20.0
PL	-380.0	196.7	0.0	2.4	640.2	-55.5	116.7	
13	16.7	71.8	0.0	0.0	0.0	-70.0	14.9	-70.0
CS	-242.1	703.1	0.0	0.0	940.5	-177.6	173.0	
15	7.2	559.3	0.0	0.0	0.0	-570.0	17.9	-570.0
HU	15.1	830.0	539.0	1.5	1557.0	-86.6	288.1	
16	-1.5	97.6	0.0	0.0	0.0	-100.0	1.0	-100.0
MK	-16.4	211.9	0.0	0.0	318.0	78.9	10.8	
17	-3.1	548.1	0.0	0.0	0.0	-560.0	8.8	-560.0
GR	160.8	943.2	0.0	0.0	947.1	69.2	95.6	
18	12.1	1200.0	0.0	0.2	0.0	-1200.0	11.9	-1200.0
IR	-51.6	45.2	0.0	0.5	120.7	-52.8	76.1	
TOTALS	**66200.5**	**64736.6**	**38.0**	**305.9**	**0.0**	**0.0**	**1120.0**	**0.0**
	10893.2	**24705.5**	**22762.2**	**964.7**	**52732.7**	**0.0**	**15193.6**	

4.2. Area interchange

BLACK SEA REGIONAL MODEL
WINTER MAXIMUM LOAD 2010

AREA INTERCHANGE

FROM AREA \ TO AREA:	1	2	3	4	5	6	7	8	10	11	12	13	15	16	17	18	19
1				-900		233							162		155	350	
BG				-37		75							62		-11	1	
2					280	-266		-214	0								
GE					-33	56		-109	0								
3				486			-186										
MD				-84			161										
4	900		-486				-402						190	-153			
RO	37		84				11						140	-8			
5		-280					757		220	854							
RU		33					413		10	-40							
6	-233	266						14								-198	
TR	-75	-56						-31								-45	
7			186	402	-757					146	-239	593		918			
UA			-161	-11	-413					-47	-52	30		-44			
8		214				-14											1200
AM		109				31											43
9		0			-220												
AZ		0			-10												
10					-854		-146										
BY					40		47										
11							239					-753		234			
SK							52					145		262			
12							-593				753						
PL							-30				-145						
13	-162			-190										-269	92		
CS	-62			-140										-75	-67		
15				153			-918				-234		269				
HU				8			44				-262		75				
16	-155												-92			147	
MK	11												67			-148	
17	-350					198									-147		
GR	-1					45									148		
18								-1200									
IR								-43									

BLACKSEA REGIONAL MODEL
SUMMER MINIMUM LOAD 2010

AREA INTERCHANGE

FROM AREA \ TO AREA:	1	2	3	4	5	6	7	8	10	11	12	13	15	16	17	18	19
1				-904		407							-16		144	369	
BG				-1		97							-17		-42	25	
2					279	29		-108	0								
GE					-21	45		-142	0								
3				457			-157										
MD				58			17										
4	904		-457				-401						133	-130			
RO	1		-58				-29						135	-46			
5		-279					1064		65	700							
RU		21					282		-16	-28							
6	-407	-29						-92								-122	
TR	-97	-45						2								-65	
7			157	401	-1064					300	-181	542		994			
UA			-17	29	-282					1	-78	-70		73			
8		108				92											1200
AM		142				-2											53
9		0			-65												
AZ		0			16												
10					-700		-300										
BY					28		-1										
11							181					-588		-74			
SK							78					126		54			
12							-542				588						
PL							70				-126						
13	16			-133										-221	268		
CS	17			-135										6	-66		
15				130			-994				74		221				
HU				46			-73				-54		-6				
16	-144												-268			313	
MK	42												66			-29	
17	-369					122									-313		
GR	-25					65									29		
18								-1200									
IR								-53									

4.3. Load flow analyses

4.3.1. BULGARIA

Figure 4.1 – Bulgaria – Load flows for Winter 2010 regime

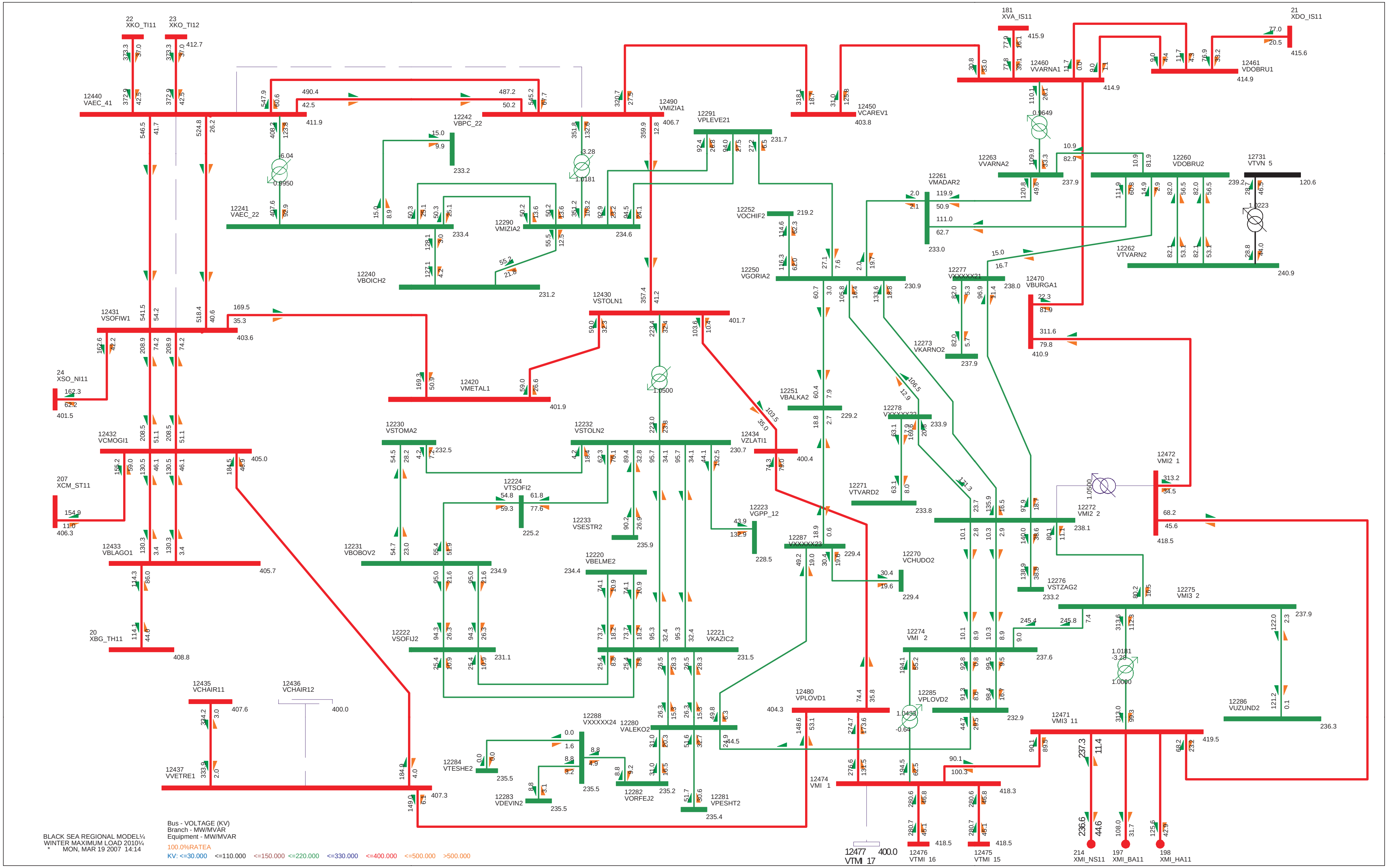
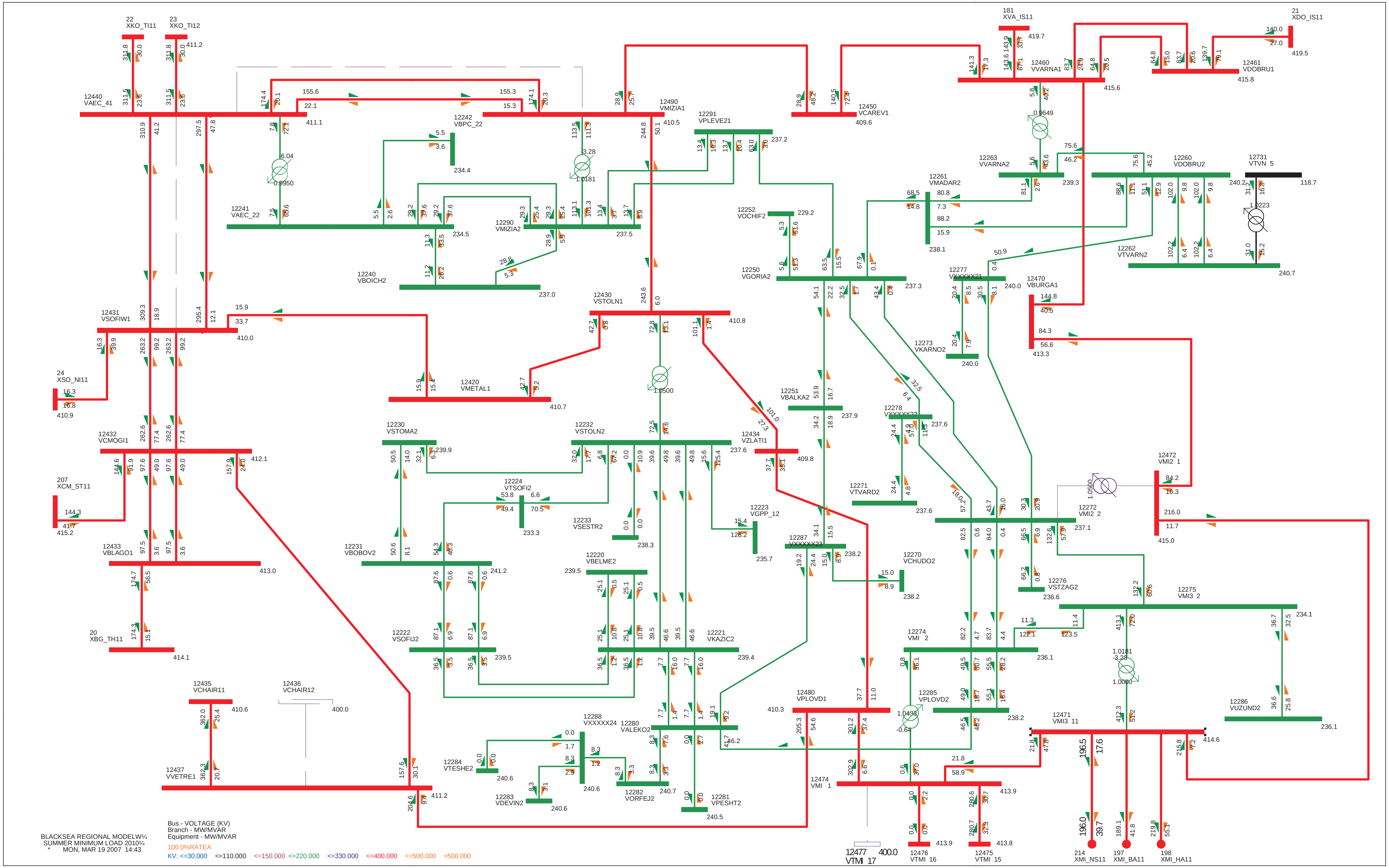


Figure 4.2 – Bulgaria – Load flows for Summer 2010 regime



4.3.2. GEORGIA

Figure 4.3 – Georgia – Load flows for Winter 2010 regime

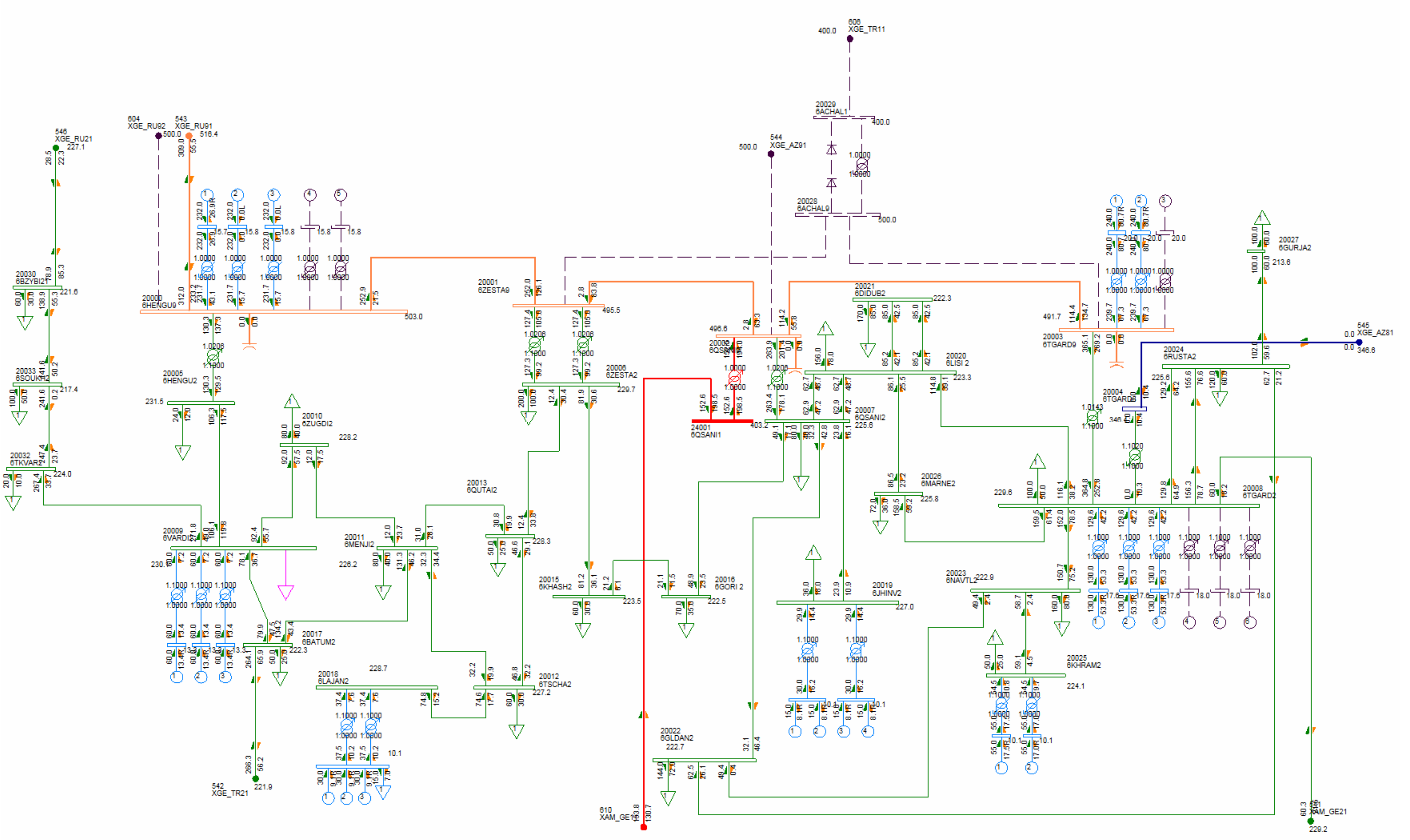
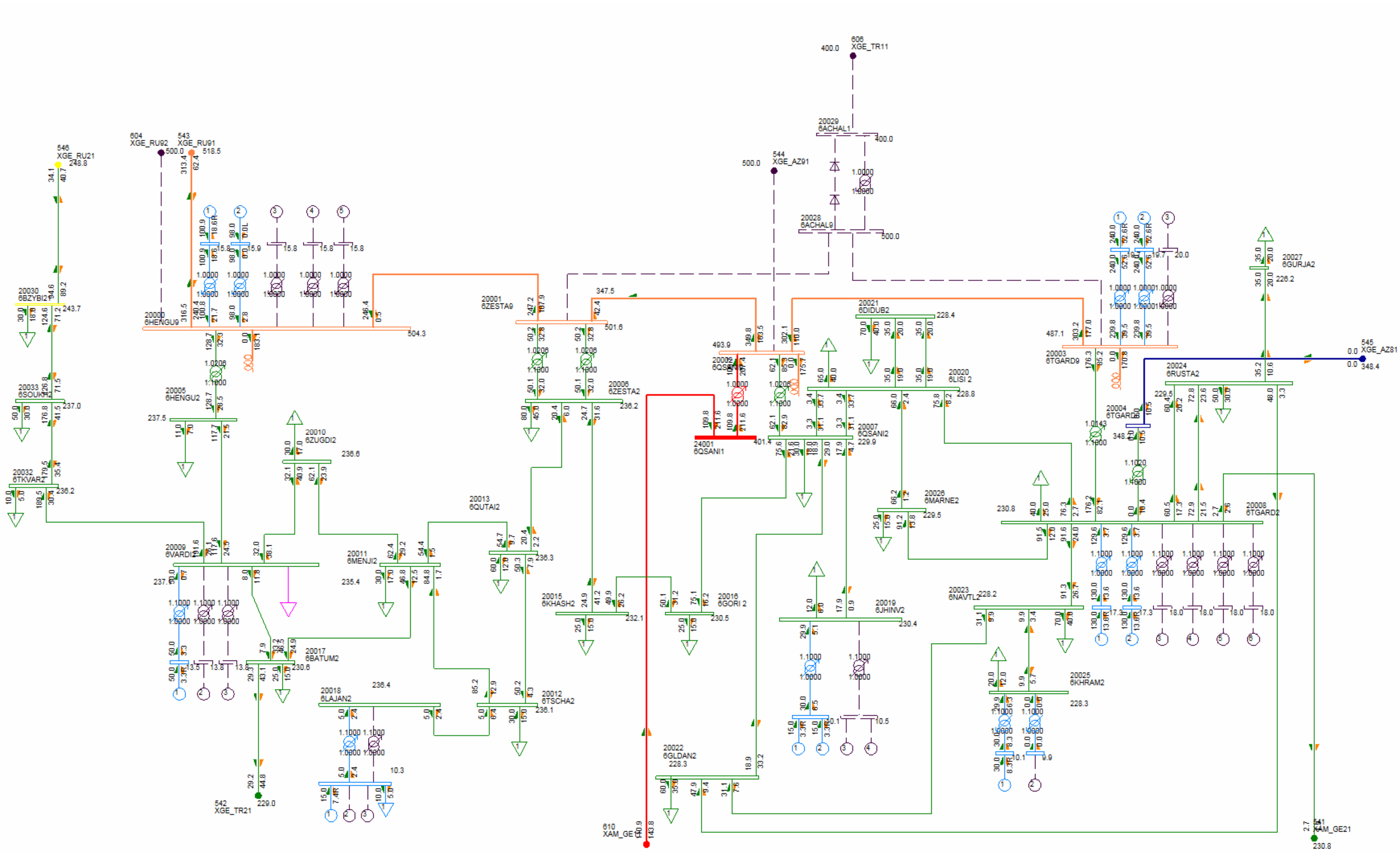


Figure 4.4 – Georgia – Load flows for Summer 2010 regime



4.3.3. MOLDOVA

Figure 4.5 – Moldova – Load flows for Winter 2010 regime

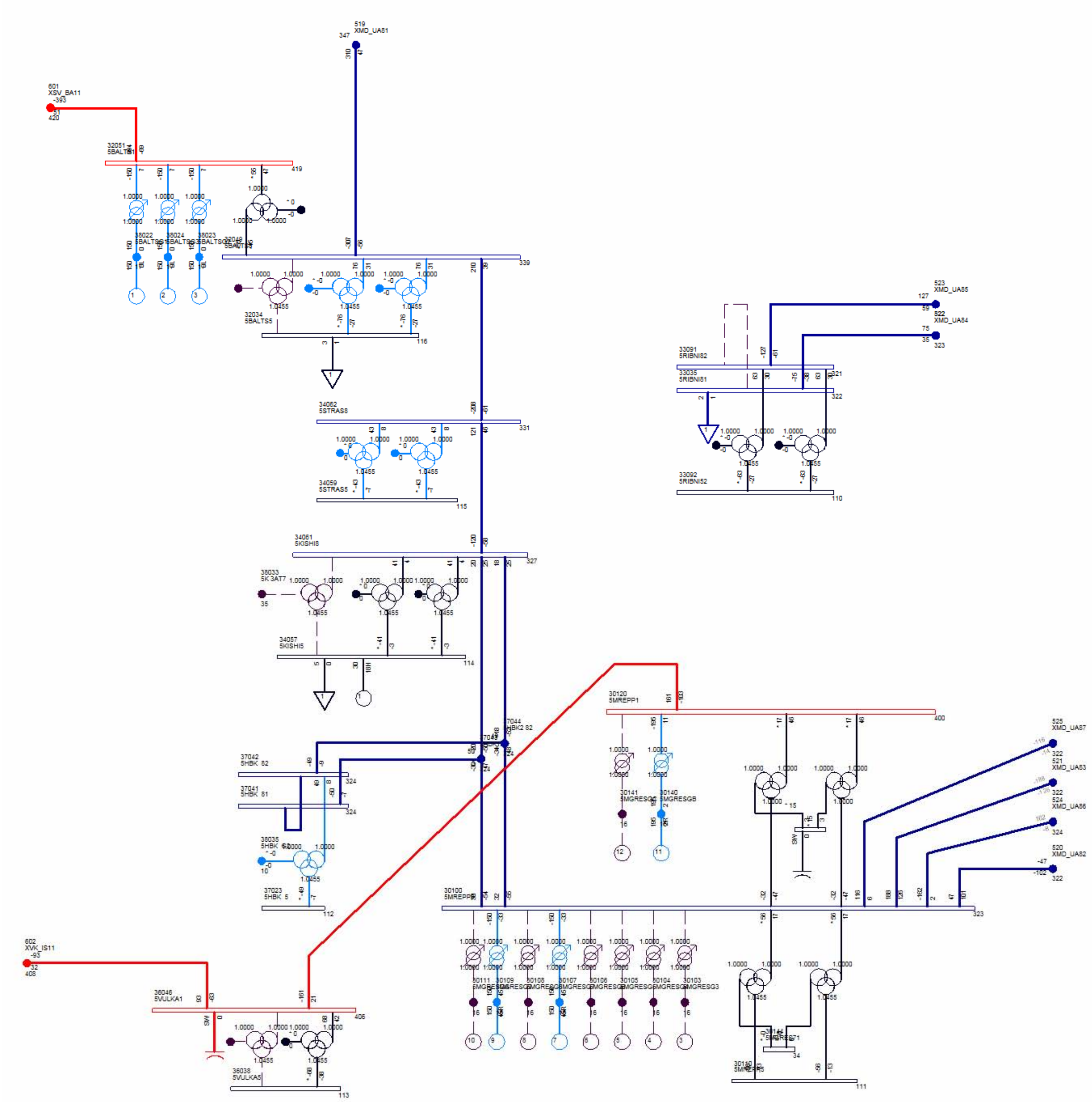
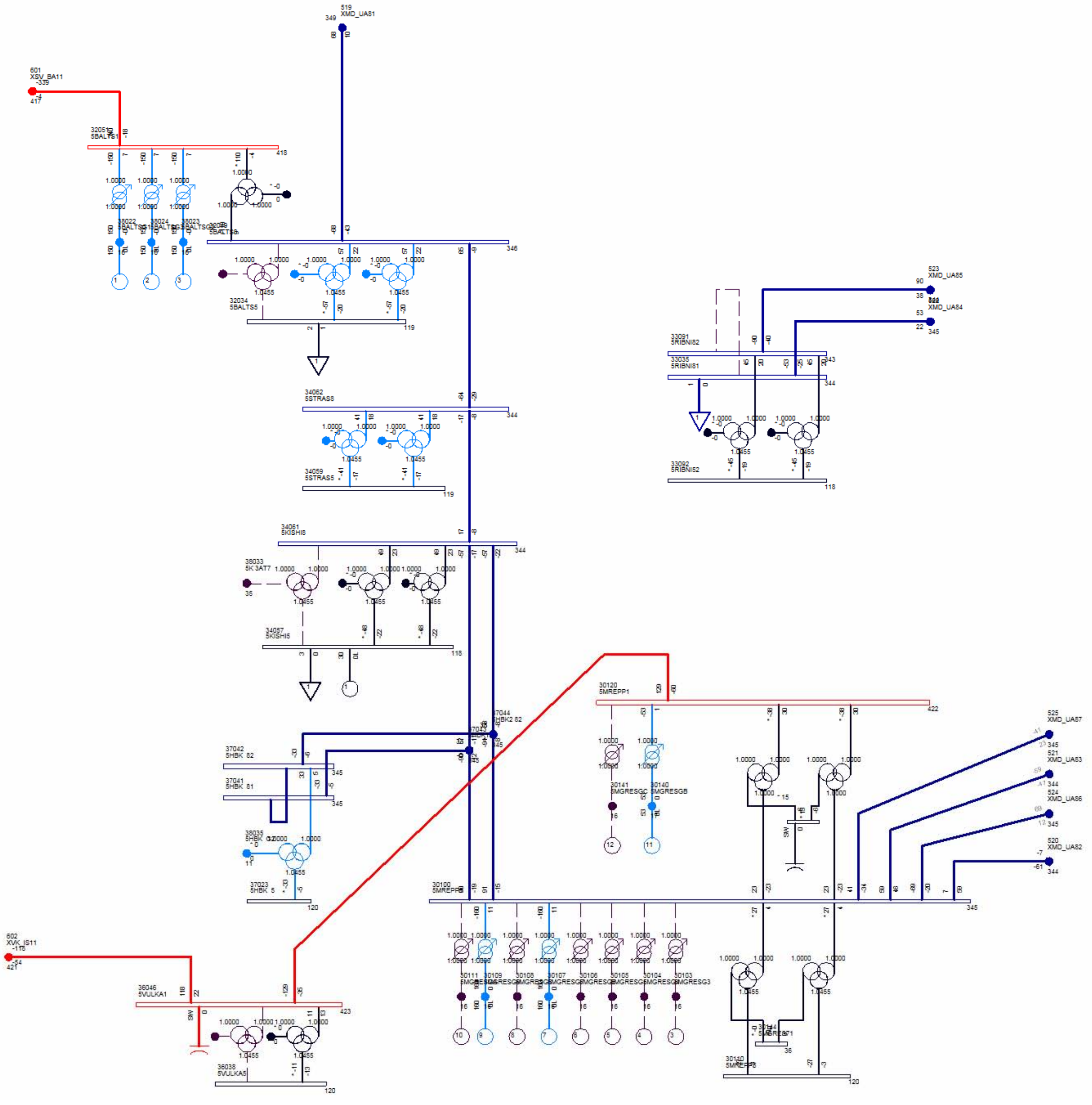


Figure 4.6 – Moldova – Load flows for Summer 2010 regime



4.3.4. ROMANIA

Figure 4.7 – Romania – Load flows forWinter 2010 regime

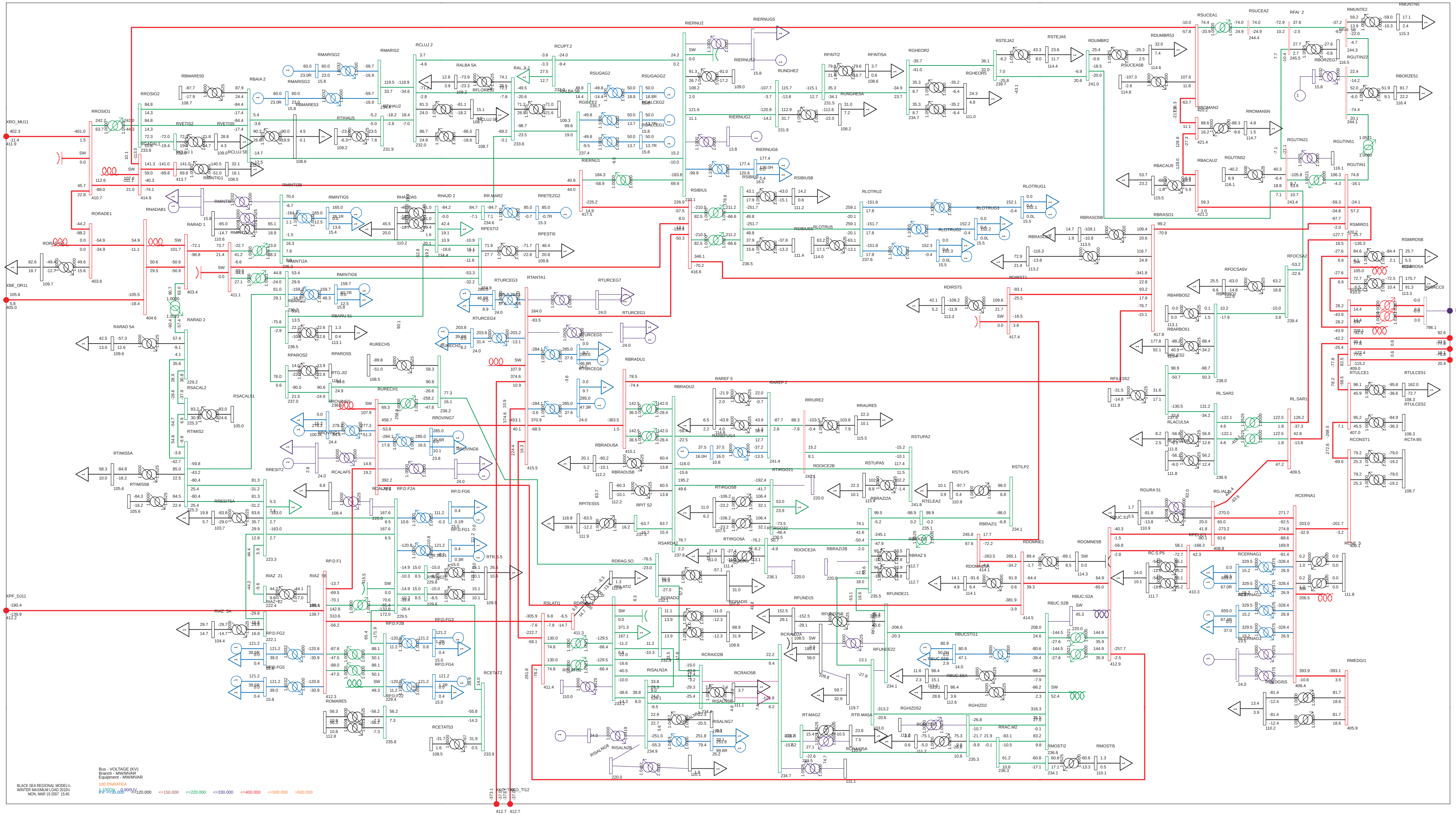
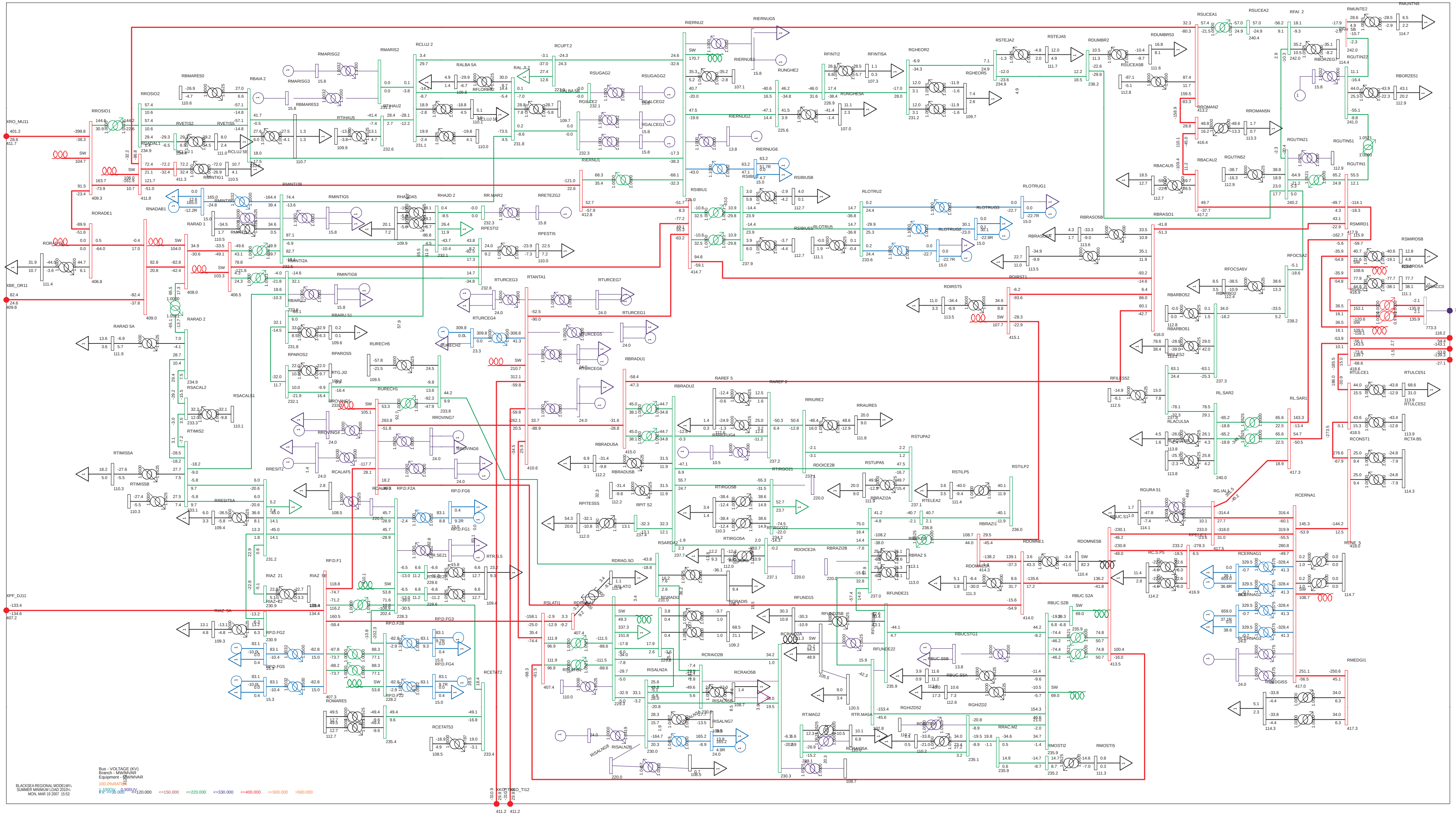


Figure 4.8 – Romania – Load flows for Summer 2010 regime



4.3.5. RUSSIA

Figure 4.9 – Russia – Load flows for Winter 2010 regime part 1

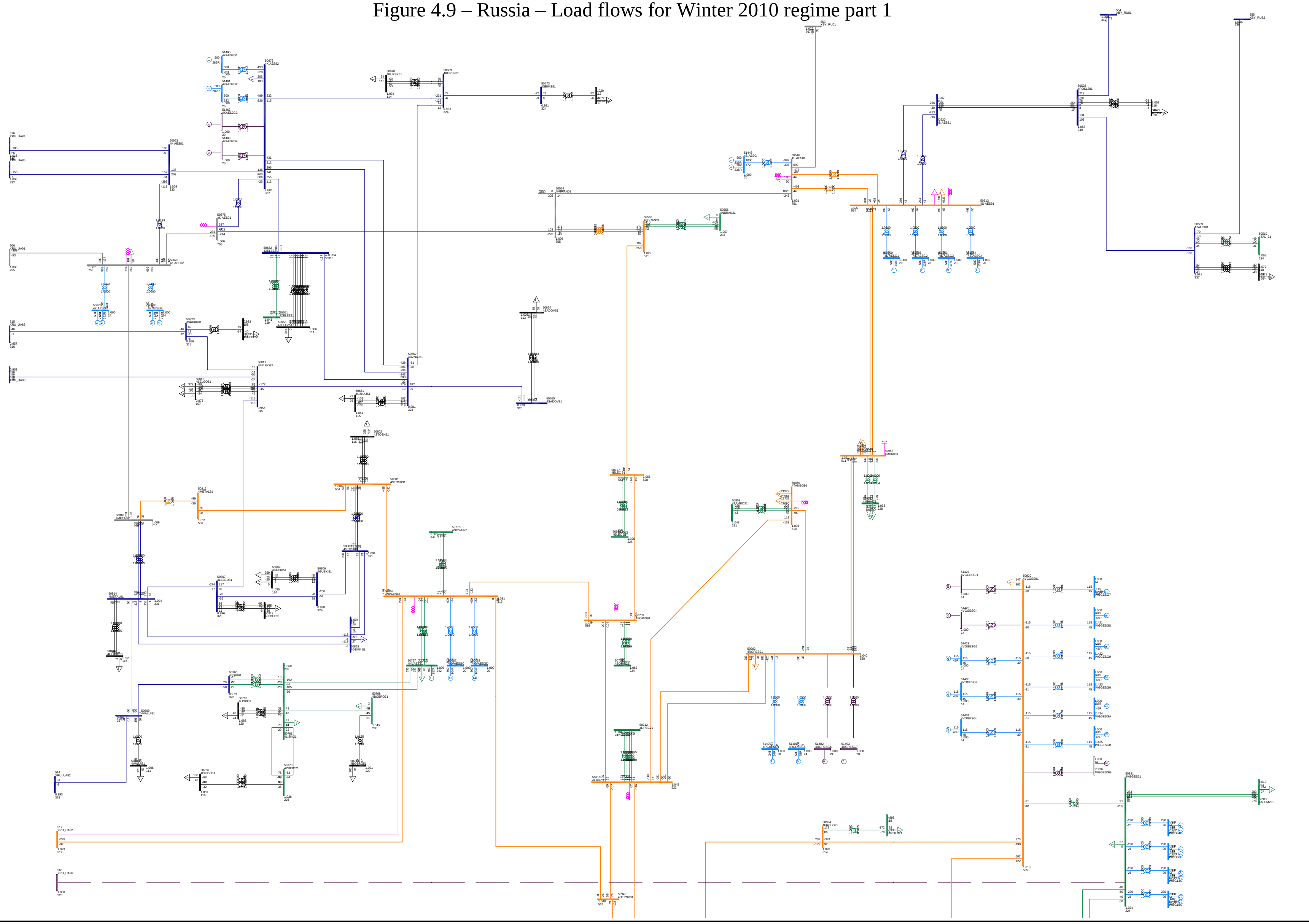


Figure 4.10 – Russia – Load flows for Winter 2010 regime part 2

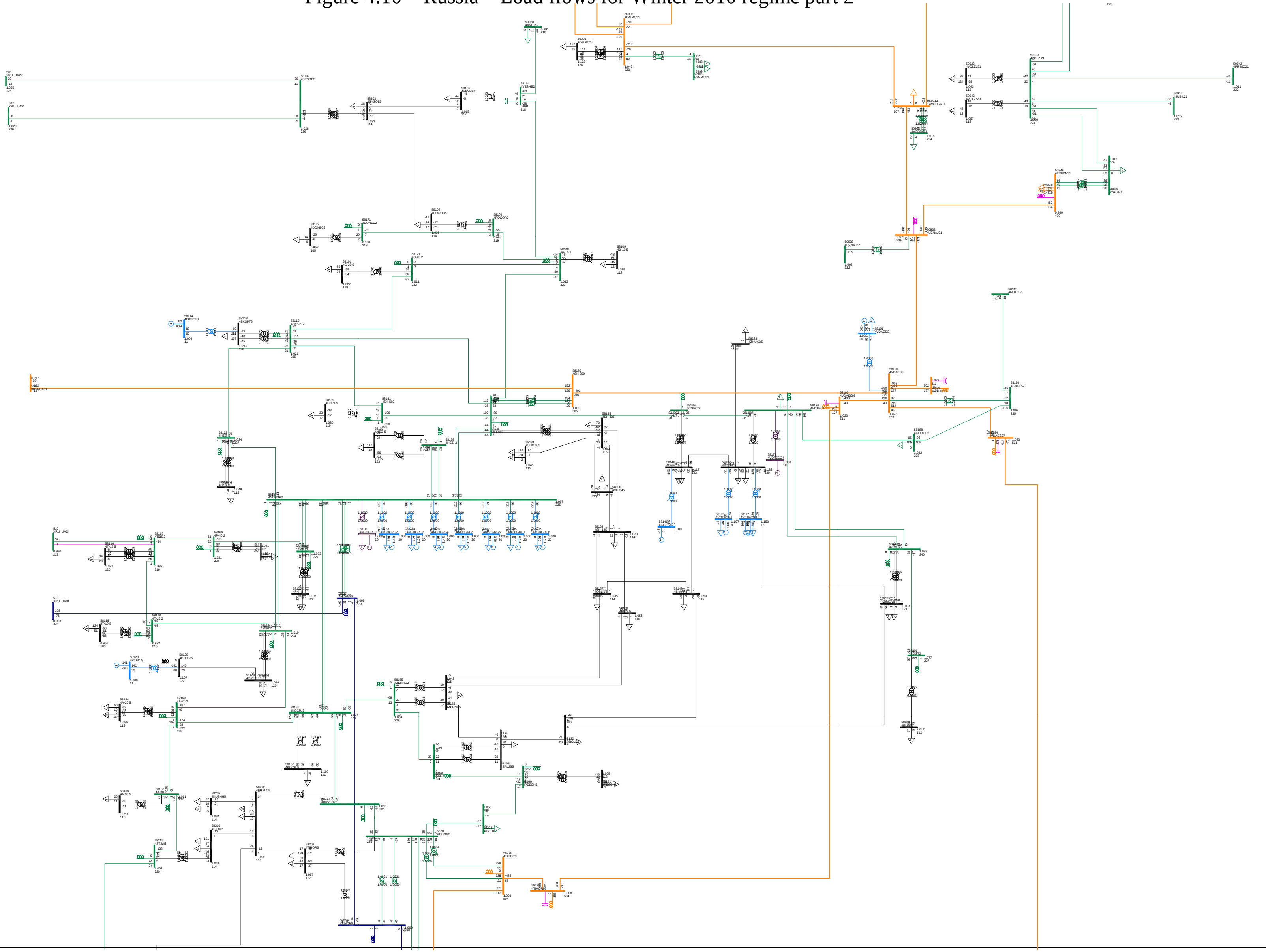


Figure 4.11 – Russia – Load flows for Winter 2010 regime part 3

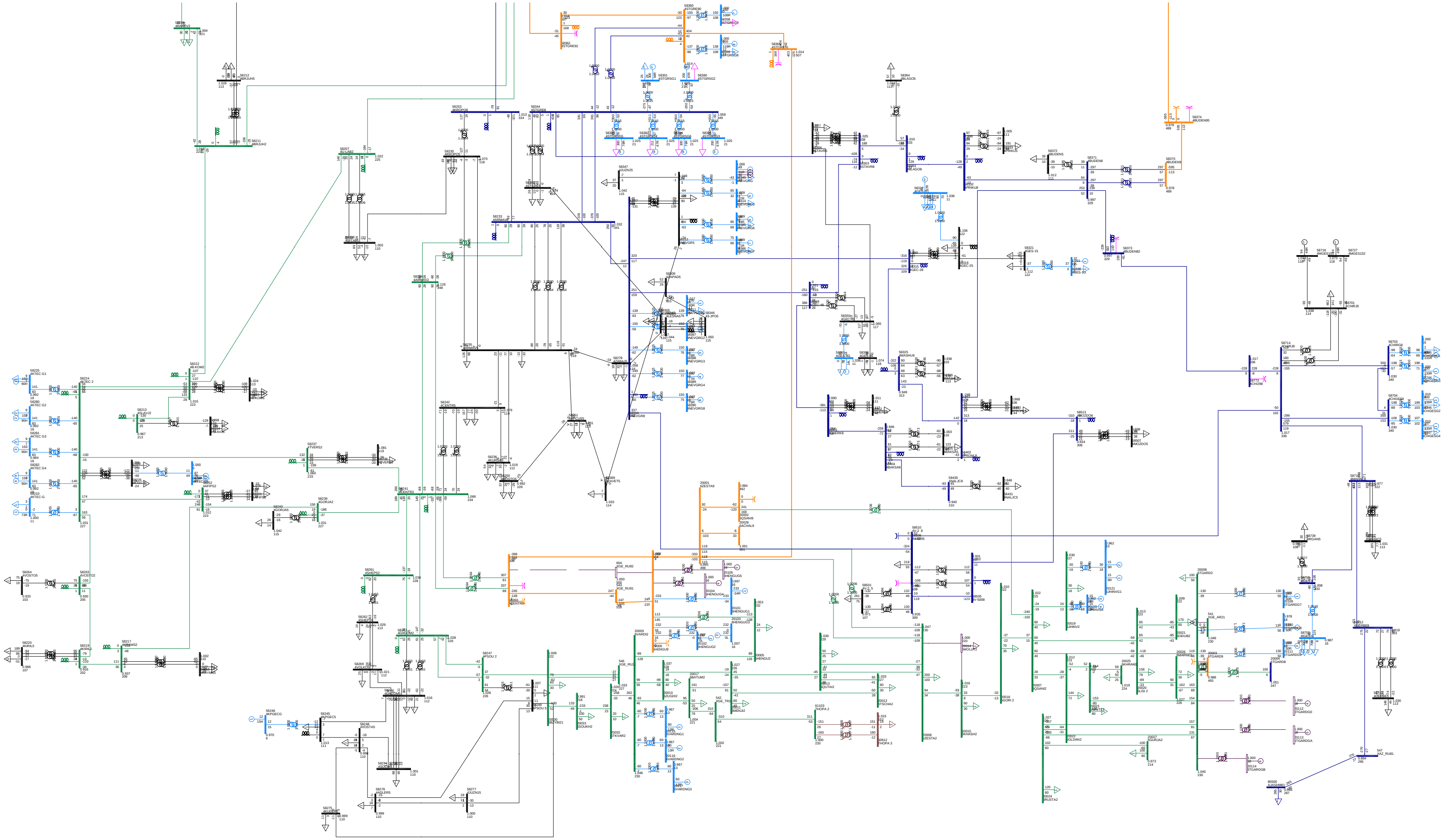


Figure 4.12 – Russia – Load flows for Summer 2010 regime part1

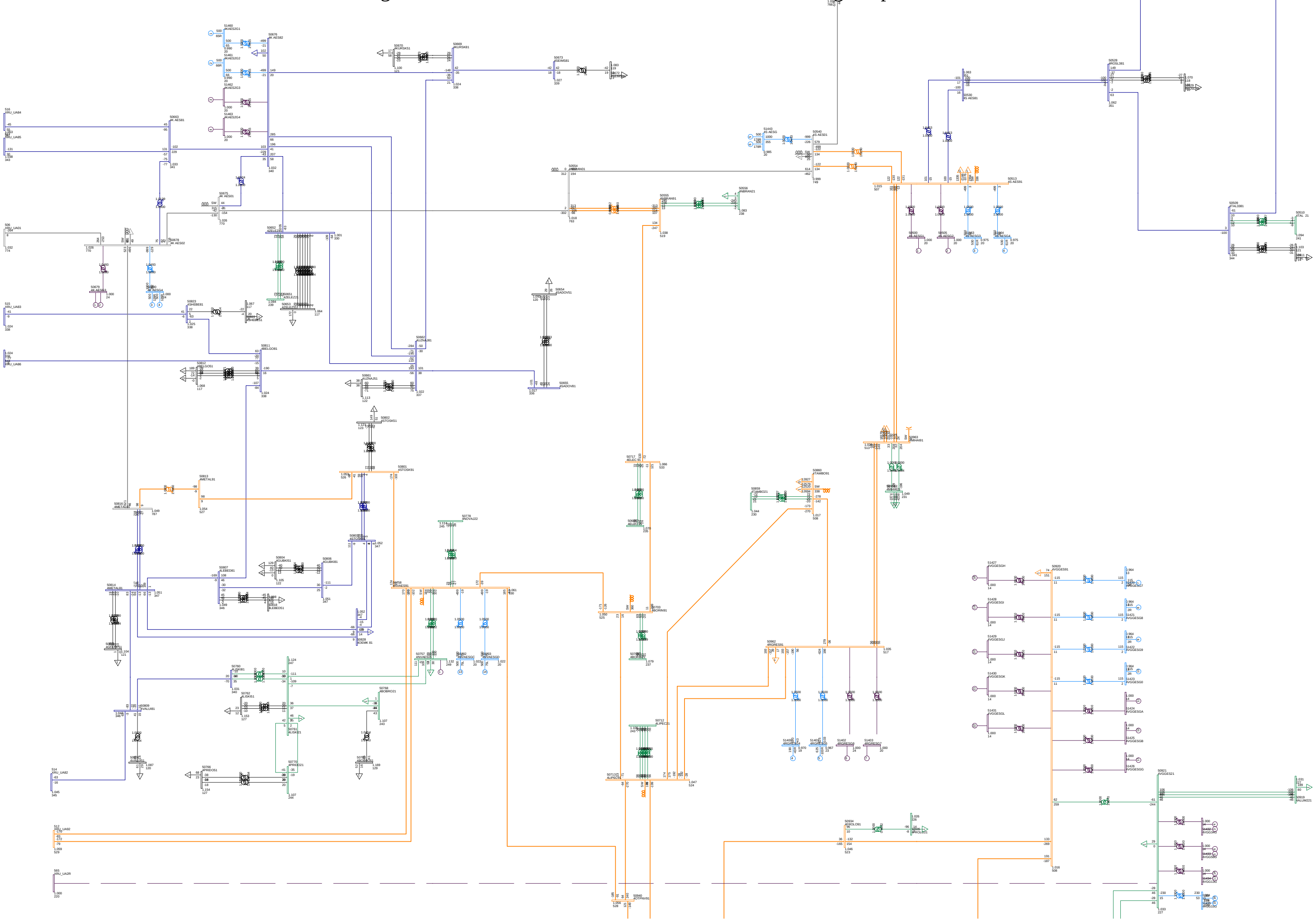


Figure 4.13 – Russia – Load flows for Summer 2010 regime part2

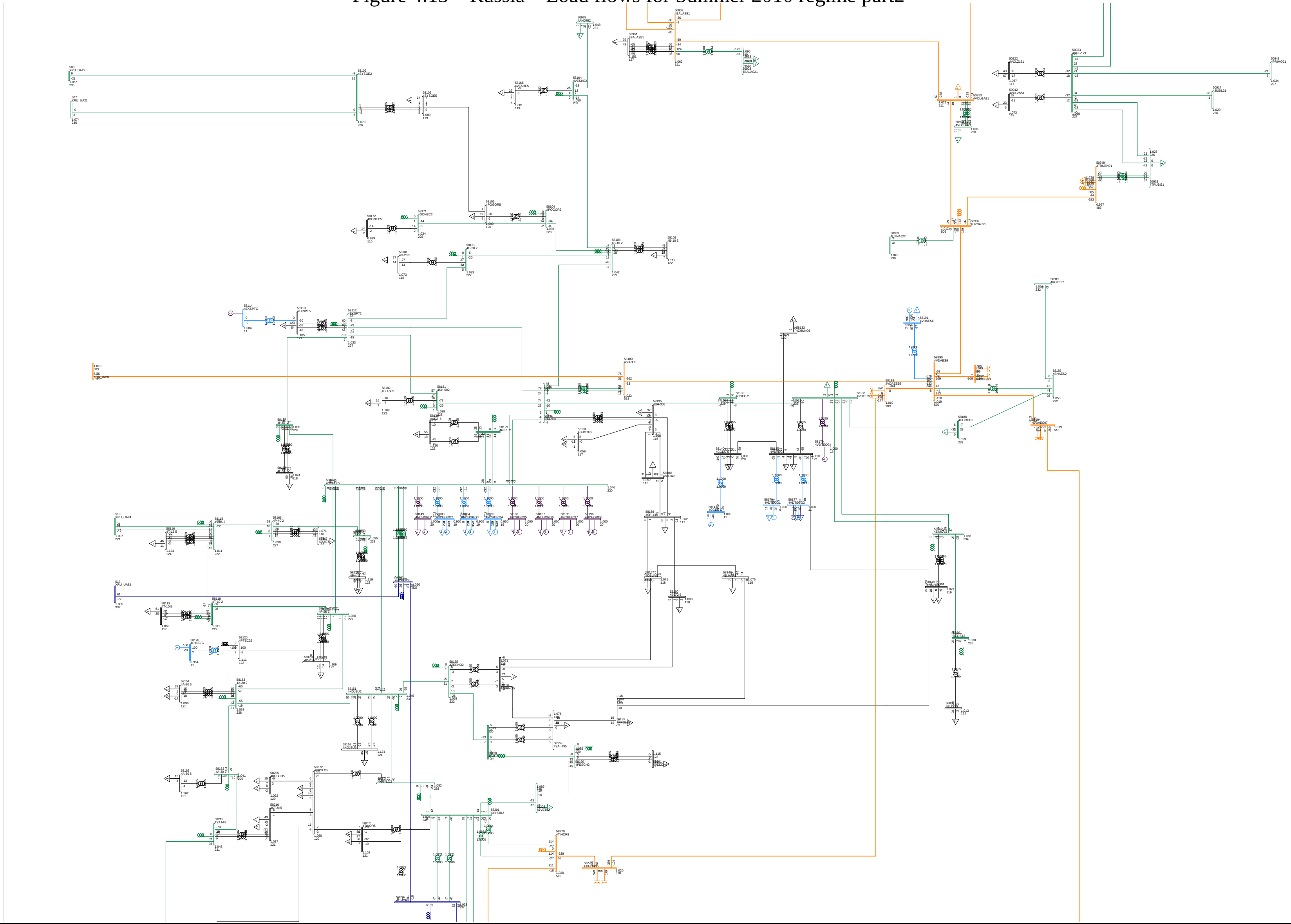
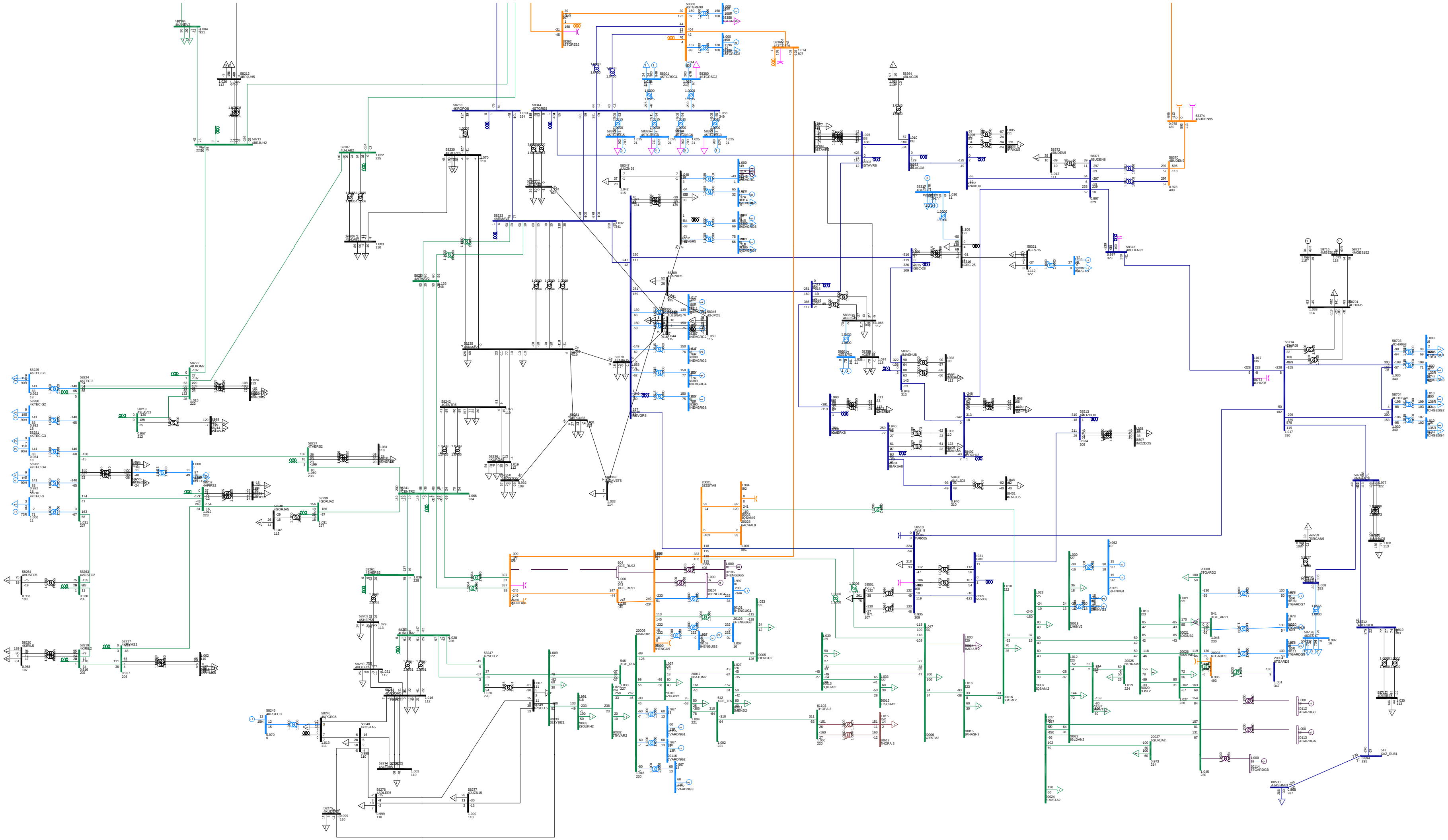


Figure 4.14 – Russia – Load flows for Summer 2010 regime part3



4.3.6. TURKEY

Figure 4.11 – Turkey – Load flows for Winter 2010 regime – North West

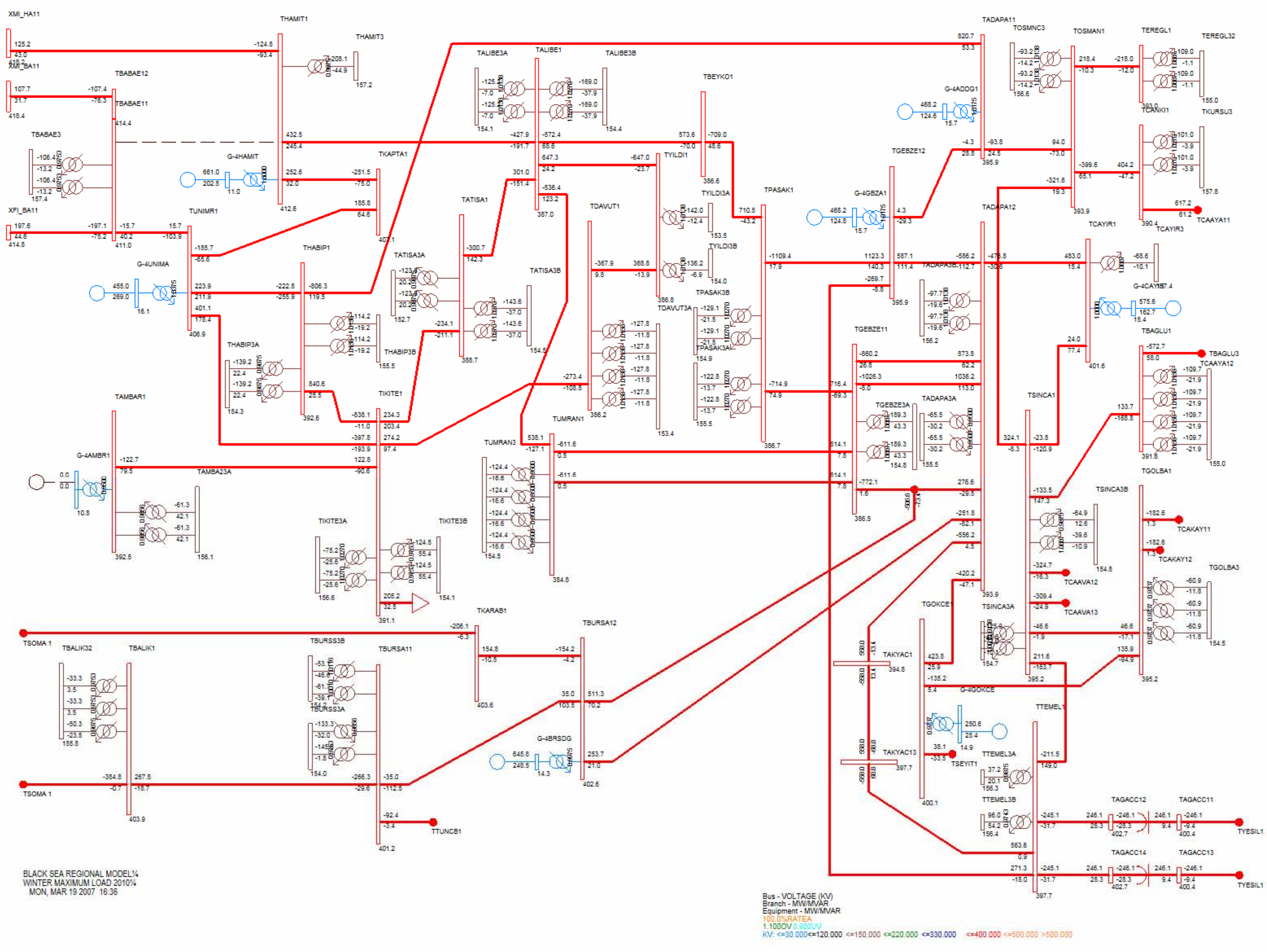


Figure 4.12 – Turkey – Load flows for Winter 2010 regime – South West

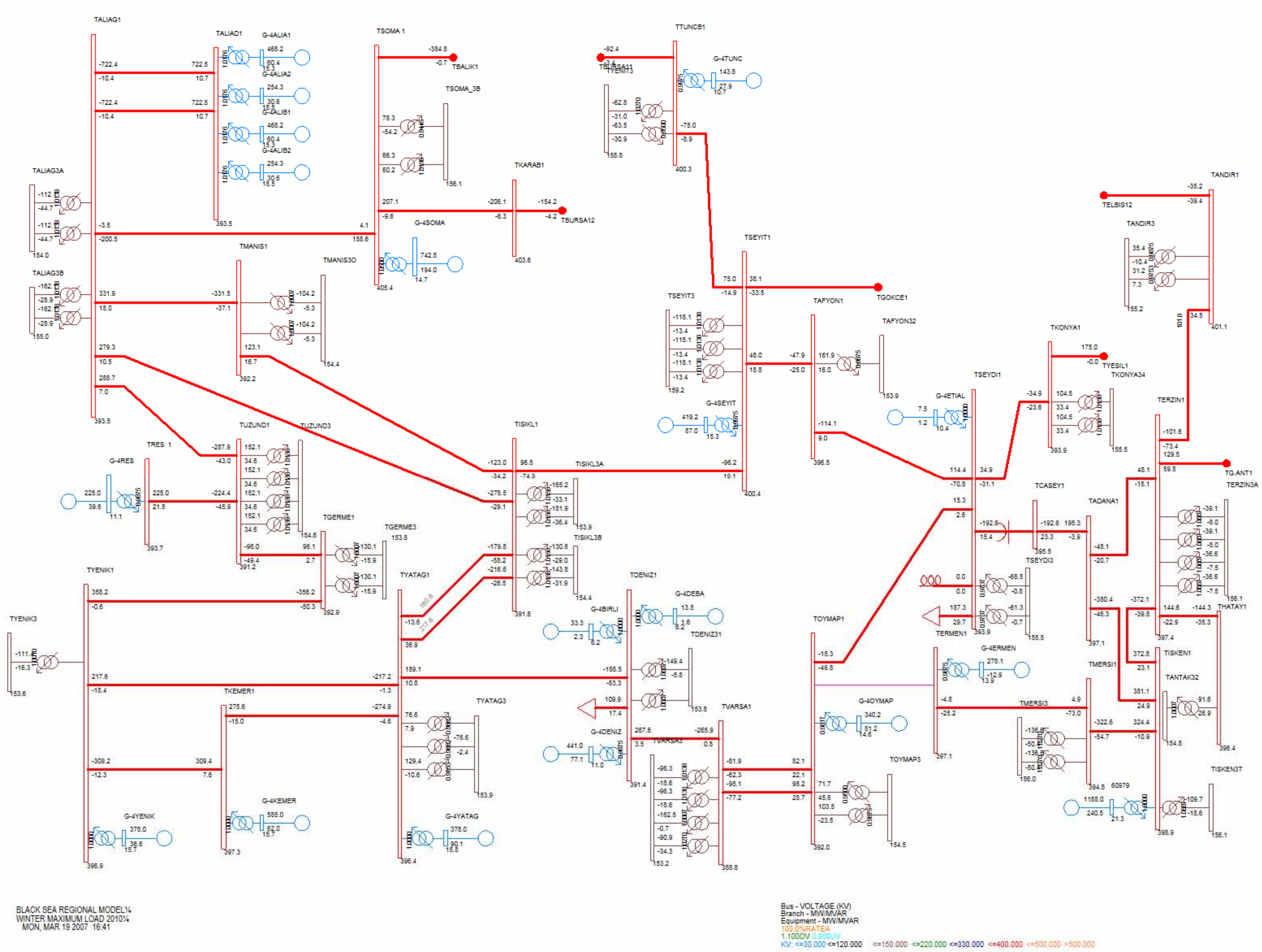


Figure 4.13 – Turkey – Load flows for Winter 2010 regime - EAST

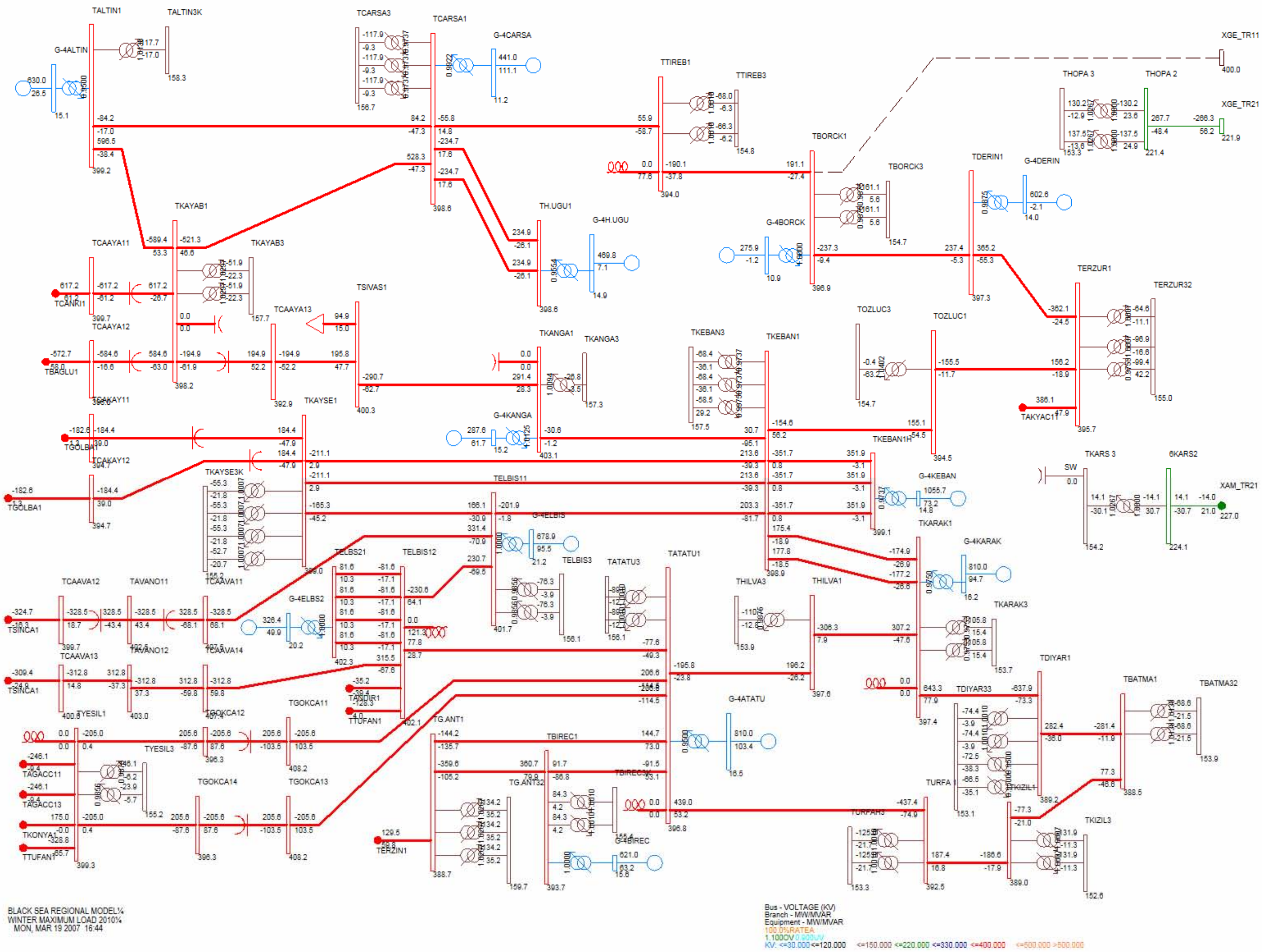


Figure 4.14 – Turkey – Load flows for Winter 2010 regime – North West

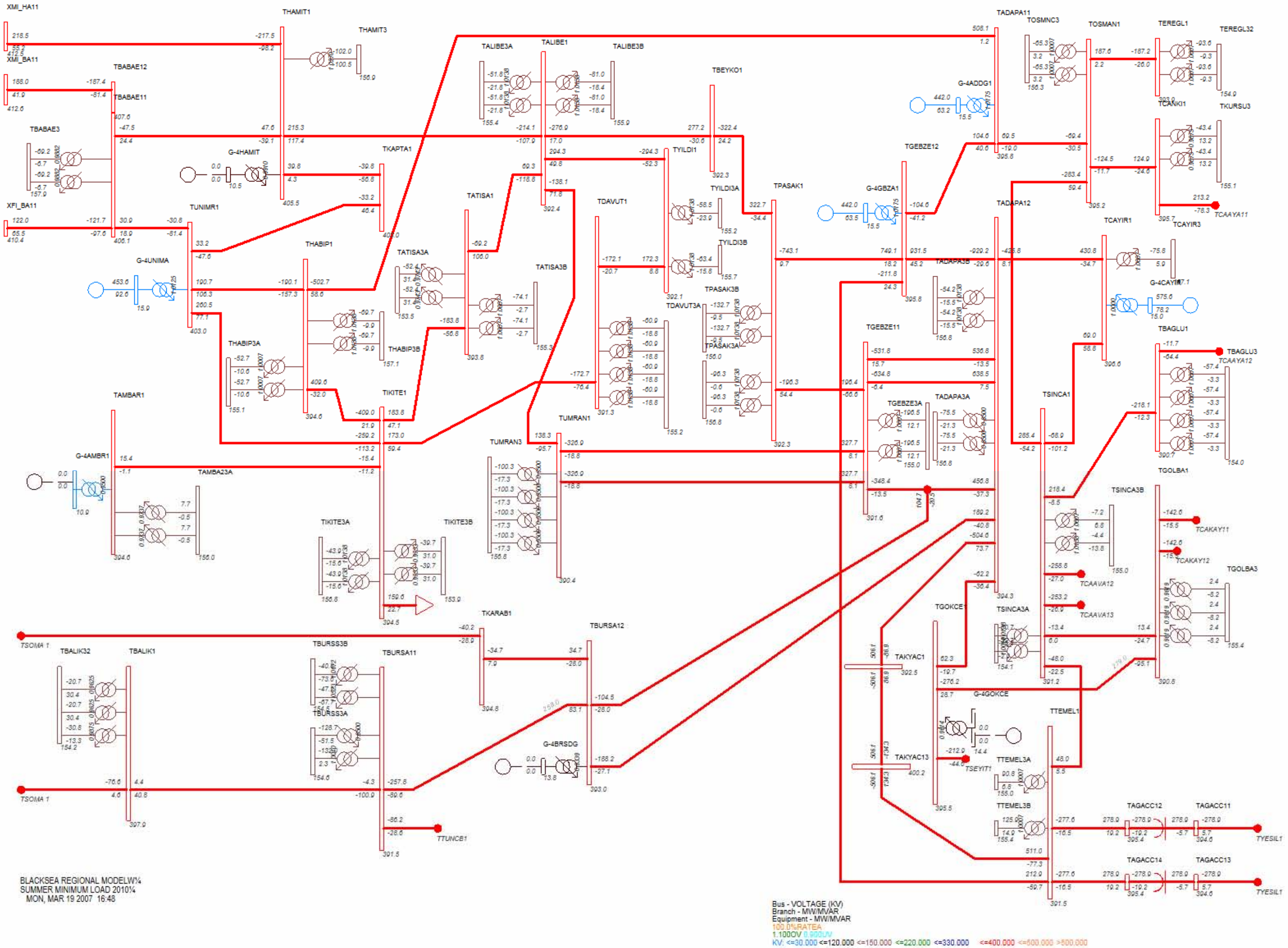


Figure 4.15 – Turkey – Load flows for Summer 2010 regime – South West

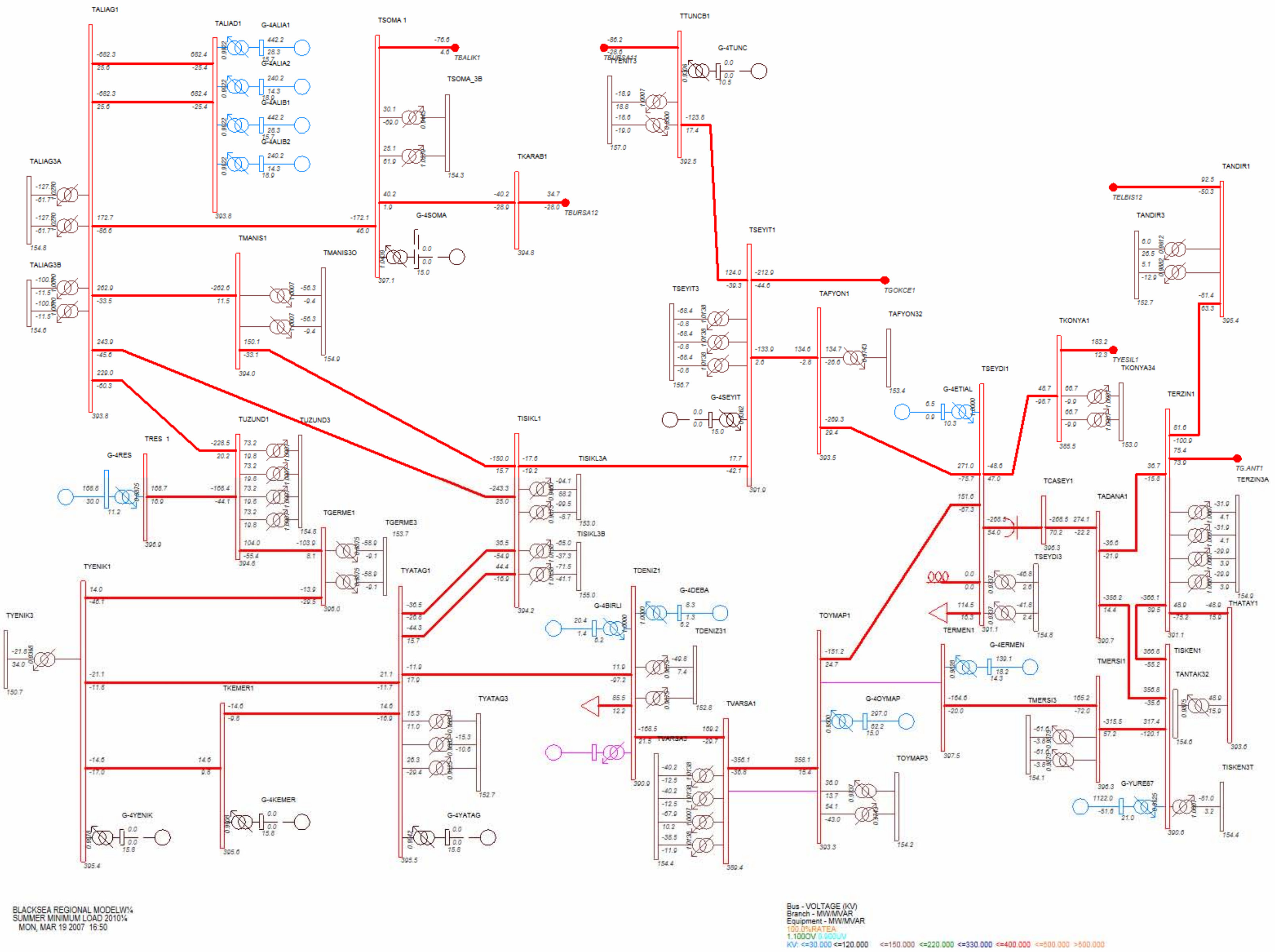
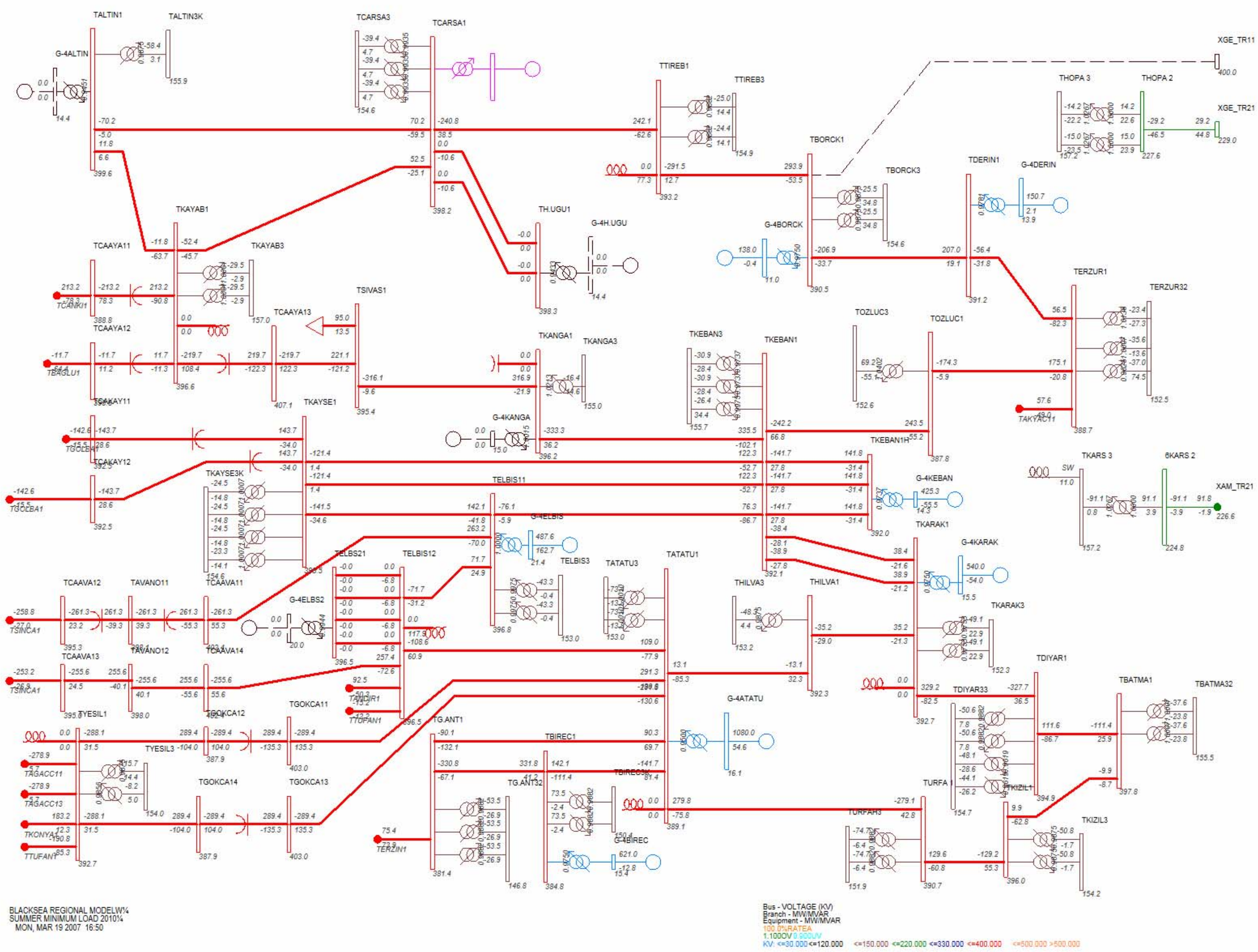


Figure 4.16 – Turkey – Load flows for Summer 2010 regime - EAST



4.3.7. UKRAINE

Figure 4.21 – Ukraina – Load flows for Winter 2010 regime – part1

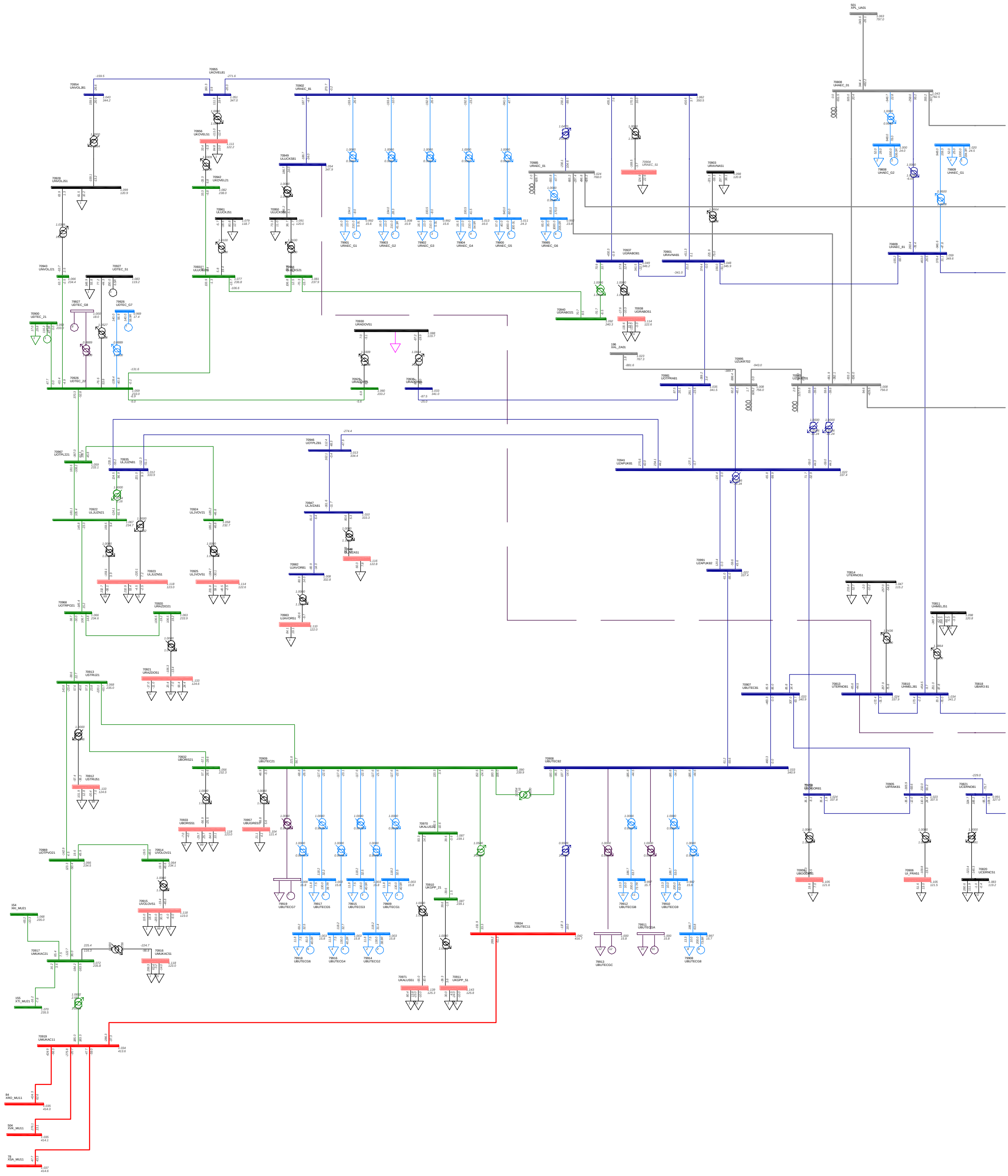


Figure 4.22 – Ukraina – Load flows for Winter 2010 regime – part2

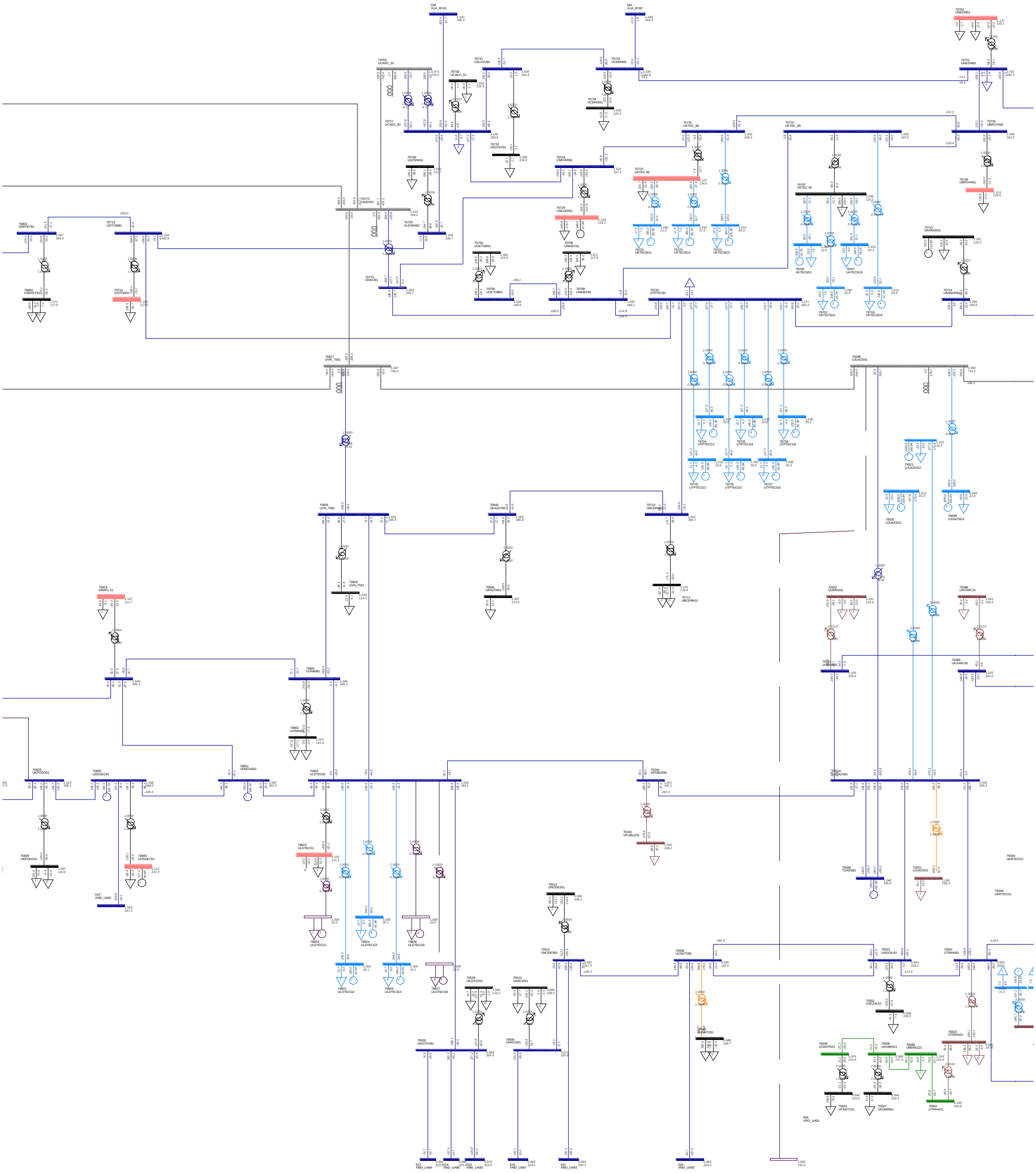


Figure 4.23 – Ukraina – Load flows for Winter 2010 regime – part3

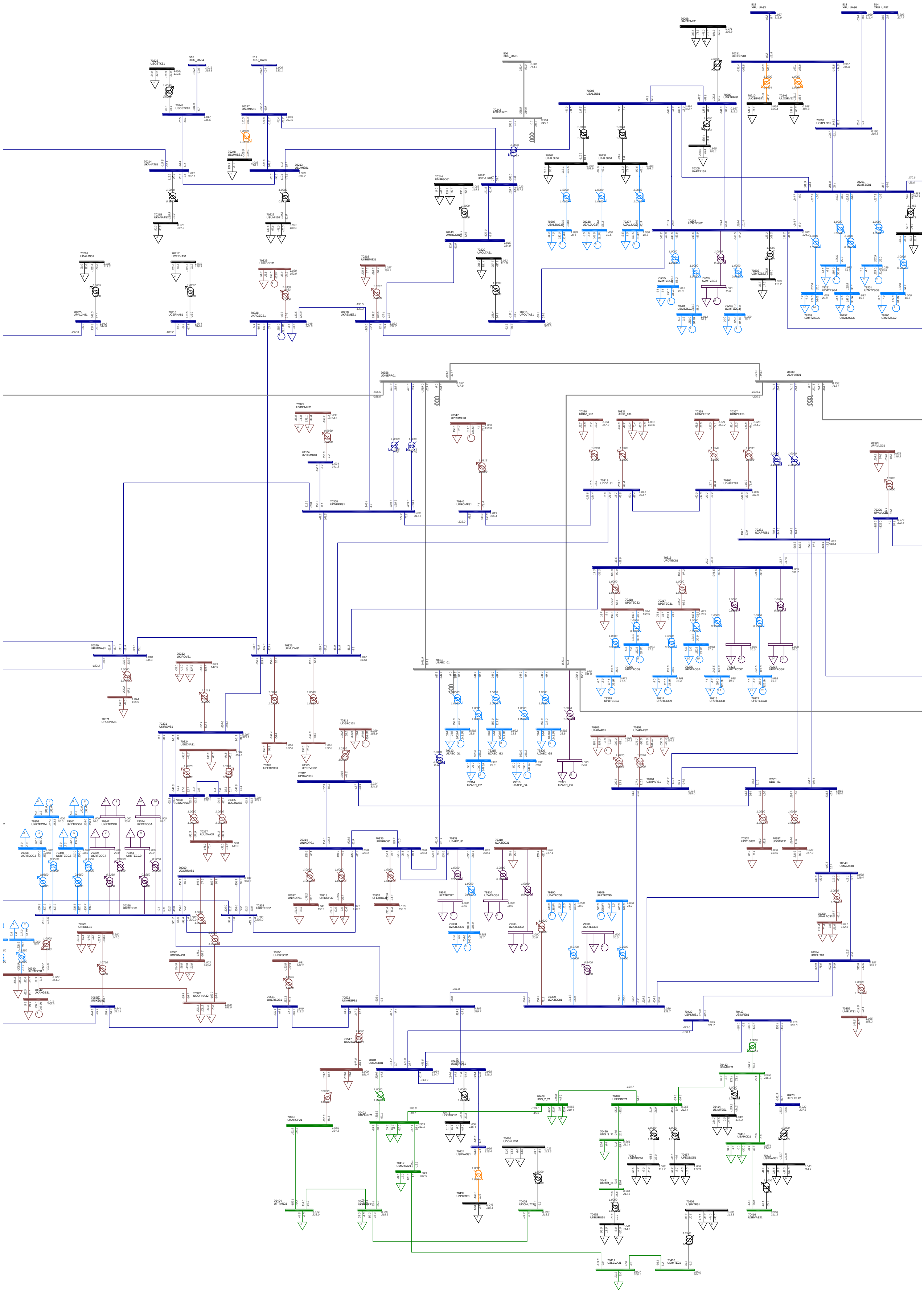


Figure 4.24 – Ukraina – Load flows for Winter 2010 regime – part4

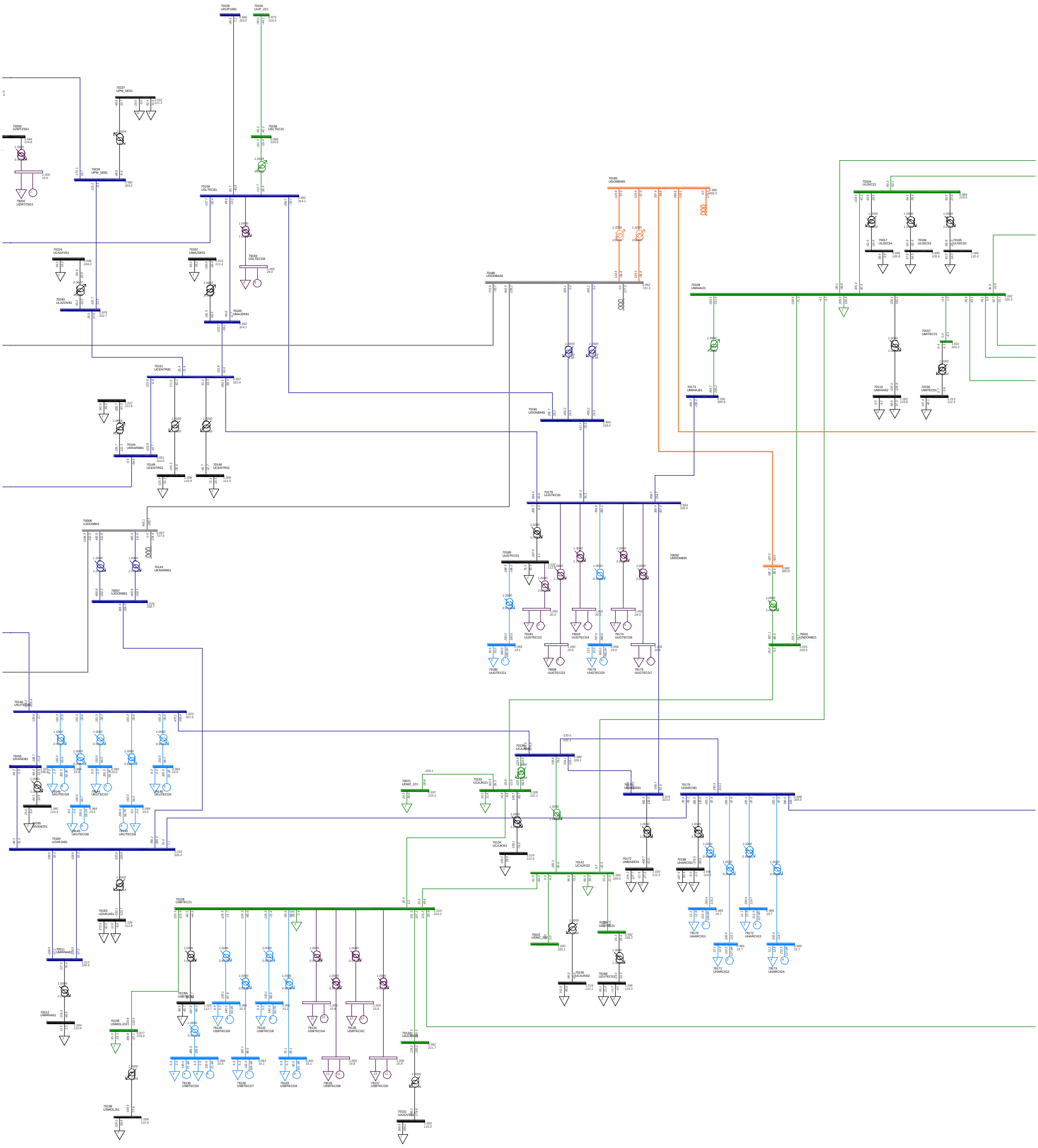
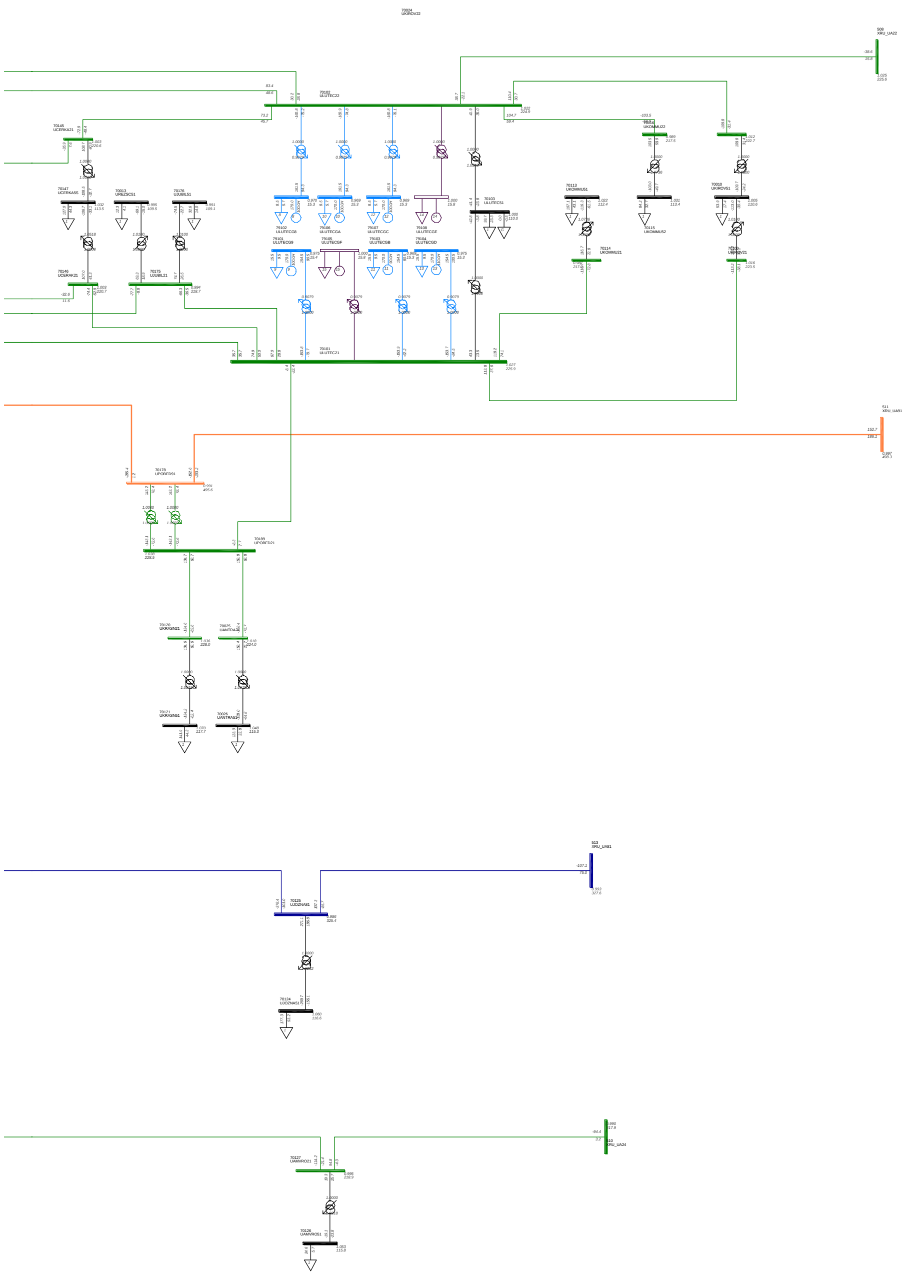


Figure 4.25 – Ukraina – Load flows for Winter 2010 regime – part5



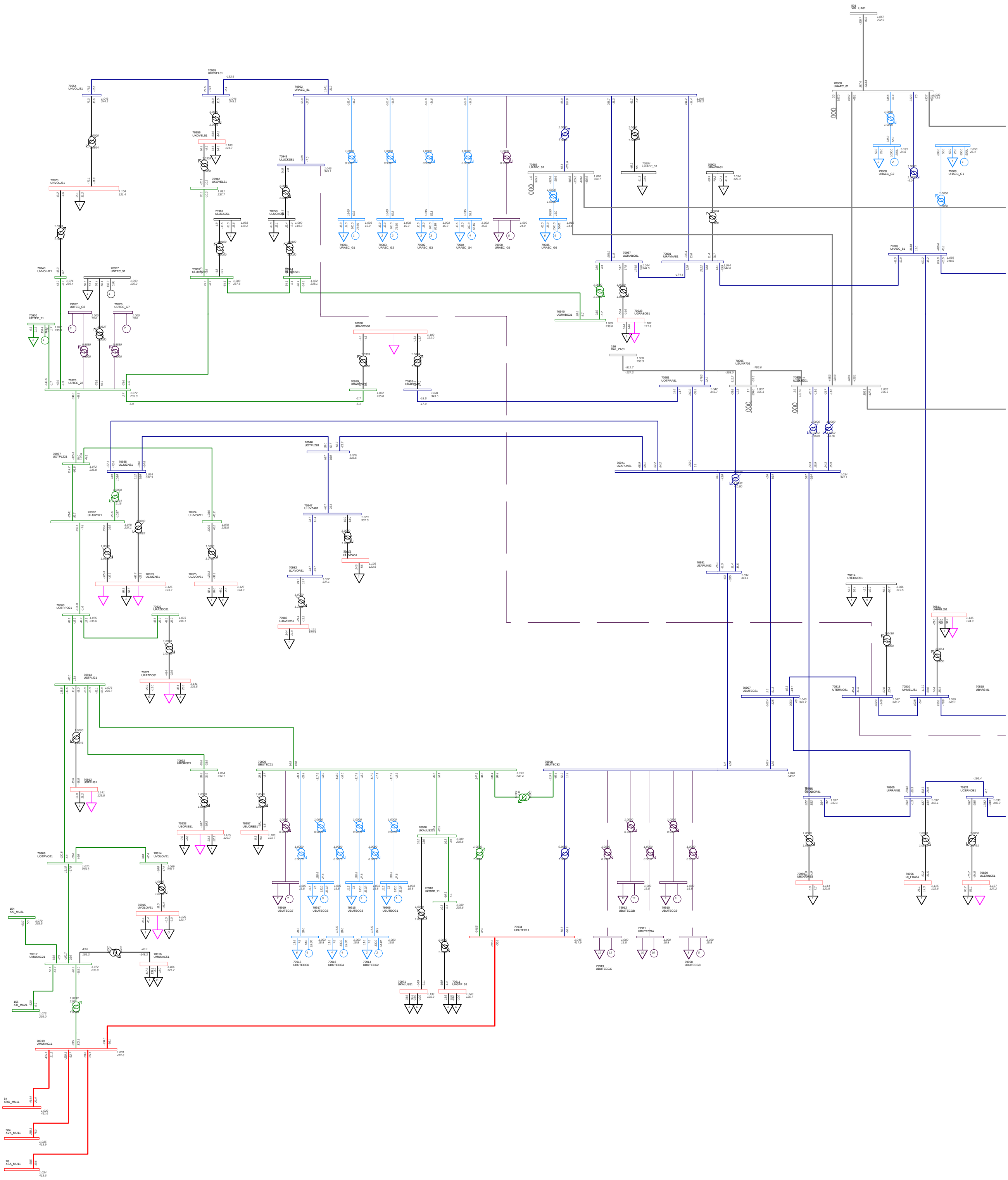


Figure 4.26 – Ukraina – Load flows for Summer 2010 regime – part1

Figure 4.27 – Ukraina – Load flows for Summer 2010 regime – part2

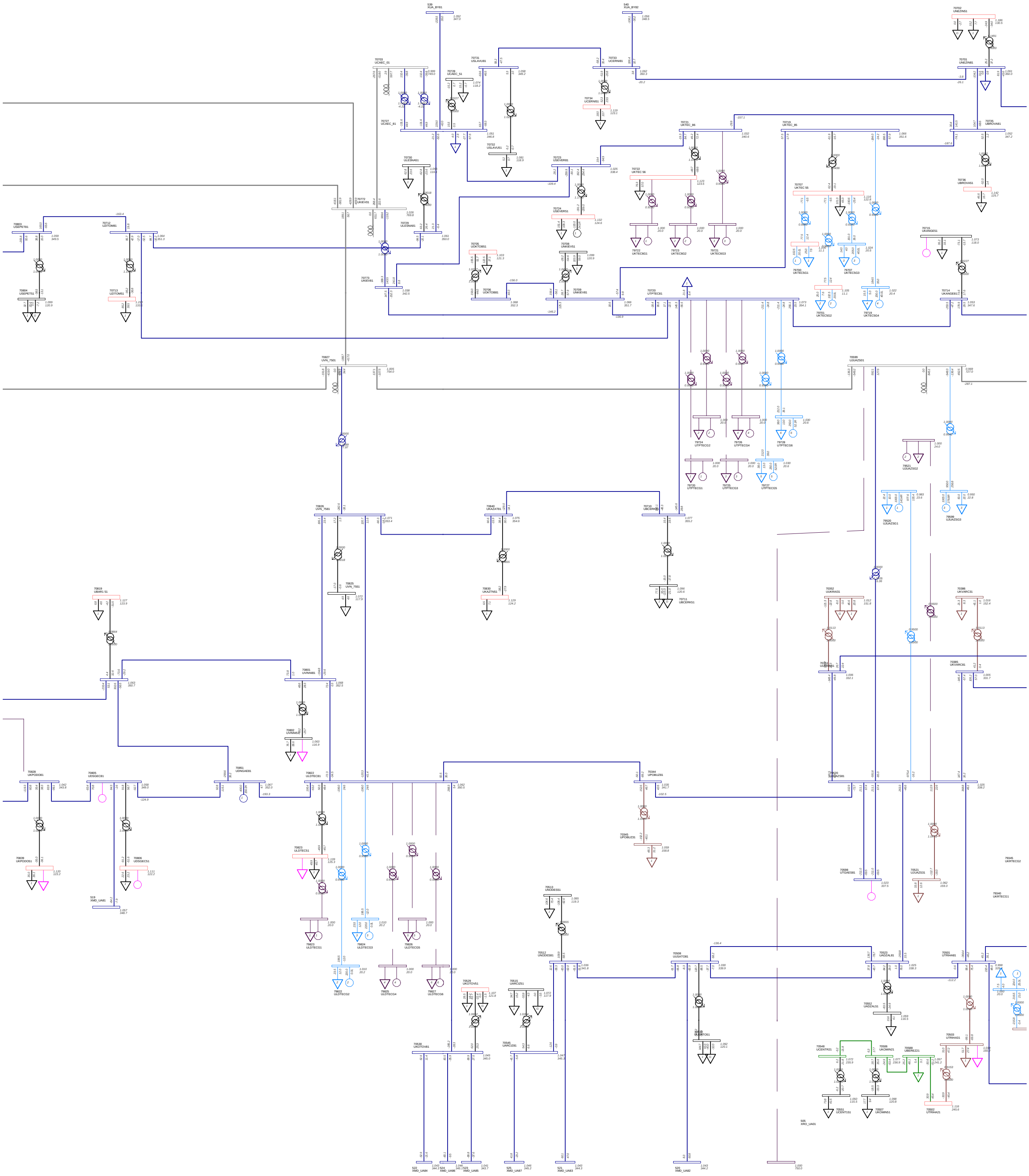


Figure 4.28 – Ukraina – Load flows for Summer 2010 regime – part3

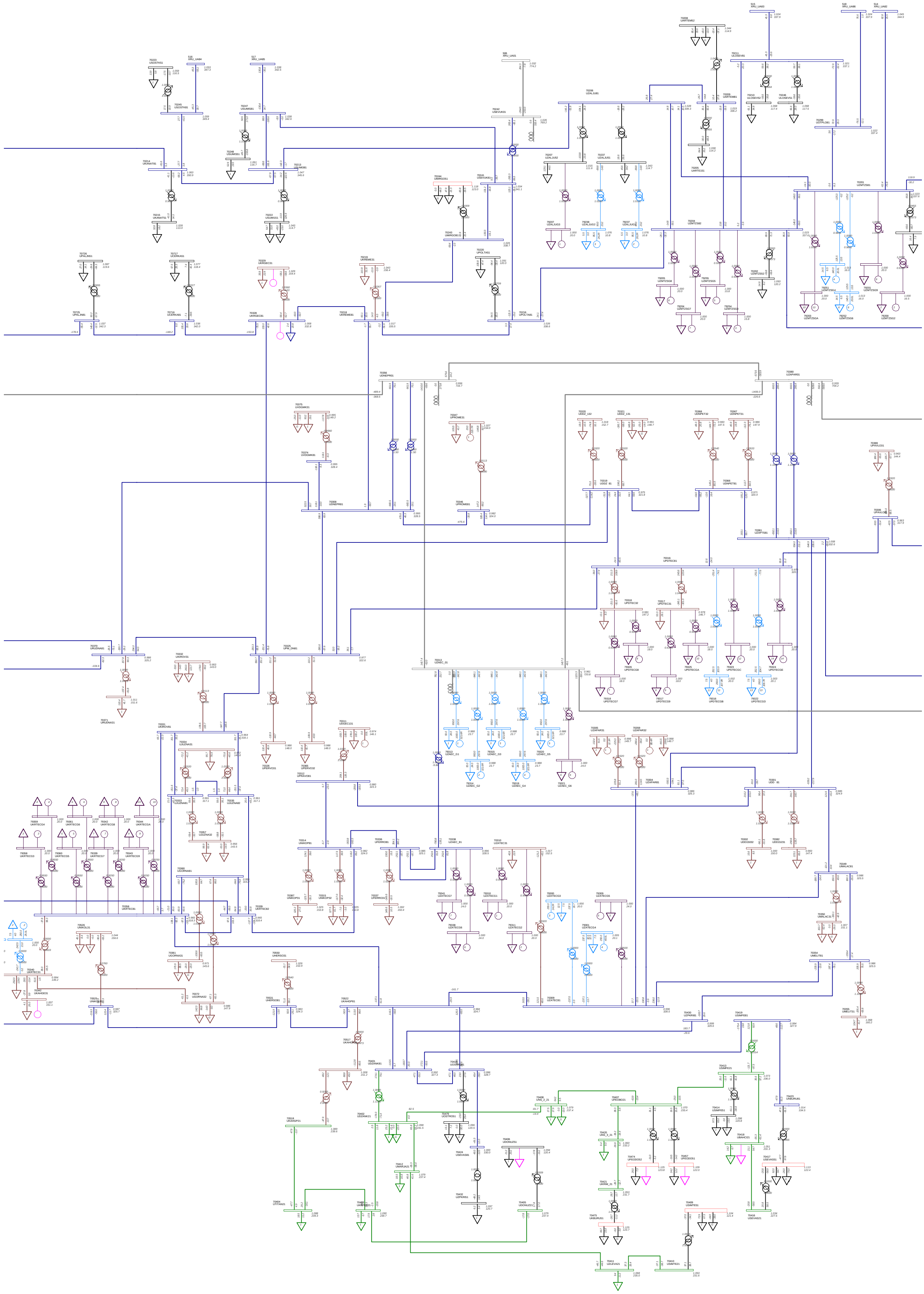


Figure 4.29 – Ukraina – Load flows for Summer 2010 regime – part4

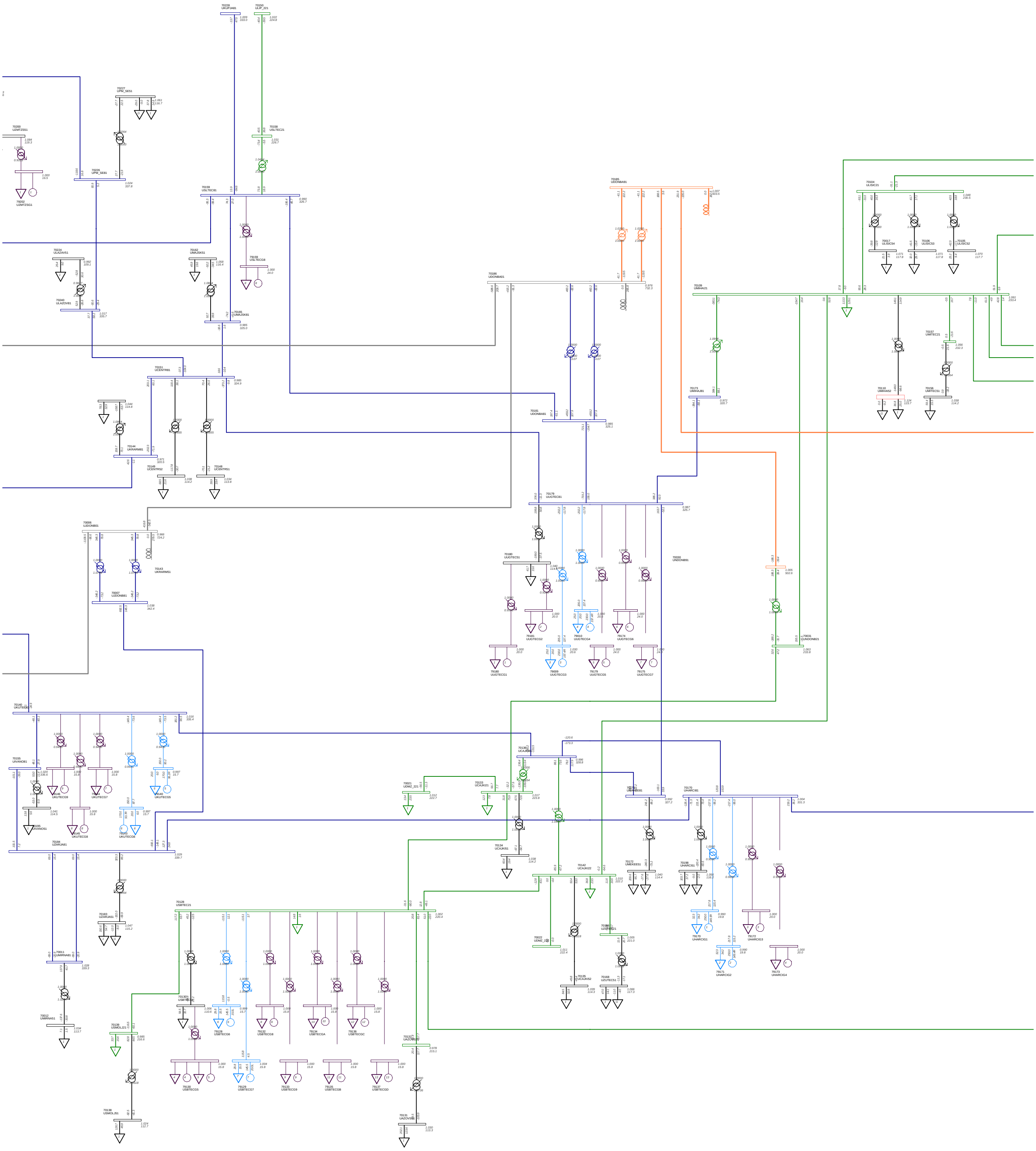
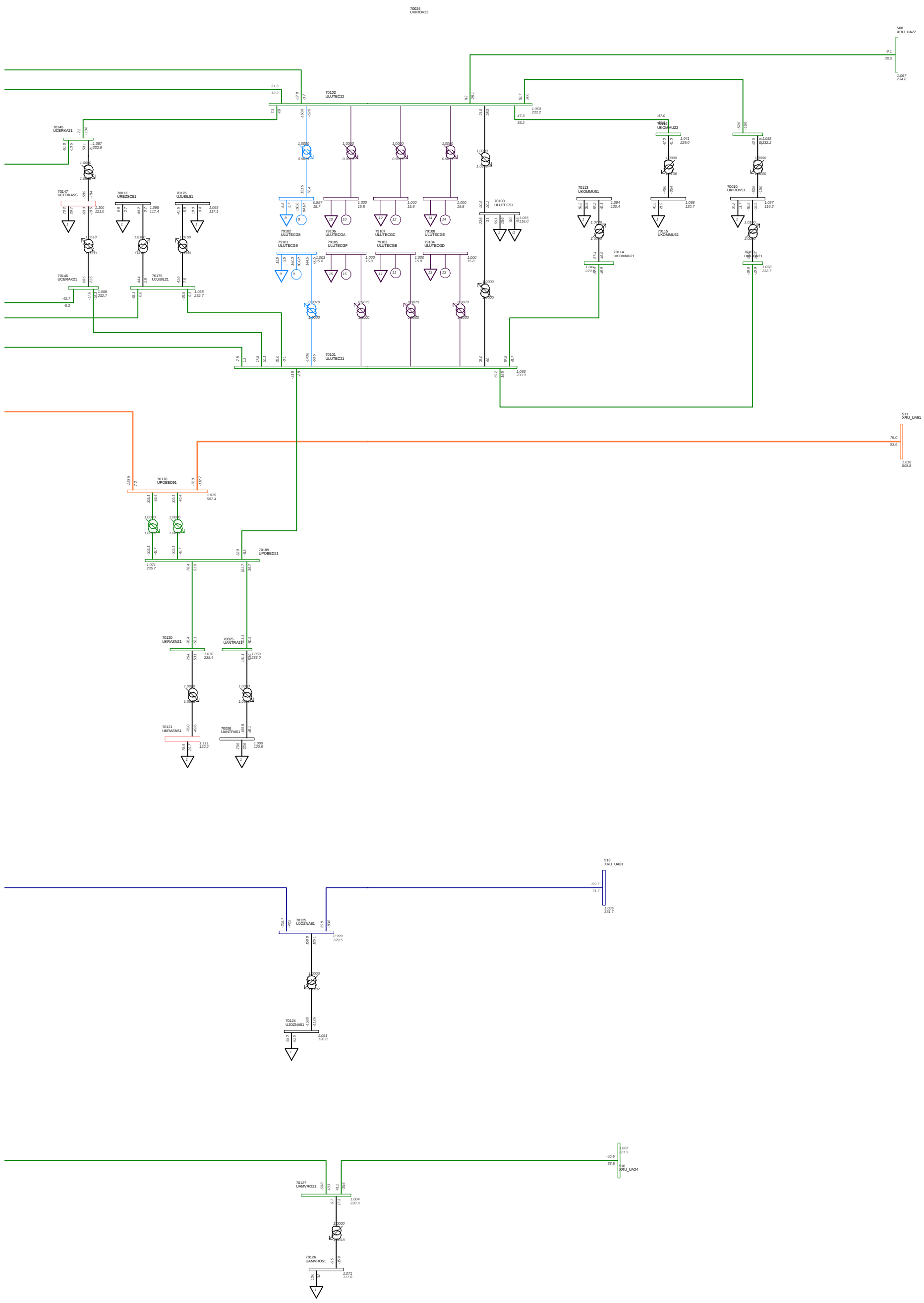


Figure 4.30 – Ukraina – Load flows for Summer 2010 regime – part5



4.3.8. ARMENIA

Figure 4.27 – Armenia – Load flows for Winter 2010 regime

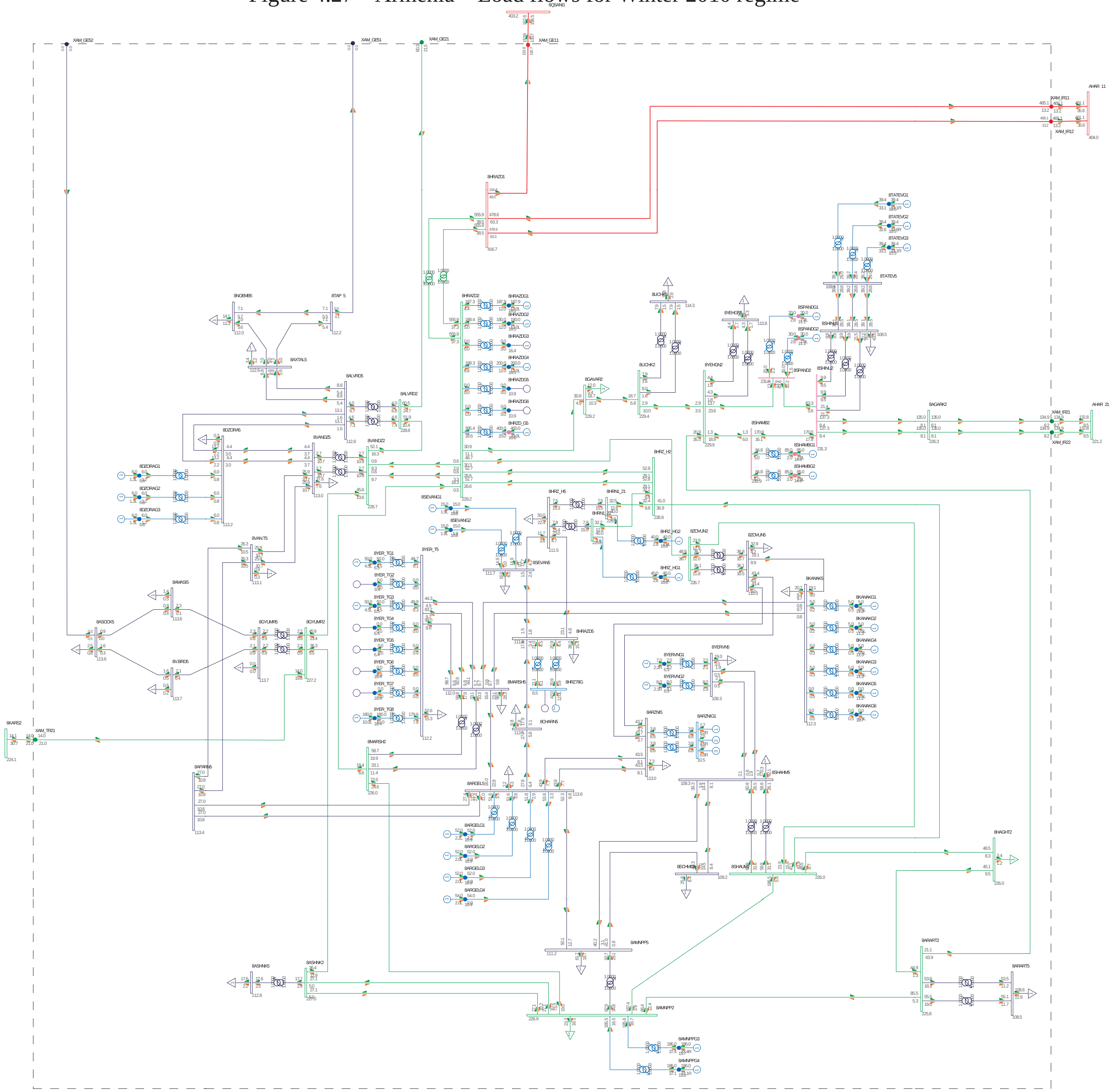
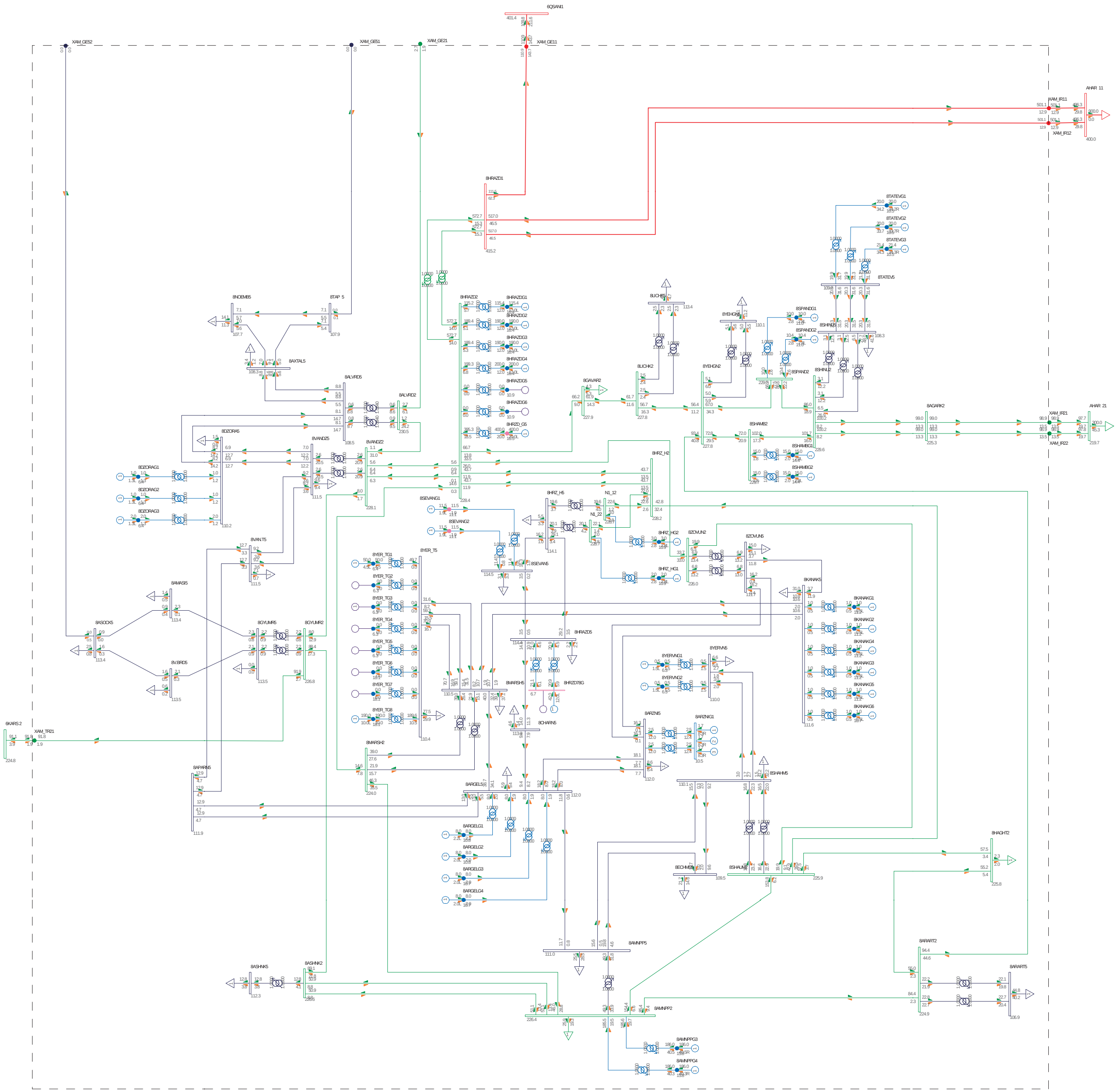


Figure 4.28 – Armenia – Load flows for Summer 2010 regime



4.3.9. REGION

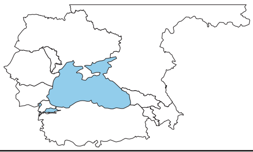
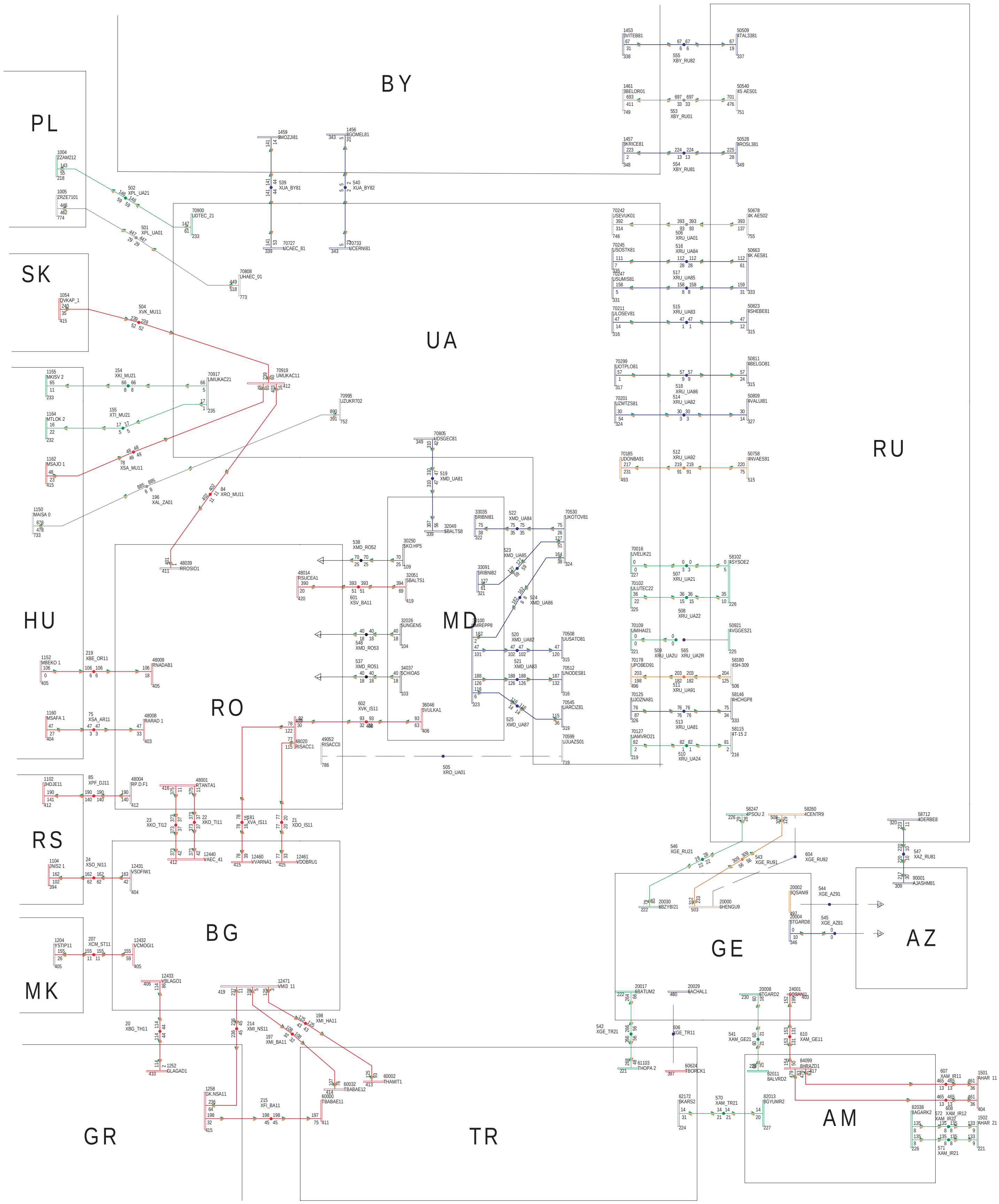


Figure 4.29 – Region – Load flows for Winter 2010 regime



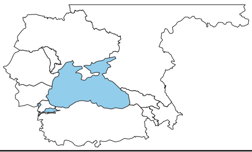
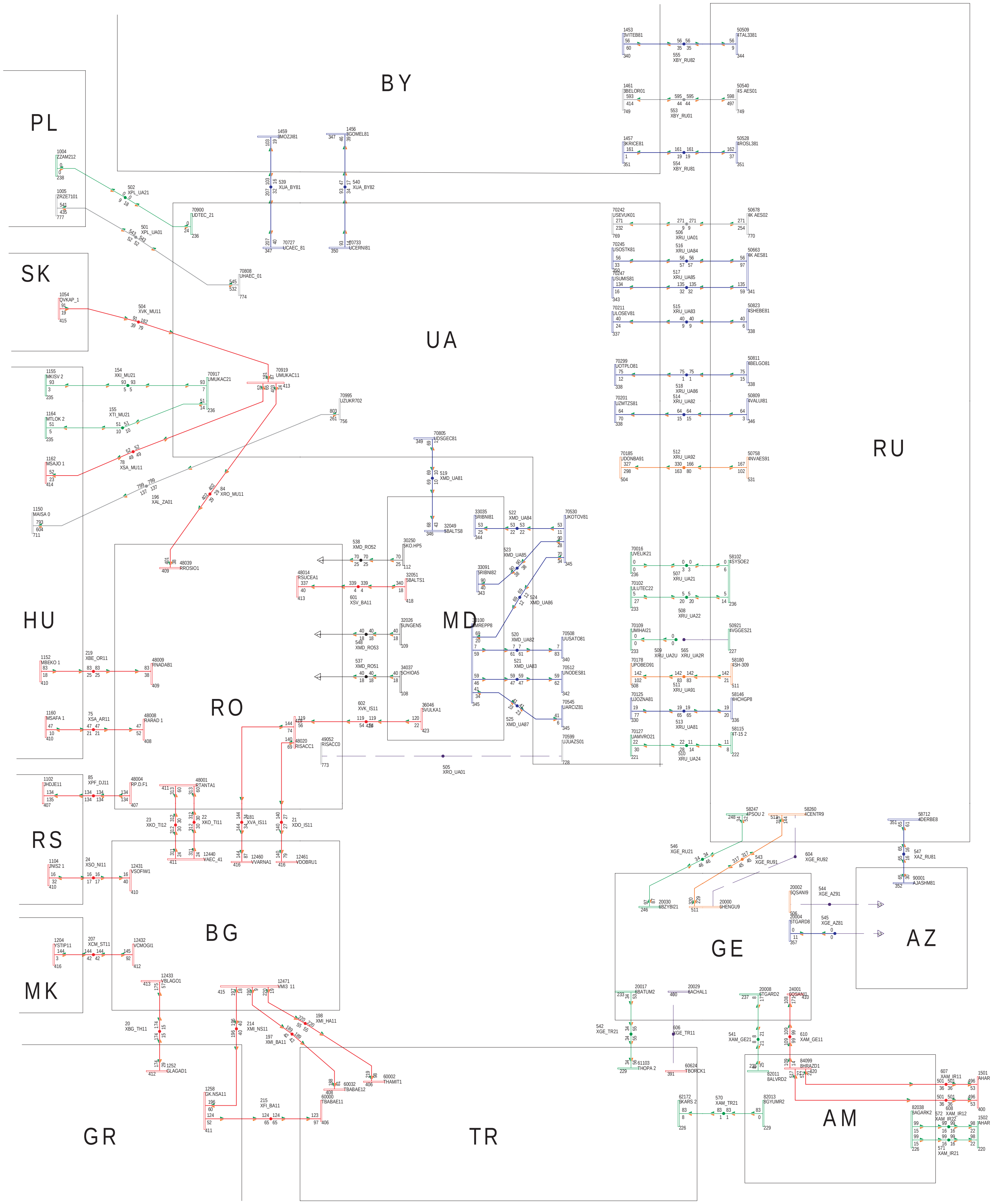


Figure 4.29 – Region – Load flows for Summer 2010 regime



4.4. Network loading analyses

BLACKSEA REGIONAL MODEL
WINTER MAXIMUM LOAD 2010

BRANCH LOADINGS ABOVE 101.0 % OF RATING SET A:

FROM BUS				TO BUS					CURRENT(MVA)		
BUS#	NAME	BASKV	AREA	BUS#	NAME	BASKV	AREA	CKT	LOADING	RATING	PERCENT
50517	4NC-2251	110.00	5	50536	4VOSTK51	110.00*	5	99	61.4	50.5	121.6
50521	4SVETT51	110.00*	5	50525	4GAGAR51	110.00	5	0	76.9	71.4	107.7
50578	4USHAK51	110.00*	5	50936	4TEC-353	110.00	5	99	87.7	71.4	122.8
50580	4VLAD 21	220.00*	5	50581	4VLAD 51	110.00	5	1	86.7	63.0	137.7
50580	4VLAD 21	220.00*	5	50581	4VLAD 51	110.00	5	2	86.1	63.0	136.6
50586	4RASSV51	110.00*	5	50591	4SRP 51	110.00	5	99	112.8	74.3	151.8
50589	4BARR 51	110.00*	5	50591	4SRP 51	110.00	5	99	230.5	148.6	155.1
50615	4DMITR51	110.00*	5	50653	4ZELEZ51	110.00	5	0	102.8	38.1	269.8
50661	4UZNAJ51	110.00	5	50664	4SUDZA51	110.00*	5	99	23.5	23.0	102.2
50661	4UZNAJ51	110.00	5	50665	4LGOV 51	110.00*	5	99	112.7	85.7	131.4
50811	4BELGO81	330.00*	5	50812	4BELGO51	110.00	5	2	140.8	135.0	104.3
50854	4TAMB-21	220.00	5	50857	4TAMB451	110.00*	5	0	357.5	100.0	357.5
50922	4VOLZ151	110.00*	5	50948	4VTEC151	110.00	5	99	237.7	228.6	104.0
50951	4DAGIL51	110.00	5	50978	4RIAZA51	110.00*	5	0	76.7	72.4	105.9
58213	4SLAVJ2	220.00*	5	58214	4SLAVJ5	110.00	5	1	136.5	125.0	109.2
58224	4KTEC 2	220.00*	5	58226	4KTEC 5	110.00	5	1	129.4	125.0	103.5
70210	ULOSEV52	110.00	7	70211	ULOSEV81	330.00*	7	0	208.2	200.0	104.1
70211	ULOSEV81	330.00*	7	70246	ULOSEV51	110.00	7	0	208.2	200.0	104.1
70247	USUMIS81	330.00*	7	70248	USUMIS51	110.00	7	0	220.2	200.0	110.1
70424	USEVAS81	330.00*	7	70432	UZPKRI51	110.00	7	0	155.7	125.0	124.5
70508	UUSATO81	330.00*	7	70510	UUSATO51	110.00	7	0	412.7	400.0	103.2
70520	UJUAZS81	330.00*	7	70521	UJUAZS31	150.00	7	0	270.8	250.0	108.3

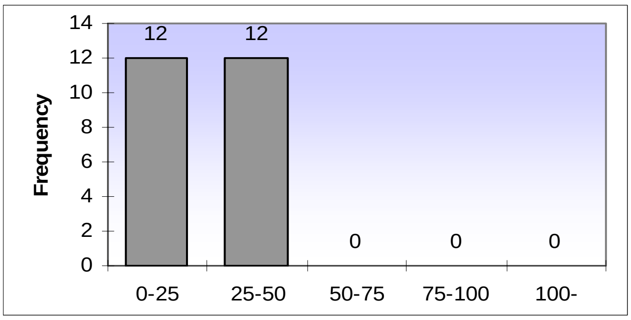
BLACK SEA REGIONAL MODEL
SUMMER MINIMUM LOAD 2010

BRANCH LOADINGS ABOVE 101.0 % OF RATING SET A:

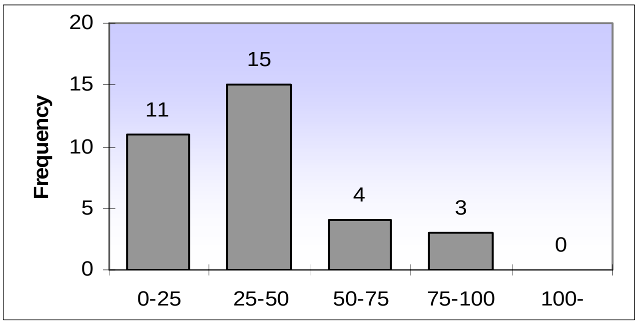
FROM BUS				TO BUS					CURRENT(MVA)		
BUS#	NAME	BASKV	AREA	BUS#	NAME	BASKV	AREA	CKT	LOADING	RATING	PERCENT
50615	4DMITR51	110.00*	5	50653	4ZELEZ51	110.00	5	0	45.4	38.1	119.2
50951	4DAGIL51	110.00	5	50978	4RIAZA51	110.00*	5	0	135.6	72.4	187.2
50977	4JAMSK52	110.00*	5	50978	4RIAZA51	110.00	5	99	93.7	84.8	110.5

As it can be seen, all overloaded elements are in lower voltage network (110 kV) so they can be treated as local problems. Also most of them are connected to equivalent circuits (in Russia).

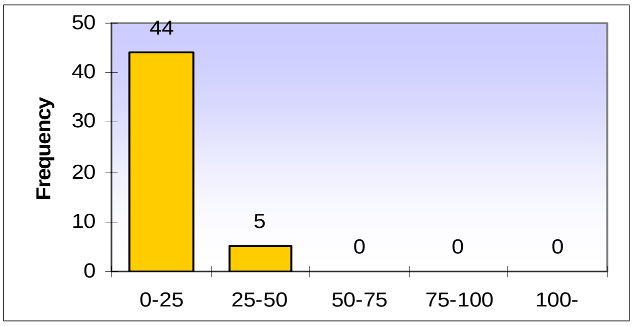
Figure 4.31 – Region –Elements Loading profile histograms for Winter 2010 regime by nominal voltage levels



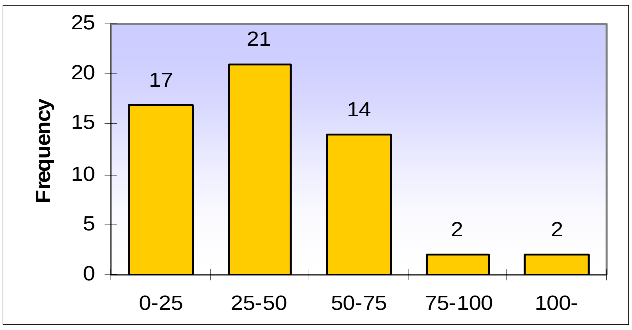
750kV lines



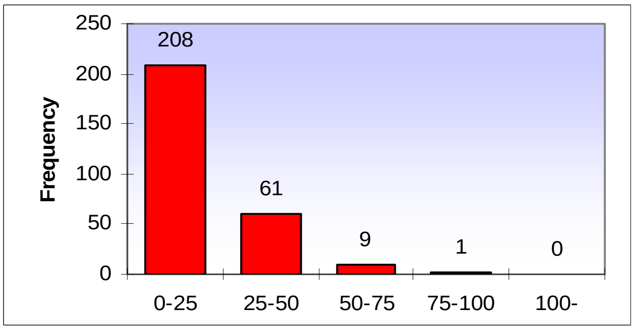
750/x kV transformers



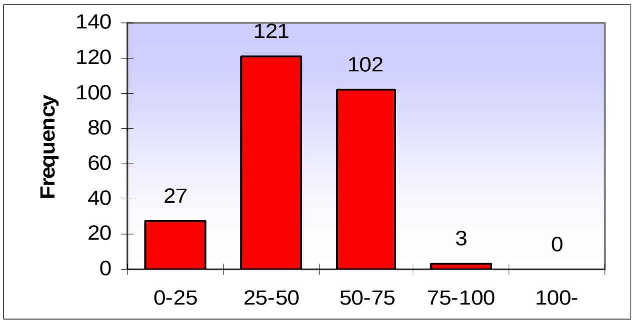
500kV lines



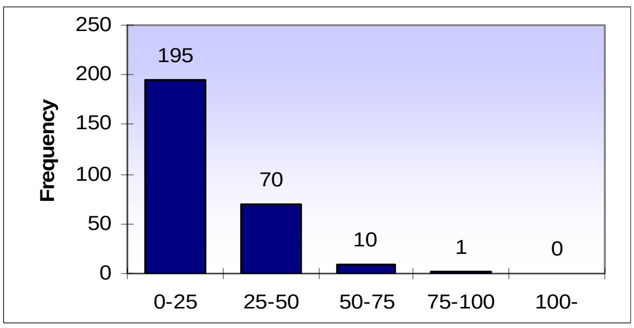
500/x transformers



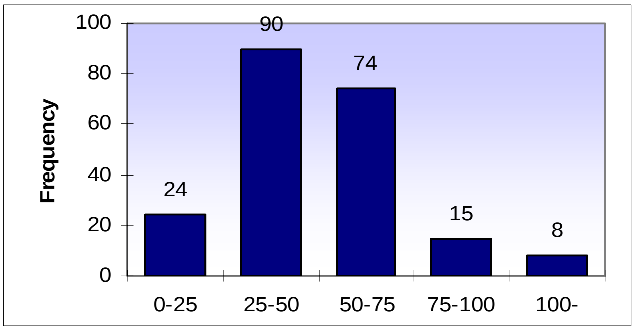
400kV lines



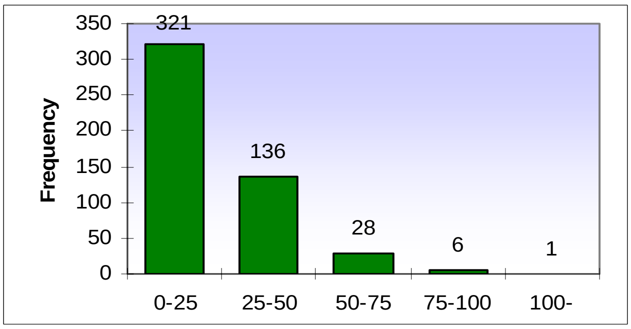
400/x kV transformers



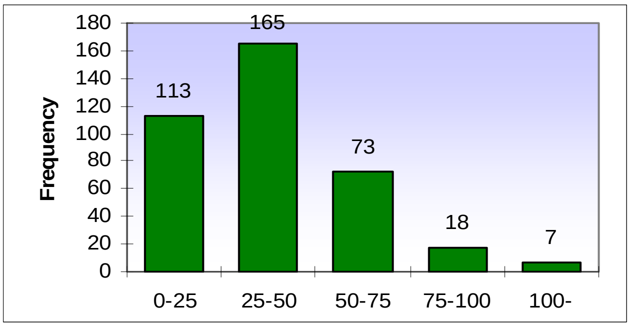
330kV lines



330/x kV transformers

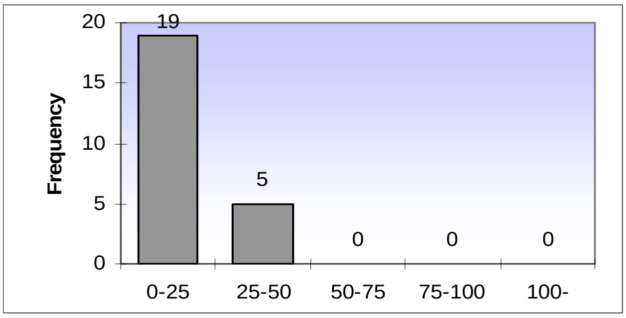


220kV lines

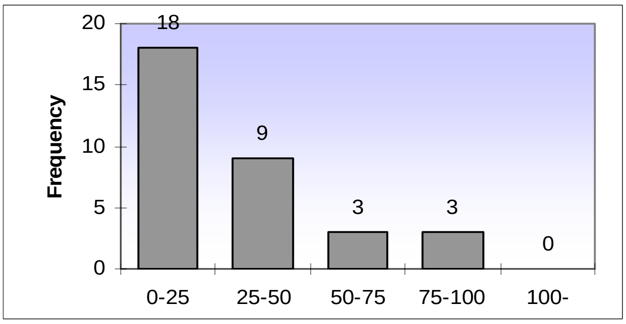


220/x kV transformers

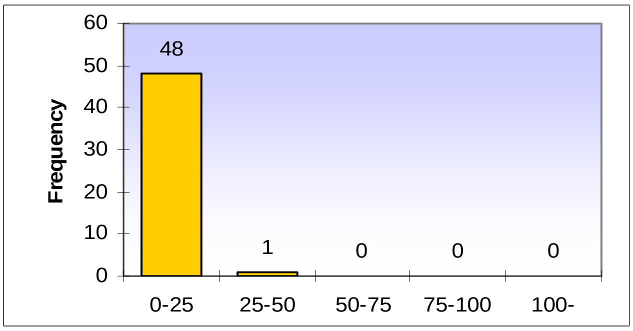
Figure 4.32 – Region –Elements Loading profile histograms for Summer 2010 regime by nominal voltage levels



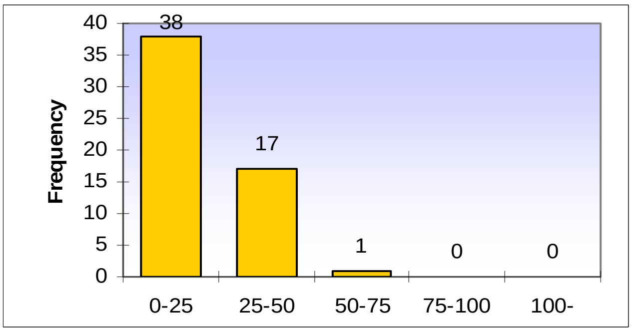
750kV lines



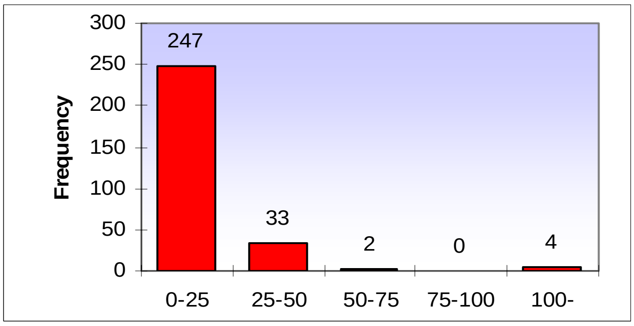
750/x kV transformers



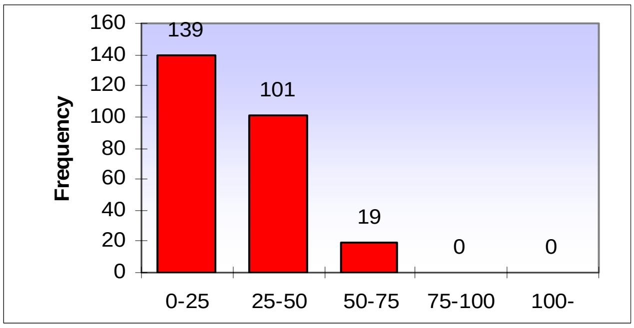
500kV lines



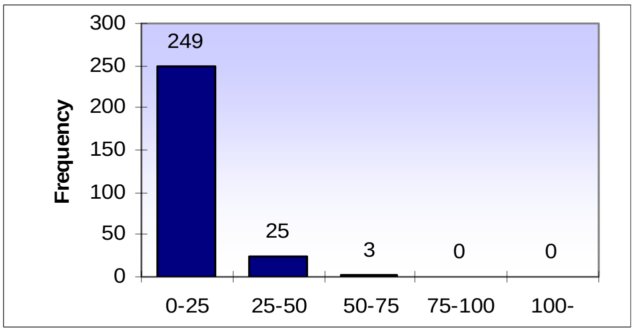
500/x transformers



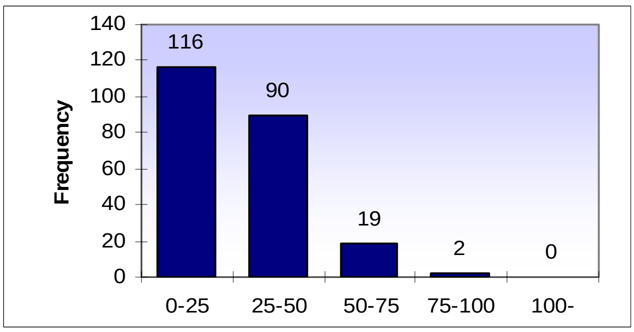
400kV lines



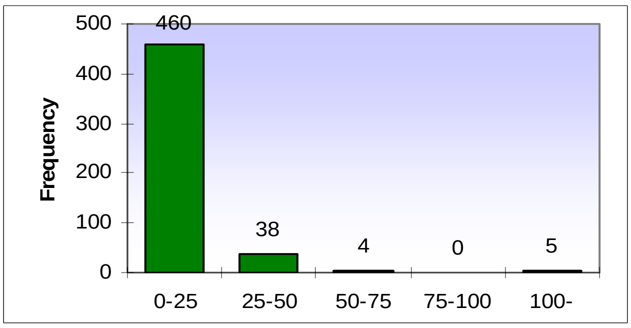
400/x kV transformers



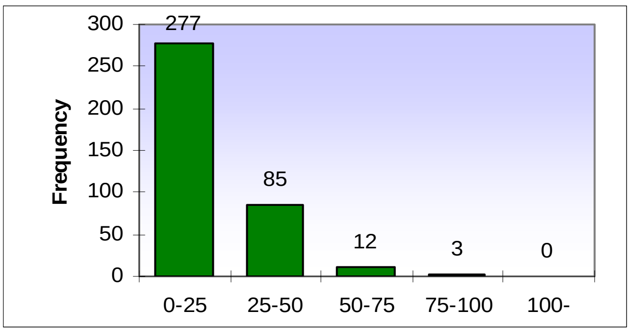
330kV lines



330/x kV transformers



220kV lines

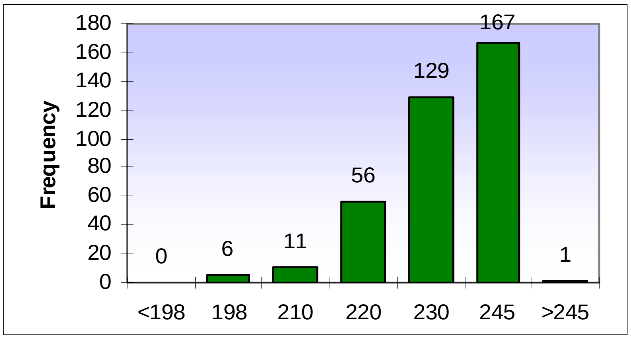


220/x kV transformers

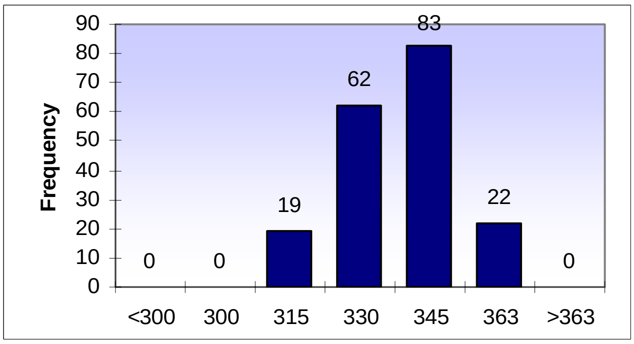
4.5. Voltage profile analyses

On Figure 4.33-Figure 4.34 are diagrams that show number of buses in network in appropriate voltage ranges, and by nominal voltage levels. These diagrams show distribution of voltages in network buses and give a rough inview of voltage profile in whole regional network. Results show that in most buses voltage level is higher than nominal levels and in allowable voltage ranges. In summer regime, overall voltage level is higher than in winter regime which is consequence of low load of transmission network, but difference is very small.

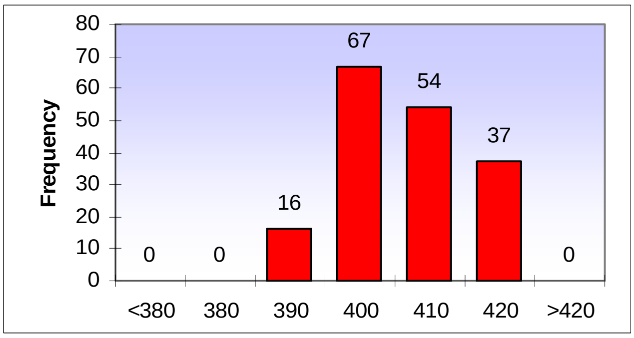
Figure 4.33 – Region – Voltage profile histograms for Winter 2010 regime by nominal voltage levels



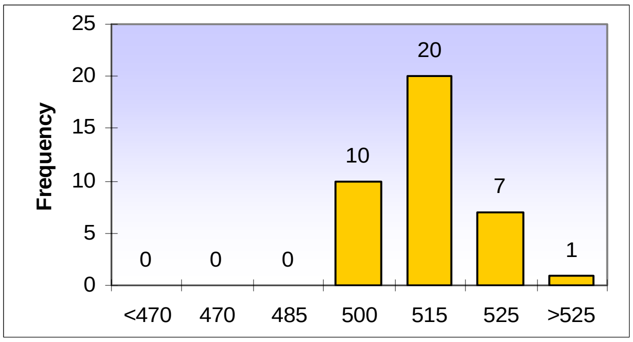
220kV network



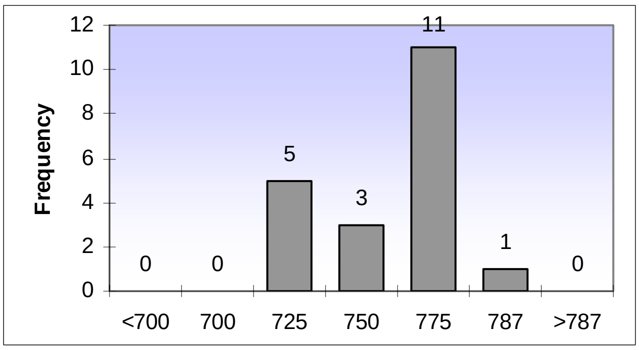
330kV network



400kV network

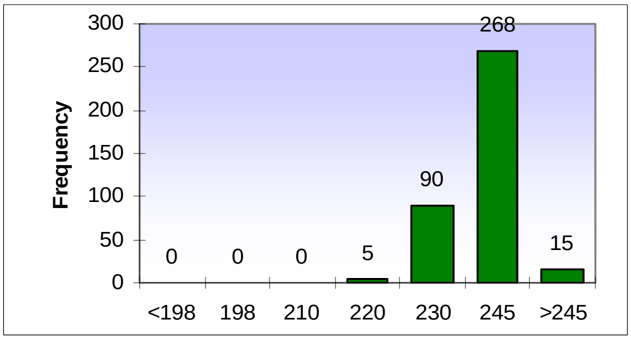


500kV network

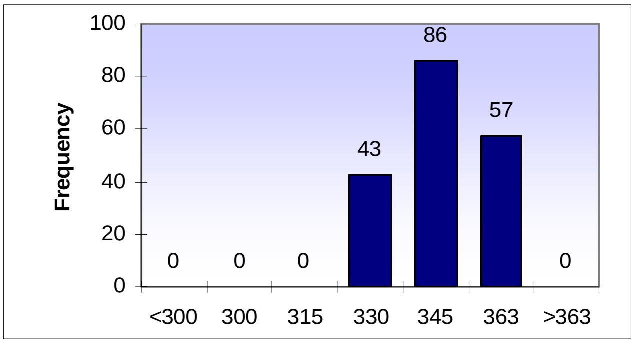


750kV network

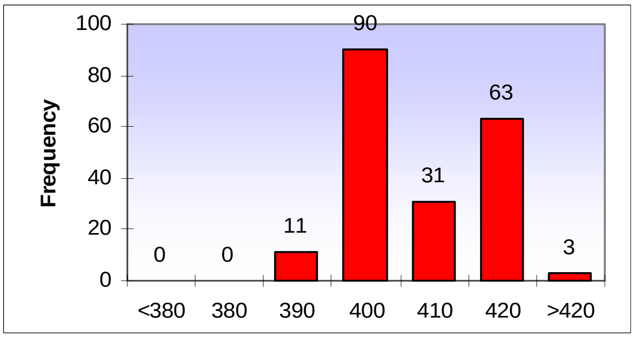
Figure 4.34 – Region – Voltage profile histograms for Summer 2010 regime by nominal voltage levels



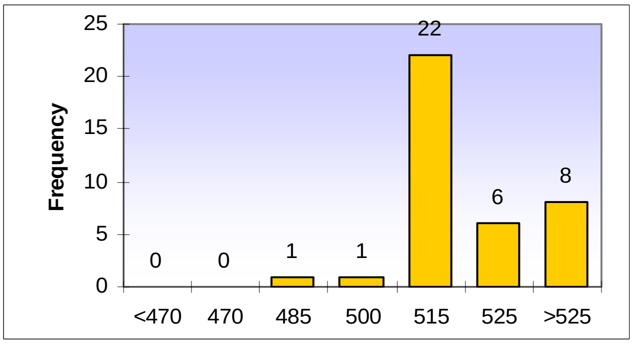
220 kV network



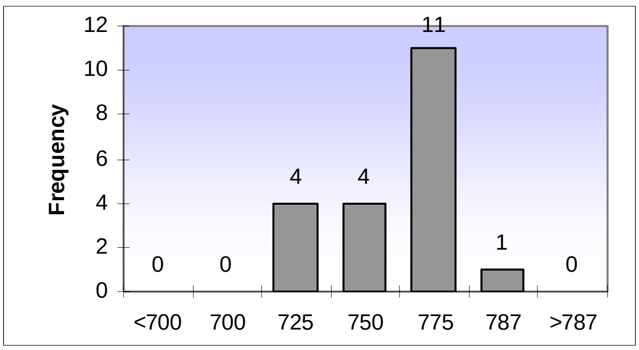
330kV network



400kV network



500kV network



750kV network

BLACKSEA REGIONAL MODEL
WINTER MAXIMUM LOAD 2010
400KV NETWORK
BUSES WITH VOLTAGE GREATER THAN 1.0500:

BUS# X-- NAME --X BASKV AREA V(PU) V(KV) BUS# X-- NAME --X BASKV AREA V(PU) V(KV)

* NONE *

BUSES WITH VOLTAGE LESS THAN 0.9500:

BUS# X-- NAME --X BASKV AREA V(PU) V(KV) BUS# X-- NAME --X BASKV AREA V(PU) V(KV)

* NONE *

220KV NETWORK
BUSES WITH VOLTAGE GREATER THAN 1.1100:

BUS# X-- NAME --X BASKV AREA V(PU) V(KV) BUS# X-- NAME --X BASKV AREA V(PU) V(KV)

* NONE *

BUSES WITH VOLTAGE LESS THAN 0.9000:

BUS# X-- NAME --X BASKV AREA V(PU) V(KV) BUS# X-- NAME --X BASKV AREA V(PU) V(KV)

* NONE *

110KV NETWORK
BUSES WITH VOLTAGE GREATER THAN 1.1100:

BUS# X-- NAME --X BASKV AREA V(PU) V(KV) BUS# X-- NAME --X BASKV AREA V(PU) V(KV)

* NONE *

BUSES WITH VOLTAGE LESS THAN 0.9000:

BUS# X-- NAME --X BASKV AREA V(PU) V(KV) BUS# X-- NAME --X BASKV AREA V(PU) V(KV)

* NONE *

BLACK SEA REGIONAL MODEL
SUMMER MINIMUM LOAD 2010
400KV NETWORK
BUSES WITH VOLTAGE GREATER THAN 1.0500:

BUS# X-- NAME --X BASKV AREA V(PU) V(KV) BUS# X-- NAME --X BASKV AREA V(PU) V(KV)

* NONE *

BUSES WITH VOLTAGE LESS THAN 0.9500:

BUS# X-- NAME --X BASKV AREA V(PU) V(KV) BUS# X-- NAME --X BASKV AREA V(PU) V(KV)

* NONE *

220KV NETWORK
BUSES WITH VOLTAGE GREATER THAN 1.1100:

BUS# X-- NAME --X BASKV AREA V(PU) V(KV) BUS# X-- NAME --X BASKV AREA V(PU) V(KV)

* NONE *

BUSES WITH VOLTAGE LESS THAN 0.9000:

BUS# X-- NAME --X BASKV AREA V(PU) V(KV) BUS# X-- NAME --X BASKV AREA V(PU) V(KV)

* NONE *

110KV NETWORK
BUSES WITH VOLTAGE GREATER THAN 1.1200:

```
  BUS# X-- NAME --X BASKV AREA  V(PU)  V(KV)      BUS# X-- NAME --X BASKV AREA  V(PU)  V(KV)

                                            * NONE *
```

BUSES WITH VOLTAGE LESS THAN 0.9000:

```
  BUS# X-- NAME --X BASKV AREA  V(PU)  V(KV)      BUS# X-- NAME --X BASKV AREA  V(PU)  V(KV)

                                            * NONE *
```

GEORGIA

BLACKSEA REGIONAL MODEL
WINTER MAXIMUM LOAD 2010
500KV NETWORK

BUSES WITH VOLTAGE GREATER THAN 1.0500:

```
  BUS# X-- NAME --X BASKV AREA  V(PU)  V(KV)      BUS# X-- NAME --X BASKV AREA  V(PU)  V(KV)

                                            * NONE *
```

BUSES WITH VOLTAGE LESS THAN 0.9500:

```
  BUS# X-- NAME --X BASKV AREA  V(PU)  V(KV)      BUS# X-- NAME --X BASKV AREA  V(PU)  V(KV)

                                            * NONE *
```

330KV NETWORK

BUSES WITH VOLTAGE GREATER THAN 1.1100:

```
  BUS# X-- NAME --X BASKV AREA  V(PU)  V(KV)      BUS# X-- NAME --X BASKV AREA  V(PU)  V(KV)

                                            * NONE *
```

BUSES WITH VOLTAGE LESS THAN 0.9000:

```
  BUS# X-- NAME --X BASKV AREA  V(PU)  V(KV)      BUS# X-- NAME --X BASKV AREA  V(PU)  V(KV)

                                            * NONE *
```

220KV NETWORK

BUSES WITH VOLTAGE GREATER THAN 1.1000:

```
  BUS# X-- NAME --X BASKV AREA  V(PU)  V(KV)      BUS# X-- NAME --X BASKV AREA  V(PU)  V(KV)

                                            * NONE *
```

BUSES WITH VOLTAGE LESS THAN 0.9000:

```
  BUS# X-- NAME --X BASKV AREA  V(PU)  V(KV)      BUS# X-- NAME --X BASKV AREA  V(PU)  V(KV)

                                            * NONE *
```

BLACK SEA REGIONAL MODEL
SUMMER MINIMUM LOAD 2010
500KV NETWORK

BUSES WITH VOLTAGE GREATER THAN 1.1000:

```
  BUS# X-- NAME --X BASKV AREA  V(PU)  V(KV)      BUS# X-- NAME --X BASKV AREA  V(PU)  V(KV)

                                            * NONE *
```

BUSES WITH VOLTAGE LESS THAN 0.9000:

```
  BUS# X-- NAME --X BASKV AREA  V(PU)  V(KV)      BUS# X-- NAME --X BASKV AREA  V(PU)  V(KV)

                                            * NONE *
```

330KV NETWORK

BUSES WITH VOLTAGE GREATER THAN 1.1000:

```
  BUS# X-- NAME --X BASKV AREA  V(PU)  V(KV)      BUS# X-- NAME --X BASKV AREA  V(PU)  V(KV)
```

* NONE *

BUSES WITH VOLTAGE LESS THAN 0.9000:

```
  BUS# X-- NAME --X BASKV AREA  V(PU)  V(KV)      BUS# X-- NAME --X BASKV AREA  V(PU)  V(KV)
```

* NONE *

220KV NETWORK

BUSES WITH VOLTAGE GREATER THAN 1.1000:

```
  BUS# X-- NAME --X BASKV AREA  V(PU)  V(KV)      BUS# X-- NAME --X BASKV AREA  V(PU)  V(KV)
```

* NONE *

BUSES WITH VOLTAGE LESS THAN 0.9000:

```
  BUS# X-- NAME --X BASKV AREA  V(PU)  V(KV)      BUS# X-- NAME --X BASKV AREA  V(PU)  V(KV)
```

* NONE *

MOLDOVA

BLACKSEA REGIONAL MODEL
WINTER MAXIMUM LOAD 2010
400KV NETWORK

BUSES WITH VOLTAGE GREATER THAN 1.0500:

```
  BUS# X-- NAME --X BASKV AREA  V(PU)  V(KV)      BUS# X-- NAME --X BASKV AREA  V(PU)  V(KV)
```

* NONE *

BUSES WITH VOLTAGE LESS THAN 0.9500:

```
  BUS# X-- NAME --X BASKV AREA  V(PU)  V(KV)      BUS# X-- NAME --X BASKV AREA  V(PU)  V(KV)
```

* NONE *

330KV NETWORK

BUSES WITH VOLTAGE GREATER THAN 1.1000:

```
  BUS# X-- NAME --X BASKV AREA  V(PU)  V(KV)      BUS# X-- NAME --X BASKV AREA  V(PU)  V(KV)
```

* NONE *

BUSES WITH VOLTAGE LESS THAN 0.9100:

```
  BUS# X-- NAME --X BASKV AREA  V(PU)  V(KV)      BUS# X-- NAME --X BASKV AREA  V(PU)  V(KV)
```

* NONE *

110KV NETWORK

BUSES WITH VOLTAGE GREATER THAN 1.1200:

```
  BUS# X-- NAME --X BASKV AREA  V(PU)  V(KV)      BUS# X-- NAME --X BASKV AREA  V(PU)  V(KV)
```

* NONE *

BUSES WITH VOLTAGE LESS THAN 0.9000:

```
  BUS# X-- NAME --X BASKV AREA  V(PU)  V(KV)      BUS# X-- NAME --X BASKV AREA  V(PU)  V(KV)
```

* NONE *

BLACK SEA REGIONAL MODEL
SUMMER MINIMUM LOAD 2010
400KV NETWORK

BUSES WITH VOLTAGE GREATER THAN 1.0500:

```
  BUS# X-- NAME --X BASKV AREA  V(PU)  V(KV)      BUS# X-- NAME --X BASKV AREA  V(PU)  V(KV)
 36046 5VULKA1     400.00    3 1.0553 422.11     30120 5MREPP1     400.00    3 1.0541 421.62
```

BUSES WITH VOLTAGE LESS THAN 0.9500:

BUS# X-- NAME --X BASKV AREA V(PU) V(KV)   BUS# X-- NAME --X BASKV AREA V(PU) V(KV)

* NONE *

330KV NETWORK

BUSES WITH VOLTAGE GREATER THAN 1.1000:

BUS# X-- NAME --X BASKV AREA V(PU) V(KV)   BUS# X-- NAME --X BASKV AREA V(PU) V(KV)

* NONE *

BUSES WITH VOLTAGE LESS THAN 0.9100:

BUS# X-- NAME --X BASKV AREA V(PU) V(KV)   BUS# X-- NAME --X BASKV AREA V(PU) V(KV)

* NONE *

110KV NETWORK

BUSES WITH VOLTAGE GREATER THAN 1.1200:

BUS# X-- NAME --X BASKV AREA V(PU) V(KV)   BUS# X-- NAME --X BASKV AREA V(PU) V(KV)

* NONE *

BUSES WITH VOLTAGE LESS THAN 0.9000:

BUS# X-- NAME --X BASKV AREA V(PU) V(KV)   BUS# X-- NAME --X BASKV AREA V(PU) V(KV)

* NONE *

ROMANIA

BLACKSEA REGIONAL MODEL
WINTER MAXIMUM LOAD 2010
400KV NETWORK

BUSES WITH VOLTAGE GREATER THAN 1.0500:

BUS# X-- NAME --X BASKV AREA V(PU) V(KV)   BUS# X-- NAME --X BASKV AREA V(PU) V(KV)

* NONE *

BUSES WITH VOLTAGE LESS THAN 0.9500:

BUS# X-- NAME --X BASKV AREA V(PU) V(KV)   BUS# X-- NAME --X BASKV AREA V(PU) V(KV)

* NONE *

220KV NETWORK

BUSES WITH VOLTAGE GREATER THAN 1.1100:

BUS# X-- NAME --X BASKV AREA V(PU) V(KV)   BUS# X-- NAME --X BASKV AREA V(PU) V(KV)

* NONE *

BUSES WITH VOLTAGE LESS THAN 0.9000:

BUS# X-- NAME --X BASKV AREA V(PU) V(KV)   BUS# X-- NAME --X BASKV AREA V(PU) V(KV)

* NONE *

110KV NETWORK

BUSES WITH VOLTAGE GREATER THAN 1.1200:

BUS# X-- NAME --X BASKV AREA V(PU) V(KV)   BUS# X-- NAME --X BASKV AREA V(PU) V(KV)

* NONE *

BUSES WITH VOLTAGE LESS THAN 0.9000:

BUS# X-- NAME --X BASKV AREA V(PU) V(KV)   BUS# X-- NAME --X BASKV AREA V(PU) V(KV)

* NONE *

BLACK SEA REGIONAL MODEL
SUMMER MINIMUM LOAD 2010
400KV NETWORK

BUSES WITH VOLTAGE GREATER THAN 1.0500:

BUS# X-- NAME --X BASKV AREA V(PU) V(KV)   BUS# X-- NAME --X BASKV AREA V(PU) V(KV)

* NONE *

BUSES WITH VOLTAGE LESS THAN 0.9500:

BUS# X-- NAME --X BASKV AREA V(PU) V(KV)   BUS# X-- NAME --X BASKV AREA V(PU) V(KV)

* NONE *

220KV NETWORK

BUSES WITH VOLTAGE GREATER THAN 1.1100:

BUS# X-- NAME --X BASKV AREA V(PU) V(KV)   BUS# X-- NAME --X BASKV AREA V(PU) V(KV)

* NONE *

BUSES WITH VOLTAGE LESS THAN 0.9000:

BUS# X-- NAME --X BASKV AREA V(PU) V(KV)   BUS# X-- NAME --X BASKV AREA V(PU) V(KV)

* NONE *

110KV NETWORK

BUSES WITH VOLTAGE GREATER THAN 1.1200:

BUS# X-- NAME --X BASKV AREA V(PU) V(KV)   BUS# X-- NAME --X BASKV AREA V(PU) V(KV)

* NONE *

BUSES WITH VOLTAGE LESS THAN 0.9000:

BUS# X-- NAME --X BASKV AREA V(PU) V(KV)   BUS# X-- NAME --X BASKV AREA V(PU) V(KV)

* NONE *

RUSSIA

BLACKSEA REGIONAL MODEL
WINTER MAXIMUM LOAD 2010
750KV NETWORK

BUSES WITH VOLTAGE GREATER THAN 1.0500:

BUS# X-- NAME --X BASKV AREA V(PU) V(KV)   BUS# X-- NAME --X BASKV AREA V(PU) V(KV)

* NONE *

BUSES WITH VOLTAGE LESS THAN 0.9500:

BUS# X-- NAME --X BASKV AREA V(PU) V(KV)   BUS# X-- NAME --X BASKV AREA V(PU) V(KV)

* NONE *

500KV NETWORK

BUSES WITH VOLTAGE GREATER THAN 1.0500:

BUS# X-- NAME --X BASKV AREA V(PU) V(KV)   BUS# X-- NAME --X BASKV AREA V(PU) V(KV)
50717 4ELEC 91   500.00   5 1.0563 528.13

BUSES WITH VOLTAGE LESS THAN 0.9500:

BUS# X-- NAME --X BASKV AREA V(PU) V(KV)   BUS# X-- NAME --X BASKV AREA V(PU) V(KV)

* NONE *

400KV NETWORK

BUSES WITH VOLTAGE GREATER THAN 1.0500:

BUS# X-- NAME --X BASKV AREA V(PU) V(KV)   BUS# X-- NAME --X BASKV AREA V(PU) V(KV)

* NONE *

BUSES WITH VOLTAGE LESS THAN 0.9500:

BUS# X-- NAME --X BASKV AREA V(PU) V(KV)   BUS# X-- NAME --X BASKV AREA V(PU) V(KV)

* NONE *

330KV NETWORK

BUSES WITH VOLTAGE GREATER THAN 1.1000:

BUS# X-- NAME --X BASKV AREA V(PU) V(KV)   BUS# X-- NAME --X BASKV AREA V(PU) V(KV)

* NONE *

BUSES WITH VOLTAGE LESS THAN 0.9000:

BUS# X-- NAME --X BASKV AREA V(PU) V(KV)   BUS# X-- NAME --X BASKV AREA V(PU) V(KV)

```
                                  * NONE *
```

220KV NETWORK

```
 BUSES WITH VOLTAGE GREATER THAN 1.1500:

   BUS# X-- NAME --X BASKV AREA  V(PU)  V(KV)      BUS# X-- NAME --X BASKV AREA  V(PU)  V(KV)

                                  * NONE *

 BUSES WITH VOLTAGE LESS THAN 0.9000:

   BUS# X-- NAME --X BASKV AREA  V(PU)  V(KV)      BUS# X-- NAME --X BASKV AREA  V(PU)  V(KV)
  50583 4NARAB21    220.00    5 0.8847 194.64     50585 4RASSV21    220.00    5 0.8831 194.29
  50587 4ASTRA21    220.00    5 0.8833 194.33     50588 4BARR 21    220.00    5 0.8750 192.51
  50592 4GAZ  21    220.00    5 0.8621 189.66     50597 4LIMAN21    220.00    5 0.8931 196.48
```

BLACK SEA REGIONAL MODEL
SUMMER MINIMUM LOAD 2010
750KV NETWORK

```
 BUSES WITH VOLTAGE GREATER THAN 1.0500:

   BUS# X-- NAME --X BASKV AREA  V(PU)  V(KV)      BUS# X-- NAME --X BASKV AREA  V(PU)  V(KV)

                                  * NONE *

 BUSES WITH VOLTAGE LESS THAN 0.9500:

   BUS# X-- NAME --X BASKV AREA  V(PU)  V(KV)      BUS# X-- NAME --X BASKV AREA  V(PU)  V(KV)

                                  * NONE *
```

500KV NETWORK

```
 BUSES WITH VOLTAGE GREATER THAN 1.0500:

   BUS# X-- NAME --X BASKV AREA  V(PU)  V(KV)      BUS# X-- NAME --X BASKV AREA  V(PU)  V(KV)
  58374 4BUDEN95    500.00    5 1.0586 529.31     50717 4ELEC 91    500.00    5 1.0655 532.74
  50758 4NVAES91    500.00    5 1.0603 530.17     50801 4STOSK91    500.00    5 1.0527 526.36
  50813 4METAL91    500.00    5 1.0540 527.00     50902 4BALAS91    500.00    5 1.0616 530.80
  50940 4OTPNV91    500.00    5 1.0557 527.83     58370 4BUDEN9     500.00    5 1.0586 529.28

 BUSES WITH VOLTAGE LESS THAN 0.9500:

   BUS# X-- NAME --X BASKV AREA  V(PU)  V(KV)      BUS# X-- NAME --X BASKV AREA  V(PU)  V(KV)

                                  * NONE *
```

400KV NETWORK

```
 BUSES WITH VOLTAGE GREATER THAN 1.0500:

   BUS# X-- NAME --X BASKV AREA  V(PU)  V(KV)      BUS# X-- NAME --X BASKV AREA  V(PU)  V(KV)

                                  * NONE *


 BUSES WITH VOLTAGE LESS THAN 0.9500:

   BUS# X-- NAME --X BASKV AREA  V(PU)  V(KV)      BUS# X-- NAME --X BASKV AREA  V(PU)  V(KV)

                                  * NONE *
```

330KV NETWORK

```
 BUSES WITH VOLTAGE GREATER THAN 1.1000:

   BUS# X-- NAME --X BASKV AREA  V(PU)  V(KV)      BUS# X-- NAME --X BASKV AREA  V(PU)  V(KV)

                                  * NONE *

 BUSES WITH VOLTAGE LESS THAN 0.9000:

   BUS# X-- NAME --X BASKV AREA  V(PU)  V(KV)      BUS# X-- NAME --X BASKV AREA  V(PU)  V(KV)

                                  * NONE *
```

220KV NETWORK

```
 BUSES WITH VOLTAGE GREATER THAN 1.1500:

   BUS# X-- NAME --X BASKV AREA  V(PU)  V(KV)      BUS# X-- NAME --X BASKV AREA  V(PU)  V(KV)

                                  * NONE *

 BUSES WITH VOLTAGE LESS THAN 0.9000:

   BUS# X-- NAME --X BASKV AREA  V(PU)  V(KV)      BUS# X-- NAME --X BASKV AREA  V(PU)  V(KV)

                                  * NONE *
```

110KV NETWORK

BUSES WITH VOLTAGE GREATER THAN 1.1500:

BUS#	X-- NAME --X	BASKV	AREA	V(PU)	V(KV)	BUS#	X-- NAME --X	BASKV	AREA	V(PU)	V(KV)
50586	4RASSV51	110.00	5	1.1668	128.35	50589	4BARR 51	110.00	5	1.1642	128.07
50591	4SRP 51	110.00	5	1.2111	133.23	50593	4GAZ1051	110.00	5	1.1642	128.06
50594	4BUZAN51	110.00	5	1.1600	127.60	50598	4LIMAN51	110.00	5	1.1539	126.93
50755	4SEMIL51	110.00	5	1.1531	126.84	50759	4NVAES51	110.00	5	1.1673	128.41
50762	4LISKI51	110.00	5	1.1528	126.81	50763	4BOBRO51	110.00	5	1.1687	128.56
50765	4EL.KO51	110.00	5	1.1522	126.74	50766	4PRIDO51	110.00	5	1.1540	126.94
50901	4BALAS51	110.00	5	1.1503	126.54	58316	4GEC-25	110.00	5	1.1653	128.19
58321	4GES-15	110.00	5	1.1684	128.52	58713	4DERBE5	110.00	5	1.2153	133.68

BUSES WITH VOLTAGE LESS THAN 0.9000:

BUS# X-- NAME --X BASKV AREA V(PU) V(KV) BUS# X-- NAME --X BASKV AREA V(PU) V(KV)

* NONE *

TURKEY

BLACKSEA REGIONAL MODEL
WINTER MAXIMUM LOAD 2010
400KV NETWORK

BUSES WITH VOLTAGE GREATER THAN 1.0500:

BUS# X-- NAME --X BASKV AREA V(PU) V(KV) BUS# X-- NAME --X BASKV AREA V(PU) V(KV)

* NONE *

BUSES WITH VOLTAGE LESS THAN 0.9300:

BUS# X-- NAME --X BASKV AREA V(PU) V(KV) BUS# X-- NAME --X BASKV AREA V(PU) V(KV)

* NONE *

150KV NETWORK

BUSES WITH VOLTAGE GREATER THAN 1.0800:

BUS# X-- NAME --X BASKV AREA V(PU) V(KV) BUS# X-- NAME --X BASKV AREA V(PU) V(KV)

* NONE *

BUSES WITH VOLTAGE LESS THAN 0.9700:

BUS# X-- NAME --X BASKV AREA V(PU) V(KV) BUS# X-- NAME --X BASKV AREA V(PU) V(KV)

* NONE *

BLACK SEA REGIONAL MODEL
SUMMER MINIMUM LOAD 2010
400KV NETWORK

BUSES WITH VOLTAGE GREATER THAN 1.0500:

BUS# X-- NAME --X BASKV AREA V(PU) V(KV) BUS# X-- NAME --X BASKV AREA V(PU) V(KV)

* NONE *

BUSES WITH VOLTAGE LESS THAN 0.9300:

BUS# X-- NAME --X BASKV AREA V(PU) V(KV) BUS# X-- NAME --X BASKV AREA V(PU) V(KV)

* NONE *

150KV NETWORK

BUSES WITH VOLTAGE GREATER THAN 1.0800:

BUS# X-- NAME --X BASKV AREA V(PU) V(KV) BUS# X-- NAME --X BASKV AREA V(PU) V(KV)

* NONE *

BUSES WITH VOLTAGE LESS THAN 0.9700:

BUS# X-- NAME --X BASKV AREA V(PU) V(KV) BUS# X-- NAME --X BASKV AREA V(PU) V(KV)

* NONE *

UKRAINE

BLACKSEA REGIONAL MODEL
WINTER MAXIMUM LOAD 2010
750KV NETWORK
BUSES WITH VOLTAGE GREATER THAN 1.0500:

BUS# X-- NAME --X BASKV AREA V(PU) V(KV) BUS# X-- NAME --X BASKV AREA V(PU) V(KV)

* NONE *

BUSES WITH VOLTAGE LESS THAN 0.9200:

BUS# X-- NAME --X BASKV AREA V(PU) V(KV) BUS# X-- NAME --X BASKV AREA V(PU) V(KV)

* NONE *

500KV NETWORK
BUSES WITH VOLTAGE GREATER THAN 1.0500:

BUS# X-- NAME --X BASKV AREA V(PU) V(KV) BUS# X-- NAME --X BASKV AREA V(PU) V(KV)

* NONE *

BUSES WITH VOLTAGE LESS THAN 0.9400:

BUS# X-- NAME --X BASKV AREA V(PU) V(KV) BUS# X-- NAME --X BASKV AREA V(PU) V(KV)

* NONE *

400KV NETWORK
BUSES WITH VOLTAGE GREATER THAN 1.0500:

BUS# X-- NAME --X BASKV AREA V(PU) V(KV) BUS# X-- NAME --X BASKV AREA V(PU) V(KV)

* NONE *

BUSES WITH VOLTAGE LESS THAN 0.9000:

BUS# X-- NAME --X BASKV AREA V(PU) V(KV) BUS# X-- NAME --X BASKV AREA V(PU) V(KV)

* NONE *

330KV NETWORK
BUSES WITH VOLTAGE GREATER THAN 1.1000:

BUS# X-- NAME --X BASKV AREA V(PU) V(KV) BUS# X-- NAME --X BASKV AREA V(PU) V(KV)

* NONE *

BUSES WITH VOLTAGE LESS THAN 0.8800:

BUS# X-- NAME --X BASKV AREA V(PU) V(KV) BUS# X-- NAME --X BASKV AREA V(PU) V(KV)

* NONE *

220KV NETWORK
BUSES WITH VOLTAGE GREATER THAN 1.1000:

BUS# X-- NAME --X BASKV AREA V(PU) V(KV) BUS# X-- NAME --X BASKV AREA V(PU) V(KV)

* NONE *

BUSES WITH VOLTAGE LESS THAN 0.8200:

BUS# X-- NAME --X BASKV AREA V(PU) V(KV) BUS# X-- NAME --X BASKV AREA V(PU) V(KV)

* NONE *

BLACKSEA REGIONAL MODEL
SUMMER MINIMUM LOAD 2010
750KV NETWORK
BUSES WITH VOLTAGE GREATER THAN 1.0500:

BUS# X-- NAME --X BASKV AREA V(PU) V(KV) BUS# X-- NAME --X BASKV AREA V(PU) V(KV)

* NONE *

BUSES WITH VOLTAGE LESS THAN 0.9200:

BUS# X-- NAME --X BASKV AREA V(PU) V(KV)   BUS# X-- NAME --X BASKV AREA V(PU) V(KV)

* NONE *

500KV NETWORK

BUSES WITH VOLTAGE GREATER THAN 1.0500:

BUS# X-- NAME --X BASKV AREA V(PU) V(KV)   BUS# X-- NAME --X BASKV AREA V(PU) V(KV)

* NONE *

BUSES WITH VOLTAGE LESS THAN 0.9400:

BUS# X-- NAME --X BASKV AREA V(PU) V(KV)   BUS# X-- NAME --X BASKV AREA V(PU) V(KV)

* NONE *

400KV NETWORK

BUSES WITH VOLTAGE GREATER THAN 1.0500:

BUS# X-- NAME --X BASKV AREA V(PU) V(KV)   BUS# X-- NAME --X BASKV AREA V(PU) V(KV)

* NONE *

BUSES WITH VOLTAGE LESS THAN 0.9000:

BUS# X-- NAME --X BASKV AREA V(PU) V(KV)   BUS# X-- NAME --X BASKV AREA V(PU) V(KV)

* NONE *

330KV NETWORK

BUSES WITH VOLTAGE GREATER THAN 1.1000:

BUS# X-- NAME --X BASKV AREA V(PU) V(KV)   BUS# X-- NAME --X BASKV AREA V(PU) V(KV)

* NONE *

BUSES WITH VOLTAGE LESS THAN 0.8800:

BUS# X-- NAME --X BASKV AREA V(PU) V(KV)   BUS# X-- NAME --X BASKV AREA V(PU) V(KV)

* NONE *

220KV NETWORK

BUSES WITH VOLTAGE GREATER THAN 1.1000:

BUS# X-- NAME --X BASKV AREA V(PU) V(KV)   BUS# X-- NAME --X BASKV AREA V(PU) V(KV)
70502 UTRIHA21   220.00   7 1.1165 245.62

BUSES WITH VOLTAGE LESS THAN 0.8200:

BUS# X-- NAME --X BASKV AREA V(PU) V(KV)   BUS# X-- NAME --X BASKV AREA V(PU) V(KV)

* NONE *

ARMENIA

BLACKSEA REGIONAL MODEL
WINTER MAXIMUM LOAD 2010
400KV NETWORK

BUSES WITH VOLTAGE GREATER THAN 1.0500:

BUS# X-- NAME --X BASKV AREA V(PU) V(KV)   BUS# X-- NAME --X BASKV AREA V(PU) V(KV)

* NONE *

BUSES WITH VOLTAGE LESS THAN 0.9000:

BUS# X-- NAME --X BASKV AREA V(PU) V(KV)   BUS# X-- NAME --X BASKV AREA V(PU) V(KV)

* NONE *

220KV NETWORK

BUSES WITH VOLTAGE GREATER THAN 1.1000:

```
  BUS# X-- NAME --X BASKV AREA  V(PU)  V(KV)      BUS# X-- NAME --X BASKV AREA  V(PU)  V(KV)

                                                * NONE *
```

BUSES WITH VOLTAGE LESS THAN 0.8200:

```
  BUS# X-- NAME --X BASKV AREA  V(PU)  V(KV)      BUS# X-- NAME --X BASKV AREA  V(PU)  V(KV)

                                                * NONE *
```

110KV NETWORK

BUSES WITH VOLTAGE GREATER THAN 1.1000:

```
  BUS# X-- NAME --X BASKV AREA  V(PU)  V(KV)      BUS# X-- NAME --X BASKV AREA  V(PU)  V(KV)

                                                * NONE *
```

BUSES WITH VOLTAGE LESS THAN 0.9000:

```
  BUS# X-- NAME --X BASKV AREA  V(PU)  V(KV)      BUS# X-- NAME --X BASKV AREA  V(PU)  V(KV)

                                                * NONE *
```

BLACKSEA REGIONAL MODEL
SUMMER MINIMUM LOAD 2010
400KV NETWORK

BUSES WITH VOLTAGE GREATER THAN 1.0500:

BUS# X-- NAME --X BASKV AREA V(PU) V(KV) BUS# X-- NAME --X BASKV AREA V(PU) V(KV)

* NONE *

BUSES WITH VOLTAGE LESS THAN 0.9000:

BUS# X-- NAME --X BASKV AREA V(PU) V(KV) BUS# X-- NAME --X BASKV AREA V(PU) V(KV)

* NONE *

220KV NETWORK

BUSES WITH VOLTAGE GREATER THAN 1.1000:

BUS# X-- NAME --X BASKV AREA V(PU) V(KV) BUS# X-- NAME --X BASKV AREA V(PU) V(KV)

* NONE *

BUSES WITH VOLTAGE LESS THAN 0.8200:

BUS# X-- NAME --X BASKV AREA V(PU) V(KV) BUS# X-- NAME --X BASKV AREA V(PU) V(KV)

* NONE *

110KV NETWORK

BUSES WITH VOLTAGE GREATER THAN 1.1000:

BUS# X-- NAME --X BASKV AREA V(PU) V(KV) BUS# X-- NAME --X BASKV AREA V(PU) V(KV)

* NONE *

BUSES WITH VOLTAGE LESS THAN 0.9000:

BUS# X-- NAME --X BASKV AREA V(PU) V(KV) BUS# X-- NAME --X BASKV AREA V(PU) V(KV)

* NONE *

4.6. Contingency analyses

Every project participant was obliged to check whether model of its systems complies according to the n-1 security criterion. In this chapter results of these analyses are shown.

4.6.1. Bulgaria

Here enclosed is contingency report output from PSS/E program as well as list of contingencies analyzed.

```
ACCC OVERLOAD REPORT: MONITORED BRANCHES AND INTERFACES LOADED ABOVE  95.0 % OF RATING SET A
                       CONTINGENCY CASE LOADING NOT CHECKED UNLESS IT DIFFERS FROM ITS BASE CASE LOADING BY   10.0
MVA (MW FOR INTERFACES)
 ACCC VOLTAGE  REPORT: VOLTAGE BAND CHECK IN CONTINGENCY CASES SKIPPED FOR ANY BUS WITHIN 0.01250 OF ITS BASE CASE
VOLTAGE MAGNITUDE

 AC CONTINGENCY RESULTS FILE:  D:\bg_2010.acc
 DISTRIBUTION FACTOR FILE:     D:\bg_2010.dfx
 SUBSYSTEM DESCRIPTION FILE:   D:\BG_2010.sub
 MONITORED ELEMENT FILE:       D:\BG_2010.mon
 CONTINGENCY DESCRIPTION FILE: D:\BG_2010.con
```

BLACKSEA REGIONAL MODEL
WINTER MAXIMUM LOAD 2010

```
 <---------------- MULTI-SECTION  LINE  ----------------> <----------------- MONITORED  BRANCH  ----------------->
CONTINGENCY    RATING     FLOW      %

 MONITORED VOLTAGE REPORT:
 SYSTEM                        CONTINGENCY  <-------- B U S -------->   V-CONT   V-INIT   V-MAX    V-MIN
```

BLACKSEA REGIONAL MODEL
SUMMER MINIMUM LOAD 2010

```
<---------------- MULTI-SECTION  LINE  ----------------> <----------------- MONITORED  BRANCH  ----------------->
CONTINGENCY    RATING     FLOW      %

 MONITORED VOLTAGE REPORT:
 SYSTEM                        CONTINGENCY  <-------- B U S -------->   V-CONT   V-INIT   V-MAX    V-MIN


 CONTINGENCY LEGEND:
 LABEL         EVENTS
 INT-20      : OPEN LINE FROM BUS 20 [XBG_TH11    400.00] TO BUS 12433 [VBLAGO1     400.00] CKT 1
               OPEN LINE FROM BUS 20 [XBG_TH11    400.00] TO BUS 80252 [GLAGAD1     400.00] CKT 1
 INT-21      : OPEN LINE FROM BUS 21 [XDO_IS11    400.00] TO BUS 12461 [VDOBRU1     400.00] CKT 1
               OPEN LINE FROM BUS 21 [XDO_IS11    400.00] TO BUS 48020 [RISACC1     400.00] CKT 1
 INT-22      : OPEN LINE FROM BUS 22 [XKO_TI11    400.00] TO BUS 12440 [VAEC_41     400.00] CKT 1
               OPEN LINE FROM BUS 22 [XKO_TI11    400.00] TO BUS 48001 [RTANTA1     400.00] CKT 1
 INT-23      : OPEN LINE FROM BUS 23 [XKO_TI12    400.00] TO BUS 12440 [VAEC_41     400.00] CKT 1
               OPEN LINE FROM BUS 23 [XKO_TI12    400.00] TO BUS 48001 [RTANTA1     400.00] CKT 2
 INT-24      : OPEN LINE FROM BUS 24 [XSO_NI11    400.00] TO BUS 12431 [VSOFIW1     400.00] CKT 1
               OPEN LINE FROM BUS 24 [XSO_NI11    400.00] TO BUS 80104 [JNIS2 1     400.00] CKT 1
 INT-181     : OPEN LINE FROM BUS 181 [XVA_IS11    400.00] TO BUS 12460 [VVARNA1     400.00] CKT 1
               OPEN LINE FROM BUS 181 [XVA_IS11    400.00] TO BUS 48020 [RISACC1     400.00] CKT 1
 INT-197     : OPEN LINE FROM BUS 197 [XMI_BA11    400.00] TO BUS 12471 [VMI3  11    400.00] CKT 1
               OPEN LINE FROM BUS 197 [XMI_BA11    400.00] TO BUS 60032 [TBABAE12    400.00] CKT 1
 INT-198     : OPEN LINE FROM BUS 198 [XMI_HA11    400.00] TO BUS 12471 [VMI3  11    400.00] CKT 1
               OPEN LINE FROM BUS 198 [XMI_HA11    400.00] TO BUS 60002 [THAMIT1     400.00] CKT 1
 INT-207     : OPEN LINE FROM BUS 207 [XCM_ST11    400.00] TO BUS 12432 [VCMOGI1     400.00] CKT 1
               OPEN LINE FROM BUS 207 [XCM_ST11    400.00] TO BUS 80204 [YSTIP11     400.00] CKT 1
 INT-214     : OPEN LINE FROM BUS 214 [XMI_FI11    400.00] TO BUS 12474 [VMI   1     400.00] CKT 1
               OPEN LINE FROM BUS 214 [XMI_FI11    400.00] TO BUS 80250 [GFILIP1     400.00] CKT 1
 SINGLE 1    : OPEN LINE FROM BUS 12220 [VBELME2     220.00] TO BUS 12221 [VKAZIC2     220.00] CKT 1
 SINGLE 2    : OPEN LINE FROM BUS 12220 [VBELME2     220.00] TO BUS 12221 [VKAZIC2     220.00] CKT 2
 SINGLE 3    : OPEN LINE FROM BUS 12221 [VKAZIC2     220.00] TO BUS 12222 [VSOFIJ2     220.00] CKT 1
 SINGLE 4    : OPEN LINE FROM BUS 12221 [VKAZIC2     220.00] TO BUS 12222 [VSOFIJ2     220.00] CKT 2
 SINGLE 5    : OPEN LINE FROM BUS 12221 [VKAZIC2     220.00] TO BUS 12232 [VSTOLN2     220.00] CKT 1
 SINGLE 6    : OPEN LINE FROM BUS 12221 [VKAZIC2     220.00] TO BUS 12232 [VSTOLN2     220.00] CKT 2
 SINGLE 7    : OPEN LINE FROM BUS 12221 [VKAZIC2     220.00] TO BUS 12280 [VALEKO2     220.00] CKT 1
 SINGLE 8    : OPEN LINE FROM BUS 12221 [VKAZIC2     220.00] TO BUS 12280 [VALEKO2     220.00] CKT 2
 SINGLE 9    : OPEN LINE FROM BUS 12222 [VSOFIJ2     220.00] TO BUS 12231 [VBOBOV2     220.00] CKT 1
 SINGLE 10   : OPEN LINE FROM BUS 12222 [VSOFIJ2     220.00] TO BUS 12231 [VBOBOV2     220.00] CKT 2
 SINGLE 11   : OPEN LINE FROM BUS 12223 [VGPP_12     220.00] TO BUS 12232 [VSTOLN2     220.00] CKT 1
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SINGLE 12   : OPEN LINE FROM BUS 12224 [VTSOFI2     220.00] TO BUS 12231 [VBOBOV2     220.00] CKT 1
SINGLE 13   : OPEN LINE FROM BUS 12224 [VTSOFI2     220.00] TO BUS 12232 [VSTOLN2     220.00] CKT 1
SINGLE 14   : OPEN LINE FROM BUS 12230 [VSTOMA2     220.00] TO BUS 12231 [VBOBOV2     220.00] CKT 1
SINGLE 15   : OPEN LINE FROM BUS 12230 [VSTOMA2     220.00] TO BUS 12232 [VSTOLN2     220.00] CKT 1
SINGLE 16   : OPEN LINE FROM BUS 12232 [VSTOLN2     220.00] TO BUS 12233 [VSESTR2     220.00] CKT 1
SINGLE 17   : OPEN LINE FROM BUS 12232 [VSTOLN2     220.00] TO BUS 12430 [VSTOLN1     400.00] CKT 1
SINGLE 18   : OPEN LINE FROM BUS 12240 [VBOICH2     220.00] TO BUS 12241 [VAEC_22     220.00] CKT 1
SINGLE 19   : OPEN LINE FROM BUS 12240 [VBOICH2     220.00] TO BUS 12290 [VMIZIA2     220.00] CKT 1
SINGLE 20   : OPEN LINE FROM BUS 12241 [VAEC_22     220.00] TO BUS 12242 [VBPC_22     220.00] CKT 1
SINGLE 21   : OPEN LINE FROM BUS 12241 [VAEC_22     220.00] TO BUS 12290 [VMIZIA2     220.00] CKT 1
SINGLE 22   : OPEN LINE FROM BUS 12241 [VAEC_22     220.00] TO BUS 12290 [VMIZIA2     220.00] CKT 2
SINGLE 23   : OPEN LINE FROM BUS 12241 [VAEC_22     220.00] TO BUS 12440 [VAEC_41     400.00] CKT 1
SINGLE 24   : OPEN LINE FROM BUS 12250 [VGORIA2     220.00] TO BUS 12251 [VBALKA2     220.00] CKT 1
SINGLE 25   : OPEN LINE FROM BUS 12250 [VGORIA2     220.00] TO BUS 12252 [VOCHIF2     220.00] CKT 1
SINGLE 26   : OPEN LINE FROM BUS 12250 [VGORIA2     220.00] TO BUS 12261 [VMADAR2     220.00] CKT 1
SINGLE 27   : OPEN LINE FROM BUS 12250 [VGORIA2     220.00] TO BUS 12272 [VMI2  2     220.00] CKT 1
SINGLE 28   : OPEN LINE FROM BUS 12250 [VGORIA2     220.00] TO BUS 12278 [VXXXXX22    220.00] CKT 1
SINGLE 29   : OPEN LINE FROM BUS 12250 [VGORIA2     220.00] TO BUS 12291 [VPLEVE21    220.00] CKT 1
SINGLE 30   : OPEN LINE FROM BUS 12251 [VBALKA2     220.00] TO BUS 12287 [VXXXXX23    220.00] CKT 1
SINGLE 31   : OPEN LINE FROM BUS 12260 [VDOBRU2     220.00] TO BUS 12261 [VMADAR2     220.00] CKT 2
SINGLE 32   : OPEN LINE FROM BUS 12260 [VDOBRU2     220.00] TO BUS 12262 [VTVARN2     220.00] CKT 1
SINGLE 33   : OPEN LINE FROM BUS 12260 [VDOBRU2     220.00] TO BUS 12262 [VTVARN2     220.00] CKT 2
SINGLE 34   : OPEN LINE FROM BUS 12260 [VDOBRU2     220.00] TO BUS 12263 [VVARNA2     220.00] CKT 1
SINGLE 35   : OPEN LINE FROM BUS 12260 [VDOBRU2     220.00] TO BUS 12277 [VXXXXX21    220.00] CKT 1
SINGLE 36   : OPEN LINE FROM BUS 12261 [VMADAR2     220.00] TO BUS 12263 [VVARNA2     220.00] CKT 1
SINGLE 37   : OPEN LINE FROM BUS 12263 [VVARNA2     220.00] TO BUS 12460 [VVARNA1     400.00] CKT 1
SINGLE 38   : OPEN LINE FROM BUS 12270 [VCHUDO2     220.00] TO BUS 12287 [VXXXXX23    220.00] CKT 1
SINGLE 39   : OPEN LINE FROM BUS 12271 [VTVARD2     220.00] TO BUS 12278 [VXXXXX22    220.00] CKT 1
SINGLE 40   : OPEN LINE FROM BUS 12272 [VMI2  2     220.00] TO BUS 12274 [VMI   2     220.00] CKT 1
SINGLE 41   : OPEN LINE FROM BUS 12272 [VMI2  2     220.00] TO BUS 12274 [VMI   2     220.00] CKT 2
SINGLE 42   : OPEN LINE FROM BUS 12272 [VMI2  2     220.00] TO BUS 12275 [VMI3  2     220.00] CKT 1
SINGLE 43   : OPEN LINE FROM BUS 12272 [VMI2  2     220.00] TO BUS 12276 [VSTZAG2     220.00] CKT 1
SINGLE 44   : OPEN LINE FROM BUS 12272 [VMI2  2     220.00] TO BUS 12277 [VXXXXX21    220.00] CKT 1
SINGLE 45   : OPEN LINE FROM BUS 12272 [VMI2  2     220.00] TO BUS 12278 [VXXXXX22    220.00] CKT 1
SINGLE 46   : OPEN LINE FROM BUS 12273 [VKARNO2     220.00] TO BUS 12277 [VXXXXX21    220.00] CKT 1
SINGLE 47   : OPEN LINE FROM BUS 12274 [VMI   2     220.00] TO BUS 12275 [VMI3  2     220.00] CKT 1
SINGLE 48   : OPEN LINE FROM BUS 12274 [VMI   2     220.00] TO BUS 12285 [VPLOVD2     220.00] CKT 1
SINGLE 49   : OPEN LINE FROM BUS 12274 [VMI   2     220.00] TO BUS 12285 [VPLOVD2     220.00] CKT 2
SINGLE 50   : OPEN LINE FROM BUS 12274 [VMI   2     220.00] TO BUS 12474 [VMI   1     400.00] CKT 1
SINGLE 51   : OPEN LINE FROM BUS 12275 [VMI3  2     220.00] TO BUS 12286 [VUZUND2     220.00] CKT 1
SINGLE 52   : OPEN LINE FROM BUS 12275 [VMI3  2     220.00] TO BUS 12471 [VMI3  11    400.00] CKT 1
SINGLE 53   : OPEN LINE FROM BUS 12280 [VALEKO2     220.00] TO BUS 12281 [VPESHT2     220.00] CKT 1
SINGLE 54   : OPEN LINE FROM BUS 12280 [VALEKO2     220.00] TO BUS 12282 [VORFEJ2     220.00] CKT 1
SINGLE 55   : OPEN LINE FROM BUS 12280 [VALEKO2     220.00] TO BUS 12285 [VPLOVD2     220.00] CKT 1
SINGLE 56   : OPEN LINE FROM BUS 12280 [VALEKO2     220.00] TO BUS 12287 [VXXXXX23    220.00] CKT 1
SINGLE 57   : OPEN LINE FROM BUS 12282 [VORFEJ2     220.00] TO BUS 12288 [VXXXXX24    220.00] CKT 1
SINGLE 58   : OPEN LINE FROM BUS 12283 [VDEVIN2     220.00] TO BUS 12288 [VXXXXX24    220.00] CKT 1
SINGLE 59   : OPEN LINE FROM BUS 12284 [VTESHE2     220.00] TO BUS 12288 [VXXXXX24    220.00] CKT 1
SINGLE 60   : OPEN LINE FROM BUS 12290 [VMIZIA2     220.00] TO BUS 12291 [VPLEVE21    220.00] CKT 1
SINGLE 61   : OPEN LINE FROM BUS 12290 [VMIZIA2     220.00] TO BUS 12291 [VPLEVE21    220.00] CKT 2
SINGLE 62   : OPEN LINE FROM BUS 12290 [VMIZIA2     220.00] TO BUS 12490 [VMIZIA1     400.00] CKT 1
SINGLE 63   : OPEN LINE FROM BUS 12420 [VMETAL1     400.00] TO BUS 12430 [VSTOLN1     400.00] CKT 1
SINGLE 64   : OPEN LINE FROM BUS 12420 [VMETAL1     400.00] TO BUS 12431 [VSOFIW1     400.00] CKT 1
SINGLE 65   : OPEN LINE FROM BUS 12430 [VSTOLN1     400.00] TO BUS 12434 [VZLATI1     400.00] CKT 1
SINGLE 66   : OPEN LINE FROM BUS 12430 [VSTOLN1     400.00] TO BUS 12490 [VMIZIA1     400.00] CKT 1
SINGLE 67   : OPEN LINE FROM BUS 12431 [VSOFIW1     400.00] TO BUS 12432 [VCMOGI1     400.00] CKT 1
SINGLE 68   : OPEN LINE FROM BUS 12431 [VSOFIW1     400.00] TO BUS 12432 [VCMOGI1     400.00] CKT 2
SINGLE 69   : OPEN LINE FROM BUS 12431 [VSOFIW1     400.00] TO BUS 12440 [VAEC_41     400.00] CKT 1
SINGLE 70   : OPEN LINE FROM BUS 12431 [VSOFIW1     400.00] TO BUS 12440 [VAEC_41     400.00] CKT 2
SINGLE 71   : OPEN LINE FROM BUS 12432 [VCMOGI1     400.00] TO BUS 12433 [VBLAGO1     400.00] CKT 1
SINGLE 72   : OPEN LINE FROM BUS 12432 [VCMOGI1     400.00] TO BUS 12433 [VBLAGO1     400.00] CKT 2
SINGLE 73   : OPEN LINE FROM BUS 12432 [VCMOGI1     400.00] TO BUS 12437 [VVETRE1     400.00] CKT 1
SINGLE 74   : OPEN LINE FROM BUS 12434 [VZLATI1     400.00] TO BUS 12480 [VPLOVD1     400.00] CKT 1
SINGLE 75   : OPEN LINE FROM BUS 12435 [VCHAIR11    400.00] TO BUS 12437 [VVETRE1     400.00] CKT 1
SINGLE 76   : OPEN LINE FROM BUS 12437 [VVETRE1     400.00] TO BUS 12480 [VPLOVD1     400.00] CKT 1
SINGLE 77   : OPEN LINE FROM BUS 12440 [VAEC_41     400.00] TO BUS 12490 [VMIZIA1     400.00] CKT 2
SINGLE 78   : OPEN LINE FROM BUS 12440 [VAEC_41     400.00] TO BUS 12490 [VMIZIA1     400.00] CKT 3
SINGLE 79   : OPEN LINE FROM BUS 12450 [VCAREV1     400.00] TO BUS 12460 [VVARNA1     400.00] CKT 1
SINGLE 80   : OPEN LINE FROM BUS 12450 [VCAREV1     400.00] TO BUS 12490 [VMIZIA1     400.00] CKT 1
SINGLE 81   : OPEN LINE FROM BUS 12460 [VVARNA1     400.00] TO BUS 12461 [VDOBRU1     400.00] CKT 1
SINGLE 82   : OPEN LINE FROM BUS 12460 [VVARNA1     400.00] TO BUS 12461 [VDOBRU1     400.00] CKT 2
SINGLE 83   : OPEN LINE FROM BUS 12460 [VVARNA1     400.00] TO BUS 12470 [VBURGA1     400.00] CKT 1
SINGLE 84   : OPEN LINE FROM BUS 12470 [VBURGA1     400.00] TO BUS 12472 [VMI2  1     400.00] CKT 1
SINGLE 85   : OPEN LINE FROM BUS 12471 [VMI3  11    400.00] TO BUS 12472 [VMI2  1     400.00] CKT 1
SINGLE 86   : OPEN LINE FROM BUS 12471 [VMI3  11    400.00] TO BUS 12474 [VMI   1     400.00] CKT 1
SINGLE 87   : OPEN LINE FROM BUS 12474 [VMI   1     400.00] TO BUS 12475 [VTMI  15    400.00] CKT 1
SINGLE 88   : OPEN LINE FROM BUS 12474 [VMI   1     400.00] TO BUS 12476 [VTMI  16    400.00] CKT 1
SINGLE 89   : OPEN LINE FROM BUS 12474 [VMI   1     400.00] TO BUS 12480 [VPLOVD1     400.00] CKT 1
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It can be concluded that in this regime, Bulgarian network fully complies with (n-1) security criterion.

4.6.2. Georgia

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 BLACKSEA REGIONAL MODEL
 WINTER MAXIMUM LOAD 2010

 ACCC OVERLOAD REPORT: MONITORED BRANCHES AND INTERFACES LOADED ABOVE 100.0 % OF RATING SET A
                       CONTINGENCY CASE LOADING NOT CHECKED UNLESS IT DIFFERS FROM ITS BASE CASE LOADING BY   10.0
MVA (MW FOR INTERFACES)
                       CONTINGENCY CASE LOADING NOT CHECKED UNLESS IT EXCEEDS ITS BASE CASE LOADING BY  5.0
PERCENT OF RATING SET A
 ACCC VOLTAGE  REPORT: VOLTAGE BAND CHECK IN CONTINGENCY CASES SKIPPED FOR ANY BUS WITHIN 0.02000 OF ITS BASE CASE
VOLTAGE MAGNITUDE

 AC CONTINGENCY RESULTS FILE:  D:\miksa\0\BlackSea\0report\GE\GEWINTER.acc
 DISTRIBUTION FACTOR FILE:     D:\miksa\0\BlackSea\0report\GE\GE.dfx
 SUBSYSTEM DESCRIPTION FILE:   D:\miksa\0\BlackSea\0report\GE\GE.sub
 MONITORED ELEMENT FILE:       D:\miksa\0\BlackSea\0report\GE\GE.mon
 CONTINGENCY DESCRIPTION FILE: D:\miksa\0\BlackSea\0report\GE\GE.con

<----------------- MONITORED BRANCH -----------------> CONTINGENCY    RATING     FLOW       %
 20009 6VARDI2     220.00  20032*6TKVAR2     220.00 1  SINGLE 102      371.0     421.6    118.5
 20032 6TKVAR2     220.00  20033*6SOUKH2     220.00 1  SINGLE 102      371.0     372.9    112.6
 20002*6QSANI9     500.00  20007 6QSANI2     220.00 1  SINGLE 114      500.0     633.8    126.8

 MONITORED VOLTAGE REPORT:
 SYSTEM                       CONTINGENCY  <-------- B U S -------->   V-CONT   V-INIT   V-MAX    V-MIN
 GE220KV                 RANGE SINGLE 2      20033 6SOUKH2     220.00  0.89503  0.97119  1.10000  0.90000
 GE220KV                 RANGE SINGLE 3      20030 6BZYBI21    220.00  0.87603  0.99323  1.10000  0.90000
 GE500KV                 RANGE SINGLE 5      20001 6ZESTA9     500.00  0.94648  0.98827  1.05000  0.95000
 GE220KV                 RANGE SINGLE 6      20032 6TKVAR2     220.00  0.89213  0.99683  1.10000  0.90000
 GE220KV                 RANGE SINGLE 6      20033 6SOUKH2     220.00  0.88298  0.97119  1.10000  0.90000
 GE220KV                 RANGE SINGLE 13     20027 6GURJA2     220.00  0.88376  0.97012  1.10000  0.90000
 GE220KV                 RANGE SINGLE 16     20033 6SOUKH2     220.00  0.89339  0.97119  1.10000  0.90000

 BLACKSEA REGIONAL MODEL
 SUMMER MINIMUM LOAD 2010

ACCC OVERLOAD REPORT: MONITORED BRANCHES AND INTERFACES LOADED ABOVE 100.0 % OF RATING SET A
                       CONTINGENCY CASE LOADING NOT CHECKED UNLESS IT DIFFERS FROM ITS BASE CASE LOADING BY   10.0
MVA (MW FOR INTERFACES)
                       CONTINGENCY CASE LOADING NOT CHECKED UNLESS IT EXCEEDS ITS BASE CASE LOADING BY  5.0
PERCENT OF RATING SET A
 ACCC VOLTAGE  REPORT: VOLTAGE BAND CHECK IN CONTINGENCY CASES SKIPPED FOR ANY BUS WITHIN 0.02000 OF ITS BASE CASE
VOLTAGE MAGNITUDE

 AC CONTINGENCY RESULTS FILE:  D:\miksa\0\BlackSea\0report\GE\GESUMMER.acc
 DISTRIBUTION FACTOR FILE:     D:\miksa\0\BlackSea\0report\GE\GE.dfx
 SUBSYSTEM DESCRIPTION FILE:   D:\miksa\0\BlackSea\0report\GE\GE.sub
 MONITORED ELEMENT FILE:       D:\miksa\0\BlackSea\0report\GE\GE.mon
 CONTINGENCY DESCRIPTION FILE: D:\miksa\0\BlackSea\0report\GE\GE.con

<----------------- MONITORED BRANCH -----------------> CONTINGENCY    RATING     FLOW       %

 MONITORED VOLTAGE REPORT:
 SYSTEM                       CONTINGENCY  <-------- B U S -------->   V-CONT   V-INIT   V-MAX    V-MIN
 GE220KV                 RANGE BASE CASE     20030 6BZYBI21    220.00  1.12439  1.12439  1.10000  0.90000
 GE220KV                 RANGE BASE CASE     20031 6LESEL51    110.00  1.13501  1.13501  1.10000  0.90000
 GE500KV                 RANGE SINGLE 7      20002 6QSANI9     500.00  0.94912  0.97787  1.05000  0.95000
 GE220KV                 RANGE SINGLE 32     20032 6TKVAR2     220.00  1.10973  1.07896  1.10000  0.90000
 GE220KV                 RANGE SINGLE 32     20033 6SOUKH2     220.00  1.11062  1.08890  1.10000  0.90000
 GE220KV                 RANGE SINGLE 47     20030 6BZYBI21    220.00  1.19101  1.12439  1.10000  0.90000
 GE220KV                 RANGE SINGLE 47     20031 6LESEL51    110.00  1.15710  1.13501  1.10000  0.90000
 GE220KV                 RANGE SINGLE 48     20033 6SOUKH2     220.00  1.10941  1.08890  1.10000  0.90000

CONTINGENCY LEGEND:
 LABEL         EVENTS
 SINGLE 1    : OPEN LINE FROM BUS 542 [XGE_TR21    220.00] TO BUS 20017 [6BATUM2     220.00] CKT 1
 SINGLE 2    : OPEN LINE FROM BUS 543 [XGE_RU91    500.00] TO BUS 20000 [6HENGU9     500.00] CKT 1
 SINGLE 3    : OPEN LINE FROM BUS 546 [XGE_RU21    220.00] TO BUS 20030 [6BZYBI21    220.00] CKT 1
 SINGLE 4    : OPEN LINE FROM BUS 552 [XGE_RU51    110.00] TO BUS 20031 [6LESEL51    110.00] CKT 1
 SINGLE 5    : OPEN LINE FROM BUS 20000 [6HENGU9     500.00] TO BUS 20001 [6ZESTA9     500.00] CKT 1
 SINGLE 6    : OPEN LINE FROM BUS 20000 [6HENGU9     500.00] TO BUS 20005 [6HENGU2     220.00] CKT 1
 SINGLE 7    : OPEN LINE FROM BUS 20001 [6ZESTA9     500.00] TO BUS 20002 [6QSANI9     500.00] CKT 1
 SINGLE 8    : OPEN LINE FROM BUS 20001 [6ZESTA9     500.00] TO BUS 20006 [6ZESTA2     220.00] CKT 1
 SINGLE 9    : OPEN LINE FROM BUS 20001 [6ZESTA9     500.00] TO BUS 20006 [6ZESTA2     220.00] CKT 2
 SINGLE 10   : OPEN LINE FROM BUS 20001 [6ZESTA9     500.00] TO BUS 20028 [6ACHAL9     500.00] CKT 1
 SINGLE 11   : OPEN LINE FROM BUS 20002 [6QSANI9     500.00] TO BUS 20003 [6TGARD9     500.00] CKT 1
 SINGLE 12   : OPEN LINE FROM BUS 20002 [6QSANI9     500.00] TO BUS 20007 [6QSANI2     220.00] CKT 1
 SINGLE 13   : OPEN LINE FROM BUS 20003 [6TGARD9     500.00] TO BUS 20008 [6TGARD2     220.00] CKT 1
 SINGLE 14   : OPEN LINE FROM BUS 20003 [6TGARD9     500.00] TO BUS 20028 [6ACHAL9     500.00] CKT 1
 SINGLE 15   : OPEN LINE FROM BUS 20004 [6TGARD8     330.00] TO BUS 20008 [6TGARD2     220.00] CKT 1
 SINGLE 16   : OPEN LINE FROM BUS 20005 [6HENGU2     220.00] TO BUS 20009 [6VARDI2     220.00] CKT 1
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 SINGLE 17   : OPEN LINE FROM BUS 20006 [6ZESTA2     220.00] TO BUS 20013 [6QUTAI2     220.00] CKT 1
 SINGLE 18   : OPEN LINE FROM BUS 20006 [6ZESTA2     220.00] TO BUS 20013 [6QUTAI2     220.00] CKT 2
 SINGLE 19   : OPEN LINE FROM BUS 20006 [6ZESTA2     220.00] TO BUS 20015 [6KHASH2     220.00] CKT 1
 SINGLE 20   : OPEN LINE FROM BUS 20007 [6QSANI2     220.00] TO BUS 20016 [6GORI 2     220.00] CKT 1
 SINGLE 21   : OPEN LINE FROM BUS 20007 [6QSANI2     220.00] TO BUS 20019 [6JHINV2     220.00] CKT 1
 SINGLE 22   : OPEN LINE FROM BUS 20007 [6QSANI2     220.00] TO BUS 20020 [6LISI 2     220.00] CKT 1
 SINGLE 23   : OPEN LINE FROM BUS 20007 [6QSANI2     220.00] TO BUS 20020 [6LISI 2     220.00] CKT 2
 SINGLE 24   : OPEN LINE FROM BUS 20007 [6QSANI2     220.00] TO BUS 20022 [6GLDAN2     220.00] CKT 1
 SINGLE 25   : OPEN LINE FROM BUS 20008 [6TGARD2     220.00] TO BUS 20020 [6LISI 2     220.00] CKT 1
 SINGLE 26   : OPEN LINE FROM BUS 20008 [6TGARD2     220.00] TO BUS 20023 [6NAVTL2     220.00] CKT 1
 SINGLE 27   : OPEN LINE FROM BUS 20008 [6TGARD2     220.00] TO BUS 20024 [6RUSTA2     220.00] CKT 1
 SINGLE 28   : OPEN LINE FROM BUS 20008 [6TGARD2     220.00] TO BUS 20024 [6RUSTA2     220.00] CKT 2
 SINGLE 29   : OPEN LINE FROM BUS 20008 [6TGARD2     220.00] TO BUS 20026 [6MARNE2     220.00] CKT 1
 SINGLE 30   : OPEN LINE FROM BUS 20009 [6VARDI2     220.00] TO BUS 20010 [6ZUGDI2     220.00] CKT 1
 SINGLE 31   : OPEN LINE FROM BUS 20009 [6VARDI2     220.00] TO BUS 20017 [6BATUM2     220.00] CKT 1
 SINGLE 33   : OPEN LINE FROM BUS 20010 [6ZUGDI2     220.00] TO BUS 20011 [6MENJI2     220.00] CKT 1
 SINGLE 34   : OPEN LINE FROM BUS 20011 [6MENJI2     220.00] TO BUS 20012 [6TSCHA2     220.00] CKT 1
 SINGLE 35   : OPEN LINE FROM BUS 20011 [6MENJI2     220.00] TO BUS 20013 [6QUTAI2     220.00] CKT 1
 SINGLE 36   : OPEN LINE FROM BUS 20011 [6MENJI2     220.00] TO BUS 20017 [6BATUM2     220.00] CKT 1
 SINGLE 37   : OPEN LINE FROM BUS 20012 [6TSCHA2     220.00] TO BUS 20013 [6QUTAI2     220.00] CKT 1
 SINGLE 38   : OPEN LINE FROM BUS 20012 [6TSCHA2     220.00] TO BUS 20018 [6LAJAN2     220.00] CKT 1
 SINGLE 39   : OPEN LINE FROM BUS 20015 [6KHASH2     220.00] TO BUS 20016 [6GORI 2     220.00] CKT 1
 SINGLE 40   : OPEN LINE FROM BUS 20020 [6LISI 2     220.00] TO BUS 20021 [6DIDUB2     220.00] CKT 1
 SINGLE 41   : OPEN LINE FROM BUS 20020 [6LISI 2     220.00] TO BUS 20021 [6DIDUB2     220.00] CKT 2
 SINGLE 42   : OPEN LINE FROM BUS 20020 [6LISI 2     220.00] TO BUS 20026 [6MARNE2     220.00] CKT 1
 SINGLE 43   : OPEN LINE FROM BUS 20022 [6GLDAN2     220.00] TO BUS 20023 [6NAVTL2     220.00] CKT 1
 SINGLE 44   : OPEN LINE FROM BUS 20022 [6GLDAN2     220.00] TO BUS 20024 [6RUSTA2     220.00] CKT 1
 SINGLE 45   : OPEN LINE FROM BUS 20023 [6NAVTL2     220.00] TO BUS 20025 [6KHRAM2     220.00] CKT 1
 SINGLE 46   : OPEN LINE FROM BUS 20024 [6RUSTA2     220.00] TO BUS 20027 [6GURJA2     220.00] CKT 1
 SINGLE 47   : OPEN LINE FROM BUS 20030 [6BZYBI21    220.00] TO BUS 20033 [6SOUKH2     220.00] CKT 1
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4.6.3. Moldova

BLACKSEA REGIONAL MODEL
WINTER MAXIMUM LOAD 2010

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 ACCC OVERLOAD REPORT: MONITORED BRANCHES AND INTERFACES LOADED ABOVE 100.0 % OF RATING SET A
                       CONTINGENCY CASE LOADING NOT CHECKED UNLESS IT DIFFERS FROM ITS BASE CASE LOADING BY   10.0
MVA (MW FOR INTERFACES)
                       CONTINGENCY CASE LOADING NOT CHECKED UNLESS IT EXCEEDS ITS BASE CASE LOADING BY  5.0
PERCENT OF RATING SET A
 ACCC VOLTAGE  REPORT: VOLTAGE BAND CHECK IN CONTINGENCY CASES SKIPPED FOR ANY BUS WITHIN 0.02000 OF ITS BASE CASE
VOLTAGE MAGNITUDE

 AC CONTINGENCY RESULTS FILE:  D:\miksa\0\BlackSea\0report\MD\MD.acc
 DISTRIBUTION FACTOR FILE:     D:\miksa\0\BlackSea\0report\MD\MD.dfx
 SUBSYSTEM DESCRIPTION FILE:   D:\miksa\0\BlackSea\0report\MD\MD.sub
 MONITORED ELEMENT FILE:       D:\miksa\0\BlackSea\0report\MD\MD.mon
 CONTINGENCY DESCRIPTION FILE: D:\miksa\0\BlackSea\0report\MD\MD.con

<----------------- MONITORED BRANCH -----------------> CONTINGENCY    RATING     FLOW       %
  520*XMD_UA82    330.00  30100 5MREPP8     330.00 1  BASE CASE       120.0    118.8    100.7
  520*XMD_UA82    330.00  30100 5MREPP8     330.00 1  SINGLE 3        120.0    235.0    199.4
  520*XMD_UA82    330.00  30100 5MREPP8     330.00 1  SINGLE 7        120.0    137.2    116.6

 MONITORED VOLTAGE REPORT:
 SYSTEM                         CONTINGENCY  <-------- B U S -------->   V-CONT   V-INIT   V-MAX    V-MIN
 MD400KV                  RANGE BASE CASE     32051 5BALTS1     400.00  1.05943  1.05943  1.05000  0.95000
 MD330KV                  RANGE SINGLE 5      33091 5RIBNI82    330.00  0.88663  0.97548  1.10000  0.90900
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BLACKSEA REGIONAL MODEL
SUMMER MINIMUM LOAD 2010

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 ACCC OVERLOAD REPORT: MONITORED BRANCHES AND INTERFACES LOADED ABOVE 100.0 % OF RATING SET A
                       CONTINGENCY CASE LOADING NOT CHECKED UNLESS IT DIFFERS FROM ITS BASE CASE LOADING BY   10.0
MVA (MW FOR INTERFACES)
                       CONTINGENCY CASE LOADING NOT CHECKED UNLESS IT EXCEEDS ITS BASE CASE LOADING BY  5.0
PERCENT OF RATING SET A
 ACCC VOLTAGE  REPORT: VOLTAGE BAND CHECK IN CONTINGENCY CASES SKIPPED FOR ANY BUS WITHIN 0.02000 OF ITS BASE CASE
VOLTAGE MAGNITUDE

 AC CONTINGENCY RESULTS FILE:  D:\miksa\0\BlackSea\0report\MD\MDSUMMER.acc
 DISTRIBUTION FACTOR FILE:     D:\miksa\0\BlackSea\0report\MD\MD1.dfx
 SUBSYSTEM DESCRIPTION FILE:   D:\miksa\0\BlackSea\0report\MD\MD.sub
 MONITORED ELEMENT FILE:       D:\miksa\0\BlackSea\0report\MD\MD.mon
 CONTINGENCY DESCRIPTION FILE: D:\miksa\0\BlackSea\0report\MD\MD.con

<----------------- MONITORED BRANCH -----------------> CONTINGENCY    RATING     FLOW       %

 MONITORED VOLTAGE REPORT:
 SYSTEM                         CONTINGENCY  <-------- B U S -------->   V-CONT   V-INIT   V-MAX    V-MIN
 OWNER 301                RANGE BASE CASE     30120 5MREPP1     400.00  1.05590  1.05590  1.05000  0.95000
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 CONTINGENCY LEGEND:
 LABEL         EVENTS
 SINGLE 1     : OPEN LINE FROM BUS 519 [XMD_UA81    330.00] TO BUS 32049 [5BALTS8     330.00] CKT 1
 SINGLE 2     : OPEN LINE FROM BUS 520 [XMD_UA82    330.00] TO BUS 30100 [5MREPP8     330.00] CKT 1
 SINGLE 3     : OPEN LINE FROM BUS 521 [XMD_UA83    330.00] TO BUS 30100 [5MREPP8     330.00] CKT 1
 SINGLE 4     : OPEN LINE FROM BUS 522 [XMD_UA84    330.00] TO BUS 33035 [5RIBNI81    330.00] CKT 1
 SINGLE 5     : OPEN LINE FROM BUS 523 [XMD_UA85    330.00] TO BUS 33091 [5RIBNI82    330.00] CKT 2
 SINGLE 6     : OPEN LINE FROM BUS 524 [XMD_UA86    330.00] TO BUS 30100 [5MREPP8     330.00] CKT 1
 SINGLE 7     : OPEN LINE FROM BUS 525 [XMD_UA87    330.00] TO BUS 30100 [5MREPP8     330.00] CKT 1
 SINGLE 8     : OPEN LINE FROM BUS 601 [XSV_BA11    400.00] TO BUS 32051 [5BALTS1     400.00] CKT 1
 SINGLE 9     : OPEN LINE FROM BUS 30100 [5MREPP8     330.00] TO BUS 37043 [5HBK1 81    330.00] CKT 1
 SINGLE 10    : OPEN LINE FROM BUS 30100 [5MREPP8     330.00] TO BUS 37044 [5HBK2 82    330.00] CKT 1
 SINGLE 11    : OPEN LINE FROM BUS 37041 [5HBK  81    330.00] TO BUS 37042 [5HBK  82    330.00] CKT 1
 SINGLE 12    : OPEN LINE FROM BUS 37041 [5HBK  81    330.00] TO BUS 37043 [5HBK1 81    330.00] CKT 1
 SINGLE 13    : OPEN LINE FROM BUS 37042 [5HBK  82    330.00] TO BUS 37044 [5HBK2 82    330.00] CKT 1
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4.6.4. Romania

BLACKSEA REGIONAL MODEL
WINTER MAXIMUM LOAD 2010

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ACCC OVERLOAD REPORT: MONITORED BRANCHES AND INTERFACES LOADED ABOVE 100.0 % OF RATING SET A
                       CONTINGENCY CASE LOADING NOT CHECKED UNLESS IT DIFFERS FROM ITS BASE CASE LOADING BY   10.0
MVA (MW FOR INTERFACES)
                       CONTINGENCY CASE LOADING NOT CHECKED UNLESS IT EXCEEDS ITS BASE CASE LOADING BY  5.0
PERCENT OF RATING SET A
 ACCC VOLTAGE  REPORT: VOLTAGE BAND CHECK IN CONTINGENCY CASES SKIPPED FOR ANY BUS WITHIN 0.02000 OF ITS BASE CASE
VOLTAGE MAGNITUDE

 AC CONTINGENCY RESULTS FILE:  D:\miksa\0\BlackSea\0report\RO\romwin.acc
 DISTRIBUTION FACTOR FILE:     D:\miksa\0\BlackSea\0report\RO\rom.dfx
 SUBSYSTEM DESCRIPTION FILE:   D:\miksa\0\BlackSea\0report\RO\Rom.sub
 MONITORED ELEMENT FILE:       D:\miksa\0\BlackSea\0report\RO\Rom.mon
 CONTINGENCY DESCRIPTION FILE: D:\miksa\0\BlackSea\0report\RO\Rom.CON

<----------------- MONITORED BRANCH -----------------> CONTINGENCY    RATING     FLOW       %
 48040*RLOTRU2     220.00  48100 RSIBIU2     220.00 2  SINGLE 6        333.4     518.2    147.2
 48040*RLOTRU2     220.00  48100 RSIBIU2     220.00 1  SINGLE 7        333.4     518.2    147.2
 48079 RBUC.S2B    220.00  49051*RFUNDE22    220.00 1  SINGLE 14       304.8     340.5    105.0
 48079 RBUC.S2B    220.00  49051*RFUNDE22    220.00 1  SINGLE 50       304.8     401.1    122.9
 48079 RBUC.S2B    220.00  49051*RFUNDE22    220.00 1  SINGLE 51       304.8     333.4    101.8
 48073*RFUNDE21    220.00  48079 RBUC.S2B    220.00 1  SINGLE 59       304.8     330.5    101.1
 48904*RBRAZI1     400.00  48905 RBRAZI2A    220.00 1  SINGLE 59       400.0     404.6    101.1
 48079 RBUC.S2B    220.00  49051*RFUNDE22    220.00 1  SINGLE 82       304.8     328.9    100.8
 48079 RBUC.S2B    220.00  49051*RFUNDE22    220.00 1  SINGLE 86       304.8     329.2    101.0
 48079 RBUC.S2B    220.00  49051*RFUNDE22    220.00 1  SINGLE 93       304.8     350.1    107.5
 48079 RBUC.S2B    220.00  49051*RFUNDE22    220.00 1  SINGLE 106      304.8     366.9    112.5

 MONITORED VOLTAGE REPORT:
 SYSTEM                      CONTINGENCY  <-------- B U S -------->   V-CONT   V-INIT   V-MAX    V-MIN
 '4-220      '          RANGE BASE CASE     48012 RGUTIN22    220.00  1.12869  1.12869  1.10000  0.90000
 '4-220      '          RANGE BASE CASE     48023 RFOCSA2     220.00  1.11161  1.11161  1.10000  0.90000
 '4-220      '          RANGE BASE CASE     48041 RAREF 2     220.00  1.10623  1.10623  1.10000  0.90000
 '4-220      '          RANGE BASE CASE     48042 RRIURE2     220.00  1.10862  1.10862  1.10000  0.90000
 '4-220      '          RANGE BASE CASE     48043 RSTUPA2     220.00  1.10767  1.10767  1.10000  0.90000
 '4-220      '          RANGE BASE CASE     48074 RL.SAR2     220.00  1.11838  1.11838  1.10000  0.90000
 '4-220      '          RANGE BASE CASE     48075 RFILES2     220.00  1.11376  1.11376  1.10000  0.90000
 '4-220      '          RANGE BASE CASE     48076 RBARBO2     220.00  1.11336  1.11336  1.10000  0.90000
 '4-220      '          RANGE BASE CASE     48077 RGUTIN21    220.00  1.12481  1.12481  1.10000  0.90000
 '4-220      '          RANGE BASE CASE     48078 RDUMBR2     220.00  1.10691  1.10691  1.10000  0.90000
 '4-220      '          RANGE BASE CASE     48080 RMUNTE2     220.00  1.12638  1.12638  1.10000  0.90000
 '4-220      '          RANGE BASE CASE     48081 RFAI  2     220.00  1.13089  1.13089  1.10000  0.90000
 '4-220      '          RANGE BASE CASE     48082 RSUCEA2     220.00  1.12670  1.12670  1.10000  0.90000
 '4-220      '          RANGE BASE CASE     48083 RSTEJA2     220.00  1.10119  1.10119  1.10000  0.90000
 '4-400      '          RANGE BASE CASE     48010 RDOMNE1     400.00  1.05592  1.05592  1.05000  0.95000
 '4-400      '          RANGE BASE CASE     48011 RBUC.S1     400.00  1.05531  1.05531  1.05000  0.95000
 '4-400      '          RANGE BASE CASE     48014 RSUCEA1     400.00  1.06569  1.06569  1.05000  0.95000
 '4-400      '          RANGE BASE CASE     48015 RPELIC1     400.00  1.06184  1.06184  1.05000  0.95000
 '4-400      '          RANGE BASE CASE     48016 RG.IAL1     400.00  1.06467  1.06467  1.05000  0.95000
 '4-400      '          RANGE BASE CASE     48017 RCONST1     400.00  1.06214  1.06214  1.05000  0.95000
 '4-400      '          RANGE BASE CASE     48019 RTULCE1     400.00  1.06398  1.06398  1.05000  0.95000
 '4-400      '          RANGE BASE CASE     48020 RISACC1     400.00  1.06815  1.06815  1.05000  0.95000
 '4-400      '          RANGE BASE CASE     48021 RL.SAR1     400.00  1.06742  1.06742  1.05000  0.95000
 '4-400      '          RANGE BASE CASE     48022 RSMIRD1     400.00  1.06950  1.06950  1.05000  0.95000
 '4-400      '          RANGE BASE CASE     48024 RGUTIN1     400.00  1.07301  1.07301  1.05000  0.95000
 '4-400      '          RANGE BASE CASE     48025 RBACAU2     400.00  1.07234  1.07234  1.05000  0.95000
 '4-400      '          RANGE BASE CASE     48031 RBRASO1     400.00  1.06148  1.06148  1.05000  0.95000
 '4-400      '          RANGE BASE CASE     48032 RDIRST1     400.00  1.06081  1.06081  1.05000  0.95000
 '4-400      '          RANGE BASE CASE     48034 RSIBIU1     400.00  1.05520  1.05520  1.05000  0.95000
 '4-400      '          RANGE BASE CASE     48036 RIERNU1     400.00  1.06208  1.06208  1.05000  0.95000
 '4-400      '          RANGE BASE CASE     48037 RGADAL1     400.00  1.05922  1.05922  1.05000  0.95000
 '4-400      '          RANGE BASE CASE     48038 RCLUJ 1     400.00  1.05582  1.05582  1.05000  0.95000
 '4-400      '          RANGE BASE CASE     48904 RBRAZI1     400.00  1.05321  1.05321  1.05000  0.95000
 '4-400      '          RANGE BASE CASE     48950 RROMAN2     400.00  1.07069  1.07069  1.05000  0.95000
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'4-400 '	RANGE BASE CASE	48973 RCERNA1	400.00	1.06228	1.06228	1.05000	0.95000
'4-400 '	RANGE BASE CASE	48974 RMEDGI1	400.00	1.06138	1.06138	1.05000	0.95000
'4-110 '	RANGE SINGLE 14	48409 RCOMAR5	110.00	0.89945	0.95923	1.12000	0.90000
'4-110 '	RANGE SINGLE 79	48349 RDRAGO5	110.00	0.80751	1.01870	1.12000	0.90000
'4-110 '	RANGE SINGLE 79	48350 RVLAD 5	110.00	0.76636	1.01544	1.12000	0.90000
'4-110 '	RANGE SINGLE 79	48351 RDOR M5	110.00	0.72270	1.01488	1.12000	0.90000
'4-110 '	RANGE SINGLE 79	48352 RLEHLI5	110.00	0.67992	1.01670	1.12000	0.90000
'4-110 '	RANGE SINGLE 79	48353 RTAMAD5	110.00	0.67237	1.01181	1.12000	0.90000
'4-110 '	RANGE SINGLE 79	48354 RMOSTI5	110.00	0.67125	1.02255	1.12000	0.90000
'4-110 '	RANGE SINGLE 79	48355 RCIORN5	110.00	0.66474	1.01871	1.12000	0.90000
'4-110 '	RANGE SINGLE 79	48356 ROLTEN5	110.00	0.65888	1.01503	1.12000	0.90000
'4-220 '	RANGE SINGLE 79	48855 RMOSTI2	220.00	0.70585	1.08338	1.10000	0.90000
'4-110 '	RANGE SINGLE 86	48309 RPOGOA5	110.00	0.89284	1.01406	1.12000	0.90000
'4-110 '	RANGE SINGLE 86	48310 RBUZAU5S	110.00	0.89715	1.01773	1.12000	0.90000
'4-110 '	RANGE SINGLE 86	48311 RBUZAU5E	110.00	0.89739	1.01749	1.12000	0.90000
'4-110 '	RANGE SINGLE 86	48312 RM.PLA51	110.00	0.89981	1.01868	1.12000	0.90000
'4-110 '	RANGE SINGLE 86	48313 RM.PLA52	110.00	0.89974	1.01863	1.12000	0.90000
'4-110 '	RANGE SINGLE 86	48315 RRM.SA5	110.00	0.89681	1.01861	1.12000	0.90000
'4-110 '	RANGE SINGLE 86	48318 RBUZAU5C	110.00	0.89941	1.01873	1.12000	0.90000
'4-110 '	RANGE SINGLE 86	48926 RCONTA5	110.00	0.89769	1.01740	1.12000	0.90000
'4-110 '	RANGE SINGLE 133	48463 RLECHI5	110.00	0.83745	0.91071	1.12000	0.90000
'4-110 '	RANGE SINGLE 133	48464 RSARAT5	110.00	0.83912	0.91221	1.12000	0.90000
'4-110 '	RANGE SINGLE 133	48465 RVIISO51	110.00	0.84067	0.91355	1.12000	0.90000
'4-110 '	RANGE SINGLE 133	48466 RBISTR5	110.00	0.83541	0.90862	1.12000	0.90000
'4-110 '	RANGE SINGLE 133	48467 RNASAU5	110.00	0.84010	0.91254	1.12000	0.90000
'4-110 '	RANGE SINGLE 133	48468 RDEJ 5	110.00	0.86900	0.93785	1.12000	0.90000
'4-110 '	RANGE SINGLE 133	48469 RBECLE5	110.00	0.85383	0.92619	1.12000	0.90000
'4-110 '	RANGE SINGLE 133	48470 RCELUL5	110.00	0.86060	0.93253	1.12000	0.90000
'4-110 '	RANGE SINGLE 133	48471 RCOLDA5	110.00	0.85635	0.92709	1.12000	0.90000
'4-110 '	RANGE SINGLE 133	48505 RBUNES5	110.00	0.87559	0.95096	1.12000	0.90000
'4-110 '	RANGE SINGLE 133	48506 RTAGA 5	110.00	0.87665	0.95082	1.12000	0.90000
'4-110 '	RANGE SINGLE 133	48507 RJUCU 5	110.00	0.89812	0.97853	1.12000	0.90000
'4-110 '	RANGE SINGLE 133	48508 RAPAHI5	110.00	0.89737	0.97784	1.12000	0.90000
'4-110 '	RANGE SINGLE 133	48519 RTURDA5	110.00	0.89824	0.96690	1.12000	0.90000
'4-110 '	RANGE SINGLE 133	48520 RMIHAI52	110.00	0.89633	0.96546	1.12000	0.90000
'4-110 '	RANGE SINGLE 133	48521 RC.TUR5	110.00	0.89297	0.96308	1.12000	0.90000
'4-110 '	RANGE SINGLE 133	48522 RPOIAN5	110.00	0.89647	0.96660	1.12000	0.90000
'4-110 '	RANGE SINGLE 133	48523 RIERNU51	110.00	0.89826	0.96844	1.12000	0.90000
'4-110 '	RANGE SINGLE 133	48525 RCALAR52	110.00	0.89304	0.96316	1.12000	0.90000
'4-110 '	RANGE SINGLE 133	48526 RLUDUS5	110.00	0.89465	0.96496	1.12000	0.90000
'4-110 '	RANGE SINGLE 133	48863 RGHERL5	110.00	0.88451	0.96208	1.12000	0.90000
'4-400 '	RANGE SINGLE 133	48038 RCLUJ 1	400.00	0.91652	1.05582	1.05000	0.95000

BLACKSEA REGIONAL MODEL
SUMMER MINIMUM LOAD 2010

ACCC OVERLOAD REPORT: MONITORED BRANCHES AND INTERFACES LOADED ABOVE 100.0 % OF RATING SET A
CONTINGENCY CASE LOADING NOT CHECKED UNLESS IT DIFFERS FROM ITS BASE CASE LOADING BY 10.0 MVA (MW FOR INTERFACES)
CONTINGENCY CASE LOADING NOT CHECKED UNLESS IT EXCEEDS ITS BASE CASE LOADING BY 5.0 PERCENT OF RATING SET A
ACCC VOLTAGE REPORT: VOLTAGE BAND CHECK IN CONTINGENCY CASES SKIPPED FOR ANY BUS WITHIN 0.02000 OF ITS BASE CASE VOLTAGE MAGNITUDE

AC CONTINGENCY RESULTS FILE: D:\miksa\0\BlackSea\0report\RO\romsum.acc
DISTRIBUTION FACTOR FILE: D:\miksa\0\BlackSea\0report\RO\rom.dfx
SUBSYSTEM DESCRIPTION FILE: D:\miksa\0\BlackSea\0report\RO\Rom.sub
MONITORED ELEMENT FILE: D:\miksa\0\BlackSea\0report\RO\Rom.mon
CONTINGENCY DESCRIPTION FILE: D:\miksa\0\BlackSea\0report\RO\Rom.CON

<----------------- MONITORED BRANCH ----------------->					CONTINGENCY	RATING	FLOW	%
48001*RTANTA1	400.00	49113 RTURCEG4	24.000	1	GENMAX	400.0	1001.7	250.4

MONITORED VOLTAGE REPORT:

SYSTEM	CONTINGENCY	<-------- B U S -------->		V-CONT	V-INIT	V-MAX	V-MIN
'4-220 '	RANGE BASE CASE	48080 RMUNTE2	220.00	1.10185	1.10185	1.10000	0.90000
'4-220 '	RANGE BASE CASE	48081 RFAI 2	220.00	1.10144	1.10144	1.10000	0.90000

CONTINGENCY LEGEND:

LABEL	EVENTS
INT-21	: OPEN LINE FROM BUS 21 [XDO_IS11 400.00] TO BUS 12461 [VDOBRU1 400.00] CKT 1
	OPEN LINE FROM BUS 21 [XDO_IS11 400.00] TO BUS 48020 [RISACC1 400.00] CKT 1
INT-22	: OPEN LINE FROM BUS 22 [XKO_TI11 400.00] TO BUS 12440 [VAEC_41 400.00] CKT 1
	OPEN LINE FROM BUS 22 [XKO_TI11 400.00] TO BUS 48001 [RTANTA1 400.00] CKT 1
INT-23	: OPEN LINE FROM BUS 23 [XKO_TI12 400.00] TO BUS 12440 [VAEC_41 400.00] CKT 1
	OPEN LINE FROM BUS 23 [XKO_TI12 400.00] TO BUS 48001 [RTANTA1 400.00] CKT 2
INT-75	: OPEN LINE FROM BUS 75 [XSA_AR11 400.00] TO BUS 48008 [RARAD 1 400.00] CKT 1
	OPEN LINE FROM BUS 75 [XSA_AR11 400.00] TO BUS 80160 [MSAFA 1 400.00] CKT 1
INT-84	: OPEN LINE FROM BUS 84 [XRO_MU11 400.00] TO BUS 48039 [RROSIO1 400.00] CKT 1
	OPEN LINE FROM BUS 84 [XRO_MU11 400.00] TO BUS 70919 [UMUKAC11 400.00] CKT 1
INT-85	: OPEN LINE FROM BUS 85 [XPF_DJ11 400.00] TO BUS 48004 [RP.D.F1 400.00] CKT 1
	OPEN LINE FROM BUS 85 [XPF_DJ11 400.00] TO BUS 80102 [JHDJE11 400.00] CKT 1
INT-181	: OPEN LINE FROM BUS 181 [XVA_IS11 400.00] TO BUS 12460 [VVARNA1 400.00] CKT 1
	OPEN LINE FROM BUS 181 [XVA_IS11 400.00] TO BUS 48020 [RISACC1 400.00] CKT 1
INT-219	: OPEN LINE FROM BUS 219 [XBE_OR11 400.00] TO BUS 48009 [RNADAB1 400.00] CKT 1
	OPEN LINE FROM BUS 219 [XBE_OR11 400.00] TO BUS 80152 [MBEKO 1 400.00] CKT 1
INT-601	: OPEN LINE FROM BUS 601 [XSV_BA11 400.00] TO BUS 32051 [5BALTS1 400.00] CKT 1

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              OPEN LINE FROM BUS 601 [XSV_BA11    400.00] TO BUS 48014 [RSUCEA1     400.00] CKT 1
INT-602     : OPEN LINE FROM BUS 602 [XVK_IS11    400.00] TO BUS 36046 [5VULKA1     400.00] CKT 1
              OPEN LINE FROM BUS 602 [XVK_IS11    400.00] TO BUS 48020 [RISACC1     400.00] CKT 1
GENMAX      : OPEN LINE FROM BUS 49218 [RCERNAG1    24.000] TO BUS 48973 [RCERNA1     400.00] CKT 1
              OPEN LINE FROM BUS 49218 [RCERNAG1    24.000] TO BUS 48973 [RCERNA1     400.00] CKT 2
SINGLE 1    : OPEN LINE FROM BUS 48005 [RP.D.F22    220.00] TO BUS 48050 [RCETAT2     220.00] CKT 1
SINGLE 2    : OPEN LINE FROM BUS 48005 [RP.D.F22    220.00] TO BUS 48050 [RCETAT2     220.00] CKT 2
SINGLE 3    : OPEN LINE FROM BUS 48012 [RGUTIN22    220.00] TO BUS 48080 [RMUNTE2     220.00] CKT 1
SINGLE 4    : OPEN LINE FROM BUS 48023 [RFOCSA2     220.00] TO BUS 48076 [RBARBO2     220.00] CKT 1
SINGLE 5    : OPEN LINE FROM BUS 48023 [RFOCSA2     220.00] TO BUS 48077 [RGUTIN21    220.00] CKT 1
SINGLE 6    : OPEN LINE FROM BUS 48040 [RLOTRU2     220.00] TO BUS 48100 [RSIBIU2     220.00] CKT 1
SINGLE 7    : OPEN LINE FROM BUS 48040 [RLOTRU2     220.00] TO BUS 48100 [RSIBIU2     220.00] CKT 2
SINGLE 8    : OPEN LINE FROM BUS 48041 [RAREF 2     220.00] TO BUS 48042 [RRIURE2     220.00] CKT 1
SINGLE 9    : OPEN LINE FROM BUS 48041 [RAREF 2     220.00] TO BUS 48044 [RBRADU2     220.00] CKT 1
SINGLE 10   : OPEN LINE FROM BUS 48042 [RRIURE2     220.00] TO BUS 48043 [RSTUPA2     220.00] CKT 1
SINGLE 11   : OPEN LINE FROM BUS 48043 [RSTUPA2     220.00] TO BUS 48044 [RBRADU2     220.00] CKT 1
SINGLE 12   : OPEN LINE FROM BUS 48044 [RBRADU2     220.00] TO BUS 48900 [RPIT S2     220.00] CKT 1
SINGLE 13   : OPEN LINE FROM BUS 48044 [RBRADU2     220.00] TO BUS 48910 [RTIRGO22    220.00] CKT 1
SINGLE 14   : OPEN LINE FROM BUS 48044 [RBRADU2     220.00] TO BUS 48911 [RTIRGO21    220.00] CKT 1
SINGLE 15   : OPEN LINE FROM BUS 48045 [RURECH2     220.00] TO BUS 48061 [RSARDA2     220.00] CKT 1
SINGLE 16   : OPEN LINE FROM BUS 48045 [RURECH2     220.00] TO BUS 48062 [RTG.JI2     220.00] CKT 1
SINGLE 17   : OPEN LINE FROM BUS 48046 [RP.D.F2B    220.00] TO BUS 48047 [RP.D.F2A    220.00] CKT 1
SINGLE 18   : OPEN LINE FROM BUS 48047 [RP.D.F2A    220.00] TO BUS 48048 [RTR.SE21    220.00] CKT 1
SINGLE 19   : OPEN LINE FROM BUS 48047 [RP.D.F2A    220.00] TO BUS 48049 [RTR.SE22    220.00] CKT 1
SINGLE 20   : OPEN LINE FROM BUS 48047 [RP.D.F2A    220.00] TO BUS 48050 [RCETAT2     220.00] CKT 1
SINGLE 21   : OPEN LINE FROM BUS 48047 [RP.D.F2A    220.00] TO BUS 48050 [RCETAT2     220.00] CKT 2
SINGLE 22   : OPEN LINE FROM BUS 48047 [RP.D.F2A    220.00] TO BUS 48052 [RRESIT2     220.00] CKT 1
SINGLE 23   : OPEN LINE FROM BUS 48047 [RP.D.F2A    220.00] TO BUS 48052 [RRESIT2     220.00] CKT 2
SINGLE 24   : OPEN LINE FROM BUS 48052 [RRESIT2     220.00] TO BUS 48053 [RIAZ  22    220.00] CKT 1
SINGLE 25   : OPEN LINE FROM BUS 48052 [RRESIT2     220.00] TO BUS 48054 [RIAZ  21    220.00] CKT 1
SINGLE 26   : OPEN LINE FROM BUS 48052 [RRESIT2     220.00] TO BUS 48071 [RTIMIS2     220.00] CKT 1
SINGLE 27   : OPEN LINE FROM BUS 48052 [RRESIT2     220.00] TO BUS 48071 [RTIMIS2     220.00] CKT 2
SINGLE 28   : OPEN LINE FROM BUS 48055 [RSLATI2     220.00] TO BUS 48056 [RGRADI2     220.00] CKT 1
SINGLE 29   : OPEN LINE FROM BUS 48055 [RSLATI2     220.00] TO BUS 48057 [RCRAIO2A    220.00] CKT 1
SINGLE 30   : OPEN LINE FROM BUS 48055 [RSLATI2     220.00] TO BUS 48058 [RCRAIO2B    220.00] CKT 1
SINGLE 31   : OPEN LINE FROM BUS 48055 [RSLATI2     220.00] TO BUS 48060 [RISALN2A    220.00] CKT 1
SINGLE 32   : OPEN LINE FROM BUS 48056 [RGRADI2     220.00] TO BUS 48060 [RISALN2A    220.00] CKT 1
SINGLE 33   : OPEN LINE FROM BUS 48057 [RCRAIO2A    220.00] TO BUS 48060 [RISALN2A    220.00] CKT 1
SINGLE 34   : OPEN LINE FROM BUS 48057 [RCRAIO2A    220.00] TO BUS 48902 [RT.MAG2     220.00] CKT 1
SINGLE 35   : OPEN LINE FROM BUS 48058 [RCRAIO2B    220.00] TO BUS 48060 [RISALN2A    220.00] CKT 1
SINGLE 36   : OPEN LINE FROM BUS 48058 [RCRAIO2B    220.00] TO BUS 48061 [RSARDA2     220.00] CKT 1
SINGLE 37   : OPEN LINE FROM BUS 48062 [RTG.JI2     220.00] TO BUS 48063 [RPAROS2     220.00] CKT 1
SINGLE 38   : OPEN LINE FROM BUS 48063 [RPAROS2     220.00] TO BUS 48064 [RBARU 2     220.00] CKT 1
SINGLE 39   : OPEN LINE FROM BUS 48064 [RBARU 2     220.00] TO BUS 48065 [RHAJD 2     220.00] CKT 1
SINGLE 40   : OPEN LINE FROM BUS 48065 [RHAJD 2     220.00] TO BUS 48066 [RPESTI2     220.00] CKT 1
SINGLE 41   : OPEN LINE FROM BUS 48065 [RHAJD 2     220.00] TO BUS 48068 [RMINTI2B    220.00] CKT 1
SINGLE 42   : OPEN LINE FROM BUS 48065 [RHAJD 2     220.00] TO BUS 48914 [RR.MAR2     220.00] CKT 1
SINGLE 43   : OPEN LINE FROM BUS 48066 [RPESTI2     220.00] TO BUS 48067 [RMINTI2A    220.00] CKT 1
SINGLE 44   : OPEN LINE FROM BUS 48066 [RPESTI2     220.00] TO BUS 48068 [RMINTI2B    220.00] CKT 1
SINGLE 45   : OPEN LINE FROM BUS 48067 [RMINTI2A    220.00] TO BUS 48071 [RTIMIS2     220.00] CKT 1
SINGLE 46   : OPEN LINE FROM BUS 48068 [RMINTI2B    220.00] TO BUS 48097 [RAL.JL2     220.00] CKT 1
SINGLE 47   : OPEN LINE FROM BUS 48069 [RARAD 2     220.00] TO BUS 48070 [RSACAL2     220.00] CKT 1
SINGLE 48   : OPEN LINE FROM BUS 48069 [RARAD 2     220.00] TO BUS 48071 [RTIMIS2     220.00] CKT 1
SINGLE 49   : OPEN LINE FROM BUS 48070 [RSACAL2     220.00] TO BUS 48071 [RTIMIS2     220.00] CKT 1
SINGLE 50   : OPEN LINE FROM BUS 48073 [RFUNDE21    220.00] TO BUS 48079 [RBUC.S2B    220.00] CKT 1
SINGLE 51   : OPEN LINE FROM BUS 48073 [RFUNDE21    220.00] TO BUS 48905 [RBRAZI2A    220.00] CKT 1
SINGLE 52   : OPEN LINE FROM BUS 48074 [RL.SAR2     220.00] TO BUS 48075 [RFILES2     220.00] CKT 1
SINGLE 53   : OPEN LINE FROM BUS 48075 [RFILES2     220.00] TO BUS 48076 [RBARBO2     220.00] CKT 1
SINGLE 54   : OPEN LINE FROM BUS 48077 [RGUTIN21    220.00] TO BUS 48078 [RDUMBR2     220.00] CKT 1
SINGLE 55   : OPEN LINE FROM BUS 48077 [RGUTIN21    220.00] TO BUS 48081 [RFAI  2     220.00] CKT 1
SINGLE 56   : OPEN LINE FROM BUS 48078 [RDUMBR2     220.00] TO BUS 48083 [RSTEJA2     220.00] CKT 1
SINGLE 57   : OPEN LINE FROM BUS 48079 [RBUC.S2B    220.00] TO BUS 48901 [RGHIZD2     220.00] CKT 1
SINGLE 58   : OPEN LINE FROM BUS 48079 [RBUC.S2B    220.00] TO BUS 48935 [RRAC.M2     220.00] CKT 1
SINGLE 59   : OPEN LINE FROM BUS 48079 [RBUC.S2B    220.00] TO BUS 49051 [RFUNDE22    220.00] CKT 1
SINGLE 60   : OPEN LINE FROM BUS 48080 [RMUNTE2     220.00] TO BUS 48081 [RFAI  2     220.00] CKT 1
SINGLE 61   : OPEN LINE FROM BUS 48081 [RFAI  2     220.00] TO BUS 48082 [RSUCEA2     220.00] CKT 1
SINGLE 62   : OPEN LINE FROM BUS 48083 [RSTEJA2     220.00] TO BUS 48084 [RGHEOR2     220.00] CKT 1
SINGLE 63   : OPEN LINE FROM BUS 48084 [RGHEOR2     220.00] TO BUS 48085 [RFINTI2     220.00] CKT 1
SINGLE 64   : OPEN LINE FROM BUS 48085 [RFINTI2     220.00] TO BUS 48086 [RUNGHE2     220.00] CKT 1
SINGLE 65   : OPEN LINE FROM BUS 48086 [RUNGHE2     220.00] TO BUS 48087 [RIERNU2     220.00] CKT 1
SINGLE 66   : OPEN LINE FROM BUS 48086 [RUNGHE2     220.00] TO BUS 48087 [RIERNU2     220.00] CKT 2
SINGLE 67   : OPEN LINE FROM BUS 48087 [RIERNU2     220.00] TO BUS 48088 [RCUPT.2     220.00] CKT 1
SINGLE 68   : OPEN LINE FROM BUS 48087 [RIERNU2     220.00] TO BUS 48093 [RBAIA 2     220.00] CKT 1
SINGLE 69   : OPEN LINE FROM BUS 48088 [RCUPT.2     220.00] TO BUS 48089 [RCLUJ 2     220.00] CKT 1
SINGLE 70   : OPEN LINE FROM BUS 48089 [RCLUJ 2     220.00] TO BUS 48090 [RMARIS2     220.00] CKT 1
SINGLE 71   : OPEN LINE FROM BUS 48089 [RCLUJ 2     220.00] TO BUS 48091 [RTIHAU2     220.00] CKT 1
SINGLE 72   : OPEN LINE FROM BUS 48089 [RCLUJ 2     220.00] TO BUS 48097 [RAL.JL2     220.00] CKT 1
SINGLE 73   : OPEN LINE FROM BUS 48091 [RTIHAU2     220.00] TO BUS 48093 [RBAIA 2     220.00] CKT 1
SINGLE 74   : OPEN LINE FROM BUS 48093 [RBAIA 2     220.00] TO BUS 48094 [RROSIO2     220.00] CKT 1
SINGLE 75   : OPEN LINE FROM BUS 48093 [RBAIA 2     220.00] TO BUS 48094 [RROSIO2     220.00] CKT 2
SINGLE 76   : OPEN LINE FROM BUS 48094 [RROSIO2     220.00] TO BUS 48095 [RVETIS2     220.00] CKT 1
SINGLE 77   : OPEN LINE FROM BUS 48097 [RAL.JL2     220.00] TO BUS 48098 [RSUGAG2     220.00] CKT 1
SINGLE 78   : OPEN LINE FROM BUS 48097 [RAL.JL2     220.00] TO BUS 48099 [RGILCE2     220.00] CKT 1
SINGLE 79   : OPEN LINE FROM BUS 48855 [RMOSTI2     220.00] TO BUS 48935 [RRAC.M2     220.00] CKT 1
SINGLE 80   : OPEN LINE FROM BUS 48901 [RGHIZD2     220.00] TO BUS 48902 [RT.MAG2     220.00] CKT 1
SINGLE 81   : OPEN LINE FROM BUS 48901 [RGHIZD2     220.00] TO BUS 48935 [RRAC.M2     220.00] CKT 1
SINGLE 82   : OPEN LINE FROM BUS 48905 [RBRAZI2A    220.00] TO BUS 48906 [RTELEA2     220.00] CKT 1
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SINGLE 83   : OPEN LINE FROM BUS 48905 [RBRAZI2A    220.00] TO BUS 48910 [RTIRGO22    220.00] CKT 1
SINGLE 84   : OPEN LINE FROM BUS 48905 [RBRAZI2A    220.00] TO BUS 48911 [RTIRGO21    220.00] CKT 1
SINGLE 85   : OPEN LINE FROM BUS 48905 [RBRAZI2A    220.00] TO BUS 49051 [RFUNDE22    220.00] CKT 1
SINGLE 86   : OPEN LINE FROM BUS 48906 [RTELEA2     220.00] TO BUS 48907 [RSTILP2     220.00] CKT 1
SINGLE 87   : OPEN LINE FROM BUS 75 [XSA_AR11    400.00] TO BUS 48008 [RARAD 1     400.00] CKT 1
SINGLE 88   : OPEN LINE FROM BUS 84 [XRO_MU11    400.00] TO BUS 48039 [RROSIO1     400.00] CKT 1
SINGLE 89   : OPEN LINE FROM BUS 85 [XPF_DJ11    400.00] TO BUS 48004 [RP.D.F1     400.00] CKT 1
SINGLE 90   : OPEN LINE FROM BUS 219 [XBE_OR11    400.00] TO BUS 48009 [RNADAB1     400.00] CKT 1
SINGLE 91   : OPEN LINE FROM BUS 48001 [RTANTA1     400.00] TO BUS 48002 [RURECH1     400.00] CKT 1
SINGLE 92   : OPEN LINE FROM BUS 48001 [RTANTA1     400.00] TO BUS 48007 [RSLATI1     400.00] CKT 1
SINGLE 93   : OPEN LINE FROM BUS 48001 [RTANTA1     400.00] TO BUS 48033 [RBRADU1     400.00] CKT 1
SINGLE 94   : OPEN LINE FROM BUS 48001 [RTANTA1     400.00] TO BUS 48034 [RSIBIU1     400.00] CKT 1
SINGLE 95   : OPEN LINE FROM BUS 48002 [RURECH1     400.00] TO BUS 48004 [RP.D.F1     400.00] CKT 1
SINGLE 96   : OPEN LINE FROM BUS 48002 [RURECH1     400.00] TO BUS 48010 [RDOMNE1     400.00] CKT 1
SINGLE 97   : OPEN LINE FROM BUS 48003 [RMINTI1     400.00] TO BUS 48008 [RARAD 1     400.00] CKT 1
SINGLE 98   : OPEN LINE FROM BUS 48003 [RMINTI1     400.00] TO BUS 48034 [RSIBIU1     400.00] CKT 1
SINGLE 99   : OPEN LINE FROM BUS 48004 [RP.D.F1     400.00] TO BUS 48007 [RSLATI1     400.00] CKT 1
SINGLE 100  : OPEN LINE FROM BUS 48004 [RP.D.F1     400.00] TO BUS 48018 [RRESIT1     400.00] CKT 1
SINGLE 101  : OPEN LINE FROM BUS 48006 [RDRAGA1     400.00] TO BUS 48007 [RSLATI1     400.00] CKT 1
SINGLE 102  : OPEN LINE FROM BUS 48007 [RSLATI1     400.00] TO BUS 48011 [RBUC.S1     400.00] CKT 1
SINGLE 103  : OPEN LINE FROM BUS 48008 [RARAD 1     400.00] TO BUS 48009 [RNADAB1     400.00] CKT 1
SINGLE 104  : OPEN LINE FROM BUS 48009 [RNADAB1     400.00] TO BUS 48096 [RORADE1     400.00] CKT 1
SINGLE 105  : OPEN LINE FROM BUS 48010 [RDOMNE1     400.00] TO BUS 48011 [RBUC.S1     400.00] CKT 1
SINGLE 106  : OPEN LINE FROM BUS 48010 [RDOMNE1     400.00] TO BUS 48904 [RBRAZI1     400.00] CKT 1
SINGLE 107  : OPEN LINE FROM BUS 48011 [RBUC.S1     400.00] TO BUS 48015 [RPELIC1     400.00] CKT 1
SINGLE 108  : OPEN LINE FROM BUS 48011 [RBUC.S1     400.00] TO BUS 48016 [RG.IAL1     400.00] CKT 1
SINGLE 109  : OPEN LINE FROM BUS 48014 [RSUCEA1     400.00] TO BUS 48037 [RGADAL1     400.00] CKT 1
SINGLE 110  : OPEN LINE FROM BUS 48014 [RSUCEA1     400.00] TO BUS 48950 [RROMAN2     400.00] CKT 1
SINGLE 111  : OPEN LINE FROM BUS 48015 [RPELIC1     400.00] TO BUS 48973 [RCERNA1     400.00] CKT 1
SINGLE 112  : OPEN LINE FROM BUS 48016 [RG.IAL1     400.00] TO BUS 48021 [RL.SAR1     400.00] CKT 1
SINGLE 113  : OPEN LINE FROM BUS 48016 [RG.IAL1     400.00] TO BUS 48973 [RCERNA1     400.00] CKT 1
SINGLE 114  : OPEN LINE FROM BUS 48016 [RG.IAL1     400.00] TO BUS 48973 [RCERNA1     400.00] CKT 2
SINGLE 115  : OPEN LINE FROM BUS 48017 [RCONST1     400.00] TO BUS 48019 [RTULCE1     400.00] CKT 1
SINGLE 116  : OPEN LINE FROM BUS 48017 [RCONST1     400.00] TO BUS 48973 [RCERNA1     400.00] CKT 1
SINGLE 117  : OPEN LINE FROM BUS 48017 [RCONST1     400.00] TO BUS 48974 [RMEDGI1     400.00] CKT 1
SINGLE 118  : OPEN LINE FROM BUS 48019 [RTULCE1     400.00] TO BUS 48020 [RISACC1     400.00] CKT 1
SINGLE 119  : OPEN LINE FROM BUS 48020 [RISACC1     400.00] TO BUS 48021 [RL.SAR1     400.00] CKT 1
SINGLE 120  : OPEN LINE FROM BUS 48020 [RISACC1     400.00] TO BUS 48022 [RSMIRD1     400.00] CKT 1
SINGLE 121  : OPEN LINE FROM BUS 48020 [RISACC1     400.00] TO BUS 48022 [RSMIRD1     400.00] CKT 2
SINGLE 122  : OPEN LINE FROM BUS 48021 [RL.SAR1     400.00] TO BUS 48022 [RSMIRD1     400.00] CKT 1
SINGLE 123  : OPEN LINE FROM BUS 48022 [RSMIRD1     400.00] TO BUS 48024 [RGUTIN1     400.00] CKT 1
SINGLE 124  : OPEN LINE FROM BUS 48024 [RGUTIN1     400.00] TO BUS 48025 [RBACAU2     400.00] CKT 1
SINGLE 125  : OPEN LINE FROM BUS 48024 [RGUTIN1     400.00] TO BUS 48031 [RBRASO1     400.00] CKT 1
SINGLE 126  : OPEN LINE FROM BUS 48025 [RBACAU2     400.00] TO BUS 48950 [RROMAN2     400.00] CKT 1
SINGLE 127  : OPEN LINE FROM BUS 48031 [RBRASO1     400.00] TO BUS 48032 [RDIRST1     400.00] CKT 1
SINGLE 128  : OPEN LINE FROM BUS 48031 [RBRASO1     400.00] TO BUS 48033 [RBRADU1     400.00] CKT 1
SINGLE 129  : OPEN LINE FROM BUS 48031 [RBRASO1     400.00] TO BUS 48034 [RSIBIU1     400.00] CKT 1
SINGLE 130  : OPEN LINE FROM BUS 48032 [RDIRST1     400.00] TO BUS 48904 [RBRAZI1     400.00] CKT 1
SINGLE 131  : OPEN LINE FROM BUS 48034 [RSIBIU1     400.00] TO BUS 48036 [RIERNU1     400.00] CKT 1
SINGLE 132  : OPEN LINE FROM BUS 48036 [RIERNU1     400.00] TO BUS 48037 [RGADAL1     400.00] CKT 1
SINGLE 133  : OPEN LINE FROM BUS 48037 [RGADAL1     400.00] TO BUS 48038 [RCLUJ 1     400.00] CKT 1
SINGLE 134  : OPEN LINE FROM BUS 48037 [RGADAL1     400.00] TO BUS 48039 [RROSIO1     400.00] CKT 1
SINGLE 135  : OPEN LINE FROM BUS 48039 [RROSIO1     400.00] TO BUS 48096 [RORADE1     400.00] CKT 1
SINGLE 136  : OPEN LINE FROM BUS 48973 [RCERNA1     400.00] TO BUS 48974 [RMEDGI1     400.00] CKT 1
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All overloadings in Romanian network can be resolved with adequate operational activities (switching on shunts or change of topology by splitting busburs or redistribution of local load) and they are not related to interconnected operation of the system but local problems, like in case of tripping 220 kV line from Lotru-Sibiu second line is overloaded because over these two lines production of HPP Lotru is placed in the network. Reduction of production in Lotru is necessary.

4.6.5. Russia

BLACKSEA REGIONAL MODEL
WINTER MAXIMUM LOAD 2010

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<----------------- MONITORED BRANCH -----------------> CONTINGENCY    RATING     FLOW       %
 58370*4BUDEN9     500.00  58371 4BUDEN8     330.00 2  SINGLE 112      500.0    573.8    114.8
 58370*4BUDEN9     500.00  58371 4BUDEN8     330.00 1  SINGLE 113      500.0    573.8    114.8

 MONITORED VOLTAGE REPORT:
 SYSTEM                        CONTINGENCY  <-------- B U S -------->   V-CONT   V-INIT   V-MAX    V-MIN
 OWNER 509               RANGE BASE CASE     50717 4ELEC 91     500.00  1.05626  1.05626  1.05000  0.95000
 OWNER 502               RANGE BASE CASE     50583 4NARAB21     220.00  0.88476  0.88476  1.15000  0.90000
 OWNER 502               RANGE BASE CASE     50585 4RASSV21     220.00  0.88317  0.88317  1.15000  0.90000
 OWNER 502               RANGE BASE CASE     50587 4ASTRA21     220.00  0.88334  0.88334  1.15000  0.90000
 OWNER 502               RANGE BASE CASE     50588 4BARR 21     220.00  0.87505  0.87505  1.15000  0.90000
 OWNER 502               RANGE BASE CASE     50592 4GAZ  21     220.00  0.86214  0.86214  1.15000  0.90000
 OWNER 502               RANGE BASE CASE     50597 4LIMAN21     220.00  0.89312  0.89312  1.15000  0.90000
 OWNER 502               RANGE SINGLE 10     58219 4KIRIL2      220.00  0.88000  0.91615  1.15000  0.90000
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OWNER 502	RANGE SINGLE 10	58263 4VOSTO2	220.00	0.89562	0.93030	1.15000	0.90000
OWNER 508	RANGE SINGLE 30	50652 4ZELEZ81	330.00	0.89635	0.95416	1.10000	0.90000
OWNER 508	RANGE SINGLE 31	50655 4SADOV81	330.00	0.89141	0.96977	1.10000	0.90000
OWNER 509	RANGE SINGLE 77	50949 4TRUBN91	500.00	0.88840	0.97962	1.05000	0.95000
OWNER 502	RANGE SINGLE 77	50580 4VLAD 21	220.00	0.86186	0.92964	1.15000	0.90000
OWNER 502	RANGE SINGLE 77	50595 4GAZ 22	220.00	0.87284	0.94473	1.15000	0.90000
OWNER 509	RANGE SINGLE 87	58370 4BUDEN9	500.00	0.94269	0.97768	1.05000	0.95000
OWNER 509	RANGE SINGLE 87	58374 4BUDEN95	500.00	0.94269	0.97768	1.05000	0.95000
OWNER 502	RANGE SINGLE 94	58217 4KRYMS2	220.00	0.89097	0.93692	1.15000	0.90000
OWNER 502	RANGE SINGLE 94	58219 4KIRIL2	220.00	0.86849	0.91615	1.15000	0.90000
OWNER 502	RANGE SINGLE 94	58263 4VOSTO2	220.00	0.88376	0.93030	1.15000	0.90000
OWNER 509	RANGE SINGLE 97	58370 4BUDEN9	500.00	0.94641	0.97768	1.05000	0.95000
OWNER 509	RANGE SINGLE 97	58374 4BUDEN95	500.00	0.94641	0.97768	1.05000	0.95000
OWNER 509	RANGE SINGLE 99	58370 4BUDEN9	500.00	0.94493	0.97768	1.05000	0.95000
OWNER 509	RANGE SINGLE 99	58374 4BUDEN95	500.00	0.94493	0.97768	1.05000	0.95000
OWNER 509	RANGE SINGLE 105	58370 4BUDEN9	500.00	0.94828	0.97768	1.05000	0.95000
OWNER 509	RANGE SINGLE 105	58374 4BUDEN95	500.00	0.94828	0.97768	1.05000	0.95000
OWNER 502	RANGE SINGLE 110	58219 4KIRIL2	220.00	0.88318	0.91615	1.15000	0.90000
OWNER 502	RANGE SINGLE 110	58263 4VOSTO2	220.00	0.89811	0.93030	1.15000	0.90000
OWNER 508	RANGE SINGLE 116	58325 4MASHU8	330.00	0.89401	0.94943	1.10000	0.90000
OWNER 508	RANGE SINGLE 116	58402 4PROHL8	330.00	0.87990	0.94693	1.10000	0.90000
OWNER 508	RANGE SINGLE 116	58404 4BAKSA8	330.00	0.88459	0.94559	1.10000	0.90000
OWNER 508	RANGE SINGLE 116	58430 4NALJC8	330.00	0.87863	0.94022	1.10000	0.90000
OWNER 508	RANGE SINGLE 116	58505 4V-5008	330.00	0.88620	0.93076	1.10000	0.90000
OWNER 508	RANGE SINGLE 116	58510 4V-2 8	330.00	0.89270	0.93531	1.10000	0.90000
OWNER 508	RANGE SINGLE 116	58513 4MOZDO8	330.00	0.87692	0.93414	1.10000	0.90000
OWNER 508	RANGE SINGLE 122	58402 4PROHL8	330.00	0.88372	0.94693	1.10000	0.90000
OWNER 508	RANGE SINGLE 122	58404 4BAKSA8	330.00	0.89335	0.94559	1.10000	0.90000
OWNER 508	RANGE SINGLE 122	58430 4NALJC8	330.00	0.88748	0.94022	1.10000	0.90000
OWNER 508	RANGE SINGLE 122	58505 4V-5008	330.00	0.78673	0.93076	1.10000	0.90000
OWNER 508	RANGE SINGLE 122	58513 4MOZDO8	330.00	0.83460	0.93414	1.10000	0.90000
OWNER 509	RANGE SINGLE 124	58370 4BUDEN9	500.00	0.94390	0.97768	1.05000	0.95000
OWNER 509	RANGE SINGLE 124	58374 4BUDEN95	500.00	0.94390	0.97768	1.05000	0.95000
OWNER 508	RANGE SINGLE 124	58325 4MASHU8	330.00	0.89331	0.94943	1.10000	0.90000
OWNER 508	RANGE SINGLE 124	58402 4PROHL8	330.00	0.87780	0.94693	1.10000	0.90000
OWNER 508	RANGE SINGLE 124	58404 4BAKSA8	330.00	0.88375	0.94559	1.10000	0.90000
OWNER 508	RANGE SINGLE 124	58430 4NALJC8	330.00	0.87777	0.94022	1.10000	0.90000
OWNER 508	RANGE SINGLE 124	58505 4V-5008	330.00	0.80095	0.93076	1.10000	0.90000
OWNER 508	RANGE SINGLE 124	58510 4V-2 8	330.00	0.80211	0.93531	1.10000	0.90000
OWNER 508	RANGE SINGLE 124	58513 4MOZDO8	330.00	0.83791	0.93414	1.10000	0.90000
OWNER 508	RANGE SINGLE 126	58712 4DERBE8	330.00	0.89376	0.91871	1.10000	0.90000
OWNER 508	RANGE SINGLE 127	58712 4DERBE8	330.00	0.89381	0.91871	1.10000	0.90000

BLACKSEA REGIONAL MODEL
SUMMER MINIMUM LOAD 2010

<----------------- MONITORED BRANCH -----------------> CONTINGENCY RATING FLOW %

MONITORED VOLTAGE REPORT:

SYSTEM	CONTINGENCY	<-------- B U S -------->		V-CONT	V-INIT	V-MAX	V-MIN
OWNER 509	RANGE BASE CASE	50717 4ELEC 91	500.00	1.06560	1.06560	1.05000	0.95000
OWNER 509	RANGE BASE CASE	50758 4NVAES91	500.00	1.06051	1.06051	1.05000	0.95000
OWNER 509	RANGE BASE CASE	50801 4STOSK91	500.00	1.05285	1.05285	1.05000	0.95000
OWNER 509	RANGE BASE CASE	50813 4METAL91	500.00	1.05413	1.05413	1.05000	0.95000
OWNER 509	RANGE BASE CASE	50902 4BALAS91	500.00	1.06186	1.06186	1.05000	0.95000
OWNER 509	RANGE BASE CASE	50940 4OTPNV91	500.00	1.05582	1.05582	1.05000	0.95000
OWNER 509	RANGE BASE CASE	58260 4CENTR9	500.00	1.05094	1.05094	1.05000	0.95000
OWNER 509	RANGE BASE CASE	58370 4BUDEN9	500.00	1.06250	1.06250	1.05000	0.95000
OWNER 509	RANGE BASE CASE	58374 4BUDEN95	500.00	1.06257	1.06257	1.05000	0.95000
OWNER 502	RANGE BASE CASE	50597 4LIMAN21	220.00	1.15040	1.15040	1.15000	0.90000
OWNER 509	RANGE SINGLE 77	50934 4FROLO91	500.00	1.07237	1.04644	1.05000	0.95000
OWNER 509	RANGE SINGLE 78	50949 4TRUBN91	500.00	0.89869	0.96657	1.05000	0.95000
OWNER 509	RANGE SINGLE 86	58194 4VDAES97	500.00	1.14198	1.01903	1.05000	0.95000
OWNER 508	RANGE SINGLE 86	58332 4PRIKU8	330.00	1.12736	1.08515	1.10000	0.90000
OWNER 508	RANGE SINGLE 86	58363 4BLAGO8	330.00	1.10383	1.07737	1.10000	0.90000
OWNER 508	RANGE SINGLE 86	58371 4BUDEN8	330.00	1.13283	1.08744	1.10000	0.90000
OWNER 508	RANGE SINGLE 86	58373 4BUDEN82	330.00	1.13274	1.08738	1.10000	0.90000
OWNER 509	RANGE SINGLE 110	58361 4STGRE91	500.00	1.05774	1.00628	1.05000	0.95000
OWNER 508	RANGE SINGLE 131	58332 4PRIKU8	330.00	1.12256	1.08515	1.10000	0.90000
OWNER 508	RANGE SINGLE 131	58363 4BLAGO8	330.00	1.10476	1.07737	1.10000	0.90000
OWNER 508	RANGE SINGLE 131	58371 4BUDEN8	330.00	1.12676	1.08744	1.10000	0.90000
OWNER 508	RANGE SINGLE 131	58373 4BUDEN82	330.00	1.12683	1.08738	1.10000	0.90000
OWNER 508	RANGE SINGLE 131	58773 4CHI298	330.00	1.24282	1.05061	1.10000	0.90000

CONTINGENCY LEGEND:

LABEL	EVENTS
SINGLE 1	: OPEN LINE FROM BUS 506 [XRU_UA01 750.00] TO BUS 50678 [4K AES02 750.00] CKT 1
SINGLE 2	: OPEN LINE FROM BUS 511 [XRU_UA91 500.00] TO BUS 58180 [4SH-309 500.00] CKT 1
SINGLE 3	: OPEN LINE FROM BUS 512 [XRU_UA92 500.00] TO BUS 50758 [4NVAES91 500.00] CKT 0
SINGLE 4	: OPEN LINE FROM BUS 513 [XRU_UA81 330.00] TO BUS 58146 [4HCHGP8 330.00] CKT 1
SINGLE 5	: OPEN LINE FROM BUS 514 [XRU_UA82 330.00] TO BUS 50809 [4VALUI81 330.00] CKT 1
SINGLE 6	: OPEN LINE FROM BUS 515 [XRU_UA83 330.00] TO BUS 50823 [4SHEBE81 330.00] CKT 1
SINGLE 7	: OPEN LINE FROM BUS 516 [XRU_UA84 330.00] TO BUS 50663 [4K AES81 330.00] CKT 1
SINGLE 8	: OPEN LINE FROM BUS 517 [XRU_UA85 330.00] TO BUS 50663 [4K AES81 330.00] CKT 1
SINGLE 9	: OPEN LINE FROM BUS 518 [XRU_UA86 330.00] TO BUS 50811 [4BELGO81 330.00] CKT 1
SINGLE 10	: OPEN LINE FROM BUS 543 [XGE_RU91 500.00] TO BUS 58260 [4CENTR9 500.00] CKT 1

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SINGLE 11   : OPEN LINE FROM BUS 547 [XAZ_RU81    330.00] TO BUS 58712 [4DERBE8     330.00] CKT 1
SINGLE 12   : OPEN LINE FROM BUS 553 [XBY_RU01    750.00] TO BUS 50540 [4S AES01    750.00] CKT 1
SINGLE 13   : OPEN LINE FROM BUS 554 [XBY_RU81    330.00] TO BUS 50528 [4ROSL381    330.00] CKT 1
SINGLE 14   : OPEN LINE FROM BUS 555 [XBY_RU82    330.00] TO BUS 50509 [4TAL3381    330.00] CKT 1
SINGLE 15   : OPEN LINE FROM BUS 50509 [4TAL3381    330.00] TO BUS 50528 [4ROSL381    330.00] CKT 0
SINGLE 16   : OPEN LINE FROM BUS 50513 [4S AES91    500.00] TO BUS 50530 [4S AES81    330.00] CKT 1
SINGLE 17   : OPEN LINE FROM BUS 50513 [4S AES91    500.00] TO BUS 50530 [4S AES81    330.00] CKT 2
SINGLE 18   : OPEN LINE FROM BUS 50513 [4S AES91    500.00] TO BUS 50540 [4S AES01    750.00] CKT 1
SINGLE 19   : OPEN LINE FROM BUS 50513 [4S AES91    500.00] TO BUS 50540 [4S AES01    750.00] CKT 2
SINGLE 20   : OPEN LINE FROM BUS 50513 [4S AES91    500.00] TO BUS 50963 [4MIHAI91    500.00] CKT 1
SINGLE 21   : OPEN LINE FROM BUS 50513 [4S AES91    500.00] TO BUS 50963 [4MIHAI91    500.00] CKT 98
SINGLE 22   : OPEN LINE FROM BUS 50528 [4ROSL381    330.00] TO BUS 50530 [4S AES81    330.00] CKT 1
SINGLE 23   : OPEN LINE FROM BUS 50528 [4ROSL381    330.00] TO BUS 50530 [4S AES81    330.00] CKT 2
SINGLE 24   : OPEN LINE FROM BUS 50540 [4S AES01    750.00] TO BUS 50554 [4NBRAN01    750.00] CKT 0
SINGLE 25   : OPEN LINE FROM BUS 50554 [4NBRAN01    750.00] TO BUS 50555 [4NBRAN91    500.00] CKT 1
SINGLE 26   : OPEN LINE FROM BUS 50554 [4NBRAN01    750.00] TO BUS 50555 [4NBRAN91    500.00] CKT 2
SINGLE 27   : OPEN LINE FROM BUS 50554 [4NBRAN01    750.00] TO BUS 50675 [4K AES01    750.00] CKT 0
SINGLE 28   : OPEN LINE FROM BUS 50555 [4NBRAN91    500.00] TO BUS 50717 [4ELEC 91    500.00] CKT 0
SINGLE 29   : OPEN LINE FROM BUS 50652 [4ZELEZ81    330.00] TO BUS 50662 [4UZNAJ81    330.00] CKT 0
SINGLE 30   : OPEN LINE FROM BUS 50652 [4ZELEZ81    330.00] TO BUS 50676 [4K AES82    330.00] CKT 0
SINGLE 31   : OPEN LINE FROM BUS 50655 [4SADOV81    330.00] TO BUS 50662 [4UZNAJ81    330.00] CKT 0
SINGLE 32   : OPEN LINE FROM BUS 50662 [4UZNAJ81    330.00] TO BUS 50669 [4KURSK81    330.00] CKT 0
SINGLE 33   : OPEN LINE FROM BUS 50662 [4UZNAJ81    330.00] TO BUS 50676 [4K AES82    330.00] CKT 1
SINGLE 34   : OPEN LINE FROM BUS 50662 [4UZNAJ81    330.00] TO BUS 50676 [4K AES82    330.00] CKT 2
SINGLE 35   : OPEN LINE FROM BUS 50662 [4UZNAJ81    330.00] TO BUS 50811 [4BELGO81    330.00] CKT 0
SINGLE 36   : OPEN LINE FROM BUS 50663 [4K AES81    330.00] TO BUS 50676 [4K AES82    330.00] CKT 99
SINGLE 37   : OPEN LINE FROM BUS 50663 [4K AES81    330.00] TO BUS 50678 [4K AES02    750.00] CKT 0
SINGLE 38   : OPEN LINE FROM BUS 50669 [4KURSK81    330.00] TO BUS 50673 [4SEIMS81    330.00] CKT 0
SINGLE 39   : OPEN LINE FROM BUS 50669 [4KURSK81    330.00] TO BUS 50676 [4K AES82    330.00] CKT 0
SINGLE 40   : OPEN LINE FROM BUS 50675 [4K AES01    750.00] TO BUS 50676 [4K AES82    330.00] CKT 0
SINGLE 41   : OPEN LINE FROM BUS 50675 [4K AES01    750.00] TO BUS 50678 [4K AES02    750.00] CKT 0
SINGLE 42   : OPEN LINE FROM BUS 50678 [4K AES02    750.00] TO BUS 50816 [4METAL01    750.00] CKT 0
SINGLE 43   : OPEN LINE FROM BUS 50703 [4BORIN91    500.00] TO BUS 50713 [4LIPEC91    500.00] CKT 0
SINGLE 44   : OPEN LINE FROM BUS 50703 [4BORIN91    500.00] TO BUS 50717 [4ELEC 91    500.00] CKT 0
SINGLE 45   : OPEN LINE FROM BUS 50703 [4BORIN91    500.00] TO BUS 50758 [4NVAES91    500.00] CKT 0
SINGLE 46   : OPEN LINE FROM BUS 50713 [4LIPEC91    500.00] TO BUS 50860 [4TAMBO91    500.00] CKT 0
SINGLE 47   : OPEN LINE FROM BUS 50713 [4LIPEC91    500.00] TO BUS 50902 [4BALAS91    500.00] CKT 0
SINGLE 48   : OPEN LINE FROM BUS 50713 [4LIPEC91    500.00] TO BUS 50940 [4OTPNV91    500.00] CKT 0
SINGLE 49   : OPEN LINE FROM BUS 50713 [4LIPEC91    500.00] TO BUS 50962 [4RGRES91    500.00] CKT 1
SINGLE 50   : OPEN LINE FROM BUS 50713 [4LIPEC91    500.00] TO BUS 50962 [4RGRES91    500.00] CKT 2
SINGLE 51   : OPEN LINE FROM BUS 50758 [4NVAES91    500.00] TO BUS 50801 [4STOSK91    500.00] CKT 0
SINGLE 52   : OPEN LINE FROM BUS 50758 [4NVAES91    500.00] TO BUS 50940 [4OTPNV91    500.00] CKT 0
SINGLE 53   : OPEN LINE FROM BUS 50760 [4LISKI81    330.00] TO BUS 50809 [4VALUI81    330.00] CKT 0
SINGLE 54   : OPEN LINE FROM BUS 50801 [4STOSK91    500.00] TO BUS 50803 [4STOSK81    330.00] CKT 1
SINGLE 55   : OPEN LINE FROM BUS 50801 [4STOSK91    500.00] TO BUS 50803 [4STOSK81    330.00] CKT 2
SINGLE 56   : OPEN LINE FROM BUS 50801 [4STOSK91    500.00] TO BUS 50813 [4METAL91    500.00] CKT 0
SINGLE 57   : OPEN LINE FROM BUS 50803 [4STOSK81    330.00] TO BUS 50806 [4GUBKI81    330.00] CKT 0
SINGLE 58   : OPEN LINE FROM BUS 50803 [4STOSK81    330.00] TO BUS 50828 [4OEMK 81    330.00] CKT 1
SINGLE 59   : OPEN LINE FROM BUS 50803 [4STOSK81    330.00] TO BUS 50828 [4OEMK 81    330.00] CKT 2
SINGLE 60   : OPEN LINE FROM BUS 50806 [4GUBKI81    330.00] TO BUS 50807 [4LEBED81    330.00] CKT 0
SINGLE 61   : OPEN LINE FROM BUS 50807 [4LEBED81    330.00] TO BUS 50811 [4BELGO81    330.00] CKT 0
SINGLE 62   : OPEN LINE FROM BUS 50807 [4LEBED81    330.00] TO BUS 50814 [4METAL81    330.00] CKT 0
SINGLE 63   : OPEN LINE FROM BUS 50809 [4VALUI81    330.00] TO BUS 50814 [4METAL81    330.00] CKT 0
SINGLE 64   : OPEN LINE FROM BUS 50811 [4BELGO81    330.00] TO BUS 50823 [4SHEBE81    330.00] CKT 0
SINGLE 65   : OPEN LINE FROM BUS 50813 [4METAL91    500.00] TO BUS 50816 [4METAL01    750.00] CKT 0
SINGLE 66   : OPEN LINE FROM BUS 50814 [4METAL81    330.00] TO BUS 50816 [4METAL01    750.00] CKT 1
SINGLE 67   : OPEN LINE FROM BUS 50814 [4METAL81    330.00] TO BUS 50816 [4METAL01    750.00] CKT 2
SINGLE 68   : OPEN LINE FROM BUS 50814 [4METAL81    330.00] TO BUS 50828 [4OEMK 81    330.00] CKT 1
SINGLE 69   : OPEN LINE FROM BUS 50814 [4METAL81    330.00] TO BUS 50828 [4OEMK 81    330.00] CKT 2
SINGLE 70   : OPEN LINE FROM BUS 50860 [4TAMBO91    500.00] TO BUS 50962 [4RGRES91    500.00] CKT 0
SINGLE 71   : OPEN LINE FROM BUS 50902 [4BALAS91    500.00] TO BUS 50913 [4VOLGA91    500.00] CKT 0
SINGLE 72   : OPEN LINE FROM BUS 50902 [4BALAS91    500.00] TO BUS 50934 [4FROLO91    500.00] CKT 0
SINGLE 73   : OPEN LINE FROM BUS 50902 [4BALAS91    500.00] TO BUS 50940 [4OTPNV91    500.00] CKT 0
SINGLE 74   : OPEN LINE FROM BUS 50913 [4VOLGA91    500.00] TO BUS 50920 [4VGGES91    500.00] CKT 0
SINGLE 75   : OPEN LINE FROM BUS 50913 [4VOLGA91    500.00] TO BUS 50932 [4UZNAJ91    500.00] CKT 0
SINGLE 76   : OPEN LINE FROM BUS 50920 [4VGGES91    500.00] TO BUS 50934 [4FROLO91    500.00] CKT 0
SINGLE 77   : OPEN LINE FROM BUS 50932 [4UZNAJ91    500.00] TO BUS 50949 [4TRUBN91    500.00] CKT 0
SINGLE 78   : OPEN LINE FROM BUS 50932 [4UZNAJ91    500.00] TO BUS 58190 [4VDAES9     500.00] CKT 0
SINGLE 79   : OPEN LINE FROM BUS 50932 [4UZNAJ91    500.00] TO BUS 58192 [4VDAES9J    500.00] CKT 0
SINGLE 80   : OPEN LINE FROM BUS 50962 [4RGRES91    500.00] TO BUS 50963 [4MIHAI91    500.00] CKT 1
SINGLE 81   : OPEN LINE FROM BUS 50962 [4RGRES91    500.00] TO BUS 50963 [4MIHAI91    500.00] CKT 2
SINGLE 82   : OPEN LINE FROM BUS 58146 [4HCHGP8     330.00] TO BUS 58254 [4TIHOR8     330.00] CKT 0
SINGLE 83   : OPEN LINE FROM BUS 58180 [4SH-309     500.00] TO BUS 58190 [4VDAES9     500.00] CKT 0
SINGLE 84   : OPEN LINE FROM BUS 58190 [4VDAES9     500.00] TO BUS 58192 [4VDAES9J    500.00] CKT 0
SINGLE 85   : OPEN LINE FROM BUS 58190 [4VDAES9     500.00] TO BUS 58193 [4VDAES95    500.00] CKT 0
SINGLE 87   : OPEN LINE FROM BUS 58193 [4VDAES95    500.00] TO BUS 58273 [4TIHOR95    500.00] CKT 0
SINGLE 89   : OPEN LINE FROM BUS 58233 [4ARMAV8     330.00] TO BUS 58253 [4KROPO8     330.00] CKT 0
SINGLE 90   : OPEN LINE FROM BUS 58233 [4ARMAV8     330.00] TO BUS 58310 [4NEVGR8     330.00] CKT 0
SINGLE 91   : OPEN LINE FROM BUS 58233 [4ARMAV8     330.00] TO BUS 58344 [4STGRE8     330.00] CKT 1
SINGLE 92   : OPEN LINE FROM BUS 58233 [4ARMAV8     330.00] TO BUS 58344 [4STGRE8     330.00] CKT 2
SINGLE 93   : OPEN LINE FROM BUS 58253 [4KROPO8     330.00] TO BUS 58254 [4TIHOR8     330.00] CKT 0
SINGLE 94   : OPEN LINE FROM BUS 58260 [4CENTR9     500.00] TO BUS 58361 [4STGRE91    500.00] CKT 0
SINGLE 95   : OPEN LINE FROM BUS 58270 [4TIHOR9     500.00] TO BUS 58273 [4TIHOR95    500.00] CKT 0
SINGLE 96   : OPEN LINE FROM BUS 58270 [4TIHOR9     500.00] TO BUS 58362 [4STGRE92    500.00] CKT 0
SINGLE 97   : OPEN LINE FROM BUS 58303 [4STAVR8     330.00] TO BUS 58344 [4STGRE8     330.00] CKT 0
SINGLE 98   : OPEN LINE FROM BUS 58303 [4STAVR8     330.00] TO BUS 58349 [4GEC-48     330.00] CKT 0
SINGLE 99   : OPEN LINE FROM BUS 58303 [4STAVR8     330.00] TO BUS 58363 [4BLAGO8     330.00] CKT 0
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SINGLE 101  : OPEN LINE FROM BUS 58310 [4NEVGR8     330.00] TO BUS 58349 [4GEC-48     330.00] CKT 0
SINGLE 104  : OPEN LINE FROM BUS 58325 [4MASHU8     330.00] TO BUS 58402 [4PROHL8     330.00] CKT 0
SINGLE 105  : OPEN LINE FROM BUS 58332 [4PRIKU8     330.00] TO BUS 58363 [4BLAGO8     330.00] CKT 0
SINGLE 106  : OPEN LINE FROM BUS 58332 [4PRIKU8     330.00] TO BUS 58371 [4BUDEN8     330.00] CKT 0
SINGLE 107  : OPEN LINE FROM BUS 58344 [4STGRE8     330.00] TO BUS 58360 [4STGRE90    500.00] CKT 3
SINGLE 108  : OPEN LINE FROM BUS 58344 [4STGRE8     330.00] TO BUS 58360 [4STGRE90    500.00] CKT 4
SINGLE 110  : OPEN LINE FROM BUS 58360 [4STGRE90    500.00] TO BUS 58361 [4STGRE91    500.00] CKT 0
SINGLE 111  : OPEN LINE FROM BUS 58360 [4STGRE90    500.00] TO BUS 58362 [4STGRE92    500.00] CKT 0
SINGLE 112  : OPEN LINE FROM BUS 58370 [4BUDEN9     500.00] TO BUS 58371 [4BUDEN8     330.00] CKT 1
SINGLE 113  : OPEN LINE FROM BUS 58370 [4BUDEN9     500.00] TO BUS 58371 [4BUDEN8     330.00] CKT 2
SINGLE 116  : OPEN LINE FROM BUS 58371 [4BUDEN8     330.00] TO BUS 58402 [4PROHL8     330.00] CKT 0
SINGLE 118  : OPEN LINE FROM BUS 58402 [4PROHL8     330.00] TO BUS 58404 [4BAKSA8     330.00] CKT 0
SINGLE 120  : OPEN LINE FROM BUS 58404 [4BAKSA8     330.00] TO BUS 58430 [4NALJC8     330.00] CKT 0
SINGLE 122  : OPEN LINE FROM BUS 58505 [4V-5008     330.00] TO BUS 58510 [4V-2  8     330.00] CKT 0
SINGLE 124  : OPEN LINE FROM BUS 58510 [4V-2  8     330.00] TO BUS 58714 [4CHIRJ8     330.00] CKT 0
SINGLE 125  : OPEN LINE FROM BUS 58703 [4CHIRG8     330.00] TO BUS 58704 [4CHGES8     330.00] CKT 0
SINGLE 126  : OPEN LINE FROM BUS 58703 [4CHIRG8     330.00] TO BUS 58714 [4CHIRJ8     330.00] CKT 0
SINGLE 127  : OPEN LINE FROM BUS 58704 [4CHGES8     330.00] TO BUS 58714 [4CHIRJ8     330.00] CKT 0
SINGLE 128  : OPEN LINE FROM BUS 58710 [4MAHAC8     330.00] TO BUS 58712 [4DERBE8     330.00] CKT 0
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4.6.6. Turkey

BLACKSEA REGIONAL MODEL
WINTER MAXIMUM LOAD 2010

<----------------- MONITORED BRANCH		----------------->		CONTINGENCY	RATING	FLOW	%
60612 THOPA 3	150.00	61103*THOPA 2	220.00 1	BASE CASE	150.0	154.4	102.9
60665 TELBIS11	400.00	61060*G-4ELBIS	21.000 1	GENMAX	345.0	481.3	139.5
60665 TELBIS11	400.00	61060*G-4ELBIS	21.000 2	GENMAX	345.0	481.3	139.5
60665 TELBIS11	400.00	61060*G-4ELBIS	21.000 3	GENMAX	345.0	481.3	139.5
60665 TELBIS11	400.00	61060*G-4ELBIS	21.000 4	GENMAX	345.0	481.3	139.5
60063 TS.MUR3	150.00	60081*TBAGCI3A	150.00 1	SINGLE 11	177.2	180.7	100.5
60088 TADAPA12	400.00	60091*TGEBZE11	400.00 1	SINGLE 19	1046.8	1022.9	102.1
60063 TS.MUR3	150.00	60081*TBAGCI3A	150.00 1	SINGLE 20	177.2	180.2	100.1
60088 TADAPA12	400.00	60091*TGEBZE11	400.00 1	SINGLE 24	1046.8	1210.0	121.1
60091*TGEBZE11	400.00	60143 TDUMYG1	400.00 1	SINGLE 24	1057.2	1035.5	102.6
60201*TBOZUY3	150.00	60212 TSEYIT3	150.00 1	SINGLE 30	177.2	190.7	105.3
60088 TADAPA12	400.00	60091*TGEBZE11	400.00 1	SINGLE 36	1046.8	1085.9	108.3
60097*TAKCAK3	150.00	60575 TEREGL32	150.00 1	SINGLE 40	128.6	172.7	129.8
60088 TADAPA12	400.00	60091*TGEBZE11	400.00 1	SINGLE 42	1046.8	1128.9	113.4
60232*TBORNO3	150.00	60259 TUNIVE3	150.00 1	SINGLE 57	177.2	185.2	102.7
60612 THOPA 3	150.00	61103*THOPA 2	220.00 1	SINGLE 134	150.0	173.5	115.7
60612 THOPA 3	150.00	61103*THOPA 2	220.00 2	SINGLE 134	180.0	183.3	101.8
60634*TAGRI 3	150.00	60647 THORAS3	150.00 1	SINGLE 135	128.6	133.2	135.3
60642*TERZUR31	150.00	60643 TERZUR32	150.00 2	SINGLE 135	128.6	174.2	139.7
60747 TADILC3	150.00	60758*TERCIS3	150.00 1	SINGLE 135	128.6	118.5	116.2
60634 TAGRI 3	150.00	60758*TERCIS3	150.00 1	SINGLE 137	128.6	118.9	102.2
60784*TBATMA32	150.00	60801 TBATMA3M	150.00 1	SINGLE 160	240.6	255.4	107.5

MONITORED VOLTAGE REPORT:

SYSTEM	CONTINGENCY	<-------- B U S	-------->	V-CONT	V-INIT	V-MAX	V-MIN
'6-400 '	RANGE SINGLE 8	60032 TBABAE12	400.00	1.05506	1.03270	1.05000	0.95000
'6-400 '	RANGE SINGLE 82	60394 THATAY1	400.00	0.94600	0.99096	1.05000	0.95000
'6-400 '	RANGE SINGLE 135	60656 TAKYAC11	400.00	0.71809	0.96498	1.05000	0.95000
'6-400 '	RANGE SINGLE 135	60797 TVAN 1	400.00	0.71910	0.95036	1.05000	0.95000
'6-400 '	RANGE SINGLE 135	60798 TCIZRE1	400.00	0.94472	0.98443	1.05000	0.95000
'6-400 '	RANGE SINGLE 135	60799 TPS3 1	400.00	0.94817	0.98931	1.05000	0.95000
'6-400 '	RANGE SINGLE 137	60797 TVAN 1	400.00	0.77371	0.95036	1.05000	0.95000
'6-400 '	RANGE SINGLE 143	60722 TURFA 1	400.00	0.91658	0.98131	1.05000	0.95000
'6-400 '	RANGE SINGLE 143	60729 TKIZIL1	400.00	0.92868	0.97248	1.05000	0.95000
'6-400 '	RANGE SINGLE 143	60783 TBATMA1	400.00	0.94011	0.97125	1.05000	0.95000
'6-400 '	RANGE SINGLE 160	60729 TKIZIL1	400.00	0.93557	0.97248	1.05000	0.95000
'6-400 '	RANGE SINGLE 160	60745 TDIYAR1	400.00	0.91917	0.97291	1.05000	0.95000
'6-400 '	RANGE SINGLE 160	60783 TBATMA1	400.00	0.92854	0.97125	1.05000	0.95000
'6-400 '	RANGE SINGLE 168	60798 TCIZRE1	400.00	0.92462	0.98443	1.05000	0.95000

BLACKSEA REGIONAL MODEL
SUMMER MINIMUM LOAD 2010

<----------------- MONITORED BRANCH		----------------->		CONTINGENCY	RATING	FLOW	%
60292 TDALAM3	150.00	69755*G-DALMSK1	6.3000 1	BASE CASE	12.0	12.9	107.1
60097*TAKCAK3	150.00	60575 TEREGL32	150.00 1	SINGLE 40	128.6	157.7	118.8
60665 TELBIS11	400.00	69544*G-4ELBIS1	21.000 1	SINGLE 65	345.0	429.3	124.4

MONITORED VOLTAGE REPORT:

SYSTEM	CONTINGENCY	<-------- B U S	-------->	V-CONT	V-INIT	V-MAX	V-MIN
'6-400 '	RANGE SINGLE 8	60032 TBABAE12	400.00	1.06477	1.02296	1.05000	0.95000
'6-400 '	RANGE SINGLE 73	60322 TVARSA1	400.00	0.94841	0.97415	1.05000	0.95000
'6-400 '	RANGE SINGLE 125	60530 TKONYA1	400.00	0.93919	0.96443	1.05000	0.95000
'6-400 '	RANGE SINGLE 169	60798 TCIZRE1	400.00	1.06116	1.00273	1.05000	0.95000
'6-400 '	RANGE SINGLE 169	60799 TPS3 1	400.00	1.06283	1.01176	1.05000	0.95000

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CONTINGENCY LEGEND:
LABEL          EVENTS
INT-197      : OPEN LINE FROM BUS 197 [XMI_BA11     400.00] TO BUS 12471 [VMI3  11     400.00] CKT 1
               OPEN LINE FROM BUS 197 [XMI_BA11     400.00] TO BUS 60032 [TBABAE12     400.00] CKT 1
INT-198      : OPEN LINE FROM BUS 198 [XMI_HA11     400.00] TO BUS 12471 [VMI3  11     400.00] CKT 1
               OPEN LINE FROM BUS 198 [XMI_HA11     400.00] TO BUS 60002 [THAMIT1      400.00] CKT 1
INT-215      : OPEN LINE FROM BUS 215 [XFI_BA11     400.00] TO BUS 60000 [TBABAE11     400.00] CKT 1
               OPEN LINE FROM BUS 215 [XFI_BA11     400.00] TO BUS 80258 [GKEXRU1      400.00] CKT 1
INT-542      : OPEN LINE FROM BUS 542 [XGE_TR21     220.00] TO BUS 20017 [6BATUM2      220.00] CKT 1
               OPEN LINE FROM BUS 542 [XGE_TR21     220.00] TO BUS 61103 [THOPA 2      220.00] CKT 1
GENMAX       : OPEN LINE FROM BUS 60979 [60979        21.000] TO BUS 60384 [TISKEN1      400.00] CKT 1
               OPEN LINE FROM BUS 60979 [60979        21.000] TO BUS 60384 [TISKEN1      400.00] CKT 2
SINGLE 1     : OPEN LINE FROM BUS 215 [XFI_BA11     400.00] TO BUS 60000 [TBABAE11     400.00] CKT 1
SINGLE 2     : OPEN LINE FROM BUS 60000 [TBABAE11     400.00] TO BUS 60001 [TUNIMR1      400.00] CKT 1
SINGLE 3     : OPEN LINE FROM BUS 60000 [TBABAE11     400.00] TO BUS 60002 [THAMIT1      400.00] CKT 1
SINGLE 4     : OPEN LINE FROM BUS 60001 [TUNIMR1      400.00] TO BUS 60031 [TKAPTA1      400.00] CKT 1
SINGLE 5     : OPEN LINE FROM BUS 60001 [TUNIMR1      400.00] TO BUS 60038 [TIKITE1      400.00] CKT 1
SINGLE 6     : OPEN LINE FROM BUS 60001 [TUNIMR1      400.00] TO BUS 60039 [THABIP1      400.00] CKT 1
SINGLE 7     : OPEN LINE FROM BUS 60002 [THAMIT1      400.00] TO BUS 60031 [TKAPTA1      400.00] CKT 1
SINGLE 8     : OPEN LINE FROM BUS 60002 [THAMIT1      400.00] TO BUS 60032 [TBABAE12     400.00] CKT 1
SINGLE 9     : OPEN LINE FROM BUS 60002 [THAMIT1      400.00] TO BUS 60037 [TALIBE1      400.00] CKT 1
SINGLE 10    : OPEN LINE FROM BUS 60036 [TAMBAR1      400.00] TO BUS 60038 [TIKITE1      400.00] CKT 1
SINGLE 11    : OPEN LINE FROM BUS 60037 [TALIBE1      400.00] TO BUS 60079 [TYILDI1      400.00] CKT 1
SINGLE 12    : OPEN LINE FROM BUS 60037 [TALIBE1      400.00] TO BUS 60082 [TATISA1      400.00] CKT 1
SINGLE 13    : OPEN LINE FROM BUS 60037 [TALIBE1      400.00] TO BUS 60094 [TUMRAN1      400.00] CKT 1
SINGLE 14    : OPEN LINE FROM BUS 60037 [TALIBE1      400.00] TO BUS 60131 [TBEYKO1      400.00] CKT 1
SINGLE 15    : OPEN LINE FROM BUS 60038 [TIKITE1      400.00] TO BUS 60039 [THABIP1      400.00] CKT 1
SINGLE 16    : OPEN LINE FROM BUS 60038 [TIKITE1      400.00] TO BUS 60041 [TDAVUT1      400.00] CKT 1
SINGLE 17    : OPEN LINE FROM BUS 60038 [TIKITE1      400.00] TO BUS 60082 [TATISA1      400.00] CKT 1
SINGLE 18    : OPEN LINE FROM BUS 60039 [THABIP1      400.00] TO BUS 60085 [TZEKER1      400.00] CKT 1
SINGLE 19    : OPEN LINE FROM BUS 60039 [THABIP1      400.00] TO BUS 60129 [TADAPA11     400.00] CKT 1
SINGLE 20    : OPEN LINE FROM BUS 60041 [TDAVUT1      400.00] TO BUS 60079 [TYILDI1      400.00] CKT 1
SINGLE 21    : OPEN LINE FROM BUS 60085 [TZEKER1      400.00] TO BUS 60093 [TPASAK1      400.00] CKT 1
SINGLE 22    : OPEN LINE FROM BUS 60088 [TADAPA12     400.00] TO BUS 60090 [TAKYAC1      400.00] CKT 1
SINGLE 23    : OPEN LINE FROM BUS 60088 [TADAPA12     400.00] TO BUS 60091 [TGEBZE11     400.00] CKT 1
SINGLE 24    : OPEN LINE FROM BUS 60088 [TADAPA12     400.00] TO BUS 60091 [TGEBZE11     400.00] CKT 2
SINGLE 25    : OPEN LINE FROM BUS 60088 [TADAPA12     400.00] TO BUS 60092 [TOSMAN1      400.00] CKT 1
SINGLE 26    : OPEN LINE FROM BUS 60088 [TADAPA12     400.00] TO BUS 60143 [TDUMYG1      400.00] CKT 1
SINGLE 27    : OPEN LINE FROM BUS 60088 [TADAPA12     400.00] TO BUS 60148 [TGEBZE12     400.00] CKT 1
SINGLE 28    : OPEN LINE FROM BUS 60088 [TADAPA12     400.00] TO BUS 60166 [TBURSA12     400.00] CKT 1
SINGLE 29    : OPEN LINE FROM BUS 60088 [TADAPA12     400.00] TO BUS 60400 [TCAYIR1      400.00] CKT 1
SINGLE 30    : OPEN LINE FROM BUS 60088 [TADAPA12     400.00] TO BUS 60401 [TGOKCE1      400.00] CKT 1
SINGLE 31    : OPEN LINE FROM BUS 60089 [TAKYAC13     400.00] TO BUS 60090 [TAKYAC1      400.00] CKT 1
SINGLE 32    : OPEN LINE FROM BUS 60089 [TAKYAC13     400.00] TO BUS 60404 [TTEMEL1      400.00] CKT 1
SINGLE 33    : OPEN LINE FROM BUS 60091 [TGEBZE11     400.00] TO BUS 60093 [TPASAK1      400.00] CKT 1
SINGLE 34    : OPEN LINE FROM BUS 60091 [TGEBZE11     400.00] TO BUS 60094 [TUMRAN1      400.00] CKT 1
SINGLE 35    : OPEN LINE FROM BUS 60091 [TGEBZE11     400.00] TO BUS 60094 [TUMRAN1      400.00] CKT 2
SINGLE 36    : OPEN LINE FROM BUS 60091 [TGEBZE11     400.00] TO BUS 60143 [TDUMYG1      400.00] CKT 1
SINGLE 37    : OPEN LINE FROM BUS 60092 [TOSMAN1      400.00] TO BUS 60129 [TADAPA11     400.00] CKT 1
SINGLE 38    : OPEN LINE FROM BUS 60092 [TOSMAN1      400.00] TO BUS 60403 [TSINCA1      400.00] CKT 1
SINGLE 39    : OPEN LINE FROM BUS 60092 [TOSMAN1      400.00] TO BUS 60449 [TCANKI1      400.00] CKT 1
SINGLE 40    : OPEN LINE FROM BUS 60092 [TOSMAN1      400.00] TO BUS 60563 [TEREGL1      400.00] CKT 1
SINGLE 41    : OPEN LINE FROM BUS 60093 [TPASAK1      400.00] TO BUS 60131 [TBEYKO1      400.00] CKT 1
SINGLE 42    : OPEN LINE FROM BUS 60093 [TPASAK1      400.00] TO BUS 60148 [TGEBZE12     400.00] CKT 1
SINGLE 43    : OPEN LINE FROM BUS 60129 [TADAPA11     400.00] TO BUS 60148 [TGEBZE12     400.00] CKT 1
SINGLE 44    : OPEN LINE FROM BUS 60143 [TDUMYG1      400.00] TO BUS 60166 [TBURSA12     400.00] CKT 1
SINGLE 45    : OPEN LINE FROM BUS 60148 [TGEBZE12     400.00] TO BUS 60404 [TTEMEL1      400.00] CKT 1
SINGLE 46    : OPEN LINE FROM BUS 60149 [TBURSA11     400.00] TO BUS 60166 [TBURSA12     400.00] CKT 1
SINGLE 47    : OPEN LINE FROM BUS 60149 [TBURSA11     400.00] TO BUS 60177 [TBALIK1      400.00] CKT 1
SINGLE 48    : OPEN LINE FROM BUS 60149 [TBURSA11     400.00] TO BUS 60196 [TTUNCB1      400.00] CKT 1
SINGLE 49    : OPEN LINE FROM BUS 60166 [TBURSA12     400.00] TO BUS 60194 [TKARAB1      400.00] CKT 1
SINGLE 50    : OPEN LINE FROM BUS 60177 [TBALIK1      400.00] TO BUS 60266 [TSOMA 1      400.00] CKT 1
SINGLE 51    : OPEN LINE FROM BUS 60194 [TKARAB1      400.00] TO BUS 60266 [TSOMA 1      400.00] CKT 1
SINGLE 52    : OPEN LINE FROM BUS 60195 [TSEYIT1      400.00] TO BUS 60196 [TTUNCB1      400.00] CKT 1
SINGLE 53    : OPEN LINE FROM BUS 60195 [TSEYIT1      400.00] TO BUS 60224 [TISIKL1      400.00] CKT 1
SINGLE 54    : OPEN LINE FROM BUS 60195 [TSEYIT1      400.00] TO BUS 60401 [TGOKCE1      400.00] CKT 1
SINGLE 55    : OPEN LINE FROM BUS 60195 [TSEYIT1      400.00] TO BUS 60558 [TAFYON1      400.00] CKT 1
SINGLE 56    : OPEN LINE FROM BUS 60223 [TALIAG1      400.00] TO BUS 60224 [TISIKL1      400.00] CKT 1
SINGLE 57    : OPEN LINE FROM BUS 60223 [TALIAG1      400.00] TO BUS 60225 [TUZUND1      400.00] CKT 1
SINGLE 58    : OPEN LINE FROM BUS 60223 [TALIAG1      400.00] TO BUS 60260 [TALIAD1      400.00] CKT 1
SINGLE 59    : OPEN LINE FROM BUS 60223 [TALIAG1      400.00] TO BUS 60260 [TALIAD1      400.00] CKT 2
SINGLE 60    : OPEN LINE FROM BUS 60223 [TALIAG1      400.00] TO BUS 60266 [TSOMA 1      400.00] CKT 1
SINGLE 61    : OPEN LINE FROM BUS 60223 [TALIAG1      400.00] TO BUS 60281 [TMANIS1      400.00] CKT 1
SINGLE 62    : OPEN LINE FROM BUS 60224 [TISIKL1      400.00] TO BUS 60281 [TMANIS1      400.00] CKT 1
SINGLE 63    : OPEN LINE FROM BUS 60224 [TISIKL1      400.00] TO BUS 60283 [TYATAG1      400.00] CKT 1
SINGLE 64    : OPEN LINE FROM BUS 60224 [TISIKL1      400.00] TO BUS 60283 [TYATAG1      400.00] CKT 2
SINGLE 65    : OPEN LINE FROM BUS 60225 [TUZUND1      400.00] TO BUS 60261 [TRES  1      400.00] CKT 1
SINGLE 66    : OPEN LINE FROM BUS 60225 [TUZUND1      400.00] TO BUS 60318 [TGERME1      400.00] CKT 1
SINGLE 67    : OPEN LINE FROM BUS 60282 [TKEMER1      400.00] TO BUS 60283 [TYATAG1      400.00] CKT 1
SINGLE 68    : OPEN LINE FROM BUS 60282 [TKEMER1      400.00] TO BUS 60284 [TYENIK1      400.00] CKT 1
SINGLE 69    : OPEN LINE FROM BUS 60283 [TYATAG1      400.00] TO BUS 60284 [TYENIK1      400.00] CKT 1
SINGLE 70    : OPEN LINE FROM BUS 60283 [TYATAG1      400.00] TO BUS 60313 [TDENIZ1      400.00] CKT 1
SINGLE 71    : OPEN LINE FROM BUS 60284 [TYENIK1      400.00] TO BUS 60318 [TGERME1      400.00] CKT 1
SINGLE 72    : OPEN LINE FROM BUS 60313 [TDENIZ1      400.00] TO BUS 60322 [TVARSA1      400.00] CKT 1
SINGLE 73    : OPEN LINE FROM BUS 60321 [TOYMAP1      400.00] TO BUS 60322 [TVARSA1      400.00] CKT 1
SINGLE 74    : OPEN LINE FROM BUS 60321 [TOYMAP1      400.00] TO BUS 60322 [TVARSA1      400.00] CKT 2
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SINGLE 75    : OPEN LINE FROM BUS 60321 [TOYMAP1     400.00] TO BUS 60515 [TSEYDI1     400.00] CKT 1
SINGLE 76    : OPEN LINE FROM BUS 60339 [TERMEN1     400.00] TO BUS 60395 [TMERSI1     400.00] CKT 1
SINGLE 77    : OPEN LINE FROM BUS 60339 [TERMEN1     400.00] TO BUS 60515 [TSEYDI1     400.00] CKT 1
SINGLE 78    : OPEN LINE FROM BUS 60342 [TADANA1     400.00] TO BUS 60343 [TERZIN1     400.00] CKT 1
SINGLE 79    : OPEN LINE FROM BUS 60342 [TADANA1     400.00] TO BUS 60384 [TISKEN1     400.00] CKT 1
SINGLE 80    : OPEN LINE FROM BUS 60342 [TADANA1     400.00] TO BUS 60514 [TCASEY1     400.00] CKT 1
SINGLE 81    : OPEN LINE FROM BUS 60343 [TERZIN1     400.00] TO BUS 60384 [TISKEN1     400.00] CKT 1
SINGLE 82    : OPEN LINE FROM BUS 60343 [TERZIN1     400.00] TO BUS 60394 [THATAY1     400.00] CKT 1
SINGLE 83    : OPEN LINE FROM BUS 60343 [TERZIN1     400.00] TO BUS 60663 [TANDIR1     400.00] CKT 1
SINGLE 84    : OPEN LINE FROM BUS 60343 [TERZIN1     400.00] TO BUS 60671 [TG.ANT1     400.00] CKT 1
SINGLE 85    : OPEN LINE FROM BUS 60384 [TISKEN1     400.00] TO BUS 60395 [TMERSI1     400.00] CKT 1
SINGLE 86    : OPEN LINE FROM BUS 60400 [TCAYIR1     400.00] TO BUS 60403 [TSINCA1     400.00] CKT 1
SINGLE 87    : OPEN LINE FROM BUS 60401 [TGOKCE1     400.00] TO BUS 60402 [TGOLBA1     400.00] CKT 1
SINGLE 88    : OPEN LINE FROM BUS 60402 [TGOLBA1     400.00] TO BUS 60403 [TSINCA1     400.00] CKT 1
SINGLE 89    : OPEN LINE FROM BUS 60402 [TGOLBA1     400.00] TO BUS 60484 [TCAKAY11    400.00] CKT 1
SINGLE 90    : OPEN LINE FROM BUS 60402 [TGOLBA1     400.00] TO BUS 60485 [TCAKAY12    400.00] CKT 1
SINGLE 91    : OPEN LINE FROM BUS 60403 [TSINCA1     400.00] TO BUS 60404 [TTEMEL1     400.00] CKT 1
SINGLE 92    : OPEN LINE FROM BUS 60403 [TSINCA1     400.00] TO BUS 60415 [TBAGLU1     400.00] CKT 1
SINGLE 93    : OPEN LINE FROM BUS 60403 [TSINCA1     400.00] TO BUS 60481 [TCAAVA12    400.00] CKT 1
SINGLE 94    : OPEN LINE FROM BUS 60403 [TSINCA1     400.00] TO BUS 60482 [TCAAVA13    400.00] CKT 1
SINGLE 95    : OPEN LINE FROM BUS 60404 [TTEMEL1     400.00] TO BUS 60475 [TAGACC12    400.00] CKT 1
SINGLE 96    : OPEN LINE FROM BUS 60404 [TTEMEL1     400.00] TO BUS 60477 [TAGACC14    400.00] CKT 1
SINGLE 97    : OPEN LINE FROM BUS 60415 [TBAGLU1     400.00] TO BUS 60447 [TCAAYA12    400.00] CKT 1
SINGLE 98    : OPEN LINE FROM BUS 60446 [TCAAYA11    400.00] TO BUS 60449 [TCANKI1     400.00] CKT 1
SINGLE 99    : OPEN LINE FROM BUS 60446 [TCAAYA11    400.00] TO BUS 60450 [TKAYAB1     400.00] CKT 1
SINGLE 100   : OPEN LINE FROM BUS 60447 [TCAAYA12    400.00] TO BUS 60450 [TKAYAB1     400.00] CKT 1
SINGLE 101   : OPEN LINE FROM BUS 60448 [TCAAYA13    400.00] TO BUS 60450 [TKAYAB1     400.00] CKT 1
SINGLE 102   : OPEN LINE FROM BUS 60448 [TCAAYA13    400.00] TO BUS 60675 [TSIVAS1     400.00] CKT 1
SINGLE 103   : OPEN LINE FROM BUS 60450 [TKAYAB1     400.00] TO BUS 60561 [TALTIN1     400.00] CKT 1
SINGLE 104   : OPEN LINE FROM BUS 60450 [TKAYAB1     400.00] TO BUS 60562 [TCARSA1     400.00] CKT 1
SINGLE 105   : OPEN LINE FROM BUS 60474 [TAGACC11    400.00] TO BUS 60475 [TAGACC12    400.00] CKT 1
SINGLE 106   : OPEN LINE FROM BUS 60474 [TAGACC11    400.00] TO BUS 60487 [TYESIL1     400.00] CKT 1
SINGLE 107   : OPEN LINE FROM BUS 60476 [TAGACC13    400.00] TO BUS 60477 [TAGACC14    400.00] CKT 1
SINGLE 108   : OPEN LINE FROM BUS 60476 [TAGACC13    400.00] TO BUS 60487 [TYESIL1     400.00] CKT 1
SINGLE 109   : OPEN LINE FROM BUS 60478 [TAVANO11    400.00] TO BUS 60480 [TCAAVA11    400.00] CKT 1
SINGLE 110   : OPEN LINE FROM BUS 60478 [TAVANO11    400.00] TO BUS 60481 [TCAAVA12    400.00] CKT 1
SINGLE 111   : OPEN LINE FROM BUS 60479 [TAVANO12    400.00] TO BUS 60482 [TCAAVA13    400.00] CKT 1
SINGLE 112   : OPEN LINE FROM BUS 60479 [TAVANO12    400.00] TO BUS 60483 [TCAAVA14    400.00] CKT 1
SINGLE 113   : OPEN LINE FROM BUS 60480 [TCAAVA11    400.00] TO BUS 60665 [TELBIS11    400.00] CKT 1
SINGLE 114   : OPEN LINE FROM BUS 60483 [TCAAVA14    400.00] TO BUS 60666 [TELBIS12    400.00] CKT 1
SINGLE 115   : OPEN LINE FROM BUS 60484 [TCAKAY11    400.00] TO BUS 60486 [TKAYSE1     400.00] CKT 1
SINGLE 116   : OPEN LINE FROM BUS 60485 [TCAKAY12    400.00] TO BUS 60486 [TKAYSE1     400.00] CKT 1
SINGLE 117   : OPEN LINE FROM BUS 60486 [TKAYSE1     400.00] TO BUS 60665 [TELBIS11    400.00] CKT 1
SINGLE 118   : OPEN LINE FROM BUS 60486 [TKAYSE1     400.00] TO BUS 60674 [TKEBAN1     400.00] CKT 1
SINGLE 119   : OPEN LINE FROM BUS 60486 [TKAYSE1     400.00] TO BUS 60674 [TKEBAN1     400.00] CKT 2
SINGLE 120   : OPEN LINE FROM BUS 60487 [TYESIL1     400.00] TO BUS 60513 [TTUFAN1     400.00] CKT 1
SINGLE 121   : OPEN LINE FROM BUS 60487 [TYESIL1     400.00] TO BUS 60530 [TKONYA1     400.00] CKT 1
SINGLE 122   : OPEN LINE FROM BUS 60487 [TYESIL1     400.00] TO BUS 60668 [TGOKCA12    400.00] CKT 1
SINGLE 123   : OPEN LINE FROM BUS 60487 [TYESIL1     400.00] TO BUS 60670 [TGOKCA14    400.00] CKT 1
SINGLE 124   : OPEN LINE FROM BUS 60513 [TTUFAN1     400.00] TO BUS 60666 [TELBIS12    400.00] CKT 1
SINGLE 125   : OPEN LINE FROM BUS 60514 [TCASEY1     400.00] TO BUS 60515 [TSEYDI1     400.00] CKT 1
SINGLE 126   : OPEN LINE FROM BUS 60515 [TSEYDI1     400.00] TO BUS 60530 [TKONYA1     400.00] CKT 1
SINGLE 127   : OPEN LINE FROM BUS 60515 [TSEYDI1     400.00] TO BUS 60558 [TAFYON1     400.00] CKT 1
SINGLE 128   : OPEN LINE FROM BUS 60561 [TALTIN1     400.00] TO BUS 60562 [TCARSA1     400.00] CKT 1
SINGLE 129   : OPEN LINE FROM BUS 60562 [TCARSA1     400.00] TO BUS 60564 [TH.UGU1     400.00] CKT 1
SINGLE 130   : OPEN LINE FROM BUS 60562 [TCARSA1     400.00] TO BUS 60564 [TH.UGU1     400.00] CKT 2
SINGLE 131   : OPEN LINE FROM BUS 60562 [TCARSA1     400.00] TO BUS 60603 [TTIREB1     400.00] CKT 1
SINGLE 132   : OPEN LINE FROM BUS 60603 [TTIREB1     400.00] TO BUS 60624 [TBORCK1     400.00] CKT 1
SINGLE 133   : OPEN LINE FROM BUS 60624 [TBORCK1     400.00] TO BUS 60625 [TDERIN1     400.00] CKT 1
SINGLE 134   : OPEN LINE FROM BUS 60625 [TDERIN1     400.00] TO BUS 60633 [TERZUR1     400.00] CKT 1
SINGLE 135   : OPEN LINE FROM BUS 60633 [TERZUR1     400.00] TO BUS 60656 [TAKYAC11    400.00] CKT 1
SINGLE 136   : OPEN LINE FROM BUS 60633 [TERZUR1     400.00] TO BUS 60746 [TOZLUC1     400.00] CKT 1
SINGLE 137   : OPEN LINE FROM BUS 60656 [TAKYAC11    400.00] TO BUS 60797 [TVAN  1     400.00] CKT 1
SINGLE 138   : OPEN LINE FROM BUS 60663 [TANDIR1     400.00] TO BUS 60666 [TELBIS12    400.00] CKT 1
SINGLE 139   : OPEN LINE FROM BUS 60664 [TATATU1     400.00] TO BUS 60666 [TELBIS12    400.00] CKT 1
SINGLE 140   : OPEN LINE FROM BUS 60664 [TATATU1     400.00] TO BUS 60667 [TGOKCA11    400.00] CKT 1
SINGLE 141   : OPEN LINE FROM BUS 60664 [TATATU1     400.00] TO BUS 60669 [TGOKCA13    400.00] CKT 1
SINGLE 142   : OPEN LINE FROM BUS 60664 [TATATU1     400.00] TO BUS 60671 [TG.ANT1     400.00] CKT 1
SINGLE 143   : OPEN LINE FROM BUS 60664 [TATATU1     400.00] TO BUS 60722 [TURFA 1     400.00] CKT 1
SINGLE 144   : OPEN LINE FROM BUS 60664 [TATATU1     400.00] TO BUS 60728 [TBIREC1     400.00] CKT 1
SINGLE 145   : OPEN LINE FROM BUS 60664 [TATATU1     400.00] TO BUS 60737 [THILVA1     400.00] CKT 1
SINGLE 146   : OPEN LINE FROM BUS 60665 [TELBIS11    400.00] TO BUS 60666 [TELBIS12    400.00] CKT 1
SINGLE 147   : OPEN LINE FROM BUS 60665 [TELBIS11    400.00] TO BUS 60674 [TKEBAN1     400.00] CKT 1
SINGLE 148   : OPEN LINE FROM BUS 60666 [TELBIS12    400.00] TO BUS 60733 [TELBS21     400.00] CKT 1
SINGLE 149   : OPEN LINE FROM BUS 60666 [TELBIS12    400.00] TO BUS 60733 [TELBS21     400.00] CKT 2
SINGLE 150   : OPEN LINE FROM BUS 60666 [TELBIS12    400.00] TO BUS 60733 [TELBS21     400.00] CKT 3
SINGLE 151   : OPEN LINE FROM BUS 60666 [TELBIS12    400.00] TO BUS 60733 [TELBS21     400.00] CKT 4
SINGLE 152   : OPEN LINE FROM BUS 60667 [TGOKCA11    400.00] TO BUS 60668 [TGOKCA12    400.00] CKT 1
SINGLE 153   : OPEN LINE FROM BUS 60669 [TGOKCA13    400.00] TO BUS 60670 [TGOKCA14    400.00] CKT 1
SINGLE 154   : OPEN LINE FROM BUS 60671 [TG.ANT1     400.00] TO BUS 60728 [TBIREC1     400.00] CKT 1
SINGLE 155   : OPEN LINE FROM BUS 60672 [TKANGA1     400.00] TO BUS 60674 [TKEBAN1     400.00] CKT 1
SINGLE 156   : OPEN LINE FROM BUS 60672 [TKANGA1     400.00] TO BUS 60675 [TSIVAS1     400.00] CKT 1
SINGLE 157   : OPEN LINE FROM BUS 60673 [TKARAK1     400.00] TO BUS 60674 [TKEBAN1     400.00] CKT 1
SINGLE 158   : OPEN LINE FROM BUS 60673 [TKARAK1     400.00] TO BUS 60674 [TKEBAN1     400.00] CKT 2
SINGLE 159   : OPEN LINE FROM BUS 60673 [TKARAK1     400.00] TO BUS 60737 [THILVA1     400.00] CKT 1
SINGLE 160   : OPEN LINE FROM BUS 60673 [TKARAK1     400.00] TO BUS 60745 [TDIYAR1     400.00] CKT 1
SINGLE 161   : OPEN LINE FROM BUS 60674 [TKEBAN1     400.00] TO BUS 60732 [TKEBAN1H    400.00] CKT 1
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 SINGLE 162  : OPEN LINE FROM BUS 60674 [TKEBAN1     400.00] TO BUS 60732 [TKEBAN1H    400.00] CKT 2
 SINGLE 163  : OPEN LINE FROM BUS 60674 [TKEBAN1     400.00] TO BUS 60732 [TKEBAN1H    400.00] CKT 3
 SINGLE 164  : OPEN LINE FROM BUS 60674 [TKEBAN1     400.00] TO BUS 60746 [TOZLUC1     400.00] CKT 1
 SINGLE 165  : OPEN LINE FROM BUS 60722 [TURFA 1     400.00] TO BUS 60729 [TKIZIL1     400.00] CKT 1
 SINGLE 166  : OPEN LINE FROM BUS 60729 [TKIZIL1     400.00] TO BUS 60783 [TBATMA1     400.00] CKT 1
 SINGLE 167  : OPEN LINE FROM BUS 60745 [TDIYAR1     400.00] TO BUS 60783 [TBATMA1     400.00] CKT 1
 SINGLE 168  : OPEN LINE FROM BUS 60798 [TCIZRE1     400.00] TO BUS 60799 [TPS3  1     400.00] CKT 1
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4.6.7. Ukraine

BLACKSEA REGIONAL MODEL
WINTER MAXIMUM LOAD 2010

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 ACCC OVERLOAD REPORT: MONITORED BRANCHES AND INTERFACES LOADED ABOVE 100.0 % OF RATING SET A
                       CONTINGENCY CASE LOADING NOT CHECKED UNLESS IT DIFFERS FROM ITS BASE CASE LOADING BY   10.0
MVA (MW FOR INTERFACES)
                       CONTINGENCY CASE LOADING NOT CHECKED UNLESS IT EXCEEDS ITS BASE CASE LOADING BY  5.0
PERCENT OF RATING SET A
 ACCC VOLTAGE  REPORT: VOLTAGE BAND CHECK IN CONTINGENCY CASES SKIPPED FOR ANY BUS WITHIN 0.02000 OF ITS BASE CASE
VOLTAGE MAGNITUDE

 AC CONTINGENCY RESULTS FILE:  D:\miksa\0\BlackSea\0report\UA\ua.acc
 DISTRIBUTION FACTOR FILE:     D:\miksa\0\BlackSea\0report\UA\UA.dfx
 SUBSYSTEM DESCRIPTION FILE:   D:\miksa\0\BlackSea\0report\UA\UA.sub
 MONITORED ELEMENT FILE:       D:\miksa\0\BlackSea\0report\UA\UA.mon
 CONTINGENCY DESCRIPTION FILE: D:\miksa\0\BlackSea\0report\UA\ukraine.con

<----------------- MONITORED BRANCH -----------------> CONTINGENCY    RATING     FLOW       %
  70520*UJUAZS81    330.00  70521 UJUAZS31    150.00 0  BASE CASE       250.0    283.0    113.2
  70380*UZAPAR01    750.00  70381 UZAP7S81    330.00 2  45-S           1000.0   1216.1    121.6
  70308 UDNEPR81    330.00  70356*UDNEPR01    750.00 2  46-S           1000.0   1112.6    111.3
  70520*UJUAZS81    330.00  70521 UJUAZS31    150.00 0  57-S            250.0    320.2    128.1
  70520*UJUAZS81    330.00  70521 UJUAZS31    150.00 0  58-S            250.0    351.8    140.7

 MONITORED VOLTAGE REPORT:
 SYSTEM                        CONTINGENCY  <-------- B U S -------->  V-CONT   V-INIT   V-MAX    V-MIN
 OWNER 703                  RANGE BASE CASE     70256 UKRJUK31    150.00 1.07623 1.07623 1.05000 0.95000
 OWNER 703                  RANGE BASE CASE     70269 ULOZ1531    150.00 0.93842 0.93842 1.05000 0.95000
 OWNER 703                  RANGE BASE CASE     70311 UDGEC131    150.00 1.05940 1.05940 1.05000 0.95000
 OWNER 703                  RANGE BASE CASE     70320 UDDZ_132    150.00 1.05132 1.05132 1.05000 0.95000
 OWNER 703                  RANGE BASE CASE     70324 UDD_TE31    150.00 1.05646 1.05646 1.05000 0.95000
 OWNER 703                  RANGE BASE CASE     70329 UKRGEC31    150.00 1.08000 1.08000 1.05000 0.95000
 OWNER 703                  RANGE BASE CASE     70345 UPOBUZ31    150.00 1.05474 1.05474 1.05000 0.95000
 OWNER 703                  RANGE BASE CASE     70347 UPROME31    150.00 1.06000 1.06000 1.05000 0.95000
 OWNER 703                  RANGE BASE CASE     70355 UMELIT31    150.00 1.05490 1.05490 1.05000 0.95000
 OWNER 703                  RANGE BASE CASE     70521 UJUAZS31    150.00 1.05538 1.05538 1.05000 0.95000
 OWNER 703                  RANGE BASE CASE     70524 UCENTR31    150.00 0.94800 0.94800 1.05000 0.95000
 OWNER 703                  RANGE BASE CASE     70533 UNTROI31    150.00 0.94948 0.94948 1.05000 0.95000
 OWNER 703                  RANGE BASE CASE     70535 USNIGI31    150.00 0.94441 0.94441 1.05000 0.95000
 OWNER 700                  RANGE 8-S           70242 USEVUK01    750.00 0.89461 0.99421 1.05000 0.92000
 OWNER 700                  RANGE 33-S          70703 UCAEC_01    750.00 0.85305 0.97259 1.05000 0.92000
 OWNER 700                  RANGE 34-S          70599 UJUAZS01    750.00 0.91018 0.95903 1.05000 0.92000
 OWNER 700                  RANGE 37-S          70006 UJDONB01    750.00 0.91670 0.95680 1.05000 0.92000
 OWNER 703                  RANGE 44-S          70315 UNIKOP32    150.00 1.07409 1.04075 1.05000 0.95000
 OWNER 703                  RANGE 44-S          70337 UFERRO31    150.00 1.05222 1.01516 1.05000 0.95000
 OWNER 703                  RANGE 44-S          70387 UNIKOP31    150.00 1.07409 1.04075 1.05000 0.95000
 OWNER 708                  RANGE 56-S          70530 UKOTOV81    330.00 0.87228 0.98442 1.10000 0.88000
 OWNER 703                  RANGE 57-S          70503 UTRIHA31    150.00 0.94959 0.97986 1.05000 0.95000
 OWNER 703                  RANGE 57-S          70516 UHNPZ_31    150.00 0.93607 0.95684 1.05000 0.95000
 OWNER 703                  RANGE 57-S          70524 UCENTR31    150.00 0.92046 0.94800 1.05000 0.95000
 OWNER 703                  RANGE 57-S          70535 USNIGI31    150.00 0.91633 0.94441 1.05000 0.95000
 OWNER 703                  RANGE 58-S          70392 UBERDN31    150.00 0.93019 0.97327 1.05000 0.95000
 OWNER 703                  RANGE 58-S          70503 UTRIHA31    150.00 0.90447 0.97986 1.05000 0.95000
 OWNER 703                  RANGE 58-S          70516 UHNPZ_31    150.00 0.89436 0.95684 1.05000 0.95000
 OWNER 703                  RANGE 58-S          70524 UCENTR31    150.00 0.87269 0.94800 1.05000 0.95000
 OWNER 703                  RANGE 58-S          70526 UNIKOL31    150.00 0.90637 0.98028 1.05000 0.95000
 OWNER 703                  RANGE 58-S          70533 UNTROI31    150.00 0.90270 0.94948 1.05000 0.95000
 OWNER 703                  RANGE 58-S          70535 USNIGI31    150.00 0.86700 0.94441 1.05000 0.95000
 OWNER 703                  RANGE 58-S          70536 UNIKOS31    150.00 0.91001 0.96554 1.05000 0.95000
 OWNER 703                  RANGE 58-S          70550 UHERSO31    150.00 0.92129 0.98131 1.05000 0.95000
 OWNER 708                  RANGE 58-S          70419 USIMFE81    330.00 0.84925 0.91509 1.10000 0.88000
 OWNER 708                  RANGE 58-S          70423 UKBURU81    330.00 0.86346 0.93184 1.10000 0.88000
 OWNER 708                  RANGE 58-S          70525 UNIKOL81    330.00 0.87795 0.94363 1.10000 0.88000
 OWNER 703                  RANGE 62-S          70269 ULOZ1531    150.00 0.91139 0.93842 1.05000 0.95000
 OWNER 703                  RANGE 62-S          70348 UPRIZO31    150.00 0.92969 0.96403 1.05000 0.95000
 OWNER 703                  RANGE 62-S          70369 UPAVLO31    150.00 0.93826 0.97488 1.05000 0.95000
```

BLACKSEA REGIONAL MODEL
SUMMER MINIMUM LOAD 2010

```
<----------------- MONITORED BRANCH -----------------> CONTINGENCY    RATING     FLOW       %
  70313*UZAEC_01    750.00  70338 UZAEC_81    330.00 0  37-S           1000.0   1035.7    103.6
```

```
 70380*UZAPAR01    750.00  70381 UZAP7S81    330.00 2  45-S          1000.0   1164.0    116.4
 70308 UDNEPR81    330.00  70356*UDNEPR01    750.00 2  46-S          1000.0   1070.5    107.0

MONITORED VOLTAGE REPORT:
SYSTEM                       CONTINGENCY  <-------- B U S -------->  V-CONT   V-INIT   V-MAX    V-MIN
OWNER 703               RANGE BASE CASE     70236 UKRMTC31    150.00  1.05232  1.05232  1.05000  0.95000
OWNER 703               RANGE BASE CASE     70345 UPOBUZ31    150.00  1.05879  1.05879  1.05000  0.95000
OWNER 703               RANGE BASE CASE     70355 UMELIT31    150.00  1.06787  1.06787  1.05000  0.95000
OWNER 703               RANGE BASE CASE     70521 UJUAZS31    150.00  1.06198  1.06198  1.05000  0.95000
OWNER 703               RANGE BASE CASE     70532 UPERV131    150.00  1.05150  1.05150  1.05000  0.95000
OWNER 703               RANGE BASE CASE     70740 UUMANJ31    150.00  1.06329  1.06329  1.05000  0.95000
OWNER 703               RANGE BASE CASE     70763 UTALJN31    150.00  1.06284  1.06284  1.05000  0.95000
OWNER 702               RANGE BASE CASE     70502 UTRIHA21    220.00  1.11645  1.11645  1.10000  0.82000
OWNER 702               RANGE 9-S           70016 UVELIK21    220.00  1.13006  1.07420  1.10000  0.82000
OWNER 700               RANGE 33-S          70703 UCAEC_01    750.00  0.91396  0.99868  1.05000  0.92000
OWNER 700               RANGE 38-S          70380 UZAPAR01    750.00  0.91552  0.93893  1.05000  0.92000

CONTINGENCY LEGEND:
LABEL         EVENTS
1-S          : OPEN BRANCH FROM BUS 78 [XSA_MU11    400.00] TO BUS 70919 [UMUKAC11    400.00] CKT 1
2-S          : OPEN BRANCH FROM BUS 84 [XRO_MU11    400.00] TO BUS 70919 [UMUKAC11    400.00] CKT 1
3-S          : OPEN BRANCH FROM BUS 154 [XKI_MU21    220.00] TO BUS 70917 [UMUKAC21    220.00] CKT 1
4-S          : OPEN BRANCH FROM BUS 155 [XTI_MU21    220.00] TO BUS 70917 [UMUKAC21    220.00] CKT 1
5-S          : OPEN BRANCH FROM BUS 196 [XAL_ZA01    750.00] TO BUS 70995 [UZUKR702    750.00] CKT 1
6-S          : OPEN BRANCH FROM BUS 501 [XPL_UA01    750.00] TO BUS 70808 [UHAEC_01    750.00] CKT 1
7-S          : OPEN BRANCH FROM BUS 504 [XVK_MU11    400.00] TO BUS 70919 [UMUKAC11    400.00] CKT 1
8-S          : OPEN BRANCH FROM BUS 506 [XRU_UA01    750.00] TO BUS 70242 [USEVUK01    750.00] CKT 1
9-S          : OPEN BRANCH FROM BUS 508 [XRU_UA22    220.00] TO BUS 70102 [ULUTEC22    220.00] CKT 1
10-S         : OPEN BRANCH FROM BUS 510 [XRU_UA24    220.00] TO BUS 70127 [UAMVRO21    220.00] CKT 1
11-S         : OPEN BRANCH FROM BUS 511 [XRU_UA91    500.00] TO BUS 70178 [UPOBED91    500.00] CKT 1
12-S         : OPEN BRANCH FROM BUS 512 [XRU_UA92    500.00] TO BUS 70185 [UDONBA91    500.00] CKT 1
13-S         : OPEN BRANCH FROM BUS 513 [XRU_UA81    330.00] TO BUS 70125 [UJOZNA81    330.00] CKT 1
14-S         : OPEN BRANCH FROM BUS 514 [XRU_UA82    330.00] TO BUS 70201 [UZMTZS81    330.00] CKT 1
15-S         : OPEN BRANCH FROM BUS 515 [XRU_UA83    330.00] TO BUS 70211 [ULOSEV81    330.00] CKT 1
16-S         : OPEN BRANCH FROM BUS 516 [XRU_UA84    330.00] TO BUS 70245 [USOSTK81    330.00] CKT 1
17-S         : OPEN BRANCH FROM BUS 517 [XRU_UA85    330.00] TO BUS 70247 [USUMIS81    330.00] CKT 1
18-S         : OPEN BRANCH FROM BUS 518 [XRU_UA86    330.00] TO BUS 70299 [UOTPLO81    330.00] CKT 1
19-S         : OPEN BRANCH FROM BUS 519 [XMD_UA81    330.00] TO BUS 70805 [UDSGEC81    330.00] CKT 1
20-S         : OPEN BRANCH FROM BUS 520 [XMD_UA82    330.00] TO BUS 70508 [UUSATO81    330.00] CKT 1
21-S         : OPEN BRANCH FROM BUS 521 [XMD_UA83    330.00] TO BUS 70512 [UNODES81    330.00] CKT 1
22-S         : OPEN BRANCH FROM BUS 522 [XMD_UA84    330.00] TO BUS 70530 [UKOTOV81    330.00] CKT 1
23-S         : OPEN BRANCH FROM BUS 523 [XMD_UA85    330.00] TO BUS 70530 [UKOTOV81    330.00] CKT 2
24-S         : OPEN BRANCH FROM BUS 524 [XMD_UA86    330.00] TO BUS 70530 [UKOTOV81    330.00] CKT 1
25-S         : OPEN BRANCH FROM BUS 525 [XMD_UA87    330.00] TO BUS 70545 [UARCIZ81    330.00] CKT 1
26-S         : OPEN BRANCH FROM BUS 539 [XUA_BY81    330.00] TO BUS 70727 [UCAEC_81    330.00] CKT 1
27-S         : OPEN BRANCH FROM BUS 540 [XUA_BY82    330.00] TO BUS 70733 [UCERNI81    330.00] CKT 1
28-S         : OPEN BRANCH FROM BUS 70985 [URAEC_01    750.00] TO BUS 70945 [UZUKR701    750.00] CKT 0
29-S         : OPEN BRANCH FROM BUS 70945 [UZUKR701    750.00] TO BUS 70808 [UHAEC_01    750.00] CKT 0
30-S         : OPEN BRANCH FROM BUS 70945 [UZUKR701    750.00] TO BUS 70827 [UVN_7501    750.00] CKT 0
31-S         : OPEN BRANCH FROM BUS 70772 [UKIEV01     750.00] TO BUS 70808 [UHAEC_01    750.00] CKT 0
32-S         : OPEN BRANCH FROM BUS 70772 [UKIEV01     750.00] TO BUS 70827 [UVN_7501    750.00] CKT 0
33-S         : OPEN BRANCH FROM BUS 70772 [UKIEV01     750.00] TO BUS 70703 [UCAEC_01    750.00] CKT 0
34-S         : OPEN BRANCH FROM BUS 70827 [UVN_7501    750.00] TO BUS 70599 [UJUAZS01    750.00] CKT 0
35-S         : OPEN BRANCH FROM BUS 70599 [UJUAZS01    750.00] TO BUS 70356 [UDNEPR01    750.00] CKT 0
36-S         : OPEN BRANCH FROM BUS 70356 [UDNEPR01    750.00] TO BUS 70380 [UZAPAR01    750.00] CKT 0
37-S         : OPEN BRANCH FROM BUS 70313 [UZAEC_01    750.00] TO BUS 70006 [UJDONB01    750.00] CKT 0
38-S         : OPEN BRANCH FROM BUS 70380 [UZAPAR01    750.00] TO BUS 70186 [UDONBA01    750.00] CKT 0
39-S         : OPEN BRANCH FROM BUS 70006 [UJDONB01    750.00] TO BUS 70186 [UDONBA01    750.00] CKT 0
40-S         : OPEN BRANCH FROM BUS 70006 [UJDONB01    750.00] TO BUS 70007 [UJDONB81    330.00] CKT 1
41-S         : OPEN BRANCH FROM BUS 70186 [UDONBA01    750.00] TO BUS 70181 [UDONBA81    330.00] CKT 1
42-S         : OPEN BRANCH FROM BUS 70186 [UDONBA01    750.00] TO BUS 70185 [UDONBA91    500.00] CKT 1
43-S         : OPEN BRANCH FROM BUS 70242 [USEVUK01    750.00] TO BUS 70241 [USEVUK81    330.00] CKT 0
44-S         : OPEN BRANCH FROM BUS 70313 [UZAEC_01    750.00] TO BUS 70338 [UZAEC_81    330.00] CKT 0
45-S         : OPEN BRANCH FROM BUS 70380 [UZAPAR01    750.00] TO BUS 70381 [UZAP7S81    330.00] CKT 1
46-S         : OPEN BRANCH FROM BUS 70356 [UDNEPR01    750.00] TO BUS 70308 [UDNEPR81    330.00] CKT 1
47-S         : OPEN BRANCH FROM BUS 70599 [UJUAZS01    750.00] TO BUS 70520 [UJUAZS81    330.00] CKT 0
48-S         : OPEN BRANCH FROM BUS 70703 [UCAEC_01    750.00] TO BUS 70727 [UCAEC_81    330.00] CKT 1
49-S         : OPEN BRANCH FROM BUS 70772 [UKIEV01     750.00] TO BUS 70773 [UKIEV81     330.00] CKT 0
50-S         : OPEN BRANCH FROM BUS 70827 [UVN_7501    750.00] TO BUS 70826 [UVN_7581    330.00] CKT 0
51-S         : OPEN BRANCH FROM BUS 70808 [UHAEC_01    750.00] TO BUS 70809 [UHAEC_81    330.00] CKT 0
52-S         : OPEN BRANCH FROM BUS 70945 [UZUKR701    750.00] TO BUS 70941 [UZAPUK81    330.00] CKT 1
53-S         : OPEN BRANCH FROM BUS 70985 [URAEC_01    750.00] TO BUS 70902 [URAEC_81    330.00] CKT 0
54-S         : OPEN BRANCH FROM BUS 70508 [UUSATO81    330.00] TO BUS 70523 [UADZAL81    330.00] CKT 1
55-S         : OPEN BRANCH FROM BUS 70508 [UUSATO81    330.00] TO BUS 70523 [UADZAL81    330.00] CKT 2
56-S         : OPEN BRANCH FROM BUS 70822 [ULDTEC81    330.00] TO BUS 70530 [UKOTOV81    330.00] CKT 0
57-S         : OPEN BRANCH FROM BUS 70520 [UJUAZS81    330.00] TO BUS 70523 [UADZAL81    330.00] CKT 0
58-S         : OPEN BRANCH FROM BUS 70520 [UJUAZS81    330.00] TO BUS 70501 [UTRIHA81    330.00] CKT 0
59-S         : OPEN BRANCH FROM BUS 70851 [UDNGAE81    330.00] TO BUS 70822 [ULDTEC81    330.00] CKT 0
60-S         : OPEN BRANCH FROM BUS 70818 [UBAR3 81    330.00] TO BUS 70851 [UDNGAE81    330.00] CKT 0
61-S         : OPEN BRANCH FROM BUS 70381 [UZAP7S81    330.00] TO BUS 70140 [UKUTEC81    330.00] CKT 0
62-S         : OPEN BRANCH FROM BUS 70316 [UPDTEC81    330.00] TO BUS 70306 [UPAVLO81    330.00] CKT 0
63-S         : OPEN BRANCH FROM BUS 70306 [UPAVLO81    330.00] TO BUS 70144 [UKRARM81    330.00] CKT 0
64-S         : OPEN BRANCH FROM BUS 70144 [UKRARM81    330.00] TO BUS 70151 [UCENTR81    330.00] CKT 0
65-S         : OPEN BRANCH FROM BUS 70328 [UKRGEC81    330.00] TO BUS 70218 [UKREME81    330.00] CKT 0
66-S         : OPEN BRANCH FROM BUS 70218 [UKREME81    330.00] TO BUS 70308 [UDNEPR81    330.00] CKT 0
67-S         : OPEN BRANCH FROM BUS 70701 [UNEZIN81    330.00] TO BUS 70214 [UKANAT81    330.00] CKT 0
68-S         : OPEN BRANCH FROM BUS 70185 [UDONBA91    500.00] TO BUS 70178 [UPOBED91    500.00] CKT 0
```

```
 69-S        : OPEN BRANCH FROM BUS 70170 [UHARCI81    330.00] TO BUS 70125 [UJOZNA81    330.00] CKT 0
 70-S        : OPEN BRANCH FROM BUS 70934 [UBUTEC11    400.00] TO BUS 70919 [UMUKAC11    400.00] CKT 0
```

4.6.8. Armenia

BLACKSEA REGIONAL MODEL
WINTER MAXIMUM LOAD 2010

```
ACCC OVERLOAD REPORT: MONITORED BRANCHES AND INTERFACES LOADED ABOVE 100.0 % OF RATING SET A
                       CONTINGENCY CASE LOADING NOT CHECKED UNLESS IT DIFFERS FROM ITS BASE CASE LOADING BY   10.0
MVA (MW FOR INTERFACES)
                       CONTINGENCY CASE LOADING NOT CHECKED UNLESS IT EXCEEDS ITS BASE CASE LOADING BY  5.0
PERCENT OF RATING SET A
 ACCC VOLTAGE  REPORT: VOLTAGE BAND CHECK IN CONTINGENCY CASES SKIPPED FOR ANY BUS WITHIN 0.02000 OF ITS BASE CASE
VOLTAGE MAGNITUDE

 AC CONTINGENCY RESULTS FILE:  E:\0\BSR\0report\AM\AM.acc
 DISTRIBUTION FACTOR FILE:     E:\0\BSR\0report\AM\AM.dfx
 SUBSYSTEM DESCRIPTION FILE:   E:\0\BSR\0report\AM\AM.sub
 MONITORED ELEMENT FILE:       E:\0\BSR\0report\AM\AM.mon
 CONTINGENCY DESCRIPTION FILE: E:\0\BSR\0report\AM\AM.con

 <----------------- MONITORED BRANCH -----------------> CONTINGENCY    RATING     FLOW       %

 MONITORED VOLTAGE REPORT:
 SYSTEM                         CONTINGENCY  <-------- B U S -------->   V-CONT   V-INIT   V-MAX    V-MIN
```

BLACKSEA REGIONAL MODEL
SUMMER MINIMUM LOAD 2010

```
<----------------- MONITORED BRANCH -----------------> CONTINGENCY    RATING     FLOW       %

 MONITORED VOLTAGE REPORT:
 SYSTEM                         CONTINGENCY  <-------- B U S -------->   V-CONT   V-INIT   V-MAX    V-MIN

 CONTINGENCY LEGEND:
 LABEL         EVENTS
 SINGLE 1    : OPEN LINE FROM BUS 541 [XAM_GE21    220.00] TO BUS 82011 [8ALVRD2     220.00] CKT 1
 SINGLE 2    : OPEN LINE FROM BUS 609 [XAM_GE11    400.00] TO BUS 84099 [8HRAZD1     400.00] CKT 1
 SINGLE 3    : OPEN LINE FROM BUS 82001 [8HRAZD2     220.00] TO BUS 82003 [8HRZ_H2     220.00] CKT 1
 SINGLE 4    : OPEN LINE FROM BUS 82001 [8HRAZD2     220.00] TO BUS 82003 [8HRZ_H2     220.00] CKT 2
 SINGLE 5    : OPEN LINE FROM BUS 82001 [8HRAZD2     220.00] TO BUS 82007 [8VANDZ2     220.00] CKT 1
 SINGLE 6    : OPEN LINE FROM BUS 82001 [8HRAZD2     220.00] TO BUS 82007 [8VANDZ2     220.00] CKT 2
 SINGLE 7    : OPEN LINE FROM BUS 82001 [8HRAZD2     220.00] TO BUS 82022 [8ZOVUN2     220.00] CKT 1
 SINGLE 8    : OPEN LINE FROM BUS 82001 [8HRAZD2     220.00] TO BUS 82029 [8MARSH2     220.00] CKT 1
 SINGLE 9    : OPEN LINE FROM BUS 82001 [8HRAZD2     220.00] TO BUS 82040 [8GAVAR2     220.00] CKT 1
 SINGLE 10   : OPEN LINE FROM BUS 82001 [8HRAZD2     220.00] TO BUS 84099 [8HRAZD1     400.00] CKT 1
 SINGLE 11   : OPEN LINE FROM BUS 82001 [8HRAZD2     220.00] TO BUS 84099 [8HRAZD1     400.00] CKT 2
 SINGLE 12   : OPEN LINE FROM BUS 82003 [8HRZ_H2     220.00] TO BUS 82021 [8SHAUM2     220.00] CKT 1
 SINGLE 13   : OPEN LINE FROM BUS 82007 [8VANDZ2     220.00] TO BUS 82011 [8ALVRD2     220.00] CKT 1
 SINGLE 14   : OPEN LINE FROM BUS 82007 [8VANDZ2     220.00] TO BUS 82013 [8GYUMR2     220.00] CKT 1
 SINGLE 15   : OPEN LINE FROM BUS 82013 [8GYUMR2     220.00] TO BUS 82015 [8ASHNK2     220.00] CKT 1
 SINGLE 16   : OPEN LINE FROM BUS 82015 [8ASHNK2     220.00] TO BUS 82018 [8AMNPP2     220.00] CKT 1
 SINGLE 17   : OPEN LINE FROM BUS 82015 [8ASHNK2     220.00] TO BUS 82018 [8AMNPP2     220.00] CKT 2
 SINGLE 18   : OPEN LINE FROM BUS 82018 [8AMNPP2     220.00] TO BUS 82021 [8SHAUM2     220.00] CKT 1
 SINGLE 19   : OPEN LINE FROM BUS 82018 [8AMNPP2     220.00] TO BUS 82029 [8MARSH2     220.00] CKT 1
 SINGLE 20   : OPEN LINE FROM BUS 82018 [8AMNPP2     220.00] TO BUS 82032 [8ARART2     220.00] CKT 1
 SINGLE 21   : OPEN LINE FROM BUS 82021 [8SHAUM2     220.00] TO BUS 82022 [8ZOVUN2     220.00] CKT 1
 SINGLE 22   : OPEN LINE FROM BUS 82021 [8SHAUM2     220.00] TO BUS 82045 [8HAGHT2     220.00] CKT 1
 SINGLE 23   : OPEN LINE FROM BUS 82032 [8ARART2     220.00] TO BUS 82033 [8YEHGN2     220.00] CKT 1
 SINGLE 24   : OPEN LINE FROM BUS 82032 [8ARART2     220.00] TO BUS 82045 [8HAGHT2     220.00] CKT 1
 SINGLE 25   : OPEN LINE FROM BUS 82033 [8YEHGN2     220.00] TO BUS 82034 [8SPAND2     220.00] CKT 1
 SINGLE 26   : OPEN LINE FROM BUS 82033 [8YEHGN2     220.00] TO BUS 82035 [8SHAMB2     220.00] CKT 1
 SINGLE 27   : OPEN LINE FROM BUS 82033 [8YEHGN2     220.00] TO BUS 82039 [8LICHK2     220.00] CKT 1
 SINGLE 28   : OPEN LINE FROM BUS 82034 [8SPAND2     220.00] TO BUS 82036 [8SHINU2     220.00] CKT 1
 SINGLE 29   : OPEN LINE FROM BUS 82035 [8SHAMB2     220.00] TO BUS 82036 [8SHINU2     220.00] CKT 1
 SINGLE 30   : OPEN LINE FROM BUS 82036 [8SHINU2     220.00] TO BUS 82038 [8AGARK2     220.00] CKT 1
 SINGLE 31   : OPEN LINE FROM BUS 82036 [8SHINU2     220.00] TO BUS 82038 [8AGARK2     220.00] CKT 2
 SINGLE 32   : OPEN LINE FROM BUS 82039 [8LICHK2     220.00] TO BUS 82040 [8GAVAR2     220.00] CKT 1
```

4.7. Border capacities

Table 4.1 - Indicative NTC values Winter 2010

Indicative values for Net Transfer Capacities (NTC) in Black Sea regio
WINTER 2010
(Non binding values)

FROM	TO	MW	VALUE PROVIDED BY
Bulgaria	Romania	1300	Bulgaria/Romania
	Turkey	650	Bulgaria/Turkey
Georgia	Russia	400	Georgia/Russia
	Turkey	200	Georgia/Turkey
Moldova	Romaina	1950	Moldova/Romania
	Ukraine	1150	Moldova/Ukraine
Romania	Bulgaria	1450	Bulgaria/Romania
	Moldova	550	Moldova/Romania
	Ukraine	2500+	Romania/Ukraine
Russia	Georgia	400	Georgia/Russia
	Ukraine	3000	Russia/Ukraine
Turkey	Bulgaria	900	Bulgaria/Turkey
	Georgia	200	Georgia/Turkey
Ukraine	Moldova	1000	Moldova/Ukraine
	Russia	3000	Russia/Ukraine
	Romania	1750	Romania/Ukraine

These indicative values have been computed by extrapolation from standard situations, in order to evaluate the transfer capacity through a single interface at the same time. Thus these figures should be considered separately and are not cumulative. When the evaluation of a transfer limit requires to use a set of assumption which are too far from usual or foreseeable situation (leading to high inaccuracies), the NTC figure has been replaced by « no realistic limit ».

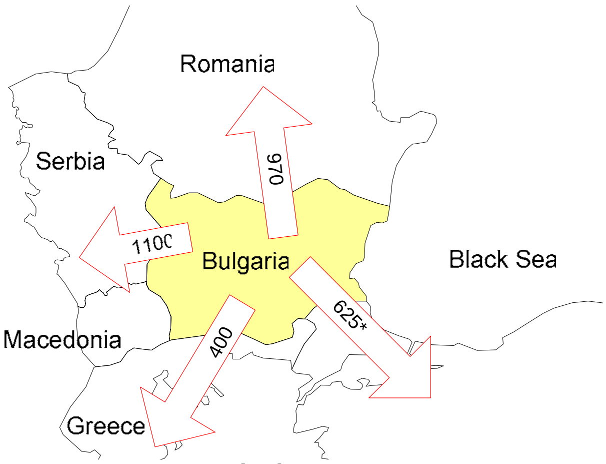
Table 4.2 – Indicative NTC values Summer 2010

Indicative values for Net Transfer Capacities (NTC) in Black Sea regio
SUMMER 2010
(Non binding values)

FROM	TO	MW	VALUE PROVIDED BY
Bulgaria	Romania	**1900**	Bulgaria/Romania
	Turkey	**600**	Bulgaria/Turkey
Georgia	Russia	**850**	Georgia/Russia
	Turkey	**200**	Georgia/Turkey
Moldova	Romaina	**700**	Moldova/Romania
	Ukraine	**1600**	Moldova/Ukraine
Romania	Bulgaria	**1550**	Bulgaria/Romania
	Moldova	**650**	Moldova/Romania
	Ukraine	**2500+**	Romania/Ukraine
Russia	Georgia	**650**	Georgia/Russia
	Ukraine	**3000**	Ukraine/Russia
Turkey	Bulgaria	**1500**	Bulgaria/Turkey
	Georgia	**200**	Georgia/Turkey
Ukraine	Moldova	**1750**	Moldova/Ukraine
	Russia	**3000**	Ukraine/Russia
	Romania	**1750**	Romania/Ukraine

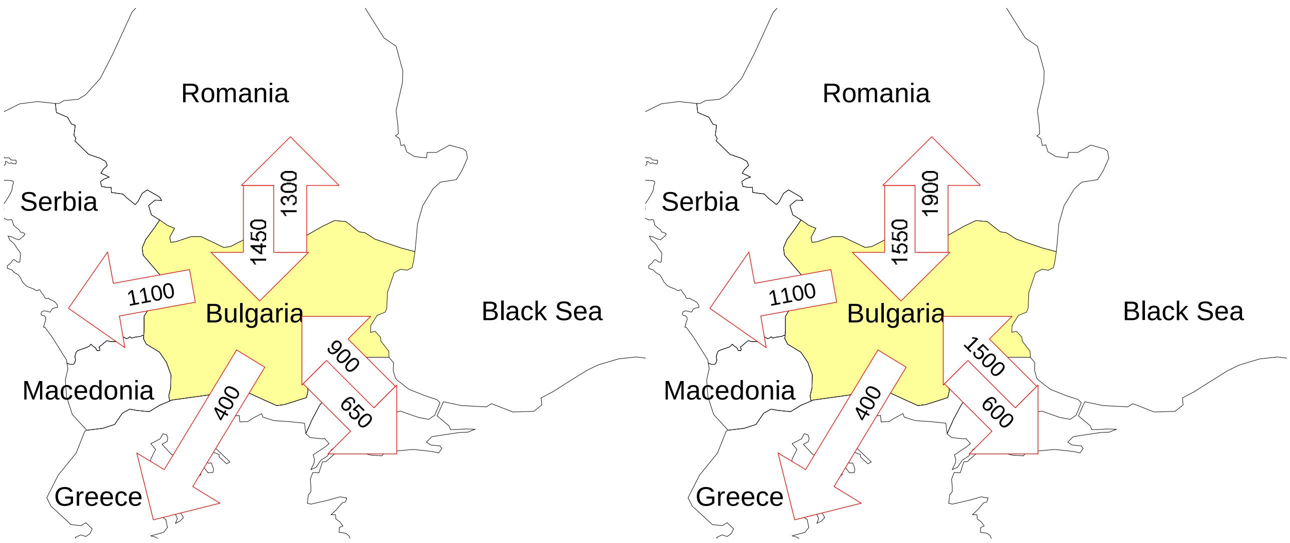
These indicative values have been computed by extrapolation from standard situations, in order to evaluate the transfer capacity through a single interface at the same time. Thus these figures should be considered separately and are not cumulative. When the evaluation of a transfer limit requires to use a set of assumption which are too far from usual or foreseeable situation (leading to high inaccuracies), the NTC figure has been replaced by « no realistic limit ».

4.7.1. BULGARIA



*in isolated operation

Figure 4.35 – Bulgaria – NTC border capacities (values for 2005)



winter summer

Figure 4.36 – Bulgaria – NTC border capacities 2010

Table 4.3 – Bulgaria – Winter 2010 results

SCENARIO	AMOUNT	Area	overloadings / out of limits voltages	Area	contingencies	#	limit / Unom	Flow / Voltage	rate / volt.dev.
		1	2	3	4	5	6	7	8
BG-RO	1500	INT	OHL 400 kV RTANTA1-VAEC_41	INT	OHL 400 kV RTANTA1-VAEC_41	1	1310MVA	1350.7MVA	101.5%
RO-BG	1650		PRODUCTION LIMIT REACHED						
BG-TR	850	BG	TR 400/220kV VMI3 2-VMI3 12	BG	OHL 400 kV VMI3 11-VMI 1	1	800MVA	795.2MVA	99.5%
TR-BG	1000	TR	OHL 400 kV TADAPA12-TGEBZE11	TR	OHL 400 kV TADAPA12-TGEBZE11	2	1430MVA	1303MVA	96.0%

Table 4.4 – Bulgaria – Summer 2010 results

SCENARIO	AMOUNT	Area	overloadings / out of limits voltages	Area	contingencies	#	limit / Unom	Flow / Voltage	rate / volt.dev.
		1	2	3	4	5	6	7	8
BG-RO	2100	INT	OHL 400 kV RTANTA1-VAEC_41	INT	OHL 400 kV RTANTA1-VAEC_41	1	1310MVA	1289MVA	97.5%
RO-BG	1750		PRODUCTION LIMIT REACHED						
BG-TR	800	BG	TR 400/220kV VMI3 2-VMI3 12	BG	OHL 400 kV VMI3 11-VMI 1	1	800 MVA	821.9 MVA	102.7%
TR-BG	2000	TR	OHL 400 kV TADAPA12-TGEBZE11	TR	OHL 400 kV TADAPA12-TGEBZE11	2	1046.8MVA	977 MVA	93.3%

4.7.2. GEORGIA

Figure 4.37 – Georgia – Network capacities 2005

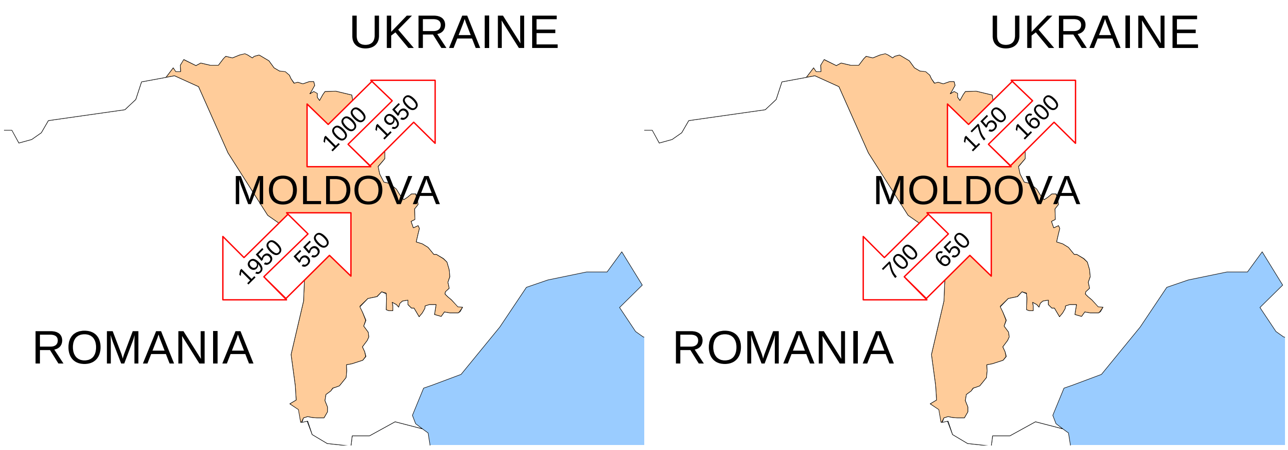
Figure 4.38 – Georgia – Network capacities 2010

Georgian and Russian Power Systems are connected through 500 KV lines is “Kavkasioni” by which the inflow amount
For 2010 summer is:
A) 1000 MW from Georgia to Russia , when the generated power by Enguri H.P.P is 1200 MW with voltage normal ranges .
B) 700 MW from Russia to Georgia, when Enguri H.P.P is out of service and in thermal plant 1 unit is operable with 120 MW.

For winter 2010 is :
A) 405 MW from Georgia to Russia, when the generated power by Enguri H.P.P is 1200 MW with normal voltages.
B) 610 MW from Russia to Georgia with normal voltages.

4.7.3. MOLDOVA

No Net Transfer Capacities for Moldova have been published up to now. The capability of Moldovan network at present is highly dependant on operation of neighboring Ukrainian network.



winter summer

Figure 4.39 – Moldova – Network capacities 2010

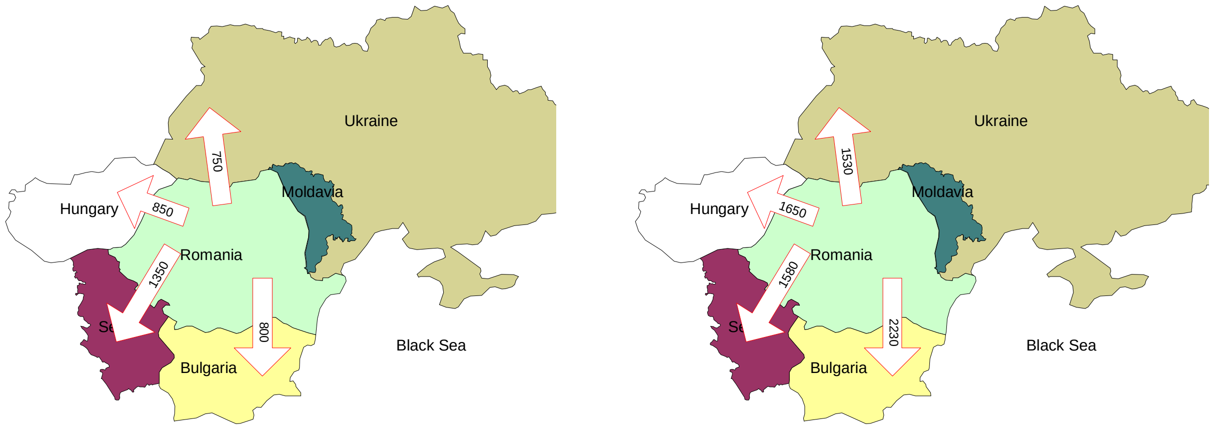
Table 4.5 – Moldova – Winter 2010 results

SCENARIO	AMOUNT	Area	overloadings / out of limits voltages	Area	contingencies	#	limit / Unom	Flow / Voltage	rate / volt.dev.
		1	2	3	4	5	6	7	8
MD-RO	1300		MODEL INSTABILITY	MD	OHL 330kV 5BALTS8-5STRAS8	1	788.8MVA		
				INT	OHL 400kV 5VULKA1-RISACC1	1	1212.4MVA		
RO-MD	800		PRODUCTION LIMIT REACHED						
MD-UA	1300		MODEL INSTABILITY	MD	OHL 330kV 5BALTS8-5STRAS8	1	788.8MVA		
				INT	OHL 400kV 5VULKA1-RISACC1	1	1212.4MVA		
UA-MD	800		PRODUCTION LIMIT REACHED						

Table 4.6 – Moldova – Summer 2010 results

SCENARIO	AMOUNT	Area	overloadings / out of limits voltages	Area	contingencies	#	limit / Unom	Flow / Voltage	rate / volt.dev.
		1	2	3	4	5	6	7	8
MD-RO	800	INT	OHL 400kV RROSIO1-UMUKAC11 1	INT	OHL 400kV 5BALTS1-RSUCEA1 1	1	692.8MVA		
RO-MD	750	RO	OHL 220kV RLOTRU2-RSIBIU2 1	RO	OHL 220kV RLOTRU2-RSIBIU2	2	333.4MVA		
MD-UA	1250	INT	OHL 400kV RROSIO1-UMUKAC11 1	INT	OHL 750kV MAISA 0-UZUKR702	1	2598.1MVA		
UA-MD	750		PRODUCTION LIMIT REACHED						

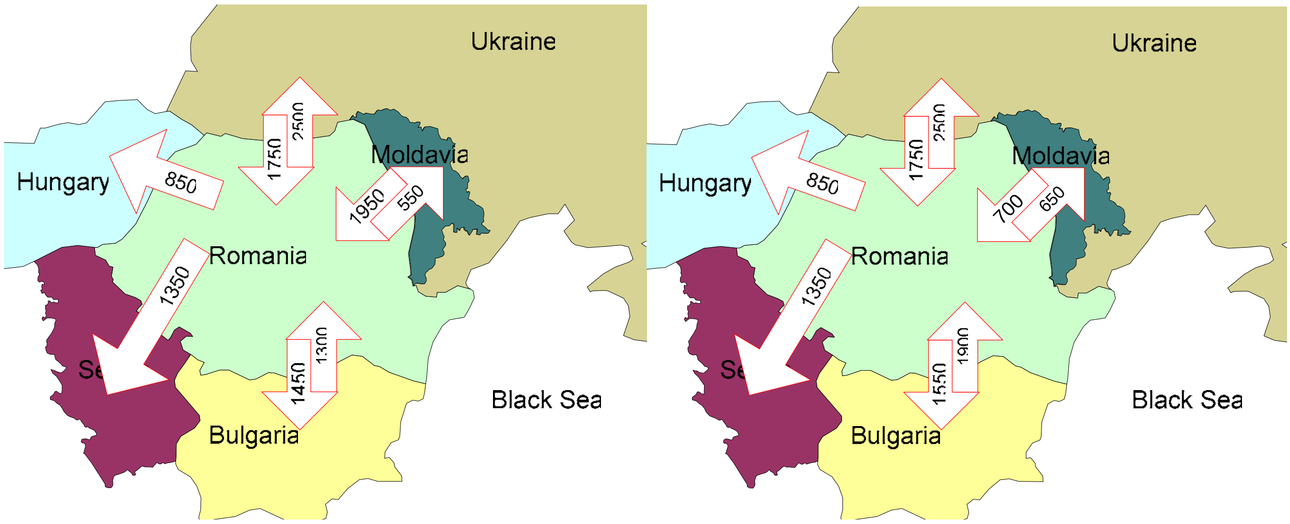
4.7.4. ROMANIA



Winter Summer

Source: Indicative values for Net Transfer Capacities (NTC) in Europe

Figure 4.40 – Romania – Network capacities 2005



Winter Summer

Figure 4.41 – Romania – Network capacities 2010

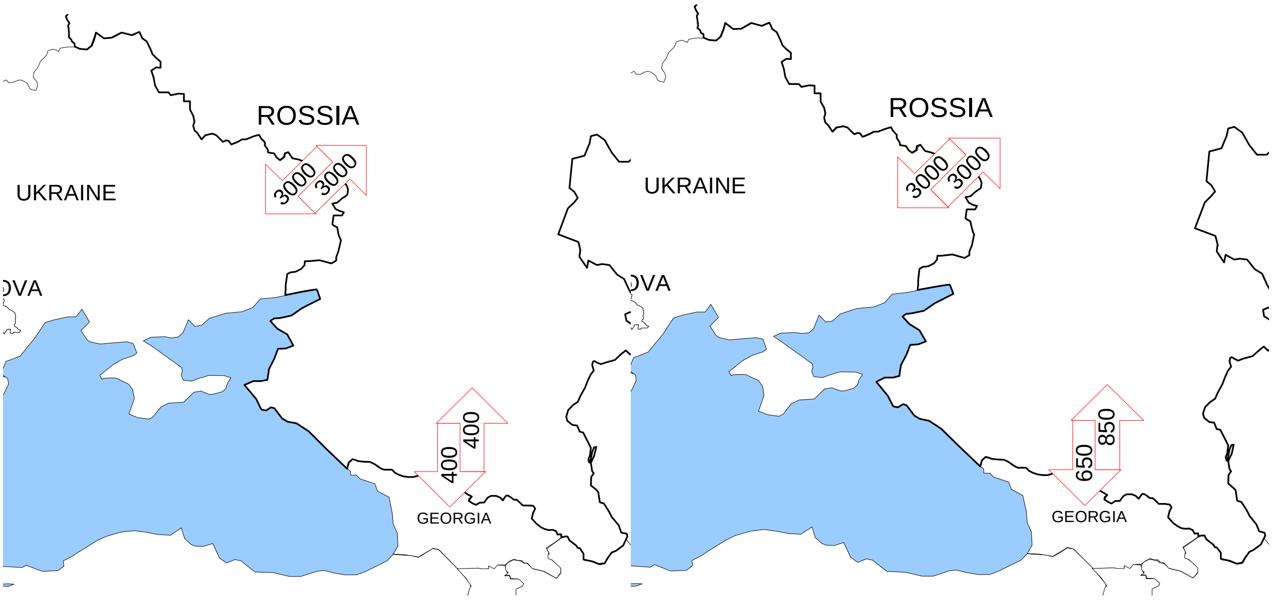
Table 4.7 – Romania – Winter 2010 results

SCENARIO	AMOUNT	Area	overloadings / out of limits voltages	Area	contingencies	#	limit / Unom	Flow / Voltage	rate / volt.dev.
		1	2	3	4	5	6	7	8
RO-MD	1400	MD	TR 330/110 5BALTS1	INT	OHL 400kV 5BALTS1-RSUCEA1 1	1	210MVA	487	231.9%
MD-RO	200	MD	PRODUCTION LIMIT REACHED						
RO-UA	2000		PRODUCTION LIMIT REACHED						
UA-RO	500	INT	OHL 400kV RROSIO1-UMUKAC11 1	INT	OHL 750kV MAISA 0-UZUKR702	1	693MVA	695	100.3%
RO-BG	1200	INT	OHL 400 kV RTANTA1-VAEC_41	INT	OHL 400 kV RTANTA1-VAEC_41	1	1211MVA	1232.8	101.8%
BG-RO	1500		PRODUCTION LIMIT REACHED						

Table 4.8 – Romania – Summer 2010 results

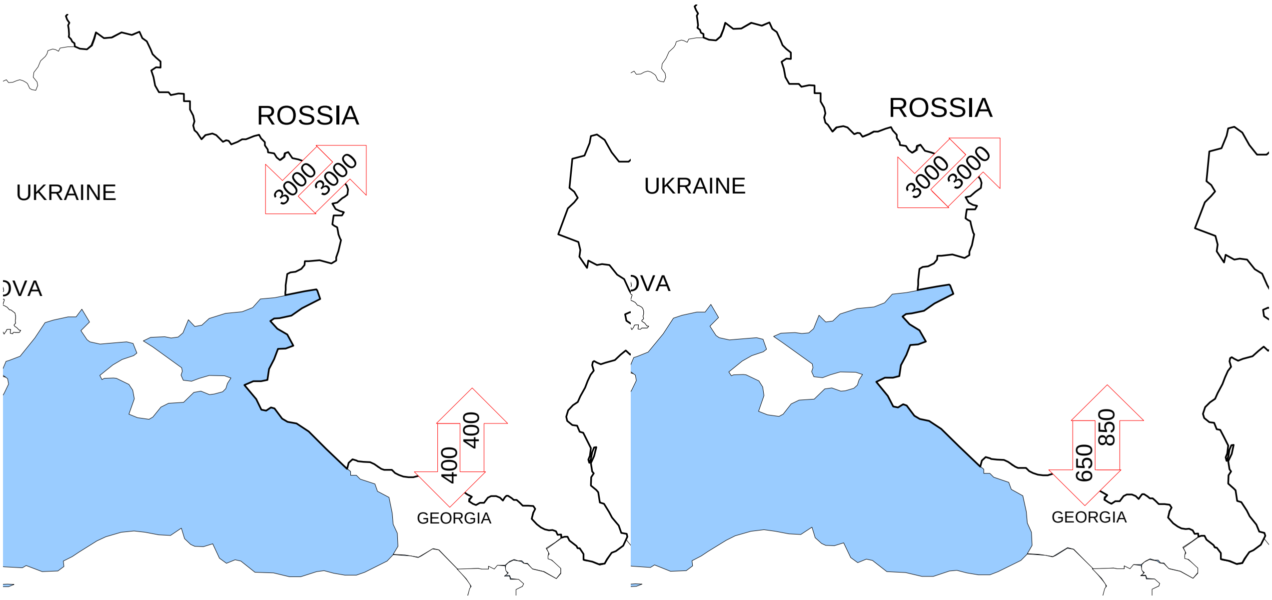
SCENARIO	AMOUNT	Area	overloadings / out of limits voltages	Area	contingencies	#	limit / Unom	Flow / Voltage	rate / volt.dev.
		1	2	3	4	5	6	7	8
RO-MD	1050	MD	TR 330/110 5BALTS1	INT	OHL 400kV 5BALTS1-RSUCEA1 1	1	210MVA	537.6	256.0%
MD-RO	200	INT	OHL 330kV UUSATO81-5MREPP8 1	INT	OHL 400kV 5BALTS1-RSUCEA1 1	1	120MVA	122.16	101.8%
RO-UA	2000		PRODUCTION LIMIT REACHED						
UA-RO	450	INT	OHL 400kV RROSIO1-UMUKAC11 1	INT	OHL 750kV MAISA 0-UZUKR702	1	693MVA	700	101.0%
RO-BG	1350	INT	OHL 400 kV RTANTA1-VAEC_41	INT	OHL 400 kV RTANTA1-VAEC_41	1	1211MVA	1215.844	100.4%
BG-RO	2100		PRODUCTION LIMIT REACHED						

4.7.5. RUSSIA



Winter Summer

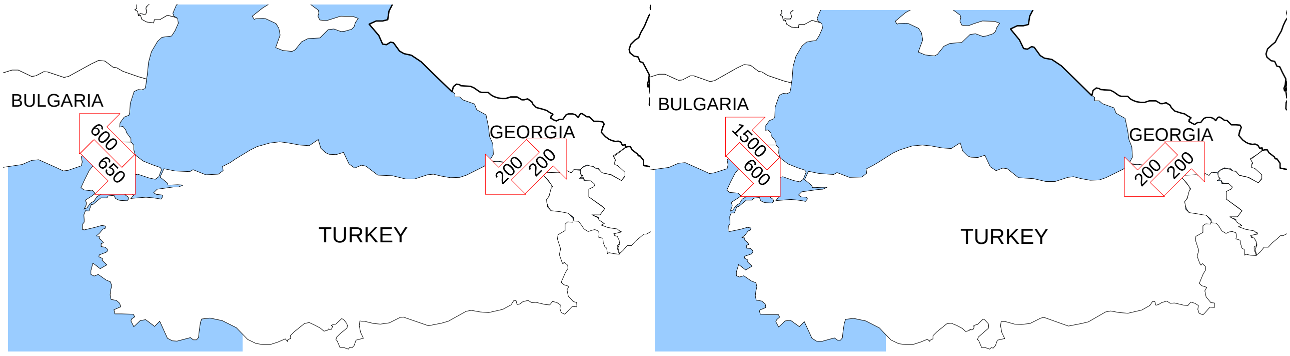
Figure 4.42 – Russia – Network capacities 2005



Winter Summer

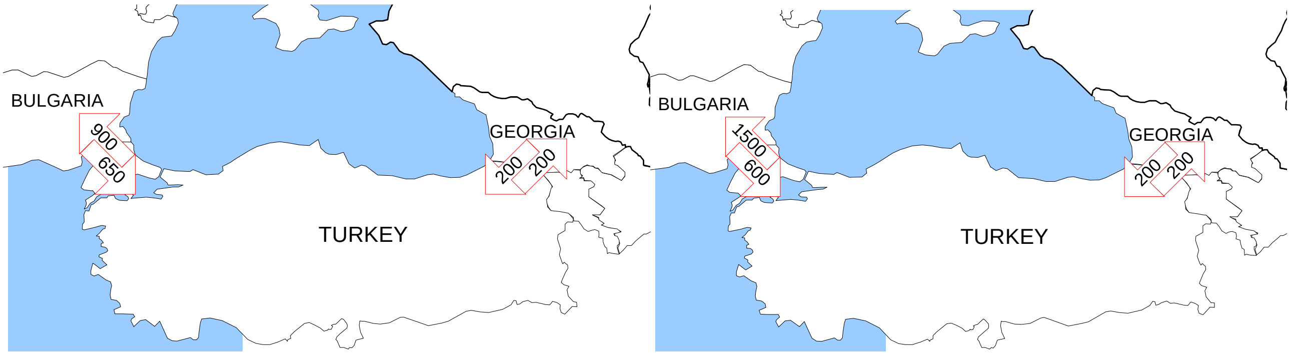
Figure 4.43 – Russia – Network capacities 2010

4.7.6. TURKEY



Winter Summer

Figure 4.44 – Turkey – Network capacities 2005



Winter Summer

Figure 4.45 – Turkey – Network capacities 2010

Table 4.9 – Turkey – winter 2010 results

SCENARIO	AMOUNT	Area	overloadings / out of limits voltages	Area	contingencies	#	limit / Unom	Flow / Voltage	rate / volt.dev.
		1	2	3	4	5	6	7	8
TR-BG	1100	TR	OHL 400 kV TADAPA12-TGEBZE11	TR	OHL 400 kV TADAPA12-TGEBZE11	2	1430.7MVA	1302.5MVA	95.9%
			TR 400/150 kV THAMIT1		OHL 400 kV TBABAE11-TUNIMR1	1	250MVA	286.5MVA	114.6%
BG-TR	850	BG	TR 400/220 kV VMI3 2 1	BG	OHL 400 kV VMI3 11-VMI 1	1	800 MVA	795.2 MVA	99.5%
TR-GE	200	TR	TR 220/150 kV THOPA 3 1	TR	OHL 500 kV 6HENGU9-6ZESTA9	1	150.0MVA	170.2MVA	113.5%
		TR	TR 220/150 kV THOPA 3 2				180.0MVA	179.8MVA	99.9%
		INT	OHL 220kV THOPA 2-6BATUM2 1				371.1MVA	349.3MVA	96.9%
		GE	OHL 220kV 6VARDI2 - 6ZUGDI2 1				318.2MVA	382.2MVA	118.9%
		INT	OHL 220kV THOPA 2-6BATUM2 1	TR	OHL 400 kV TDERIN1-TERZUR1	1	371.1MVA	356.1MVA	97.3%
		TR	TR 220/150 kV THOPA 3 1				150.0MVA	172.9MVA	115.3%
		TR	TR 220/150 kV THOPA 3 2				180.0MVA	182.6MVA	101.5%
		TR	TR 400/150 kV TBORCK1 1				250.0MVA	243.4MVA	97.4%
		TR	TR 400/150 kV TBORCK1 2				250.0MVA	243.4MVA	97.4%
GE-TR	200	GE	OHL 220 kV 6VARDI2 - 6ZUGDI2	GE	OHL 500 kV 6HENGU9-6ZESTA9	1	318.2 MVA	455.0 MVA	145.0%
		GE	TR 500/220 kV 6HENGU9 1				500 MVA	773.7 MVA	154.7%

Table 4.10 – Turkey – Summer 2010 results

SCENARIO	AMOUNT	Area	overloadings / out of limits voltages	Area	contingencies	#	limit / Unom	Flow / Voltage	rate / volt.dev.
		1	2	3	4	5	6	7	8
TR-BG	1700	TR	OHL 400 kV TADAPA12-TGEBZE11	TR	OHL 400 kV TADAPA12-TGEBZE11	2	1046.8MVA	976.8	95.3%
BG-TR	800	BG	TR 400/220 kV VMI3 2 1	BG	OHL 400 kV VMI3 11-VMI 1	1	800 MVA	821.9	102.7%
TR-GE	200	TR	TR 220/150 kV THOPA 3 1	TR	OHL 400 kV TTIREB1-TBORCK1	1	150.0MVA	165.6MVA	110.4%
		TR	TR 220/150 kV THOPA 3 2				180.0MVA	174.9MVA	97.2%
		TR	OHL 150 kV TMURAT3-TBORCK3				240.6MVA	370.2MVA	154.2%
GE-TR	200	GE	TR 500/220 kV 6HENGU9 1	INT	OHL 500kV 4CENTR9-6HENGU9	1	500MVA	483.8MVA	96.8%
		TR	TR 220/150 kV THOPA 3 1				150.0MVA	177.7MVA	118.5%

		TR	TR 220/150 kV THOPA 3 2				180.0MVA	187.7MVA	104.3%
		INT	OHL 220kV THOPA 2-6BATUM2 1				371.1MVA	360.8MVA	103.3%
		GE	OHL 220kV 6VARDI2 - 6TKVAR2 1				371.0MVA	375.2MVA	104.7%
		GE	OHL 220kV 6TKVAR2-6SOUKH2 1				371.0MVA	365.0MVA	101.9%

4.7.7. UKRAINE

Figure 4.46 - Ukraine – Network capacities for 2005

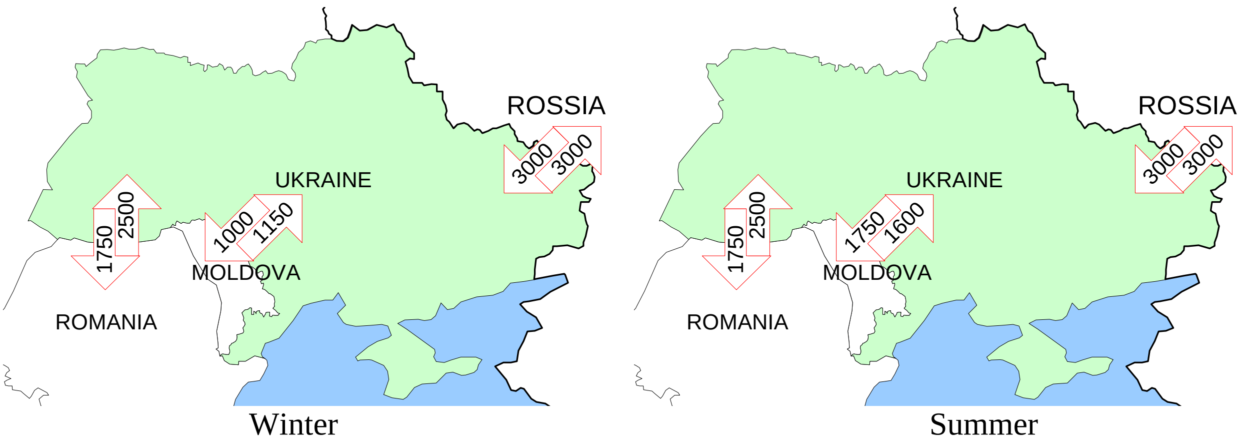


Figure 4.47 – Ukraine – Network capacities 2010

Table 4.11 – Ukraine – winter 2010 results

SCENARIO	AMOUNT	Area	overloadings / out of limits voltages	Area	contingencies	#	limit / Unom	Flow / Voltage	rate / volt.dev.
		1	2	3	4	5	6	7	8
UA-MD	500	RO	OHL 220kV RBUC.S2B-RFUNDE22 1				304.8MVA	398.4	130.7%
MD-UA	1850		PRODUCTION LIMIT REACHED						
UA-RO	350	INT	OHL 400kV RROSIO1-UMUKAC11 1	INT	OHL 750kV MAISA 0-UZUKR702	1	692MVA	728	105.2%
RO-UA	3000		PRODUCTION LIMIT REACHED						

Table 4.12 – Ukraine – Summer 2010 results

SCENARIO	AMOUNT	Area	overloadings / out of limits voltages	Area	contingencies	#	limit / Unom	Flow / Voltage	rate / volt.dev.
		1	2	3	4	5	6	7	8
UA-MD	2000	RO	OHL 220kV RFUNDE22-RBUC.S2B 1				304.8MVA	348.4	114.3%
		RO	OHL 220kV RFUNDE21-RBUC.S2B 1				304.8MVA	342	112.2%
MD-UA	2000		PRODUCTION LIMIT REACHED						
UA-RO	300	INT	OHL 400kV RROSIO1-UMUKAC11 1	INT	OHL 750kV MAISA 0-UZUKR702	1	692	717	103.6%
RO-UA	3000		PRODUCTION LIMIT REACHED						

4.7.8. ARMENIA

There are no NTC values for Armenia, since it operates only in radial operation with neighboring countries, and transfers are limited by the capacities of existing interconnection lines.

4.8. Import/Export Scenarios

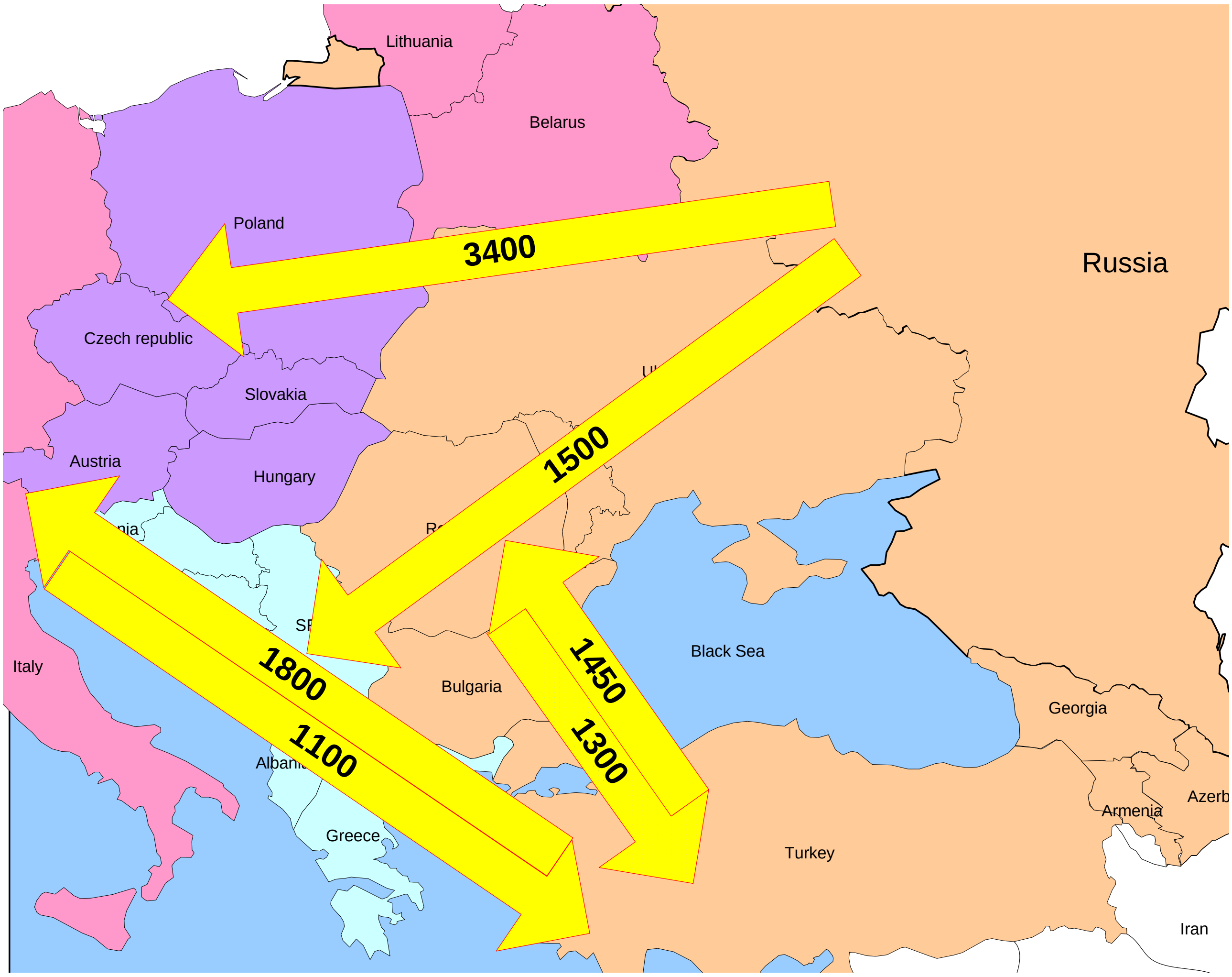


Figure 4.48 – Import/Export – Network capacities Winter 2010

Table 4.13 – Import/Export - Winter 2010 results

SCENARIO	AMOUNT	Area	overloadings / out of limits voltages	Area	contingencies	#	limit / Unom	Flow / Voltage	rate / volt.dev.
		1	2	3	4	5	6	7	8
RO-TR	1300	INT	OHL 400 kV RTANTA1-VAEC_41	INT	OHL 400 kV RTANTA1-VAEC_41	1	1211MVA	1236.2	102.0%
TR-RO	1450	TR	OHL 400kV TADAPA12-TGEBZE11 1	TR	OHL 400kV TADAPA12-TGEBZE11	2	1430.7MVA	1456.5	101.8%
UA+RU-CE	3450	INT	OHL 750kV ZRZE7101-UHAEC_01 1	INT	OHL 400kV RROSIO1-UMUKAC11	1	2507.1MVA		
UA+RU-SEE	1500	RO	TR 400/220kV RROSIO1 1	RO	OHL 400kV RROSIO1-RGADAL1	1	400MVA		
TR-UCTE	1200	TR	OHL 400 kV TADAPA12-TGEBZE11		OHL 400 kV TADAPA12-TGEBZE11	2	1430.7MVA	1314.4MVA	96.9%
			TR 400/150 kV THAMIT1	TR	OHL 400 kV TBABAE11-TUNIMR1	1	250.0MVA	320.2MVA	128.1%
UCTE-TR	1000	TR	TR 400/150 kV THAMIT1 1	TR	OHL 400 kV GFILIP1-VMI3 11	1	250.0MVA	259.4MVA	103.8%
				TR	OHL 400 kV GKEXRU1-TBABAE11	1	250.0MVA	348.5MVA	139.4%
		RO	OHL 110kV RCTA N5-RCTA B5	RO	OHL 400 kV TBABAE12-VMI3 11	1	149.6MVA	165.4MVA	111.1%
		BG	TR 220/110 kV VPLEVE21 1	BG	OHL 400 kV VCAREV1-VMIZIA1	1	200.0MVA	194.9MVA	97.5%

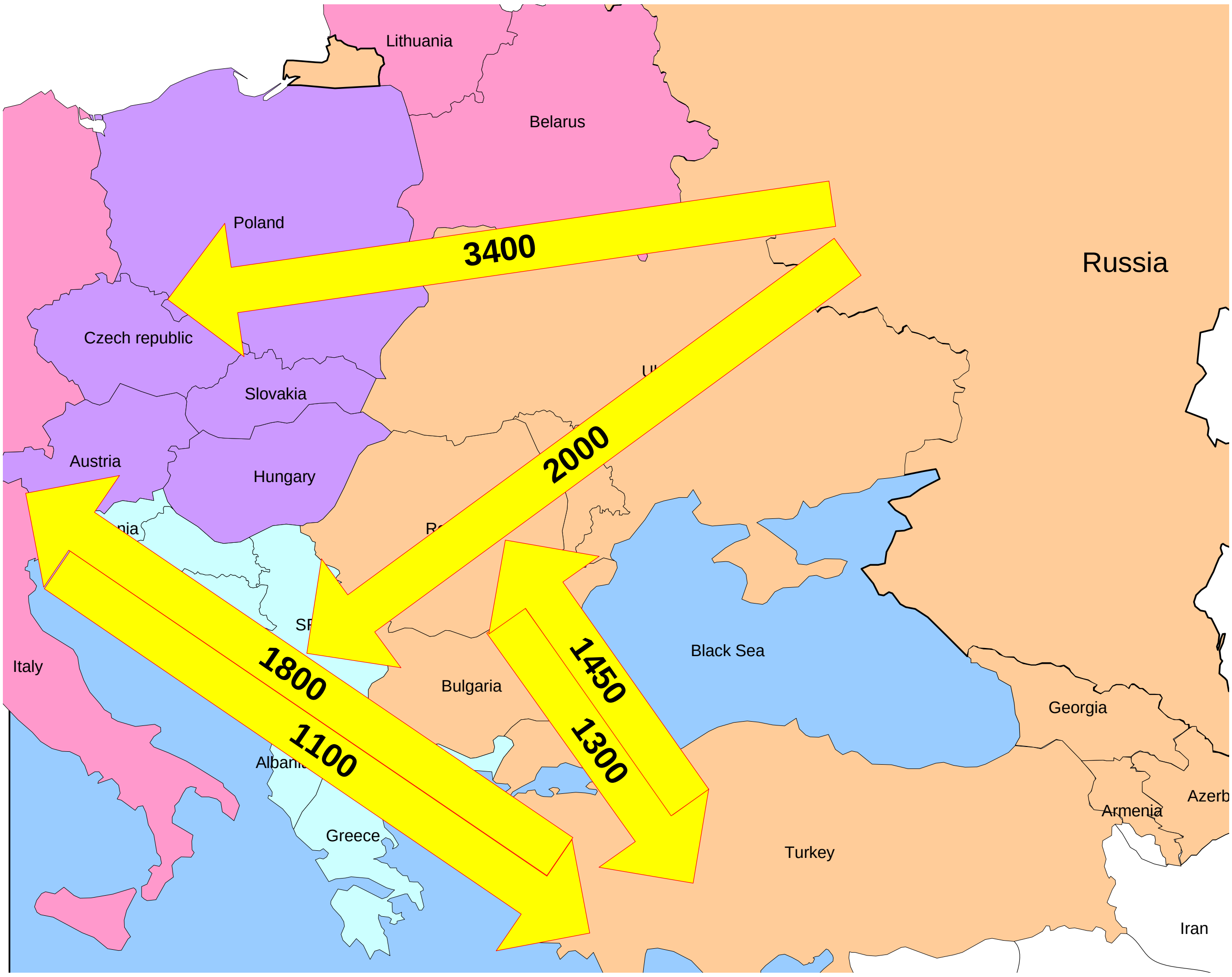


Figure 4.49 – Import/Export – Network capacities Summer 2010

Table 4.14 – Import/Export - Summer 2010 results

SCENARIO	AMOUNT	Area	overloadings / out of limits voltages	Area	contingencies	#	limit / Unom	Flow / Voltage	rate / volt.dev.
		1	2	3	4	5	6	7	8
RO-TR	1450	TR	OHL 400kV THAMIT1-TBABAE12	INT	OHL 400kV THAMIT1-VMI3 11	1	1057.2MVA	1082.6	102.4%
TR-RO	1300		PRODUCTION LIMIT REACHED						
UA+RU-CE	3400	INT	OHL 750kV ZRZE7101-UHAEC_01 1	INT	OHL 400kV QVKAP_1-UMUKAC11	1	692.8MVA		
UA+RU-SEE	2000	INT	OHL 400kV 5BALTS1-RSUCEA1 1	INT	OHL 750kV MAISA 0-UZUKR702	1	1212.4MVA		
TR-UCTE	1800	TR	OHL 400 kV TADAPA12-TGEBZE11	TR	OHL 400 kV TADAPA12-TGEBZE11	2	1046.8MVA	998.1MVA	97.5%
UCTE-TR	1100	TR	OHL 400 kV TADAPA12-TGEBZE12	TR	OHL 400 kV TPASAK1-TGEBZE12	1	1589.3MVA	1480.0MVA	95.2%
		BG	TR 400/220 kV VMI3 2 1	BG	OHL 400 kV VMI3 11-VMI 1	1	800MVA	810.8MVA	101.3%

5. NEW PLANNED LINES AND SUBSTATIONS

Table 5.1 – Black Sea region - Planned network reinforcements

TYPE	SUBSTATION1		SUBSTATION2		VOLTAGE LEVEL kV/kV	Number Of Circuits /units	CAPACITY A or MVA	CAPACITY limited A or MVA	MATERIAL OR TRANSFORMER TYPE	CROSS mm2	LENGTH BR1 km	LENGTH BR2 km	LENGTH TOTAL km	DATE OF COMMISSION	STATUS
1	2	3	2	3	4	5	6	7	8	9	10	11	12	13	14
BULGARIA															
OHL	BG	C.Mogila	MK	Stip	400	1	1890	-	ACSR	2X500	80	70	150	2008	construction
OHL	BG	M.East	GR	Nea Santa	400	1	1890	-	ACSR	2X500	-	-	-	-	Feasibility study
OHL	BG	Zlatitsa	BG	Plovdiv	400	1	1890	-	ACSR	2X500	-	-	140	2007	
GEORGIA															
SS	GE	Qsani			500/400	1	3X267		LTC					2009	Feasibility study
OHL	GE	Qsani	AM	TPP Hrazdan	400	1	1100	1400	ACSR	2x300	80	90	170	2009	Feasibility study
OHL	GE	Mukharani	AZ	AZ TPP	330	1							283		
SS	GE	Akhaltske			500/400	1									
BB	GE	Akhaltske			400	1									
OHL	GE	Akhaltske		Marneuli	500	1									
OHL	GE	Marneuli		Gardabani	500	1									
OHL	GE	Akhaltske		Menji	500	1									
OHL	GE	Menji		Kudoni	500	1									
OHL	GE	Akhaltske		Zestaponi	500	1							71		
OHL	GE	Akhaltske	TR	Borcka	400	1							130		
OHL	GE	Gardabani	AR	Atarbeksan	330	1									
OHL	GE	Enguri	RU	Centralna(Sochi)	500	1							450		
MOLDOVA															
OHL	MD	Balti	RO	Suceava	400	1									
SS	MD	Chisinau			400/330	1									
OHL	MD	Chisinau	RO	Iasi	400	1									
OHL	MD	Balti	UA	Dnestrovska HPP	330	1									
OHL	MD	Balti	MD	Straseni	330	1									
OHL	MD	Straseni	MD	Chisinau	330	1									
OHL	MD	Balti	MD	Ribnita	330	1									
SS	MD	Balti			400/330	1			IPC						
SS	MD	Moldovskaya			400/330	1			IPC						
ROMANIA															
SS	RO	Portile de Fier II			220/110	2	2*200		2 windings					2008	
OHL	RO	Portile de Fier II	RO	Cetate	220	1	875		Ol-Al	450			80	2008	
OHL	RO	Portile de Fier II	RO	Portile de Fier I	220	1	875		Ol-Al	450			71	2008	
CSS	RO	Nadab		-	400										
OHL	RO	Oradea	RO	Nadab	400	1	1997		Ol-Al	3*300			75		
OHL	RO	Arad	RO	Nadab	400	1	1997		Ol-Al	3*300			35		
OHL	RO	Nadab	HU	Bekescsaba Border	400	1	1750		Ol-Al	3*300			23	2008	
OHL	HU	Bekescsaba Border	HU	Bekescsaba	400	1	1750		Ol-Al	2*500			37	2010	
SS	RO	Suceava			400/110	2	250		2 windings					2010	
OHL	RO	Suceava	MD	Balti	400	1	1750		Ol-Al	3*300			95	2014	

SS	RO	Bacau			400/220	1	400		2 windings					2014	
SS	RO	Roman			400/220	1	400		2 windings					2014	
OHL	RO	Suceava	RO	Roman	400	1	1700		Ol-Al	3*300			100	2014	
OHL	RO	Roman	RO	Bacau	400	1	1700		Ol-Al	3*300			58.8	2014	
OHL	RO	Bacau	RO	Gutinas	400	1	1700		Ol-Al	3*300			55.3	2014	
SS	RO	Iasi			400/220									2010	
OHL	RO	Iasi	MD	Chisinau	400	1								2010	
SS	RO	Resita			400/220	1	400		2 windings					2014	
SS	RO	Resita			400/110	1	250		2 windings					2014	
OHL	RO	Portile de Fier I	RO	Resita	400	1	1997		Ol-Al	3*300			117	2014	
SS	RO	Timisoara			400/220	1	400		2 windings					2014	
OHL	RO	Timisoara	RO	Resita	400	1	1997		Ol-Al	3*300			73	2014	
OHL	RO	Timisoara	RO	Arad	400	1	1997		Ol-Al	3*300			55	2014	
OHL	RO	Timisoara	CS	Vrsac	400	1	1750		Ol-Al	3*300			100	2014	
DC	RO	Constanta			400		600							?	
SK	RO	Constanta	TR	Pasakoy	400	1	600				200	200	400	?	
OHL	RO	Constanta	RO	Medgidia	400	1	1800		Ol-Al	3*300			21	2010-2014	
RUSSIA															
OHL	RU	Sotchi	GE	Enguri	500	1							450		
SS	RU	Rostov			500	2									
OHL	RU	Rostov		Sahti 30	500	1									
OHL	RU	Rostov		Frolovskaya	500	1									
OHL	RU	Rostov		R 20	220	1									
SS	RU	Krimskaya II			500	2									
OHL	RU	Krimskaya II		Tihoreck	500	1									
SS	RU	Senaya		Senaya	220	1									
OHL	RU	Krimskaya II		Senaya	220	1									
OHL	RU	Krimskaya II		Slavyansk	220	1									
OHL	RU	Slavyansk		Senaya	220	1									
SS	RU	Nevinomysk			500	1									
OHL	RU	Nevinomysk		Volgodonskaya	500	1									
SS	RU	Mozdok			500	2									
OHL	RU	Nevinomysk		Mozdok	500	1									
SS	RU	Alagir			330	2									
OHL	RU	Nalcik		Alagir	330	1									
OHL	RU	V2		Alagir	330	1									
SS	RU	Kizljar			330	2									
SS	RU	Grozniy			330	2									
SS	RU	Artem			330	2									
OHL	RU	Mozdok		Artem	330	1									
OHL	RU	HP Irganskaya		Artem	330	1									
OHL	RU	Derbent		Artem	330	1									
OHL	RU	Derbent	AZ	Apsheron	330	1									
TURKEY															
SS	TR	Afyon	-	-	400/150		250							2006	construction
SS	TR	Agri	-	-	400/150		250+150							2006	construction

OHL	TR	Aliağa		Manisa	400	1			ACSR	3Bx1272				2006	completed
SS	TR	Baglum	-	-	400/150		2x250							2006	construction
SS	TR	Beykoz GIS	-	-	400/33		2x125							2006	construction
SS	TR	Davutpaşa GIS	-	-	400/150		250							2006	construction
SS	TR	Davutpaşa GIS	-	-	400/33		125							2006	construction
SS	TR	Erzurum	-	-	400/150		250							2006	construction
OHL	TR	Erzurum		Horasan	400	1			ACSR	3Bx954				2006	construction
SS	TR	Germencik	-	-	400/150		2x250							2006	construction
SS	TR	Hilvan	-	-	400/150		250							2006	construction
SS	TR	Hilvan	-	-	400/33		125							2006	construction
OHL	TR	Horasan		Agri	400	1			ACSR	3Bx954				2006	construction
OHL	TR	HPP Borçka-Deriner		HPP Yusufeli	400	1			ACSR	3Bx954				2006	construction
OHL	TR	HPP Oymapinar		Varsak	400	1			ACSR	3Bx954				2006	construction
OHL	TR	HPP Yusufeli		Erzurum	400	1			ACSR	3Bx954				2006	construction
SS	TR	Ikiteli	-	-	400/33		2x125							2005	completed
K	TR	Ikitelli		Davutpasa	400	1				2000 mm2				2006	completed
OHL	TR	Isiklar		Manisa	400	1			ACSR	3Bx1272				2006	completed
OHL	TR	Iyidere		HPP Borçka	400	1			ACSR	3Bx1272				2006	completed
OHL	TR	Karabiga-Çan		TPP Soma	400	1			ACSR	3Bx954				2006	construction
OHL	TR	Karakya-Ataturk		Hilvan	400	1			ACSR	3Bx954				2006	completed
SS	TR	Manisa	-	-	400/150		2x250							2006	construction
OHL	TR	Tirebolu		Iyidere	400	1			ACSR	3Bx1272				2006	completed
SS	TR	TPP Iskenderun	-	-	400/150		250							2006	construction
OHL	TR	TPP Unimar		Babaeski	400	1			ACSR	3Bx954				2006	construction
OHL	TR	Yeniköy-Uzundere		Aydin	400	2			ACSR	3Bx954				2006	completed
K	TR	Yildiztepe		Davutpasa	400	2				2000 mm2				2006	construction
SS	TR	Zekeriyakoy GIS	-	-	400/150		250							2006	construction
SS	TR	Zekeriyakoy GIS	-	-	400/33		125							2006	construction
SS	TR	Hatay	-	-	400/150		250							2007	construction
SS	TR	Hatay	-	-	400/33		125							2007	construction
OHL	TR	Hatay		Erzin	400	1			ACSR	3Bx954				2007	construction
SS	TR	Mersin	-	-	400/150		250							2007	construction
SS	TR	Mersin	-	-	400/33		125							2007	construction
OHL	TR	Mersin		TPP Iskenderun	400	1			ACSR	3Bx954				2007	construction
OHL	TR	Seydişehir		HPP Oymapinar	400	1			ACSR	3Bx954				2007	construction
SS	TR	Umraniye	-	-	400/150		2x250							2007	construction
SS	TR	Borçka	-	-	400/150		250							?	
OHL	TR	Borcka	GE	Akhaltske	400	1							130		
OHL	TR	Babaeski	GR	N.Santa	400	1			ACSR	3Bx954	64			2010	F.study
DC	TR	Pasakoy			400		600 MW								Idea
SK	TR	Pasakoy	RO	Constanta	400	1	600 MW				200	200	400		Idea
UKRAINE															
OHL	UA	Pivdenoukrainskaya	RO	Isaccea	750	1	4000 A	-	ACSR	400*5	406	3	409	2015	Feasibility study
SS	UA	Kyivska			750/330	1	1000 MVA	-	PST	-	-	-	-	2008	Construction
OHL	UA	Rivnenska NPP	UA	Kyivska	750	1	4000 A	-	ACSR	400*5	370	0	370	2008	Construction
OHL	UA	Zahidnoukrainska	UA	Bogorodchani	330	1	1670 A	-	ACSR	400*2	111	0	111	2010	Construction

OHL	UA	Dnistrovska PSHPP	UA	Bar	330	1	1670 A	-	ACSR	400*2	95	0	95	2007	Construction
OHL	UA	Novoodeska	UA	Artsyz	330	1	1670 A	-	ACSR	400*2	140	0	140	2007	Feasibility study
OHL	UA	Adgalyk	UA	Usatovo	330	1	1670 A	-	ACSR	400*2	124	0	124	2007	Feasibility study
OHL	UA	Zarya	UA	Mirna	330	1	1380 A	-	ACSR	300*2	14	0	14	2008	Construction
OHL	UA	Simferopol	UA	Sevastopol	330	1	1670 A	-	ACSR	400*2	70	0	70	2007	Feasibility study
OHL	UA	Dgankoj	UA	Melitopol–Simferopol	330	1	1380 A	-	ACSR	400*2	16	0	16	2006	Construction
OHL	UA	Pivnichnoukrainska	UA	Kyivska	750	1	4000 A	-	ACSR	400*5	292	0	292	2015	Feasibility study
OHL	UA	Zaporizka NPP	UA	Kahovska	750	1	4000 A	-	ACSR	400*5	190	0	190	2015	Feasibility study
OHL	UA	Lutsk Pivnichna	UA	Ternopil	330	1	1670 A	-	ACSR	400*2	180	0	180	2010	Feasibility study
OHL	UA	K.Podolska	UA	Ternopil	330	1	1670 A	-	ACSR	400*2	150	0	150	2012	Feasibility study
OHL	UA	HPP Dnistrovska	MD	Balti	330	1	1670 A	-	ACSR	400*2	120	0	120	2012	Idea
ARMENIA															
SS	AM	Hrazdan TPP			400/220	10	2x5x200	2x5x220						2009	Feasibility study
OHL	AM	Hrazdan TPP	IR	Tavriz	400	2	2x1800	2x1900	ACSR	2x(2x500)	332	100	432	2010	Feasibility study
OHL	AM	Hrazdan TPP	GE	Ksani	400	1	1100	1400	ACSR	2x300	90	80	170	2009	Feasibility study

1 Type of project (OHL - overhead line, K - cable, SK - submarine cable, SS - substation, BB - back to back system...)
2 Country (ISO code)
3 Substation name
4 Installed voltage (for lines nominal voltage, for transformers ratio in voltages)
5 number of circuits/units
6 Conventional transmission capacity of elements for OHL in Amps, for transformers in MVA
7 Conventional transmission capacity limited by transformers or substations
8 Type of conductor or transformer (ACSR - Aluminum Cross-section Steel Reinforced, or code of conductor, PS - phase shift transformer...)
9 Cross-section (number of ropes in bundle x cross-section/cross-section of reinforcement rope)
10 Length till border of first state
11 Length till border of second state
12 Total length
13 Date of commissioning (estimate)
14 Status of project (Idea, Feasibility study, Construction, Damaged, out of service, Decommissioned...)

Table 5.2 – Black Sea region - Planned new generation units

TYPE	SUBSTATION1		VOLTAGE LEVEL kV	kV	CAPACITY MW	MVA	DATE OF COMMISSIONING year	STATUS
1	2	3	4	5	6	7	8	9
NPP	BG	Belene	24	400	2x1000	2x1111	2012	construction
CCHP	MD	Balti	15.75	400	3x150	3x176	2010	
CCHP	MD	Vulkanesti	15.75	400	3x150	3x176	2010	
NPP	RO	Cernavoda	24	400	2x700	740	2010- 2014	construction
HPP	RU	Zaramagskaya		330			2010	
HPP	RU	Cherkeskaya II		330			2010	
NPP	RU	Volgodonskaya	20	500	1000	1111	2010	
HPP	TR	Ermenek		400	320		-2010	
HPP	TR	Kargı		400	214		-2010	
HPP	TR	Borçka		400	300		-2010	

HPP	TR	Deriner		400	670		-2010	
PSHPP	UA	Dnistrovska	15.75	330	324/416	360	2008	Construction
CCHP	UA	Kyivska 6	20	330	250	353	2008	Construction
PSHPP	UA	Tashlykska	15.75	330	2x146/2x211	307	2006	Construction
PSHPP	UA	Tashlykska	15.75	330	2x146/2x211	307	2008	Construction
CCHP	AM	Yerevan TPP new unit	18	110	208	240	2009	Tendering
TPP	AM	Hrarzdan TPP unit 5	15.75	220	440	510	2009	Partly Constructed

1 Type of plant (HPP - Hydropower plant, TPP - Thermal power plant, PSHPP - Pump Storage Hydro Power Plant, CCHP - Combined Cycle Heating Plant...)
2 Country
3 Substation name
4 Generator voltage level
5 Network voltage level
6 Installed active power
7 Installed apparent power
8 Date of commissioning (estimate)
9 Status of the project (Idea, Feasibility study, Construction...)

6. FINDINGS

Findings based on past experience and calculations performed, what are critical points of interconnected network, limitations in regional network and how new elements that are modeled influence these limitations

Connection between Turkey and Georgia is at present only one 220kV line Hopa(TR)-Batumi(GE), and this is most limiting factor for transfer capacity between these two countries. Building of the new 400 kV line Borcka (TR)- Akhaltske (GE) will significantly increase transfer capacity between these two countries, to at least 600 MW in both directions.

It is also essential to strengthen internal 500 kV network in Georgia, with two new lines connecting Achalciche (GE) substation with existing stations Zestafoni and Gardabani. To increase further secure operation of the system is also necessary to build line Enguri-Achalchice as back up to old line Enguri-Zestafoni. Together with building the second line between Centralna (RU)-Enguri(GE), this will significantly increase overall network capacities in the region.

1. In case of a synchronous operation of the whole area a natural load flow loop is triggered. The direction is Russia → Ukraine → Romania → Bulgaria → Turkey → Georgia → Russia and it can involve up to 300 MW creating big problems for the weak interconnection between Georgia and Turkey. {to be checked for Armenia}
2. Connection between Turkey and Georgia (only one 220 kV s.c. OHL) is presently the most limiting factor for transfer capacity in the analyzed area. Building of a new interconnection 400 kV s.c. OHL (Borcka – Akhaltsikhe) operating in asynchronous mode (back-to-back station of 650 MW) will significantly increase the safety in operation of Georgian Power System and the total transfer capacity in both directions.
3. According to the calculations the NTC between the countries are presented in the following Table:

Table 1 – Indicative values for the bilateral transmission capacity – Winter Peak Load

No	FROM	TO	ΔEmax [MW]	BCE [MW]	TRM [MW]	NTC [MW]
1	Bulgaria	Romania	1500	0	200	1300
2	Bulgaria	Turkey	850	0	200	650
3	Georgia	Russia	650	-200	50	400
4	Georgia	Turkey	250	0	50	200
5	Moldova	Romania	1300	750	100	1950
6	Moldova	Ukraine	1850	-450	250	1150
7	Romania	Bulgaria	1650	0	200	1450
8	Romania	Moldova	1400	-750	100	550
9	Romania	Ukraine	above2500	0	150	2500
10	Russia	Georgia	250	200	50	400
11	Russia	Ukraine	3150	200	350	3000
12	Turkey	Bulgaria	1100	0	200	900
13	Turkey	Georgia	450	0	50	400
14	Ukraine	Moldova	800	450	250	1000
15	Ukraine	Russia	3550	-200	350	3000
16	Ukraine	Romania	1900	0	150	1750

Table 2 – Indicative values for the bilateral transmission capacity – Summer Light Load

No	FROM	TO	ΔEmax [MW]	BCE [MW]	TRM [MW]	NTC [MW]
1	Bulgaria	Romania	2100	0	200	1900
2	Bulgaria	Turkey	800	0	200	600
3	Georgia	Russia	900	0	50	850
4	Georgia	Turkey	50	200	50	200
5	Moldova	Romania	450	350	100	700
6	Moldova	Ukraine	2200	-350	250	1600
7	Romania	Bulgaria	1750	0	200	1550
8	Romania	Moldova	1100	-350	100	650
9	Romania	Ukraine	above2500	0	150	2500
10	Russia	Georgia	700	0	50	650
11	Russia	Ukraine	3150	200	350	3000
12	Turkey	Bulgaria	1700	0	200	1500
13	Turkey	Georgia	450	-200	50	200
14	Ukraine	Moldova	1650	350	250	1750
15	Ukraine	Russia	3550	-200	350	3000
16	Ukraine	Romania	1900	0	150	1750

4. If we consider the structure forecasted for 2010 the results from the previous tables shows a very strongly meshed power grid between some of the countries in the area, thus:
   - Between Ukraine and Russia – over 3000 MW in both winter and summer regimes.
   - Between Romania and Ukraine – over 2500 MW in both winter and summer regimes
5. Also, for the same time horizon (2010) and power grid structure we can identify some “weak points” :
   - Between Georgia and Turkey – only 200 MW in both winter and summer regimes
   - Between Turkey and Bulgaria – only 600 MW in the winter regime
   - Between Romania and Moldova - ~600 MW in both winter and summer regimes
   - Between Russia and Georgia – 600 ÷ 700 MW

   Taking into account the geographical conditions and the other interconnection of Turkey with Greece in the same area, it is understandable the low capacity between Turkey and Bulgaria but for the rest of the week points identified in this project new investments are to be recommended.
6. According to the companies proposals the new projects were classified in three categories:
   - construction;
   - Feasibility study
   - Ideas/proposals.

   The projects in construction or in a very close stage to the construction starting were classified in the first category and included in the model with the status “ON”.

   Elements classified as Feasibility study are projects for which technical evaluation is in progress or it is finished. Now they are in stage of finding adequate ways to financial fund they realization.

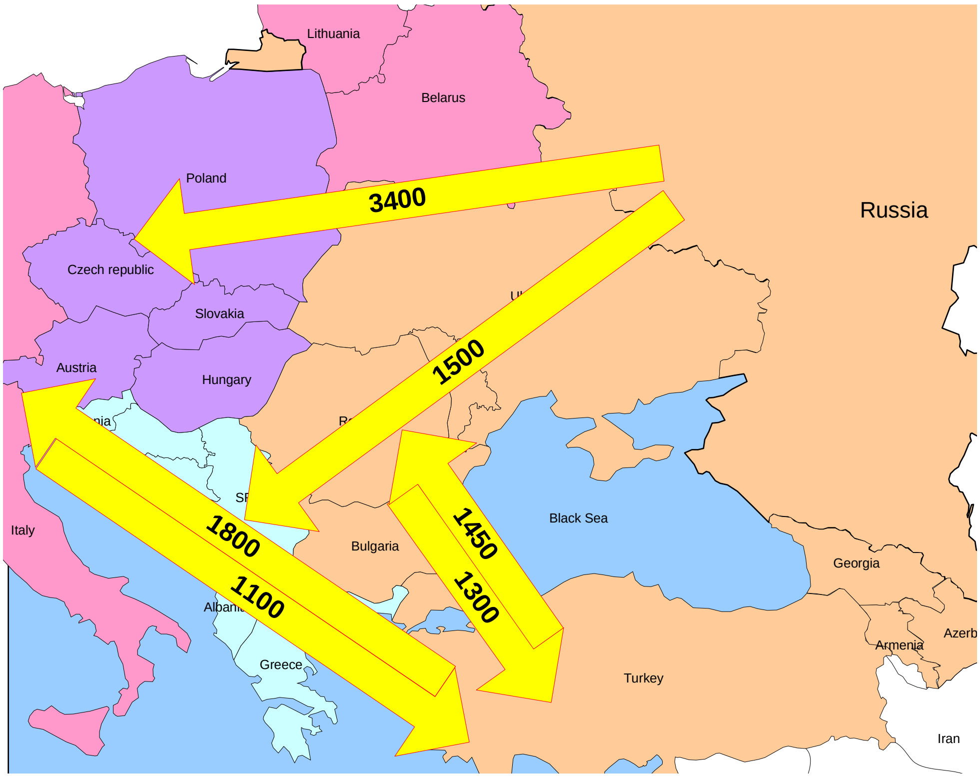
The rest of the new projects were classified in the category Idea/proposal and most of them are included in the model with the status “OFF”. These projects will be analyzed in the future weather they are feasible or not.

TYPE	SUBSTATION1		SUBSTATION2		VOLTAGE LEVEL kV/kV	CAPACITY A or MVA	DATE OF COMM	STATUS
				BULGARIA				
OHL	BG	C.Mogila	MK	Stip	400	1890	2008	construction
OHL	BG	M.East	GR	Nea Santa	400	1890	-	Feasibility study
OHL	BG	Zlatitsa	BG	Plovdiv	400	1890	2007	Feasibility study
				GEORGIA				
SS	GE	Qsani			500/400	3X267	2009	Feasibility study
OHL	GE	Qsani	AM	TPP Hrazdan	400	1100	2009	Feasibility study
OHL	GE	Mukharani	AZ	AZ TPP	330			existing
SS	GE	Akhaltske			500/400			Feasibility study
BB	GE	Akhaltske			400			Feasibility study
OHL	GE	Akhaltske		Marneuli	500			Feasibility study
OHL	GE	Marneuli		Gardabani	500			Feasibility study
OHL	GE	Akhaltske		Menji	500			Feasibility study
OHL	GE	Menji		Kudoni	500			Feasibility study
OHL	GE	Akhaltske		Zestaponi	500			Feasibility study
OHL	GE	Akhaltske	TR	Borcka	400			Feasibility study
OHL	GE	Enguri	RU	Centralna(Sochi)	500			Idea
				MOLDOVA				
OHL	MD	Balti	RO	Suceava	400			Idea
SS	MD	Chisinau			400/330			Idea
OHL	MD	Chisinau	RO	Iasi	400			Idea
OHL	MD	Balti	UA	Dnestrovska HPP	330			Idea
OHL	MD	Balti	MD	Straseni	330			Idea
OHL	MD	Straseni	MD	Chisinau	330			Idea
OHL	MD	Balti	MD	Ribnita	330			Idea
SS	MD	Balti			400/330			Idea
SS	MD	Moldovskaya			400/330			Idea
				ROMANIA				
SS	RO	Portile de Fier II			220/110	2*200	2008	Feasibility study
OHL	RO	Portile de Fier II	RO	Cetate	220	875	2008	Feasibility study
OHL	RO	Portile de Fier II	RO	Portile de Fier I	220	875	2008	Feasibility study
CSS	RO	Nadab		-	400			Feasibility study
OHL	RO	Oradea	RO	Nadab	400	1997		Feasibility study
OHL	RO	Arad	RO	Nadab	400	1997		Feasibility study
OHL	RO	Nadab	HU	Bekescsaba Border	400	1750	2008	Feasibility study
OHL	HU	Bekescsaba Border	HU	Bekescsaba	400	1750	2010	Feasibility study
SS	RO	Suceava			400/110	250	2010	Feasibility study
OHL	RO	Suceava	MD	Balti	400	1750	2014	Feasibility study
SS	RO	Bacau			400/220	400	2014	Feasibility study
SS	RO	Roman			400/220	400	2014	Feasibility study
OHL	RO	Suceava	RO	Roman	400	1700	2014	Feasibility study
OHL	RO	Roman	RO	Bacau	400	1700	2014	Feasibility study
OHL	RO	Bacau	RO	Gutinas	400	1700	2014	Feasibility study
SS	RO	Iasi			400/220		2010	Feasibility study
OHL	RO	Iasi	MD	Chisinau	400		2010	Feasibility study
SS	RO	Resita			400/220	400	2014	Feasibility study
SS	RO	Resita			400/110	250	2014	Feasibility study
OHL	RO	Portile de Fier I	RO	Resita	400	1997	2014	Feasibility study
SS	RO	Timisoara			400/220	400	2014	Feasibility study
OHL	RO	Timisoara	RO	Resita	400	1997	2014	Feasibility study
OHL	RO	Timisoara	RO	Arad	400	1997	2014	Feasibility study
OHL	RO	Timisoara	CS	Vrsac	400	1750	2014	Feasibility study
DC	RO	Constanta			400	600	?	Feasibility study
SK	RO	Constanta	TR	Pasakoy	400	600	?	Feasibility study
OHL	RO	Constanta	RO	Medgidia	400	1800	2014	Feasibility study
				RUSSIA				
OHL	RU	Sotchi	GE	Enguri	500			Idea
SS	RU	Rostov			500			Feasibility study
OHL	RU	Rostov		Sahti 30	500			Feasibility study
OHL	RU	Rostov		Frolovskaya	500			Feasibility study
OHL	RU	Rostov		R 20	220			Feasibility study
SS	RU	Krimskaya II			500			Feasibility study
OHL	RU	Krimskaya II		Tihoreck	500			Feasibility study
SS	RU	Senaya		Senaya	220			Feasibility study

OHL	RU	Krimskaya II		Senaya	220			Feasibility study
OHL	RU	Krimskaya II		Slavyansk	220			Feasibility study
OHL	RU	Slavyansk		Senaya	220			Feasibility study
SS	RU	Nevinomysk			500			Feasibility study
OHL	RU	Nevinomysk		Volgodonskaya	500			Feasibility study
SS	RU	Mozdok			500			Feasibility study
OHL	RU	Nevinomysk		Mozdok	500			Feasibility study
SS	RU	Alagir			330			Feasibility study
OHL	RU	Nalcik		Alagir	330			Feasibility study
OHL	RU	V2		Alagir	330			Feasibility study
SS	RU	Kizljar			330			Feasibility study
SS	RU	Grozniy			330			Feasibility study
SS	RU	Artem			330			Feasibility study
OHL	RU	Mozdok		Artem	330			Feasibility study
OHL	RU	HP Irganskaya		Artem	330			Feasibility study
OHL	RU	Derbent		Artem	330			Feasibility study
OHL	RU	Derbent	AZ	Apsheron	330			Feasibility study
TURKEY								
SS	TR	Afyon	-	-	400/150	250	2006	construction
SS	TR	Agri	-	-	400/150	250+150	2006	construction
SS	TR	Baglum	-	-	400/150	2x250	2006	construction
SS	TR	Beykoz GIS	-	-	400/33	2x125	2006	construction
SS	TR	Davutpaşa GIS	-	-	400/150	250	2006	construction
SS	TR	Davutpaşa GIS	-	-	400/33	125	2006	construction
SS	TR	Erzurum	-	-	400/150	250	2006	construction
OHL	TR	Erzurum		Horasan	400		2006	construction
SS	TR	Germencik	-	-	400/150	2x250	2006	construction
SS	TR	Hilvan	-	-	400/150	250	2006	construction
SS	TR	Hilvan	-	-	400/33	125	2006	construction
OHL	TR	Horasan		Agri	400		2006	construction
OHL	TR	HPP Borçka-Deriner		HPP Yusufeli	400		2006	construction
OHL	TR	HPP Oymapinar		Varsak	400		2006	construction
OHL	TR	HPP Yusufeli		Erzurum	400		2006	construction
OHL	TR	Karabiga-Çan		TPP Soma	400		2006	construction
SS	TR	Manisa	-	-	400/150	2x250	2006	construction
SS	TR	TPP Iskenderun	-	-	400/150	250	2006	construction
OHL	TR	TPP Unimar		Babaeski	400		2006	construction
K	TR	Yildiztepe		Davutpasa	400		2006	construction
SS	TR	Zekeriyakoy GIS	-	-	400/150	250	2006	construction
SS	TR	Zekeriyakoy GIS	-	-	400/33	125	2006	construction
SS	TR	Hatay	-	-	400/150	250	2007	construction
SS	TR	Hatay	-	-	400/33	125	2007	construction
OHL	TR	Hatay		Erzin	400		2007	construction
SS	TR	Mersin	-	-	400/150	250	2007	construction
SS	TR	Mersin	-	-	400/33	125	2007	construction
OHL	TR	Mersin		TPP Iskenderun	400		2007	construction
OHL	TR	Seydişehir		HPP Oymapinar	400		2007	construction
SS	TR	Umraniye	-	-	400/150	2x250	2007	construction
SS	TR	Borçka	-	-	400/150	250	2010	Feasibility study
OHL	TR	Borcka	GE	Akhaltske	400			Feasibility study
OHL	TR	Babaeski	GR	N.Santa	400		2010	F.study
DC	TR	Pasakoy			400	600 MW		Idea
SK	TR	Pasakoy	RO	Constanta	400	600 MW		Idea
UKRAINE								
OHL	UA	Pivdenoukrainskaya	RO	Isaccea	750	4000 A	2015	Feasibility study
SS	UA	Kyivska			750/330	1000 MVA	2008	Construction
OHL	UA	Rivnenska NPP	UA	Kyivska	750	4000 A	2008	Construction
OHL	UA	Zahidnoukrainska	UA	Bogorodchani	330	1670 A	2010	Construction
OHL	UA	Dnistrovska PSHPP	UA	Bar	330	1670 A	2007	Construction
OHL	UA	Novoodeska	UA	Artsyz	330	1670 A	2007	Feasibility study
OHL	UA	Adgalyk	UA	Usatovo	330	1670 A	2007	Feasibility study
OHL	UA	Zarya	UA	Mirna	330	1380 A	2008	Construction
OHL	UA	Simferopol	UA	Sevastopol	330	1670 A	2007	Feasibility study
OHL	UA	Dgankoj	UA	Melitopol–Simferopol	330	1380 A	2006	Construction
OHL	UA	Pivnichnoukrainska	UA	Kyivska	750	4000 A	2015	Feasibility study
OHL	UA	Zaporizka NPP	UA	Kahovska	750	4000 A	2015	Feasibility study
OHL	UA	Lutsk Pivnichna	UA	Ternopil	330	1670 A	2010	Feasibility study
OHL	UA	K.Podolska	UA	Ternopil	330	1670 A	2012	Feasibility study
OHL	UA	HPP Dnistrovska	MD	Balti	330	1670 A	2012	Idea
ARMENIA								
SS	AM	Hrazdan TPP			400/220	2x5x200	2009	Feasibility study

OHL	AM	Hrazdan TPP	IR	Tavriz	400	2x1800	2010	Feasibility study
OHL	AM	Hrazdan TPP	GE	Ksani	400	1100	2009	Feasibility study

7. Network capacities analyses for market realistic scenarios of power exchanges showed that expected network topology enables secure exchange of following quantities from Black Sea region



Import/Export – Network capacities Winter 2010

Import/Export – Network capacities Summer 2010