	Observations
[1]	Limited by transformer with regulation in quadrature in Meeden
[2]	Limited by transformer with regulation in quadrature in Meeden
[3]	Limited by transformer with regulation in quadrature in Gronau
[4]	Limited by transformer with regulation in quadrature in Gronau
[5]	Transformer in Borssele
[6]	Transformer in Jamiolle
[7]	(220/150)
[8]	Installed in Verbois
[9]	(380/220)
[10]	Cross-border power station
[11]	(220/130)
[12]	Cross-border power station
[13]	(220/130)
[14]	Cross-border power station
[15]	(220/130)
[16]	Line property EnBW Netz in Germany Partially on the same tower as line Asphard-Kühmoos or Sierentz-Laufenburg
[17]	DC link with three connections
[18]	Transforming station of Lucciana in Corsica
[19]	DC link with three connections
[20]	Transforming station of Lucciana in Corsica
[21]	Partially on the same tower as the Laufenbourg-Engstlatt line (No. 105.1)
[22]	Transducer
[23]	Transducer
[24]	On the same tower as line No. 81 Laufenbourg-Sierentz 380 kV
[25]	Sag of conductor taken into consideration
[26]	From Kühmoos to Laufenbourg on the same tower
[27]	Disconnector
[28]	Limited by protection device
[29]	From Kühmoos to Laufenbourg on the same tower
[30]	On the same tower as line Sierentz-Laufenburg
[31]	Limited by switching devices in Austria

T 9

Frontier point	Line	Circuit	Connection between: from substation			to substation		
			Country	Name	Operated by	Country	Name	Operated by
Nr.	Nr.	Nr.						
1	2	3	4	5	6	7	8	9
11	1	1	D	Diele	E.ON Netz	NL	Meeden	TenneT
11	2	1	D	Conneforde	E.ON Netz	NL	Meeden	TenneT
13	1	1	D	Siersdorf	RWE Net	NL	Maasbracht	TenneT
13	1	2	D	Rommerskirchen	RWE Net	NL	Maasbracht	TenneT
15	1	1	D	Gronau W	RWE Net	NL	Hengelo	TenneT
15	1	2	D	Gronau Z	RWE Net	NL	Hengelo	TenneT
25	1	1	B	Gramme	Elia	NL	Maasbracht	TenneT
25	1	2	B	Meerhout	Elia	NL	Maasbracht	TenneT
26	1	1	B	Zandvliet	Elia	NL	Geertruidenberg	TenneT
26	2	1	B	Zandvliet	Elia	NL	Borssele	TenneT
27	1	1	B	Maldegem	ELECTRABEL	NL	Oostburg	TenneT
41	1	1	B	Aubange	ELECTRABEL	L	Belval	SOTEL
41	1	2	B	Aubange	ELECTRABEL	L	Belval	SOTEL
41	2	1	B	Aubange	ELECTRABEL	L	Belval	SOTEL
41	3	1	B	Aubange	ELECTRABEL	L	Belval	SOTEL
51	1	1	B	Jamiolle	ELECTRABEL	F	Chooz	RTE
51	2	1	B	Avelgem	Elia	F	Avelin	RTE
51	3	1	B	Achène	Elia	F	Lonny	RTE
52	1	1	B	Aubange	ELECTRABEL	F	Moulaine	RTE
71	1	1	D	Uchtelfangen	RWE Net	F	Vigy	RTE
71	1	2	D	Uchtelfangen	RWE Net	F	Vigy	RTE
71	2	1	D	Ensdorf	RWE Net	F	St-Avold	RTE
72	1	1	D	Eichstetten	EnBW	F	Vogelgrün	RTE
72	1	2	D	Eichstetten	EnBW	F	Muhlbach	RTE
81	1	1	CH	Bassecourt	BKW	F	Sierentz	RTE
81	2	1	CH	Laufenburg	EGL	F	Sierentz	RTE
81	3	1	CH	Bassecourt	BKW	F	Mambelin	RTE
82	1	1	CH	Verbois	EOS	F	Bois-Tollot	RTE
82	1	2	CH	Chamoson	EOS	F	Bois-Tollot	RTE
82	2	1	CH	Verbois	EOS	F	Génissiat	RTE
82	2	2	CH	Verbois	EOS	F	Génissiat	RTE
82	3	1	CH	Verbois	EOS	F	Chancy-Pougny	SFM C-P
82	4	1	CH	La Bâtiaz	Atel	F	Vallorcine	RTE
82	5	1	CH	Riddes	EGL	F	Cornier	RTE
82	6	1	CH	St.-Triphon	EOS	F	Cornier	RTE
83	1	1 [16]	CH/D	Asphard	Atel/NOK /EnBW	F	Sierentz	RTE
91	1	1	F	Albertville	RTE	I	Rondissone	GRTN
91	1	2	F	Albertville	RTE	I	Rondissone	GRTN
92	1	1	F	Le Broc Carros	RTE	I	Camporosso	GRTN
93	1	1	F	Villarodin	RTE	I	Venaus	GRTN
94	1	1 [17]	F	Lucciana	RTE	I	Suvereto	GRTN
94	1	2 [19]	F	Lucciana	RTE	I	Suvereto	GRTN
102	1 [21]	1	CH	Laufenburg	EGL	D	Gurtweil	EnBW
102	1	2	CH	Laufenburg	EGL	D	Gurtweil	EnBW
102	2	1 [24]	CH	Laufenburg	EGL	D	Kühmoos	EnBW
102	3 [26]	1	CH	Laufenburg	EGL	D	Kühmoos	EnBW
102	3	2	CH	Laufenburg	EGL	D	Kühmoos	EnBW
102	4	1	CH	Laufenburg	EGL	D	Kühmoos	EnBW
102	4	2	CH	Laufenburg	EGL	D	Kühmoos	RWE Net
102	5 [29]	1	CH	Laufenburg	EGL	D	Tiengen	RWE Net
103	1	1	CH	Beznau	NOK	D	Tiengen	RWE Net
103	1	2	CH	Koblenz	NOK	D	Tiengen	RWE Net
103	1	3	CH	Klingnau	AWAG	D	Tiengen	RWE Net
104	1	1 [30]	CH	Asphard	Atel/NOK	D	Kühmoos	EnBW
105	1	1	CH	Laufenburg	EGL	D	Engstlatt	EnBW
111	1	1	A	Bürs	VIW	D	Obermooweiler	EnBW
111	1	2	A	Bürs	VIW	D	Obermooweiler	EnBW
111	2	1	A	Bürs	VIW	D	Herbertingen	RWE Net
111	3	1	A	Bürs	VIW	D	Dellmensingen	RWE Net
111	4	1	A	Rieden	VKW -ÜN	D	Lindau	VKW -ÜN
111	4	2	A	Hörbranz	VKW -ÜN	D	Lindau	VKW -ÜN
111	5	1	A	Vorderwald	VKW -ÜN	D	Weiler	VKW -ÜN

*The conventional transmission capacity of cross-frontier tie-lines is based upon parameters standardised within UCTE for the calculation of the thermal load capability of ea
For aerial lines these are : ambient temperature of +35 °C, wind velocity of 0,56 m/s at a right angle to the line as well as the voltage value stated in column 7 or 8. The co
the line depends on many other factors, such as load flow distribution, upholding of voltage, real ambient conditions, limits of stability, n-1 security, etc., the conventional tra
Adding together the conventional transmission capacity of several tie-lines does not allow to infer on the real total transmission capability and leads to irrelevant results from the point of view of system ope

T 9

Voltage of the circuit		Conventional transmission capacity of the connection (thermal)*		Limited by the transformers or by the substations of circuits		of lines	
Forecast	Present	Forecast	Present	at	Voltage	Transmission capacity	Voltage
kV	kV	MVA	MVA	MVA	kV	MVA	kV
10	11	12	13	14	15	16	17
	380		1382	1000 [1]			
	380		1382	1000 [2]			
	380		1645				
	380		1698				
	380		1790			1300 [3]	
	380		1790			1300 [4]	
	380		1207				
	380		1270				
	380		1476				
	380		1476	450 [5]			
	150		139				
	220		358				
	220		358				
	150		157	100			
	150		157	100			
	220		356	290	150 [6,7]		
	380		1109				
	380		1229				
	220		286				
	380		1167				
	380		1167				
	220		261				
380	220		338				
	380		1751				
	380		1186				
	380		1167				
	380		789				
	380		1211	800	220 [8,9]		
	380		1409	600			
	220		280				11 [10,11]
	220		280				11 [12,13]
	130		52	42			11 [14,15]
	220		266				
	220		275				
	220		275				
	380		1167				
	380		1150				
	380		1150				
	220		335				
	380		879				
	220 [18]		300			50	
	220 [20]		300			50	
	220		485	457[22]	220		
	220		485	457[23]	220		
	220		295[25]				
380	220		485	476 [25]	220		
	380		1620				
	380		1620				
	380		1580	984 [28]			
	380		1158				
	380		1158				
380	220		335				
380	110		57	40			
	380		1340				
	380		1675				
	380		1369				
	380		1369				
380	220		389				
380	220		492	457 [31]			
	110		84				
	110		84				
	110		141				

ch line.

nditions relevant to system operation in various countries at various time of the year can strongly differ from those above. Because the real allowable load capability of ansmission capacity has no relevance from the point of view of system operation or economics but allows just a comparison of order of magnitude of the various lines.

eration.

Observations	
[32]	Cable at Braunau
[33]	Cable at Braunau
[34]	Normally no electricity exchange across this line/ electricity loop at pylon 32 open, circuit grounded
[35]	Transducer at Ering
[36]	Transducer at Ering
[37]	Isolator in St. Peter
[38]	Isolator in St. Peter
[39]	Normally no electricity exchange across this line
[40]	Line section national border-tower 62 owned by E.ON Netz
[41]	Normally no electricity exchange across this line
[42]	Line section national border-tower 62 owned by E.ON Netz
[43]	No international interconnector
[44]	CFT blocker at St. Peter
[45]	No international interconnector
[46]	CFT blocker at St. Peter
[47]	Switching device at Oberbrunn
[48]	Switching device at Oberbrunn
[49]	Possible to lay a second circuit
[50]	(130/150)
[51]	Possible to lay a second circuit
[52]	New substation with 400kV near spanish frontier : replace Cantegrit
[53]	New substation with 225 kV near spanish frontier : replace Mouguerre
[54]	Limited by transformer
[55]	Limited by transformer
[56]	Transducer at Kassø
[57]	Transducer at Kassø
[58]	Monopol
[59]	DC submarine and underground cable
[60]	Limited by high-frequency coil
[61]	Generator line in radial operation - interconnected operation impossible
[62]	Installed at Vianden
[63]	Generator line in radial operation - interconnected operation impossible
[64]	Installed at Vianden
[65]	Generator line in radial operation - interconnected operation impossible
[66]	Installed at Vianden
[67]	Generator line in radial operation - interconnected operation impossible
[68]	Installed at Vianden
[69]	Limited by transformer
[70]	Limited by pumped storage power station at Bauler
[71]	520 MW in total because of the use of pumps in the power station of Vianden
[72]	520 MW in total because of the use of pumps in the power station of Vianden
[73]	The 400kV link between GR-I is composed of an overhead line and a submarine cable

T 9

Frontier point	Line	Circuit	Connection between: from substation			to substation		
			Country	Name	Operated by	Country	Name	Operated by
Nr.	Nr.	Nr.						
1	2	3	4	5	6	7	8	9
115	1	1	A	Braunau	ÖBK	D	Neuötting	E.ON Netz
115	2	1	A	Braunau	ÖBK	D	Stammham	E.ON Netz
115	3	1	A	Ranshofen	Verbund - APG	D	Neuötting	E.ON Netz
115	3	2 [34]	A	Ranshofen	Verbund - APG	D	Neuötting	E.ON Netz
115	4	1	A	Antiesenhofen	Verbund - APG	D	Egglfing	BWK
115	5	1	A	St. Peter	Verbund - APG	D	Altheim	E.ON Netz
115	6	1	A	St. Peter	Verbund - APG	D	Simbach	E.ON Netz
115	7	1	A	St. Peter	Verbund - APG	D	Ering	E.ON Netz
115	7	2	A	St. Peter	Verbund - APG	D	Ering	E.ON Netz
115	8	1	A	St. Peter	Verbund - APG	D	Egglfing	BWK
115	9	1	A	St. Peter	Verbund - APG	D	Pirach	E.ON Netz
115	10	1	A	St. Peter	Verbund - APG	D	Pleinting	E.ON Netz
115	11	1	A	Ranna	EAGOÖ	D	Passau [39,40]	E.ON Netz
115	11	2	A	Ranna	EAGOÖ	D	Passau [41,42]	E.ON Netz
115	12	1	A	Oberaudorf	ÖBK	D	Rosenheim	E.ON Netz
115	13	1	A	Oberaudorf	ÖBK	D	Kiefersfelden	E.ON Netz
115	14	1	A	Antiesenhofen	EAGOÖ	D	Weidach	Thüga
115	14	2	A	Antiesenhofen	EAGOÖ	D	Weidach	Thüga
115	15	1	A	Aigerding	Verbund - APG/EAGOÖ	D	Passau	ÖBK
115	16 [43]	1	A	St. Peter	Verbund - APG	D	Schärding	ÖBK
115	16 [45]	2	A	St. Peter	Verbund - APG	D	Schärding	ÖBK
115	17	1	A	Kufstein	TIRAG	D	Oberaudorf	ÖBK
115	17	2	A	Ebbs	TIRAG	D	Oberaudorf	ÖBK
116	1	1	A	Westtirol	Verbund - APG	D	Leupolz	RWE Net
116	2	1	A	Westtirol	Verbund - APG	D	Memmingen	RWE Net
117	1	1	A	Silz	TIRAG	D	Oberbrunn	E.ON Netz
117	1	2	A	Silz	TIRAG	D	Oberbrunn	E.ON Netz
117	3	1	A	Reutte	TIRAG	D	Füssen	EW Reutte
117	3	2	A	Reutte	TIRAG	D	Füssen	EW Reutte
121	1	1	CH	Airolo	Atel	I	Ponte	GRTN
121	2	1	CH	Gorduno	Atel	I	Mese	GRTN
121	3	1	CH	Soazza	EGL	I	Bulciago	GRTN
121	4	1	CH	Lavorgo	Atel	I	Musignano	GRTN
122	1	1 [49]	CH	Campocologno	RE	I	Poschiavino	GRTN
122	2	1	CH	Robbia	RE	I	Sondrio	GRTN
123	1	1	CH	Riddes	EGL	I	Avise	GRTN
123	2	1	CH	Riddes	EGL	I	Valpelline	GRTN
123	3	1	CH	Mörel	RHOWAG	I	Pallanzeno	GRTN
132	1	1	A	Lienz	Verbund - APG	I	Soverzene	GRTN
141	1	1 [51]	A	Meiningen	VKW-ÜN	CH	Y-Rehag	NOK
142	1	1	A	Westtirol	Verbund - APG	CH	Pradella	EGL
142	2	1	A	Westtirol	Verbund - APG	CH	Pradella	EGL
151	1	1	E	Hernani	REE	F	Argia [52]	RTE
151	2	1	E	Irún	REE	F	Errondenia	RTE
151	3	1	E	Arkale	REE	F	Argia [53]	RTE
151	4	1	E	Biescas	REE	F	Pragnères	RTE
152	1	1	E	Benós	REE	F	Lac d'Oo	RTE
153	1	1	E	Vic	REE	F	Baixas	RTE
161	1	1	D	Flensburg	E.ON Netz	DK	Ensted	ELSAM
161	2	1	D	Flensburg	E.ON Netz	DK	Kassø	ELSAM
161	3	1	D	Audorf	E.ON Netz	DK	Kassø	ELSAM
161	3	2	D	Audorf	E.ON Netz	DK	Kassø	ELSAM
162	1 [58]	1	D	Bentwisch	VE Transmission	DK	Bjæverskov	ELKRAFT
171	1	1	A	Bisamberg	Verbund - APG	CZ	Sokolnice	CEPS
171	2	1	A	Bisamberg	Verbund - APG	CZ	Sokolnice	CEPS
172	1	1	A	Dürnrohr	Verbund - APG	CZ	Slavetice	CEPS
181	1	1	A	Obersielach	Verbund - APG	SLO	Podlog	ELES
182	1	1	A	Kainachtal	Verbund - APG	SLO	Maribor	ELES
182	2	1	A	Kainachtal	Verbund - APG	SLO	Maribor	ELES
191	1	1	D	Niederstedem	RWE Net	L	Vianden	SEO
191	2	1	D	Niederstedem	RWE Net	L	Vianden	SEO
191	2	2	D	Niederstedem	RWE Net	L	Vianden	SEO
191	3	1	D	Bauler	RWE Net	L	Vianden	SEO
191	4	1	D	Bauler	RWE Net	L	Flebour	CEGEDEL
191	4	2	D	Bauler	RWE Net	L	Roost	CEGEDEL
192	1	1	D	Trier	RWE Net	L	Heisdorf	CEGEDEL
192	2	1	D	Quint	RWE Net	L	Heisdorf	CEGEDEL
201	1	1	I	Redipuglia	GRTN	SLO	Divača	ELES
201	2	1	I	Padriciano	GRTN	SLO	Divača	ELES
205	1 [73]	1	I	Galatina	GRTN	GR	Arachthos	HTSO

*The conventional transmission capacity of cross-frontier tie-lines is based upon parameters standardised within UCTE for the calculation of the thermal load capability of ea
For aerial lines these are : ambient temperature of +35 °C, wind velocity of 0,56 m/s at a right angle to the line as well as the voltage value stated in column 7 or 8. The co
the line depends on many other factors, such as load flow distribution, upholding of voltage, real ambient conditions, limits of stability, n-1 security, etc., the conventional tra
Adding together the conventional transmission capacity of several tie-lines does not allow to infer on the real total transmission capability and leads to irrelevant results from the point of view of system ope

T 9

Voltage of the circuit		Conventional transmission capacity of the connection (thermal)*		Limited by the transformers or by the substations			
				of circuits		of lines	
Forecast	Present	Forecast	Present	at	Voltage	Transmission capacity	Voltage
kV	kV	MVA	MVA	MVA	kV	MVA	kV
10	11	12	13	14	15	16	17
	110		102			82 [32]	
	110		102			82 [33]	
	110		90				
	110		90				
	110		102				
	220		301				
	220		301				
	110		152	137		114 [35]	
	110		152	137		114 [36]	
	110		105				
	220		518	457 [37]			
	220		518	457 [38]			
	110		90				
	110		90				
	110		93				
	110		102				
	110		130				
	110		130				
	110		102				
	220		301			229 [44]	
	220		301			229 [46]	
	110		90				
	110		127				
	380		1316				
380	220		762				
	220		793	762 [47]			
	220		793	762 [48]			
	110		127				
	110		127				
	220		257				
	220		257	250			
	380		1142				
	380		1118				
	150		103	55	130 [50]		
	220		257				
	220		290				
	220		290				
	220		257				
	220		257				
	220		501				
	380		1340				
	380		1340				
	380		1136				
	132		59				
	220		340				
	220		247				
	110		76				
	380		1105				
	220		332	305 [54]			
	220		332	305 [55]			
	380		1382	658 [56]			
	380		1382	658 [57]			
	400		600 [59]				
	220		269				
	220		269				
	380		1711	1386 [60]			
	220		351				
	380		1514	450			
	380		1514	450			
	220		730	460	220 [61,62]		
	220		365		220 [63,64]	345	
	220		365		220 [65,66]	345	
	220		730	460	220 [67,68]	345[69]	
	220		490	358[70]		520 [71]	
	220		490			520 [72]	
	220		490				
	220		490				
	380		1712				
	220		330				
	400		500				

ach line.

onditions relevant to system operation in various countries at various time of the year can strongly differ from those above. Because the real allowable load capability of ansmission capacity has no relevance from the point of view of system operation or economics but allows just a comparison of order of magnitude of the various lines.

eration.

Observations	
[74]	In Hungary 2 systems in parallel operation
[75]	DC submarine cable
[76]	DC submarine cable
[77]	Limited by the connected network
[78]	Nominal voltage in Croatia
[79]	Limited by the connected network
[80]	Nominal voltage in Croatia
[81]	Substation under construction
[82]	Limited by the measuring transformer of current in SK
[83]	Built for 750 kV
[84]	4500 MVA at 750 kV
[85]	Limited by the measuring transformer of current in SK
[86]	Capacity of current transformers at Bistrica
[87]	Limitating installations in CZ
[88]	Limitating installations in Etzenricht
[89]	Limited by disconnector / CEPS
[90]	Limited by disconnector / CEPS
[91]	Disconnected in Yugoslavia
[92]	Limeted by lower voltage
[93]	Limitation by measuring transducer
[94]	Destroied line
[95]	Destroied line
[96]	Out of operation

T 9

Frontier point	Line	Circuit	Connection between: from substation			to substation		
			Country	Name	Operated by	Country	Name	Operated by
Nr.	Nr.	Nr.						
1	2	3	4	5	6	7	8	9
211	1	1	A	Wien Süd-Ost	Verbund - APG	H	Györ	MAVIR
211	1	2	A	Neusiedl	Verbund - APG	H	Györ	MAVIR
212	1	1 [74]	A	Wien Süd-Ost	Verbund - APG	H	Györ	MAVIR
221	1	1	F	Mandarins	RTE	GB	Sellindge	National Grid
221	2	1	F	Mandarins	RTE	GB	Sellindge	National Grid
231	1	1	E	Las Conchas	REE	P	Lindoso	REN
232	1	1	E	Aldeadávila	REE	P	Bemposta	REN
232	2	1	E	Aldeadávila	REE	P	Pocinho	REN
232	3	1	E	Saucelle	REE	P	Pocinho	REN
233	1	1	E	Cedillo	REE	P	Falagueira	REN
234	1	1	E	Cartelle	REE	P	Alto Lindoso	REN
241	1	1	FYROM	Dubrovo	ESM	GR	Thessaloniki	HTSO
242	1	1	FYROM	Bitola	ESM	GR	Amynteo	HTSO
245	1	1	CZ	Liskovec	CEPS	PL	Kopanina	PSE SA
246	1	1	CZ	Liskovec	CEPS	PL	Bujaków	PSE SA
251	1	1	H	Lenti	MAVIR	HR	Nedeljanec	HEP
251	2	1	H	Siklos	MAVIR	HR	Donji Miholjac	HEP
251	3	1	H	Héviz	MAVIR	HR	Tumbri [81]	HEP
251	3	2	H	Héviz	MAVIR	HR	Tumbri	HEP
261	1	1	YU	Djerdap	EPS	RO	Portile de Fier	TRANSELECTRICA
261	2	1	YU	Sip	EPS	RO	Guravai	TRANSELECTRICA
262	1	1	YU	Kikinda 1	EPS	RO	Temisvar	TRANSELECTRICA
263	1	1	YU	Kusijak	EPS	RO	Ostrvo Mare	TRANSELECTRICA
270	1	1	CZ	Liskovec	CEPS	SK	Pov. Bystrica	SEPS
271	1	1	BG	Sofija Zapad	NEK	YU	Niš	EPS
272	1	1	BG	Breznik	NEK	YU	HE Vrla 1	EPS
273	1	1	BG	Kula	NEK	YU	Zaječar	EPS
275	1	1	RO	Isaccea	TRANSELECTRICA	BG	Dobrodja Varna)	NEK
276	1	1	RO	Işalniţa	TRANSELECTRICA	BG	Kozlodui	NEK
277	1	1	RO	Ţânţăreni	TRANSELECTRICA	BG	Kozlodui	NEK
277	1	2	RO	Ţânţăreni	TRANSELECTRICA	BG	Kozlodui	NEK
280	1	1	CZ	Sokolnice	CEPS	SK	Senica	SEPS
281	1	1	AL	Vau i Dejës	KESH	YU	Podgorica	EP CG
282	1	1	AL	Fierza	KESH	YU	Prizren	EPS
291	1	1	AL	Elbassan	KESH	GR	Kardia	HTSO
292	1	1	AL	Bistrica	KESH	GR	Mourtos	HTSO
301	1	1	BG	Blagoevgrad	NEK	GR	Thessaloniki	HTSO
321	1	1	CZ	Hradec	CEPS	D	Etzenricht	E.ON Netz
321	1	2	CZ	Prestice	CEPS	D	Etzenricht	E.ON Netz
322	1	1	CZ	Hradec	CEPS	D	Röhrsdorf	VE Transmission
322	1	2	CZ	Hradec	CEPS	D	Röhrsdorf	VE Transmission
331	1	1	H	Sándorfalva	MAVIR	YU	Subotica 3	EPS
332	1	1	H	Szeged	MAVIR	YU	Subotica	EPS
341	1	1	BG	Petric	NEK	FYROM	Sušica	ESM
341	2	1	BG	Skakavica	NEK	FYROM	Kriva Palaka	ESM
351	1	1	HR	Melina	HEP	SLO	Divača	ELES
351	2	1	HR	Pehlin	HEP	SLO	Divača	ELES
351	3	1	HR	Buje	HEP	SLO	Koper	ELES
351	4	1	HR	Matulji	HEP	SLO	Ilirska Bistrica	ELES
352	1	1	HR	Tumbri	HEP	SLO	Krško	ELES
352	1	2	HR	Tumbri	HEP	SLO	Krško	ELES
352	2	1	HR	Mraclin	HEP	SLO	Cirkovce	ELES
352	3	1	HR	Nedeljanec	HEP	SLO	Formin	ELES
361	1	1	BiH	Mostar	JPCC	HR	Konjsko	HEP
361	2	1	BiH	Mostar	JPCC	HR	Zakučac	HEP
361	3	1	BiH	Grahovo	JPCC	HR	Knin	HEP
361	4	1	BiH	Buško Blato	JPCC	HR	Kraljevac	HEP
361	5	1	BiH	Buško Blato	JPCC	HR	Peruca	HEP
361	6	1	BiH	Grude	JPCC	HR	Imotski	HEP
361	7	1	BiH	Kulen Vakuf	JPCC	HR	Gracac	HEP
362	1	1	BiH	Jajce	JPCC	HR	Mraclin	HEP
362	2	1	BiH	Prijedor	JPCC	HR	Međurić	HEP
363	1	1	BiH	Trebinje	JPCC	HR	Dubrovnik	HEP
363	2	1	BiH	Trebinje	JPCC	HR	Dubrovnik	HEP
363	3	1	BiH	Čaplјina	JPCC	HR	Opuzen	HEP
363	4	1	BiH	Neum	JPCC	HR	Opuzen	HEP
363	5	1	BiH	Neum	JPCC	HR	Ston	HEP
363	6	1	BiH	Trebinje	JPCC	HR	Komolac	HEP

*The conventional transmission capacity of cross-frontier tie-lines is based upon parameters standardised within UCTE for the calculation of the thermal load capability of ea
For aerial lines these are : ambient temperature of +35 °C, wind velocity of 0,56 m/s at a right angle to the line as well as the voltage value stated in column 7 or 8. The co
the line depends on many other factors, such as load flow distribution, upholding of voltage, real ambient conditions, limits of stability, n-1 security, etc., the conventional tra
Adding together the conventional transmission capacity of several tie-lines does not allow to infer on the real total transmission capability and leads to irrelevant results from the point of view of system ope

T 9

Voltage of the circuit		Conventional transmission capacity of the connection (thermal)*		Limited by the transformers or by the substations			
				of circuits		of lines	
Forecast	Present	Forecast	Present	at	Voltage	Transmission capacity	Voltage
kV	kV	MVA	MVA	MVA	kV	MVA	kV
10	11	12	13	14	15	16	17
	220		305				
	220		305				
	380		1514				
	270 [75]						
	270 [76]						
	132		90				
	220		268				
	220		268				
	220		268				
	380		707				
	380		1036				
	400		1300	700			
	150		120	100			
	220		400				
	220		400				
	120		82	50 [77]	110 [78]		
	120		114	50 [79]	110 [80]		
	400		1246				
	400		1246				
	380		1264				
	110		90				
	110		90				
	110		257				
	220		269		229[82]		
	380		1264				
	110		90				
	110		90				
750	400 [83]	500	2400 [84]				
	220		360				
	400		1450				
	400		1450				
	220		318		305 [85]		
	220		311				
	220		311				
	400		1300				
	150		120	40 [86]			
	400		1300	700			
	380		1639	1316 [87]			
	380		1645	1579 [88]			
	380		1476	1320 [89]		2630	
	380		1476	1320 [90]		2630	
	380		1246	1050			
	120		86 [91]				
	110		123				
	110		123				
	380		1264				
	220		366				
	110		89				
	110		53				
	380		1316				
	380		1316				
	220		297				
	110		115				
	400		1316	311 [92]	220		
	220		311				
	110		90				
	110		115				
	110		90				
	110		72				
	110		120	101 [93]			
	220		297[94]				
	220		297[95]				
	220		460[96]				
	220		460				
	110		84				
	110		84				
	110		76				
	110		84				

ch line.

nditions relevant to system operation in various countries at various time of the year can strongly differ from those above. Because the real allowable load capability of ansmission capacity has no relevance from the point of view of system operation or economics but allows just a comparison of order of magnitude of the various lines.

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Observations	
[97]	Destroied line and substation
[98]	Destroied line
[99]	Destroied line
[100]	Destroied line
[101]	Destroied line
[102]	Monopol
[103]	Temporarily limited by 380/110 kV transformer at Herrenwyk (456 MW towards south, 372/396 MW towards north)
[104]	Limited by the measuring transformer of current
[105]	Limited by the connections among equipments
[106]	Limited by the measuring transformer of current
[107]	Limited by the measuring transformer of current
[108]	Limited by the sag of line
[109]	Limited by the sag of line
[110]	Transformer PPGC
[111]	Transformer PPGC
[112]	Submarine cable
[113]	Limited by current transformer at Krosna and Lemešany
[114]	Limited by current transformer at Krosno and Lemešany
[115]	Out of operation/ substation local automatic equipment
[116]	Radial operation
[117]	Isolated operation
[118]	Submarine cable
[119]	Limited by HF attenuator
[120]	Limited by the measuring transformer of current
[121]	Limited by HF attenuator
[122]	Limited by HF attenuator
[123]	Out of operation/ substation local automatic equipment
[124]	Limited by the measuring transformer of current

T 9

Frontier point	Line	Circuit	Connection between: from substation			to substation		
			Country	Name	Operated by	Country	Name	Operated by
Nr.	Nr.	Nr.						
1	2	3	4	5	6	7	8	9
364	1	1	BiH	Ugljevik	JPCC	HR	Ernestinovo	HEP
364	2	1	BiH	Gradačac	JPCC	HR	Đakovo	HEP
364	3	1	BiH	Tuzla	JPCC	HR	Đakovo	HEP
364	4	1	BiH	Bosanski Brod	JPCC	HR	Bjelis	HEP
364	5	1	BiH	Orasje	JPCC	HR	Županja	HEP
371	1	1	HR	Ernestinovo	HEP	YU	Mladost	EPS
371	2	1	HR	Nijemci	HEP	YU	Šid	EPS
371	3	1	HR	Beli Manastir	HEP	YU	Apatin	EPS
381	1	1	BiH	Trebinje	JPCC	YU	Podgorica	EP CG
381	2	1	BiH	Trebinje	JPCC	YU	Peručica	EP CG
381	3	1	BiH	Trebinje	JPCC	YU	Herceg Novi	EP CG
381	4	1	BiH	Bileča	JPCC	YU	Vilusi	EP CG
382	1	1	BiH	Sarajevo 20	JPCC	YU	Piva	EP CG
382	2	1	BiH	Goražde	JPCC	YU	Pljevlja	EP CG
383	1	1	BiH	Višegrad	JPCC	YU	Požega	EPS
383	2	1	BiH	Bijeljina	JPCC	YU	Lešnica	EPS
383	3	1	BiH	Zvornik	JPCC	YU	HE Zvornik	EPS
383	4	1	BiH	Višegrad	JPCC	YU	Potpeć	EPS
391	1	1	FYROM	Skopje 1	ESM	YU	Kosovo A	EPS
391	2	1	FYROM	Skopje 1	ESM	YU	Kosovo A	EPS
391	3	1	FYROM	Skopje 4	ESM	YU	Kosovo B	EPS
401	1 [94]	1	D	Herrenwyk	E.ON Netz	S	Kruseberg	Sydkraft/Vattenfall
404	1	1	CZ	Nosovice	CEPS	SK	Varin	SEPS
424	1	1	CZ	Sokolnice	CEPS	SK	Krizovany	SEPS
440	1	1	SK	V.Kapusany	SEPS	UA	Mukachevo	NPC Ukrenergo
443	1	1	CZ	Albrechtice	CEPS	PL	Wielopole	PSE SA
444	1	1	CZ	Nošovice	CEPS	PL	Wielopole	PSE SA
497	1	1	CZ	Sokolnice	CEPS	SK	Stupava	SEPS
501	1	1	D	Vierraden	VE Transmission	PL	Krajnik	PSE SA
501	1	2	D	Vierraden	VE Transmission	PL	Krajnik	PSE SA
502	1	1	D	Hagenwerder	VE Transmission	PL	Mikulowa	PSE SA
502	1	2	D	Hagenwerder	VE Transmission	PL	Mikulowa	PSE SA
601	1 [112]	1	E	Pinar del Rey	REE	MA	Melloussa	ONE
700	1	1	PL	Krosno Iskrzynia	PSE SA	SK	Lemešany	SEPS
700	1	2	PL	Krosno Iskrzynia	PSE SA	SK	Lemešany	SEPS
701	1	1	PL	Rzeszów	PSE SA	UA	Chmielnicka	NPC Ukrenergo
702	1	1	PL	Zamość	PSE SA	UA	Dobrotwor	NPC Ukrenergo
703	1	1	PL	Bialystok	PSE SA	BY	Roś	Grodnoenergo
704	1	1	PL	Slupsk	PSE SA	S	Stärno	SvK
710	1	1	H	Györ	MAVIR	SK	Gabcikovo	SEPS
711	1	1	H	Göd	MAVIR	SK	Levice	SEPS
720	1	1	H	Albertirsa	MAVIR	UA	Zahidno Ukrainska	NPC Ukrenergo
721	1	1	H	Sajószöged	MAVIR	UA	Mukacevo	NPC Ukrenergo
722	1	1	H	Kisvárda	MAVIR	UA	Mukacevo	NPC Ukrenergo
722	1	2	H	Tiszalök	MAVIR	UA	Mukacevo	NPC Ukrenergo
730	1	1	H	Sándorfalva	MAVIR	RO	Arad	TRANSELECTRICA
740	1	1	RO	Roşiori	TRANSELECTRICA	UA	Mukacevo	NPC Ukrenergo
741	1	1	RO	Isaccea	TRANSELECTRICA	UA	Niwnitschnoi Ukrainska	NPC Ukrenergo
750	1	1	RO	Stânca	TRANSELECTRICA	MD	Costeşti	Moldenergo
751	1	1	RO	Huşi	TRANSELECTRICA	MD	Cioara	Moldenergo
752	1	1	RO	Huşi	TRANSELECTRICA	MD	Ungheni	Moldenergo

*The conventional transmission capacity of cross-frontier tie-lines is based upon parameters standardised within UCTE for the calculation of the thermal load capability of ea
For aerial lines these are : ambient temperature of +35 °C, wind velocity of 0,56 m/s at a right angle to the line as well as the voltage value stated in column 7 or 8. The co
the line depends on many other factors, such as load flow distribution, upholding of voltage, real ambient conditions, limits of stability, n-1 security, etc., the conventional tra
Adding together the conventional transmission capacity of several tie-lines does not allow to infer on the real total transmission capability and leads to irrelevant results from the point of view of system ope

T 9

Voltage of the circuit		Conventional transmission capacity of the connection (thermal)*		Limited by the transformers or by the substations of circuits		of lines	
Forecast	Present	Forecast	Present	at	Voltage	Transmission capacity	Voltage
kV	kV	MVA	MVA	MVA	kV	MVA	kV
10	11	12	13	14	15	16	17
	400		831 [97]				
	220		229 [98]				
	220		229				
	110		115 [99]				
	110		76				
	380		831				
	110		76				
	110		78				
	380		1264				
	220		311				
	110		90				
	110		84				
	220		366				
	110		90				
	220		311				
	110		123				
	110		123				
	110		123				
	220		311 [100]				
	220		311 [101]				
	380		1264				
	450		600	372 [103]			
	400		1465	1386 [104]			
	400		1503	1323 [105]			
	400		1186	639 [106]			
	400		1212				
	400		1212				
	400		1711	831 [107]			
	220		392	196[108]			
	220		392	196[109]			
	380		1427	1320[110]			
	380		1427	1320[111]			
	380		730				
	400		1434	831 [113]			
	400		1434	831 [114]			
	750		2676	1300 [115]			
	220		168[116]				
	220		154 [117]				
	450		600 [118]				
	400		1246	830			
	400		1246	830			
	750		4000	2146[119]			
	400		1635	1385 [120]			
	220		275	381 [121]			
	220		275	381 [122]			
	400		1246				
	400		1400 [123]	693 [124]			
	750		4000				
	110		90				
	110		90				
	110		90				

ch line.

nditions relevant to system operation in various countries at various time of the year can strongly differ from those above. Because the real allowable load capability of ansmission capacity has no relevance from the point of view of system operation or economics but allows just a comparison of order of magnitude of the various lines. eration.

Abbreviations used of grid operators

BELGIQUE	ELIA	- Elia System Operator SA/NV
DEUTSCHLAND	E.ON Netz	- E.ON Netz, Bayreuth
	EnBW	- EnBW Transportnetze AG, Karlsruhe
	RWE Net	- RWE Net AG, Dortmund
	Vattenfall Europe	- Vattenfall Europe Transmission GmbH, Berlin
ESPAÑA	REE	- Red Eléctrica de España S.A., Madrid
FRANCE	RTE	- Gestionnaire du Réseau de Transport d'Electricité, Paris
HELLAS	HTSO	- Hellenic Transmission System Operator
ITALIA	GRTN	- Gestore della Rete di Trasmissione Nazionale S.p.A., Roma
SLOVENIJA	ELES	- Elektro-Slovenija, Ljubljana
HRVATSKA	HEP	- Hrvatska Elektroprivreda d.d., Zagreb
S.R. JUGOSLAVIJA	EPCG	- Elektroprivreda Crne Gore, Niksic
	EPS	- Elektroprivreda Srbije, Beograd
FYROM	ESM	- Elektrostopanstvo na Makedonija, Skopje
BOSNA i HERCEGOVINA	JPCC	- Joint Power Coordination Center
LUXEMBOURG	CEGEDEL	- Compagnie Grand Ducale d'Electricité du Luxembourg, Luxembourg
NEDERLAND	TenneT bV	- TenneT bV Transmission System Operator
ÖSTERREICH	TIRAG	- Tiroler Regelzone AG
	Verbund-APG	- Verbund - Austria Power Grid GmbH, Wien
	VKW-ÜN	- Vorarlberger Kraftwerke Übertragungsnetz AG, Bregenz
PORTUGAL	REN	- Rede Eléctrica Nacional, S.A., Lisboa
SCHWEIZ	Atel	- Aare-Tessin AG für Elektrizität, Olten (Aar et Tessin Société Anony me d'Electricité)
	BKW UTN	- BKW Übertragungsnetz AG, Bern
	EGL Grid	- Elektrizitäts-Gesellschaft Laufenburg AG, Laufenburg (Electricité de Laufenbourg S.A.)
	ETRANS	- Etrans Ltd.
	EOS	- Energie Ouest Suisse S.A., Lausanne
	NOK	- Nordostschweizerische Kraftwerke AG, Baden (Forces Motrices du Nord-Est de la Suisse)

CESKA REPUBLIKA	CEPS	- CEPS a.s., Praha
MAGYARORSZÁG	MAVIR Rt	- Magyar Villamosenergia - ipari Rendszerirányitó Rt., Budapest
POLSKA	PSE SA	- Polskie Sieci Elektroenergetyczne SA
SLOVENSKO	SEPS, a.s.	- Slovenska Elektrizacna Prenosova Sustava, a.s.
BULGARIJA	NEK	- Nationalna Elektricheska Kompania EAD, Sofia
DANMARK	ELTRA	- ELTRA , Fredericia
GREAT BRITAIN	National Grid	- The National Grid Company plc, London
MAROC	ONE	- Office National de l'Electricité, Casablanca
ROMANIA	TRANSELECTRICA	- Transelectrica S.A., National Power Grid Company, Bucaresti
SHQIPËRIA	KESH	- Albanian Electroenergetic Corporation
SVERIGE	SYDKRAFT VATTENFALL	- Sydkraft AB, Malmö - Vattenfall AB, Stockholm
UKRAINA	NPC Ukrenergo	- NPC Ukrenergo

T9a Unavailability of international tie lines - Overview

Circuit ID	From substation	To substation	Voltage [kV]	Thermal conventional transmission capacity [MVA]	Major Reason	Time whole year [min]
11.1.1	D - Diele (E.ON Netz)	NL - Meeden (TenneT)	380	1382	R10	83433
11.2.1	D - Conneforde (E.ON Netz)	NL - Meeden (TenneT)	380	1382	R10	145813
13.1.1	D - Siersdorf (RWE Net)	NL - Maasbracht (TenneT)	380	1645	R1	826
13.1.2	D - Rommerskirchen (RWE Net)	NL - Maasbracht (TenneT)	380	1698	R1	17254
15.1.1	D - Gronau W+Z (RWE Net)	NL - Hengelo (TenneT)	380	1790	R1	1033
15.1.2	D - Gronau W+Z (RWE Net)	NL - Hengelo (TenneT)	380	1790	R1	2321
25.1.1	B - Gramme (Elia)	NL - Maasbracht (TenneT)	380	1207	R2	228
25.1.2	B - Meerhout (Elia)	NL - Maasbracht (TenneT)	380	1270	R1	1524
26.1.1	B - Zandvliet (Elia)	NL - Geertruidenberg (TenneT)	380	1476	R1	625
41.1.1	B - Aubange (ELECTRABEL)	L - Belval (SOTEL)	220	358	R1	631
41.1.2	B - Aubange (ELECTRABEL)	L - Belval (SOTEL)	220	358	R1	1070
41.2.1	B - Aubange (ELECTRABEL)	L - Belval (SOTEL)	150	157	R1	751
41.3.1	B - Aubange (ELECTRABEL)	L - Belval (SOTEL)	150	157	R1	506
51.1.1	B - Jamiolle (ELECTRABEL)	F - Chooz (RTE)	220	356	R1	5081
51.2.1	B - Avelgem (Elia)	F - Avelin (RTE)	380	1109	R1	16938
51.3.1	B - Achène (Elia)	F - Lonny (RTE)	380	1229	R10	541
52.1.1	B - Aubange (ELECTRABEL)	F - Moulaine (RTE)	220	286	R10	3118
71.1.1	D - Uchtelfangen (RWE Net)	F - Vigy (RTE)	380	1167	R10	36759
71.1.2	D - Uchtelfangen (RWE Net)	F - Vigy (RTE)	380	1167	R10	37202
71.2.1	D - Ensdorf (RWE Net)	F - St-Avold (RTE)	220	261	R1	14389
72.1.1	D - Eichstetten (EnBW)	F - Vogelgrün (RTE)	220	338	R1	3658
72.1.2	D - Eichstetten (EnBW)	F - Muhlbach (RTE)	380	1751	R1	6807
81.1.1	CH - Bassecourt (BKW)	F - Sierentz (RTE)	380	1186	R1	5164
81.2.1	CH - Laufenburg (EGL)	F - Sierentz (RTE)	380	1167	R1	6100
81.3.1	CH - Bassecourt (BKW)	F - Mambelin (RTE)	380	789	R1	7000
82.1.1	CH - Verbois (EOS)	F - Bois-Tollot (RTE)	380	1211	R1	16555
82.1.2	CH - Chamoson (EOS)	F - Bois-Tollot (RTE)	380	1409	R1	42802
82.2.1	CH - Verbois (EOS)	F - Génissiat (RTE)	220	280	R1	1901
82.2.2	CH - Verbois (EOS)	F - Génissiat (RTE)	220	280	R1	3947
82.4.1	CH - La Bâtiaz (Atel)	F - Vallorcine (RTE)	220	266	R1	3368
82.5.1	CH - Riddes (EGL)	F - Cornier (RTE)	220	275	R1	6934
82.6.1	CH - St.-Triphon (EOS)	F - Cornier (RTE)	220	275	R10	16228
83.1.1	CH/D - Asphard (Atel/NOK/EnBW)	F - Sierentz (RTE)	380	1167	R1	20550
91.1.1	F - Albertville (RTE)	I - Rondissone (GRTN)	380	1150	R1	15480
91.1.2	F - Albertville (RTE)	I - Rondissone (GRTN)	380	1150	R1	24060
92.1.1	F - Le Broc Carros (RTE)	I - Camporosso (GRTN)	220	335	R1	757
93.1.1	F - Villarodin (RTE)	I - Venaus (GRTN)	380	879	R1	14640
94.1.1	F - Lucciana (RTE)	I - Suvereto (GRTN)	220	300	R1	11100
94.1.2	F - Lucciana (RTE)	I - Suvereto (GRTN)	220	300	R1	11100
102.1.1	CH - Laufenburg (EGL)	D - Gurtweil (EnBW)	220	485	R1	4971
102.1.2	CH - Laufenburg (EGL)	D - Gurtweil (EnBW)	220	485	R1	3919
102.2.1	CH - Laufenburg (EGL)	D - Kühmoos (EnBW)	220	295	R11	24265
102.3.1	CH - Laufenburg (EGL)	D - Kühmoos (EnBW)	220	485	R1	25108
102.3.2	CH - Laufenburg (EGL)	D - Kühmoos (EnBW)	380	1620	R1	32677
102.4.1	CH - Laufenburg (EGL)	D - Kühmoos (EnBW)	380	1620	R1	34459
102.4.2	CH - Laufenburg (EGL)	D - Kühmoos (EnBW)	380	1580	R1	869
102.5.1	CH - Laufenburg (EGL)	D - Tiengen (RWE Net)	380	1158	R1	825
103.1.1	CH - Beznau (NOK)	D - Tiengen (RWE Net)	380	1158	R2	620
104.1.1	CH - Asphard (Atel/NOK)	D - Kühmoos (EnBW)	380	1340	R1	11847
105.1.1	CH - Laufenburg (EGL)	D - Engstlatt (EnBW)	380	1675	R1	33441
111.1.1	A - Bürs (VIW)	D - Obermooweiler (EnBW)	380	1369	R1	3131
111.1.2	A - Bürs (VIW)	D - Obermooweiler (EnBW)	380	1369	R1	15815
111.2.1	A - Bürs (VIW)	D - Herbertingen (RWE Net)	220	389	R1	12482
111.3.1	A - Bürs (VIW)	D - Dellmensingen (RWE Net)	220	492	R10	37383

Reasons: R1, R2 - Planned unavailability R3 - Overload R4, R5, R6 - Failured transmission network

January [min]	February [min]	March [min]	April [min]	May [min]	June [min]	July [min]	August [min]	September [min]	October [min]	November [min]	December [min]
	3934	16072		6908		133	1007	7442	20887	21176	5874
5248	21523	6345	23970	15958	43139	22614		2119	4643	254	
							452				374
							17254				
								1033			
				2321							
											228
				60			1464				
					625						
		631									
		1070									
460			151					140			
355			151								
			412							4669	
						375					16563
											541
				3118							
									25597	11162	
452									25588	11162	
			3337	1614		3859	2168		3411		
		1234	1107		1317						
		5780			1011			16			
			4599			565					
	723	4820									557
		12	6988								
			1967							14588	
3502		1108	1624		642			16816	5301	13809	
					1901						
					3411					536	
								3368			
	585							989	5360		
									16228		
	8394		669			5023				6464	
							420		15060		
							9000		15060		
		157	600								
							14640				
								11100			
								11100			
	470								4501		
			3389				530				
332			3190	20743							
331			4032	20745							
			636		1955		5072	25014			
			2280		2092		5072	25015			
			230			639					
			98				550	177			
			61				559				
	3348	2154								6345	
							29900			3541	
			3065					66			
		6339	6109	3367							
			3335	7565		1582					
			7200	3538		1061	3606			8100	13878

R7, R8, R9 - External impacts

R10, R11 - Other reasons

Unavailability of international tie lines - Overview

Circuit ID	From substation	To substation	Voltage [kV]	Thermal conventional transmission capacity [MVA]	Major Reason	Time whole year [min]
115.5.1	A - St. Peter (Verbund-APG)	D - Altheim (E.ON Netz)	220	301	R1	21481
115.6.1	A - St. Peter (Verbund-APG)	D - Simbach (E.ON Netz)	220	301	R1	337
115.9.1	A - St. Peter (Verbund-APG)	D - Pirach (E.ON Netz)	220	518	R1	624
115.10.1	A - St. Peter (Verbund-APG)	D - Pleinting (E.ON Netz)	220	518	R10	103
116.1.1	A - Westtirol (Verbund-APG)	D - Leupolz (RWE Net)	380	1316	R1	5373
116.2.1	A - Westtirol (Verbund-APG)	D - Memmingen (RWE Net)	220	762	R10	90759
117.1.1	A - Silz (TIRAG)	D - Oberbrunn (E.ON Netz)	220	793	R1	6863
117.1.2	A - Silz (TIRAG)	D - Oberbrunn (E.ON Netz)	220	793	R1	4623
121.1.1	CH - Airolo (Atel)	I - Ponte (GRTN)	220	257	R1	6528
121.2.1	CH - Gorduno (Atel)	I - Mese (GRTN)	220	257	R1	8043
121.3.1	CH - Soazza (EGL)	I - Bulciago (GRTN)	380	1142	R1	3591
121.4.1	CH - Lavorgo (Atel)	I - Musignano (GRTN)	380	1118	R1	747
122.2.1	CH - Robbia (RE)	I - Sondrio (GRTN)	220	257	R1	30062
123.1.1	CH - Riddes (EGL)	I - Avise (GRTN)	220	290	R7	33499
123.2.1	CH - Riddes (EGL)	I - Valpelline (GRTN)	220	290	R7	20089
123.3.1	CH - Mörel (RHOWAG)	I - Pallanzeno (GRTN)	220	257	R1	15501
132.1.1	A - Lienz (Verbund-APG)	I - Soverzene (GRTN)	220	257	R1	24969
141.1.1	A - Meiningen (VKW-ÜN)	CH - Y-Rehag (NOK)	220	501	R1 , R10	37539
142.1.1	A - Westtirol (Verbund-APG)	CH - Pradella (EGL)	380	1340	R1	19096
142.2.1	A - Westtirol (Verbund-APG)	CH - Pradella (EGL)	380	1340	R1	11323
151.1.1	E - Hernani (REE)	F - Argia (RTE)	380	1136	R1 , R10	46729
151.3.1	E - Arkale (REE)	F - Argia (RTE)	220	340	R1	46854
151.4.1	E - Biescas (REE)	F - Pragnères (RTE)	220	247	R1	5632
152.1.1	E - Benós (REE)	F - Lac d'Oo (RTE)	110	76	R1	29865
153.1.1	E - Vic (REE)	F - Baixas (RTE)	380	1105	R2	1264
161.1.1	D - Flensburg (E.ON Netz)	DK - Ensted (ELSAM)	220	332	R1	4004
161.2.1	D - Flensburg (E.ON Netz)	DK - Kassø (ELSAM)	220	332	R1	4037
161.3.1	D - Audorf (E.ON Netz)	DK - Kassø (ELSAM)	380	1382	R1	340
161.3.2	D - Audorf (E.ON Netz)	DK - Kassø (ELSAM)	380	1382	R1 , R7	2020
162.1.1	D - Bentwisch (VE Transmission)	DK - Bjæverskov (ELKRAFT)	400	600	R2	71980
171.1.1	A - Bisamberg (Verbund-APG)	CZ - Sokolnice (CEPS)	220	269	R1	12639
171.2.1	A - Bisamberg (Verbund-APG)	CZ - Sokolnice (CEPS)	220	269	R1	17509
172.1.1	A - Dürnrohr (Verbund-APG)	CZ - Slavetice (CEPS)	380	1711	R1	7468
181.1.1	A - Obersielach (Verbund-APG)	SLO - Podlog (ELES)	220	351	R1	19196
182.1.1	A - Kainachtal (Verbund-APG)	SLO - Maribor (ELES)	380	1514	R1	6189
182.2.1	A - Kainachtal (Verbund-APG)	SLO - Maribor (ELES)	380	1514	R1	5983
191.4.1	D - Bauler (RWE Net)	L - Flebour (CEGEDEL)	220	490	R8	216
191.4.2	D - Bauler (RWE Net)	L - Roost (CEGEDEL)	220	490	R1 , R10	2071
192.1.1	D - Trier (RWE Net)	L - Heisdorf (CEGEDEL)	220	490	R1	4371
192.2.1	D - Quint (RWE Net)	L - Heisdorf (CEGEDEL)	220	490	R1	3568
201.1.1	I - Redipuglia (GRTN)	SLO - Divača (ELES)	380	1712	R1	6120
201.2.1	I - Padriciano (GRTN)	SLO - Divača (ELES)	220	330	R1	4793
205.1.1	I - Galatina (GRTN)	GR - Arachthos (HTSO)	380	500	R6	714
211.1.1	A - Wien Süd-Ost (Verbund-APG)	H - Györ (MAVIR)	220	305	R2 , R7	38316
211.1.2	A - Neusiedl (Verbund-APG)	H - Györ (MAVIR)	220	305	R11	4984
212.1.1	A - Wien Süd-Ost (Verbund-APG)	H - Györ (MAVIR)	380	1514	R1	16937
221.1.1	F - Mandarins (RTE)	GB - Sellindge (National Grid)	270		R8 , R10	1879
221.2.1	F - Mandarins (RTE)	GB - Sellindge (National Grid)	270		R1, R8, R10	5772
231.1.1	E - Las Conchas (REE)	P - Lindoso (REN)	132	90	R1	995
232.1.1	E - Aldeadávila (REE)	P - Bemposta (REN)	220	268	R1	44545
232.2.1	E - Aldeadávila (REE)	P - Pocinho (REN)	220	268	R1	89790
232.3.1	E - Saucelle (REE)	P - Pocinho (REN)	220	268	R7	385
233.1.1	E - Cedillo (REE)	P - Falagueira (REN)	380	707	R7	251
234.1.1	E - Cartelle (REE)	P - Alto Lindoso (REN)	380	1036	R1	2241
241.1.1	FYROM - Dubrovo (ESM)	GR - Thessaloniki (HTSO)	380	1300	R1	3409
242.1.1	FYROM - Bitola (ESM)	GR - Amyndeo (HTSO)	150	120	R1	1088

Reasons: R1, R2 - Planned unavailability R3 - Overload R4, R5, R6 - Failured transmission network

January [min]	February [min]	March [min]	April [min]	May [min]	June [min]	July [min]	August [min]	September [min]	October [min]	November [min]	December [min]
3793		199		87	877	2198	5635	4962	3582		148
		67			270						
	557	67									
							38		65		
					5047					326	
		117			5009				25440	43200	16993
		814	153	102	3549					1221	1024
		404			2140	12					2067
					6208						320
		1740	292					840	5171		
		120					3368				103
							747				
			19260		8555			2247			
								19737		6925	6837
								6325		6925	6839
			14917		110				232		242
							24960	9			
	3473	13375		414			169		14149	5959	
					5596		1562	11938			
					4799		556	5968			
				21169	25560						
			46175			679					
			954					4678			
						224	29448	14			179
	3	1125						136			
						1712			2292		
						1940			2097		
									340		
		1035			581				404		
					402			20160	1019	43200	7199
3618	1948		574			6410		89			
	3061	487	574			6469	6414	89	415		
								7468			
519				620			64	2054	15939		
		6189									
		5983									
216											
173		539	434			698					227
			1190		2581	107			493		
	378		690			2500					
							6120				
600		2400			660						1133
			93	357		264					
	129		2547			4177	30658	99	706		
				3424		528	1032				
	132			6783	9455	187	380				
80	120	78	79			301	232	133	856		
356	138	89	233		4009	19	44		884		
					383	612					
33885	5337	3545			1721	44	13				
12353	40320	37117									
							385				
										251	
									167	944	1130
				2405	1004						
		171		554			35			328	

R7, R8, R9 - External impacts

R10, R11 - Other reasons

Unavailability of international tie lines - Overview

Circuit ID	From substation	To substation	Voltage [kV]	Thermal conventional transmission capacity [MVA]	Major Reason	Time whole year [min]
245.1.1	CZ - Lieskovec (CEPS)	PL - Kopanina (PSE SA)	220	400	R1	7575
246.1.1	CZ - Lieskovec (CEPS)	PL - Bujaków (PSE SA)	220	400	R1	7969
251.1.1	H - Lenti (MAVIR)	HR - Nedeljanec (HEP)	120	82	R10	41301
251.2.1	H - Siklos (MAVIR)	HR - Donji Miholjac (HEP)	120	114	R10	18669
261.1.1	YU - Djerdap (EPS)	RO - Portile de Fier (TRANSELECTRICA)	380	1264	R1	8535
261.2.1	YU - Sip (EPS)	RO - Guravai (TRANSELECTRICA)	110	90	R10	525600
262.1.1	YU - Kikinda 1 (EPS)	RO - Temisvar (TRANSELECTRICA)	110	90	R10	525600
263.1.1	YU - Kusijak (EPS)	RO - Ostrvo Mare (TRANSELECTRICA)	110	257	R10	525600
270.1.1	CZ - Lieskovec (CEPS)	SK - Pov. Bystrica (SEPS)	220	269	R1	11075
271.1.1	BG - Sofija Zapad (NEK)	YU - Niš (EPS)	380	1264	R2	1760
272.1.1	BG - Breznik (NEK)	YU - HE Vrla 1 (EPS)	110	90	R10	525600
273.1.1	BG - Kula (NEK)	YU - Zaječar (EPS)	110	90	R10	525600
280.1.1	CZ - Sokolnice (CEPS)	SK - Senica (SEPS)	220	318	R1	37012
281.1.1	AL - Vau i Dejës (KESH)	YU - Podgorica (EP CG)	220	311	R2	317
282.1.1	AL - Fierza (KESH)	YU - Prizren (EPS)	220	311	R4	122
291.1.1	AL - Elbassan (KESH)	GR - Kardia (HTSO)	380	1300	R6	72
301.1.1	BG - Blagoevgrad (NEK)	GR - Thessaloniki (HTSO)	380	1300	R1	11325
321.1.1	CZ - Hradec (CEPS)	D - Etzenricht (E.ON Netz)	380	1639	R1	28057
321.1.2	CZ - Prestice (CEPS)	D - Etzenricht (E.ON Netz)	380	1645	R1	17684
322.1.1	CZ - Hradec (CEPS)	D - Röhrsdorf (VE Transmission)	400	1476	R1 , R10	21588
322.1.2	CZ - Hradec (CEPS)	D - Röhrsdorf (VE Transmission)	400	1476	R10	23822
331.1.1	H - Sandorfalva (MAVIR)	YU - Subotica 3 (EPS)	380	1246	R10	21101
371.1.1	HR - Ernestinovo (HEP)	YU - Mladost (EPS)	380	831	R10	525600
371.2.1	HR - Nijemci (HEP)	YU - Šid (EPS)	110	76	R10	413303
371.3.1	HR - Beli Manastir (HEP)	YU - Apatin (EPS)	110	78	R10	525600
381.1.1	BiH - Trebinje (JPCC)	YU - Podgorica (EP CG)	380	1264	R1	825
381.2.1	BiH - Trebinje (JPCC)	YU - Peručica (EP CG)	220	311	R1 , R2	5972
381.3.1	BiH - Trebinje (JPCC)	YU - Herceg Novi (EP CG)	110	90	R1	4530
381.4.1	BiH - Bileča (JPCC)	YU - Vilusi (EP CG)	110	84	R1 , R4	3258
382.1.1	BiH - Sarajevo 20 (JPCC)	YU - Piva (EP CG)	220	366	R1	2374
383.1.1	BiH - Višegrad (JPCC)	YU - Požega (EPS)	220	311	R2	1637
383.2.1	BiH - Bijeljina (JPCC)	YU - Lešnica (EPS)	110	123	R1 , R2	1022
383.3.1	BiH - Zvornik (JPCC)	YU - HE Zvornik (EPS)	110	123	R1 , R2	2340
383.4.1	BiH - Višegrad (JPCC)	YU - Potpeć (EPS)	110	123	R1	388
401.1.1	D - Herrenwyk (E.ON Netz)	S - Kruseberg (Sydkraft/Vattenfall)	450	600	R7	81303
404.1.1	CZ - Nosovice (CEPS)	SK - Varin (SEPS)	400	1465	R1	26884
424.1.1	CZ - Sokolnice (CEPS)	SK - Krizovany (SEPS)	400	1503	R1	17257
440.1.1	SK - V.Kapusany (SEPS)	UA - Mukacevo (NPC Ukrenergo)	400	1186	R1	41061
443.1.1	CZ - Albrechtice (CEPS)	PL - Wielopole (PSE SA)	400	1212	R1	46790
444.1.1	CZ - Nošovice (CEPS)	PL - Wielopole (PSE SA)	400	1212	R1	22016
497.1.1	CZ - Sokolnice (CEPS)	SK - Stupava (SEPS)	400	1711	R1	30572
501.1.1	D - Vierraden (VE Transmission)	PL - Krajnik (PSE SA)	220	392	R1 , R9	4915
501.1.2	D - Vierraden (VE Transmission)	PL - Krajnik (PSE SA)	220	392	R10	18620
502.1.1	D - Hagenwerder (VE Transmission)	PL - Mikulowa (PSE SA)	380	1427	R1	4003
502.1.2	D - Hagenwerder (VE Transmission)	PL - Mikulowa (PSE SA)	380	1427	R1	4266
601.1.1	E - Pinar del Rey (REE)	MA - Melloussa (ONE)	380	730	R1	2826
700.1.1	PL - Krosno Iskrzynia (PSE SA)	SK - Lemešany (SEPS)	400	1434	R1	17605
700.1.2	PL - Krosno Iskrzynia (PSE SA)	SK - Lemešany (SEPS)	400	1434	R1	16935
702.1.1	PL - Zamosc (PSE SA)	UA - Dobrotwor (NPC Ukrenergo)	220	168	R1	65526
703.1.1	PL - Bialystok (PSE SA)	BY - Ros (Grodnoenergo)	220	154	R2 , R11	8112
704.1.1	PL - Slupsk (PSE SA)	S - Stärno (SvK)	450	600	R2, R9, R11	136851
710.1.1	H - Györ (MAVIR)	SK - Gabcikova (SEPS)	400	1246	R1	6720
711.1.1	H - Göd (MAVIR)	SK - Levice (SEPS)	400	1246	R1	13799
720.1.1	H - Albertirsa (MAVIR)	UA - Zahidno Ukrainska (NPC Ukrenergo)	750	4000	R10	243335
721.1.1	H - Sajoszöged (MAVIR)	UA - Mukacevo (NPC Ukrenergo)	380	1635	R11	37082
722.1.1	H - Kisvárda (MAVIR)	UA - Mukacevo (NPC Ukrenergo)	220	275	R1	39206
722.1.2	H - Tiszalök (MAVIR)	UA - Mukacevo (NPC Ukrenergo)	220	275	R7	126
730.1.1	H - Sándorfalva (MAVIR)	RO - Arad (TRANSELECTRICA)	400	1246	R10	18881

Reasons: R1, R2 - Planned unavailability R3 - Overload R4, R5, R6 - Failured transmission network

January [min]	February [min]	March [min]	April [min]	May [min]	June [min]	July [min]	August [min]	September [min]	October [min]	November [min]	December [min]
		130	6462			983					
			6325			986	658				
		199		41102							
891						17167					611
	203				427						7905
44640	40320	44640	43200	44640	43200	44640	44640	43200	44640	43200	44640
44640	40320	44640	43200	44640	43200	44640	44640	43200	44640	43200	44640
44640	40320	44640	43200	44640	43200	44640	44640	43200	44640	43200	44640
		4290				6240	373			172	
					1760						
44640	40320	44640	43200	44640	43200	44640	44640	43200	44640	43200	44640
44640	40320	44640	43200	44640	43200	44640	44640	43200	44640	43200	44640
							8207	28805			
173		32					14	30	24		44
					122						
			50				22				
			10814			511					
		1736	174			4006	22116		25		
		3222					14462				
517					3657			9763			7651
513		1149				16212					5948
262		28	16		19431	1165				23	176
44640	40320	44640	43200	44640	43200	44640	44640	43200	44640	43200	44640
44640	40320	44640	18719			44664	44640	43200	44640	43200	44640
44640	40320	44640	43200	44640	43200	44640	44640	43200	44640	43200	44640
				8	1	699		41	76		
	13	98	22	2797	709	14	196	1998		125	
	14			351			20	1285	10	4	2846
5	1142			525			56	1347	163	9	11
343				23					2008		
			34	85	1518						
						26			551	445	
		6				30			508	1796	
						15				373	
		21979	43200	8389			38	7641	56		
	293				26331		140		110	10	
								1004	16253		
	2239	2736	1685	25483	6305				2613		
		569				28349	13723			4149	
		576			2355	5284	13801				
275			29503		424				316	54	
1046	600	3111									158
1173	676	3590				13181					
			4003								
			4007	259							
617				629	54	49	654	823			
		1089			110		15880			526	
282		563			206		15884				
		360						43200	21966		
	883	575				1428		3637		1589	
279	521	632	12546	13081	26	1019	21	17654	36319	43200	11553
			8					6211		501	
		13415			31				353		
44640	40320	44640	23079	44640	43200	1376			285	279	876
		2735	1674	25480	6305				301	587	
		12106		986				26114			
											126
					18714	126				41	

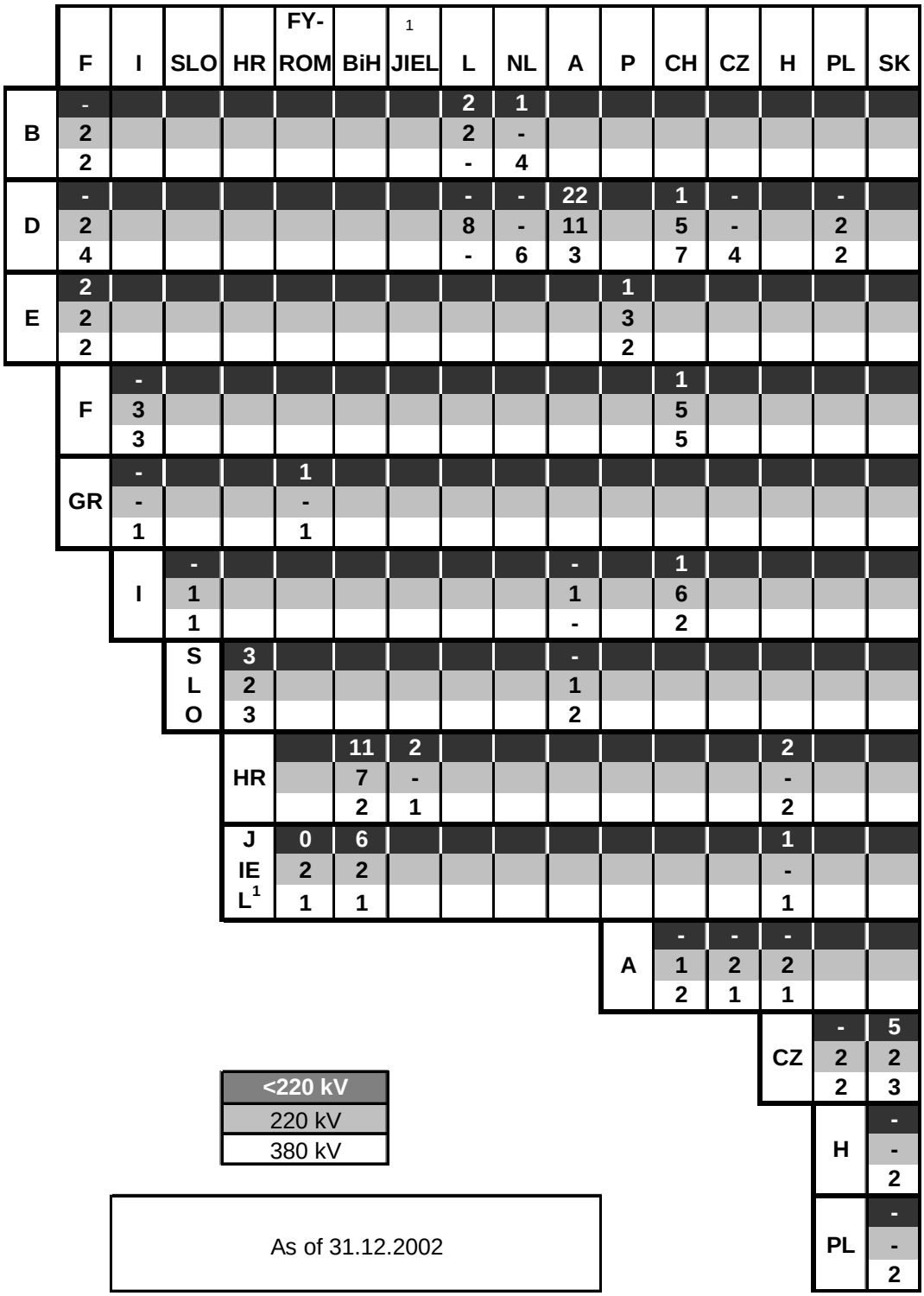
R7, R8, R9 - External impacts

R10, R11 - Other reasons

	Circuit length (km)				Transformers 400kV → 220kV		
					in the network		
Country	220 kV	of which cable	400 kV	of which cable	Number	Capacity GVA	
B	388	0	1476	0	6	2,1	
D[1]	20000	35	18600	65	87	51,8	
E[1]	16179	114	15197	15	83	35,5	
F	26289	899	20866	2	208	106,0	
GR	8146	166	2623	160	35	9,3	
I	12883	859	9978	204	51	20,5	
SLO	328	0	510	0	3	1,2	
HR[2]	1224	0	1157	0	0	0,0	
JIEL[4]	2723	0	2143	0	12	4,8	
L	236	6	0	0	0	0,0	
NL	683	6	2003	0,4	4	2,5	
A[3]	3765	5	2474	56	17	10,8	
P	2705	11	1301	0	6	2,7	
CH	5047	20	1597	0	19	10,6	
CZ	1904	0	3367	0	4	2,0	
H[3]	1488	0	1956	0	3	1,5	
PL	8112	0	4660	245	16	7,2	
SK	962	0	1753	0	3	1,4	
UCTE	**113062**	**2121**	**91661**	**747**	**557**	**269,9**	

[1] Transformers of power units as of December 31, 2001
[2] Values as of December 31, 2001
[3] Values as of December 31, 2000
[4] JIEL = FRY + FYROM (Federal Republic of Yugoslavia and former Yugoslav Republic of Macedonia)

	Transformers 220kV → < 220kV				Transformers 400kV → < 220kV			
	of power units		in the network		of power units		in the network	
	Number	Capacity GVA	Number	Capacity GVA	Number	Capacity GVA	Number	Capacity GVA
	3	0,8	17	2,8	14	8,4	24	11,8
	111	31,0	435	81,9	100	62,0	188	54,6
	155	18,6	506	48,3	56	22,5	31	11,8
	263	31,0	1156	106,0	211	86,0	55	13,0
	69	7,1	360	15,1	16	5,0	0	0,0
	112	23,0	150	24,7	116	34,8	206	52,9
	0	0,0	10	1,1	0	0,0	4	1,2
	5	0,8	10	2,4	1	0,3	3	2,5
	20	3,8	53	8,0	16	6,6	17	5,0
	11	1,8	18	2,6	0	0,0	0	0,0
	9	3,2	25	4,6	6	3,6	33	15,1
	64	7,1	67	11,5	3	1,2	13	3,9
	60	3,6	61	7,2	15	3,2	13	3,7
	101	4,7	149	13,9	8	4,3	1	0,2
	5	1,1	20	4,0	33	11,3	41	11,1
	n.a.	n.a.	26	4,2	n.a.	n.a.	20	4,2
	57	13,4	108	17,3	24	8,2	34	9,1
	8	1,5	13	2,6	20	4,1	18	4,7
	65	**14,9**	**3184**	**358,2**	**639**	**261,5**	**701**	**204,8**



[1] JIEL = FRY + FYROM (Federal Republic of Yugoslavia and former Yugoslav Republic of Macedonia)

T12 Commissioning of new transmission installations

Country	Name of line	Designed for	Equipped for	Operated with
Deutschland	Goldisthal - Altenfeld	2 x 380 kV	2 x 380 kV	2 x 380 kV
	Röhrsdorf - Hradec	2 x 380 kV	2 x 380 kV	2 x 380 kV
	Zukunft - Verlautenheide	2 x 380 kV	2 x 380 kV	2 x 380 kV
		2 x 110 kV	2 x 110 kV	2 x 110 kV
	Anschluss Trossingen [1]	2 x 380 kV	2 x 380 kV	1 x 380 kV
Hellas	Florina - Amyndeo	1 x 400 kV	1 x 400 kV	1 x 400 kV
Schweiz	T-Rehag - Austrian Border [2]	1 x 400 kV	1 x 220 kV	1 x 220 kV

[1] In the year 2002 new constructions took place in the area of Engstlatt and Trossingen. A new 380 kV substation was built in Trossingen. For the additional support of this substation a new 380 kV line has been built between Engstlatt, Kühmoos and Villingen, using the existing 380 kV line between Kühmoos and Villingen.

[2] This line is the second 220 kV circuit of the existing line between T-Rehag and Meiningen in Austria