

Observations

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

T 9

			Connection between:					
Frontier point	Line	Circuit	from substation			to substation		
			Country	Name	Operated by	Country	Name	Operated by
Nr.	Nr.	Nr.	4	5	6	7	8	9
11	1	1	D	Diele	E.ON Netz	NL	Meeden	TenneT
11	1	2	D	Diele	E.ON Netz	NL	Meeden	TenneT
13	1	1	D	Siersdorf	RWE Transportnetz Strom	NL	Maasbracht	TenneT
13	1	2	D	Rommerskirchen	RWE Transportnetz Strom	NL	Maasbracht	TenneT
15	1	1	D	Gronau W	RWE Transportnetz Strom	NL	Hengelo	TenneT
15	1	2	D	Gronau Z	RWE Transportnetz Strom	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 Transportnetz Strom	F	Vigy	RTE
71	1	2	D	Uchtelfangen	RWE Transportnetz Strom	F	Vigy	RTE
71	2	1	D	Ensdorf	RWE Transportnetz Strom	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	Géniissiat	RTE
82	2	2	CH	Verbois	EOS	F	Géniissiat	RTE
82	3	1	CH	Verbois	EOS	F	Chancy-Pougny	SFM C-P
82	4	1	CH	La Bâtiâz	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 [12]	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 [13]	F	Lucciana	RTE	I	Suvereto	GRTN
94	1	2 [15]	F	Lucciana	RTE	I	Suvereto	GRTN
102	1 [17]	1	CH	Laufenburg	EGL Grid	D	Gurtweil	EnBW
102	1	2	CH	Laufenburg	EGL Grid	D	Gurtweil	EnBW
102	2	1 [20]	CH	Laufenburg	EGL Grid	D	Kühmoos	EnBW
102	3 [22]	1	CH	Laufenburg	EGL Grid	D	Kühmoos	EnBW
102	3	2	CH	Laufenburg	EGL Grid	D	Kühmoos	EnBW
102	4	1	CH	Laufenburg	EGL Grid	D	Kühmoos	EnBW
102	4	2	CH	Laufenburg	EGL Grid	D	Kühmoos	RWE Transportnetz Strom
102	5 [25]	1	CH	Laufenburg	EGL Grid	D	Tiengen	RWE Transportnetz Strom
103	1	1	CH	Beznav	NOK	D	Tiengen	RWE Transportnetz Strom
103	1	2	CH	Beznav	NOK	D	Tiengen	RWE Transportnetz Strom
103	1	3	CH	Klingnau	AWAG	D	Tiengen	RWE Transportnetz Strom
104	1	1 [26]	CH	Asphard	Atel/NOK	D	Kühmoos	EnBW
105	1	1	CH	Laufenburg	EGL Grid	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 Transportnetz Strom
111	3	1	A	Bürs	VIW	D	Dellmensingen	RWE Transportnetz Strom
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 10 or 11. The of 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 t 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

Voltage of the circuit		Conventional transmission capacity of the connection (thermal)*		Limited by the transformers or by the substations				T 9
				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]			
	380		1109					
	380		1229					
	220		286					
	380		1167					
	380		1167					
	220		261					
380	220		338 [7]					
	380		1751					
	380		1186					
	380		1167					
	380		789					
	380		1211	800	220 [8]			
	380		1409	600				
	220		280				11 [9]	
	220		280				11 [10]	
	130		52	42			11 [11]	
	220		266					
	220		275					
	220		275					
	380		1167					
	380		1150					
	380		1150					
	220		320					
	380		879					
	220 [14]		300			50		
	220 [16]		300			50		
	220		485	457[18]	220			
	220		485	457[19]	220			
	220		295[21]					
380	220		485	476 [23]	220			
	380		1620					
	380		1620					
	380		1580	984 [24]				
	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 [27]				
	110		84					
	110		84					
	110		141					

each line.

conditions 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 transmission 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. from the point of view of system operation.

Observations

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

T 9

			Connection between:					
Frontier point	Line	Circuit	from substation			to substation		
			Country	Name	Operated by	Country	Name	Operated by
Nr.	Nr.	Nr.	4	5	6	7	8	9
115	1	1	A	Braunau	GKW	D	Neuötting	E.ON Netz
115	2	1	A	Braunau	GKW	D	Stammham	E.ON Netz
115	3	1	A	Ranshofen	Verbund - APG	D	Neuötting	E.ON Netz
115	3	2 [30]	A	Ranshofen	Verbund - APG	D	Neuötting	E.ON Netz
115	4	1	A	Antiesenhofen	Verbund - APG	D	Eggfling	E.ON Netz
115	5	1	A	St. Peter	Verbund - APG	D	Altheim	E.ON Netz
115	6	1	A	St. Peter	Verbund - APG	D	Sirnbach	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	Eggfling	E.ON Netz
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 [35,36]	E.ON Netz
115	11	2	A	Ranna	EAGOÖ	D	Passau [37,38]	E.ON Netz
115	12	1	A	Oberaudorf	GKW	D	Rosenheim	E.ON Netz
115	13	1	A	Oberaudorf	GKW	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	GKW
115	16 [39]	1	A	St. Peter	Verbund - APG	D	Schärding	GKW
115	16 [41]	2	A	St. Peter	Verbund - APG	D	Schärding	GKW
115	17	1	A	Kufstein	TIRAG	D	Oberaudorf	GKW
115	17	2	A	Ebbs	TIRAG	D	Oberaudorf	GKW
116	1	1	A	Westtirol	Verbund - APG	D	Leupolz	RWE Transportnetz Strom
116	2	1	A	Westtirol	Verbund - APG	D	Memmingen	RWE Transportnetz Strom
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 Grid	I	Bulciago	GRTN
121	4	1	CH	Lavorgo	Atel	I	Musignano	GRTN
122	1	1 [45]	CH	Campocologno	RE	I	Poschiavino	GRTN
122	2	1	CH	Robbia	RE	I	Sondrio	GRTN
123	1	1	CH	Riddes	EGL Grid	I	Avise	GRTN
123	2	1	CH	Riddes	EGL Grid	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 [47]	A	Meiningen	VKW-ÜN	CH	Y-Rehag	NOK
141	2	1	A	Meiningen	VKW-ÜN	CH	Winkeln	NOK
142	1	1	A	Westtirol	Verbund - APG	CH	Pradella	EGL Grid
142	2	1	A	Westtirol	Verbund - APG	CH	Pradella	EGL Grid
151	1	1	E	Hernani	REE	F	Argia [48]	RTE
151	2	1	E	Irún	REE	F	Errondenia	RTE
151	3	1	E	Arkale	REE	F	Argia [49]	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	ELTRA
161	2	1	D	Flensburg	E.ON Netz	DK	Kassø	ELTRA
161	3	1	D	Audorf	E.ON Netz	DK	Kassø	ELTRA
161	3	2	D	Audorf	E.ON Netz	DK	Kassø	ELTRA
162	1 [54]	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	Dürrohr	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 Transportnetz Strom	L	Vianden	SEO
191	2	1	D	Niederstedem	RWE Transportnetz Strom	L	Vianden	SEO
191	2	2	D	Niederstedem	RWE Transportnetz Strom	L	Vianden	SEO
191	3	1	D	Bauler	RWE Transportnetz Strom	L	Vianden	SEO
191	4	1	D	Bauler	RWE Transportnetz Strom	L	Flebour	CEGEDEL
191	4	2	D	Bauler	RWE Transportnetz Strom	L	Roost	CEGEDEL
192	1	1	D	Trier	RWE Transportnetz Strom	L	Heisdorf	CEGEDEL
192	2	1	D	Quint	RWE Transportnetz Strom	L	Heisdorf	CEGEDEL
201	1	1	I	Redipuglia	GRTN	SLO	Divča	ELES
201	2	1	I	Padriciano	GRTN	SLO	Divča	ELES
205	1 [69]	1	I	Galatina	GRTN	GR	Arachthos	HTSO

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Voltage of the circuit		Conventional transmission capacity of the connection (thermal)*		Limited by the transformers or by the substations			
Forecast	Present	Forecast	Present	of circuits		of lines	
				at	Voltage	Transmission capacity	Voltage
kV	kV	MVA	MVA	MVA	kV	MVA	kV
10	11	12	13	14	15	16	17
	110		102			82 [28]	
	110		102			82 [29]	
	110		90				
	110		90				
	110		102				
	220		301				
	220		301				
	110		152	137		114 [31]	
	110		152	137		114 [32]	
	110		105				
	220		518	457 [33]			
	220		518	457 [34]			
	110		90				
	110		90				
	110		93				
	110		102				
	110		130				
	110		130				
	110		102				
	220		301			229 [40]	
	220		301			229 [42]	
	110		90				
	110		127				
380	380		1316				
	220		762				
	220		793	762 [43]			
	220		793	762 [44]			
	110		127				
	110		127				
	220		257				
	220		257	250			
	380		1142				
	380		1118				
	150		103	55	130 [46]		
	220		257				
	220		290				
	220		290				
	220		257				
	220		257				
	220		501				
	220		776				
	380		1340				
	380		1340				
	380		1136				
	132		56				
	220		340				
	220		257				
	110		63				
	380		1105				
	220		332	305 [50]			
	220		332	305 [51]			
	380		1382	658 [52]			
	380		1382	658 [53]			
	400		600 [55]				
	220		269				
	220		269				
	380		1711	1386 [56]			
	220		351				
	380		1514	450			
	380		1514	450			
	220		730	460	220 [57,58]		
	220		365		220 [59,60]	345	
	220		365		220 [61,62]	345	
	220		730	460	220 [63,64]	345[65]	
	220		490	358[66]		520 [67]	
	220		490			520 [68]	
	220		490				
	220		490				
	380		1712				
	220		305				
	380		305				

each line.

conditions 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 transmission 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. from the point of view of system operation.

Observations

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

T 9

			Connection between:					
Frontier point	Line	Circuit	from substation			to substation		
			Country	Name	Operated by	Country	Name	Operated by
Nr.	Nr.	Nr.	4	5	6	7	8	9
1	2	3						
211	1	1	A	Wien Süd-Ost	Verbund - APG	H	Győr	MAVIR
211	1	2	A	Neusiedl	Verbund - APG	H	Győr	MAVIR
212	1	1 [70]	A	Wien Süd-Ost	Verbund - APG	H	Győr	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	Hévíz	MAVIR	HR	Zerjavinec [77]	HEP
251	3	2	H	Hévíz	MAVIR	HR	Tumbri	HEP
261	1	1	SCG	Djerdap	EPS	RO	Portile de Fier	TRANSELECTRICA
261	2	1	SCG	Sip	EPS	RO	Gura Văii	TRANSELECTRICA
262	1	1	SCG	Kikinda 1	EPS	RO	Jimbolia	TRANSELECTRICA
263	1	1	SCG	Kusijak	EPS	RO	Ostrovu Mare	TRANSELECTRICA
270	1	1	CZ	Liskovec	CEPS	SK	Pov. Bystrica	SEPS
271	1	1	BG	Sofija Zapad	NEK	SCG	Niš	EPS
272	1	1	BG	Breznik	NEK	SCG	HE Vrla 1	EPS
273	1	1	BG	Kula	NEK	SCG	Zaječar	EPS
275	1	1	RO	Isaccea	TRANSELECTRICA	BG	Dobrodja Varna	NEK
276	1	1	RO	Işalnița	TRANSELECTRICA	BG	Kozlodui	NEK
277	1	1	RO	Țântăreni	TRANSELECTRICA	BG	Kozlodui	NEK
277	1	2	RO	Țântăreni	TRANSELECTRICA	BG	Kozlodui	NEK
280	1	1	CZ	Sokolnice	CEPS	SK	Senica	SEPS
281	1	1	AL	Vau i Dejës	KESH	SCG	Podgorica	EP CG
282	1	1	AL	Fierza	KESH	SCG	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	SCG	Subotica 3	EPS
332	1	1	H	Szeged	MAVIR	SCG	Subotica	EPS
341	1	1	BG	Skakavica	NEK	FYROM	Kriva Palanka	ESM
341	2	1	BG	Petric	NEK	FYROM	Sušica	ESM
351	1	1	HR	Melina	HEP	SLO	Divča	ELES
351	2	1	HR	Pehlin	HEP	SLO	Divča	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	Čapljina	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

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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 10 or 11. The
of 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 t
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

Voltage of the circuit		Conventional transmission capacity of the connection (thermal)*		Limited by the transformers or by the substations				T 9
				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[71]							
	270[72]							
	132		90					
	220		321					
	220		321					
	220		321					
	380		948					
	380		1036					
	400		1300	700				
	150		120	100				
	220		400					
	220		400					
	110		82	50 [73]	110 [74]			
	110		114	50 [75]	110 [76]			
	400		1246					
	400		1246					
	380		1264					
	110		90					
	110		90					
	110		257					
	220		269		229[78]			
	380		1264					
	110		90					
750	110		90					
	400 [79]		1715 [80]					
	220		360					
	400		1309		1000			
	400		1309					
	220		318		305 [81]			
	220		311					
	220		311					
	400		1300	250 [82]				
	150		120	40 [83]				
	400		1300	700				
	380		1639	1316 [84]				
	380		1645	1579 [85]				
	380		1476	1320 [86]		2630		
	380		1476	1320 [87]		2630		
	380		1246	1050				
	120		86 [88]					
	110		123					
	110		123					
	380		1264					
	220		366					
	110		89					
	110		53					
	400		1316					
	400		1316					
	220		297					
	110		115					
	400		1316	311 [89]	220			
	220		311					
	110		90					
	110		115					
	110		90					
	110		72					
	110		120	101 [90]				
	220		297[91]					
	220		297					
	220		460[92]					
	220		460					
	110		84					
	110		84					
	110		76					
	110		84					

ch line.

conditions 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 transmission 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. from the point of view of system operation.

Observations

[93]	Destroyed line and substation
[94]	Destroyed line
[95]	Destroyed line
[96]	Destroyed line
[97]	Destroyed line
[98]	Monopol
[99]	Temporarily limited by 380/110 kV transformer at Herrenwyk (456 MW towards south, 372/396 MW towards north)
[100]	Limited by the measuring transformer of current
[101]	Limited by the connections among equipments
[102]	Limited by a measuring transformer of current
[103]	Limited by a measuring transformer of current
[104]	Transformer PSE SA
[105]	Transformer PSE SA
[106]	Submarine cable
[107]	Limited by a metering current transformer
[108]	Limited by current transformer at Lemesany
[109]	Limited by current transformer at Lemesany
[110]	Out of operation/ substation local automatic equipment
[111]	Limited by HF attenuator
[112]	Radial operation
[113]	Limited by HF attenuator
[114]	Isolated operation
[115]	Submarine cable
[116]	Limited by a metering current transformer
[117]	Limited by a disconnecter
[118]	Limited by HF attenuator
[119]	Limited by the measuring transformer of current
[120]	Limited by HF attenuator
[121]	Limited by HF attenuator
[122]	Out of operation/ substation local automatic equipment
[123]	Limited by the measuring transformer of current
[124]	Out of operation / substation local automatic equipment
[125]	Limited by HF attenuator

T 9

			Connection between:					
Frontier point	Line	Circuit	from substation			to substation		
			Country	Name	Operated by	Country	Name	Operated by
Nr.	Nr.	Nr.	4	5	6	7	8	9
1	2	3						
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	Slavonski Brod 2	HEP
364	5	1	BiH	Orasje	JPCC	HR	Županja	HEP
371	1	1	HR	Ernestinovo	HEP	SCG	Mladost	EPS
371	2	1	HR	Nijemci	HEP	SCG	Šid	EPS
371	3	1	HR	Beli Manastir	HEP	SCG	Apatin	EPS
381	1	1	BiH	Trebinje	JPCC	SCG	Podgorica	EP CG
381	2	1	BiH	Trebinje	JPCC	SCG	Perućica	EP CG
381	3	1	BiH	Trebinje	JPCC	SCG	Herceg Novi	EP CG
381	4	1	BiH	Bileća	JPCC	SCG	Vilusi	EP CG
382	1	1	BiH	Sarajevo 20	JPCC	SCG	Piva	EP CG
382	2	1	BiH	Goražde	JPCC	SCG	Pijevlja	EP CG
383	1	1	BiH	Višegrad	JPCC	SCG	Požega	EPS
383	2	1	BiH	Bijeljina	JPCC	SCG	Lešnica	EPS
383	3	1	BiH	Zvornik	JPCC	SCG	HE Zvornik	EPS
383	4	1	BiH	Višegrad	JPCC	SCG	Potpeć	EPS
391	1	1	FYROM	Skopje 1	ESM	SCG	Kosovo A	EPS
391	2	1	FYROM	Skopje 1	ESM	SCG	Kosovo A	EPS
391	3	1	FYROM	Skopje 4	ESM	SCG	Kosovo B	EPS
401	1 [98]	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	West UA	Mukachevo	NPC Ukrenergo
443	1	1	CZ	Albrechtice	CEPS	PL	Dobrzyen	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 [106]	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	West UA	Chmielnicka	NPC Ukrenergo
702	1	1	PL	Zamość	PSE SA	West UA	Dobrotwor	NPC Ukrenergo
703	1	1	PL	Białystok	PSE SA	BY	Roś	Grodnoenergo
704	1	1	PL	Slupsk	PSE SA	S	Stámo	Svk
710	1	1	H	Győr	MAVIR	SK	Gabcikovo	SEPS
711	1	1	H	Göd	MAVIR	SK	Levice	SEPS
720	1	1	H	Albertirsa	MAVIR	West UA	Zahidno Ukrainaska	NPC Ukrenergo
721	1	1	H	Sajószöged	MAVIR	West UA	Mukacevo	NPC Ukrenergo
722	1	1	H	Kisvárda	MAVIR	West UA	Mukacevo	NPC Ukrenergo
722	1	2	H	Tiszalök	MAVIR	West UA	Mukacevo	NPC Ukrenergo
730	1	1	H	Sándorfalva	MAVIR	RO	Arad	TRANSELECTRICA
740	1	1	RO	Roşiori	TRANSELECTRICA	West UA	Mukacevo	NPC Ukrenergo
741	1	1	RO	Isaccea	TRANSELECTRICA	West UA	PviddenoUkrainska	NPC Ukrenergo
750	1	1	RO	Stânca	TRANSELECTRICA	MD	Costeşti	Moldenergo
751	1	1	RO	Huşi	TRANSELECTRICA	MD	Cioara	Moldenergo
752	1	1	RO	Tuţora	TRANSELECTRICA	MD	Ungheni	Moldenergo
753	1	1	BG	Maritsa3	NEK	TR	Babaeski	TEIAS
754	1	1	BG	Maritsa3	NEK	TR	Hamitabat	TEIAS

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Voltage of the circuit		Conventional transmission capacity of the connection (thermal)*		Limited by the transformers or by the substations				T 9
				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 [93]					
	220		229 [94]					
	220		229					
	110		115 [95]					
	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 [96]					
	220		311 [97]					
	380		1264					
	450		600	372 [99]				
	400		1465	1386 [100]				
	400		1503	1323 [101]				
	400		1186	693 [102]				
	400		1088					
	400		1088					
	400		1711	831 [103]				
	220	400	173					
	220	400	173					
	380		1302 [104]					
	380		1302 [105]					
	380		730					
	400		1252[107]	831[108]				
	400		1252	831[109]				
	750		2676[110]	1949[111]				
	220		309[112]	381 [113]				
	220		215[114]					
	450		600 [115]					
	400		1246	1108[116]				
	400		1246	1108[117]				
	750		4000	2146[118]				
	400		1635	693[119]				
	220		312	305[120]				
	220		312	305[121]				
	400		1246					
	400		1400[122]	693 [123]				
	750		4000[124]	2598[125]				
	110		90					
	110		90					
	110		90					
	400							
	400							

each line.

Conditions 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 transmission 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. From the point of view of system operation.

Abbreviations used of grid operators

Belgium	Elia	- Elia System Operator SA / NV
Germany	E.ON Netz EnBW Transportnetz RWE Transportnetz Strom VE Transmission	- E.ON Netz GmbH, Bayreuth - EnBW Transportnetze AG, Karlsruhe - RWE Transportnetz Strom GmbH, Dortmund - Vattenfall Europe Transmission GmbH, Berlin
Spain	REE	- Red Eléctrica de España S.A., Madrid
France	RTE	- Gestionnaire du Réseau de Transport d'Electricité, Paris la Défense
Greece	HTSO / DESMIE	- Hellenic Transmission System Operator / Diachristis Elinikou Sistimatos Metaforas Energias
Italy	GRTN	- Gestore della Rete di Trasmissione Nazionale S.p.A., Roma
Slovenia	ELES	- Elektro-Slovenija, Ljubljana
Croatia	HEP	- Hrvatska Elektroprivreda d.d., Zagreb
Serbia - Montenegro	EPCG EPS	- Elektroprivreda Crne Gore, Niksic - Elektroprivreda Srbije, Beograd
FYROM	ESM	- Elektrostopastvo na Makedonija, Skopje
Bosnia - Herzegovina	JPCC	- Joint Power Coordination Center
Luxembourg	CEGEDEL	- Compagnie Grand Ducale d'Electricité du Luxembourg, Luxembourg
The Netherlands	TenneT	- TenneT bV Transmission System Operator
Austria	TIRAG Verbund APG VKW-ÜNG GKW	- Tiroler Regelzone AG - Verbund - Austria Power Grid GmbH, Wien - Vorarlberger Kraftwerke Übertragungsnetz AG, Bregenz - Grenzkraftwerke GmbH, Simbach
Portugal	REN	- Rede Eléctrica Nacional, S.A., Lisboa
Switzerland	ATEL BKW UTN EGL Grid EOS ETRANS NOK	- Aare-Tessin AG für Elektrizität, Olten (Aar et Tessin Société Anonyme d'Electricité) - BKW Übertragungsnetz AG, Bern - Elektrizitäts-Gesellschaft Laufenburg Grid AG, Laufenburg (Electricité de Laufenbourg Grid S.A.) - Energie Ouest Suisse S.A., Lausanne - ETRANSAG - Nordostschweizerische Kraftwerke AG, Baden (Forces Motrices du Nord-Est de la Suisse)

Czech Republic	CEPS	- CEPS a.s., Praha
Hungary	MAVIR Rt	- Magyar Villamosenergia - ipari Rendszerirányító Rt., Budapest
Poland	PSE SA	- Polskie Sieci Elektroenergetyczne SA
Slovak Republic	SEPS, a.s.	- Slovenska Elektrizacna Prenosova Sustava, a.s.
Romania	TRANSELECTRICA	- Transelectrica S.A., National Power Grid Company, Bucaresti
Bulgaria	NEK	- Nationalna Elektricheska Kompania EAD, Sofia
Ukraine	NPC Ukrenergo	- NPC Ukrenergo
Albania	KESH	- Albanian Electroenergetic Corporation
Belarus	Grodnoenergo	
Denmark	ELTRA	- ELTRA , Fredericia
Great Britain	National Grid	- The National Grid Company plc, London
Morocco	ONE	- Office National de l'Electricité, Casablanca
Republic of Moldavia	Moldenergo	
Republic of Turkey	TEIAS	- Türkiye Elektrik İletim A.S., Ankara
Sweden	SYDKRAFT VATTENFALL	- Sydkraft AB, Malmö - Vattenfall AB, Stockholm

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	35565
11.1.2	D - Conneford (E.ON Netz)	NL - Meeden (TenneT)	380	1382	R10	16507
13.1.1	D - Siersdorf (RWE Transportnetz Strom)	NL - Maasbracht (TenneT)	380	1645	R10	13225
13.1.2	D - Rommerskirchen (RWE Tr.netzStrom)	NL - Maasbracht (TenneT)	380	1698	R1	3292
15.1.1	D - Gronau W (RWE Transportnetz Strom)	NL - Hengelo (TenneT)	380	1790	R10, R7	1163
15.1.2	D - Gronau Z (RWE Transportnetz Strom)	NL - Hengelo (TenneT)	380	1790	R1	1317
25.1.1	B - Gramme (CPTe)	NL - Maasbracht (TenneT)	380	1207	R1	900
25.1.2	B - Meerhout (CPTe)	NL - Maasbracht (TenneT)	380	1270	R1	532
26.1.1	B - Zandvliet (CPTe)	NL - Geertruidenberg (TenneT)	380	1476	R1	2297
26.2.1	B - Zandvliet (CPTe)	NL - Borssele (TenneT)	380	1476	R1	2773
27.1.1	B - Maldegem (ELECTRABEL)	NL - Oostburg (TenneT)	150	139	R1	9721
41.1.1	B - Aubange (ELECTRABEL)	L - Belval (SOTEL)	220	358	R1	17999
41.1.2	B - Aubange (ELECTRABEL)	L - Belval (SOTEL)	220	358	R1	2502
41.2.1	B - Aubange (ELECTRABEL)	L - Belval (SOTEL)	150	157	R1	16715
41.3.1	B - Aubange (ELECTRABEL)	L - Belval (SOTEL)	150	157	R1	16476
51.1.1	B - Jamiolle (ELECTRABEL)	F - Chooz (RTE)	220	356	R1	4145
51.2.1	B - Avelgem (CPTe)	F - Avelin (RTE)	380	1109	R1	671
51.3.1	B - Achène (CPTe)	F - Lonny (RTE)	380	1229	R1	6327
52.1.1	B - Aubange (ELECTRABEL)	F - Moulaine (RTE)	220	286	R1	6312
71.1.1	D - Uchtelfangen (RWE Transportnetz Strom)	F - Vigy (RTE)	380	1167	R1, R10	7813
71.1.2	D - Uchtelfangen (RWE Transportnetz Strom)	F - Vigy (RTE)	380	1167	R1, R10	9477
71.2.1	D - Ensdorf (RWE Transportnetz Strom)	F - St-Avold (RTE)	220	261	R1	3359
72.1.1	F - Vogelgrün (RTE)	D - Eichstetten (EnBW)	220	338	R1	1120
72.1.2	F - Muhlbach (RTE)	D - Eichstetten (EnBW)	380	1751	R1, R10	4597
81.1.1	F - Sierentz (RTE)	CH - Bassecourt (BKW)	380	1186	R1	14760
81.2.1	F - Sierentz (RTE)	CH - Laufenburg (EGL Grid)	380	1167	R1	39086
81.3.1	F - Mambelin (RTE)	CH - Bassecourt (BKW)	380	789	R1	11740
82.1.1	F - Bois-Tollot (RTE)	CH - Verbois (EOS)	380	1211	R1	5911
82.1.2	F - Bois-Tollot (RTE)	CH - Chamoson (EOS)	380	1409	R1	28797
82.2.1	F - Génissiat (RTE)	CH - Verbois (EOS)	220	280	R1	15834
82.2.2	F - Génissiat (RTE)	CH - Verbois (EOS)	220	280	R1	6224
82.4.1	F - Vallorcine (RTE)	CH - La Bâtière (Atel)	220	266	R1	2192
82.5.1	F - Cornier (RTE)	CH - Riddes (EGL Grid)	220	275	R1	20654
82.6.1	F - Cornier (RTE)	CH - St-Triphon (EOS)	220	275	R1	5036
83.1.1	F - Sierentz (RTE)	CH - Asphard (Atel/NOK/EnBW)	380	1167	R1	19799
91.1.1	F - Albertville (RTE)	I - Rondissone (GRTN)	380	1150	R1, R3	39109
91.1.2	F - Albertville (RTE)	I - Rondissone (GRTN)	380	1150	R1, R3	29265
92.1.1	F - Le Broc Carros (RTE)	I - Camporosso (GRTN)	220	335	R1, R3	36216
93.1.1	F - Villarodin (RTE)	I - Venaus (GRTN)	380	879	R1, R3	703
94.1.1	F - Lucciana (RTE)	I - Suvereto (GRTN)	220	300	R1	30959
102.1.1	CH - Laufenburg (EGL Grid)	D - Gurtweil (EnBW)	220	485	R1	1220
102.1.2	CH - Laufenburg (EGL Grid)	D - Gurtweil (EnBW)	220	485	R1	423
102.2.1	CH - Laufenburg (EGL Grid)	D - Kühmoos (EnBW)	220	295	R1	3198
102.3.1	CH - Laufenburg (EGL Grid)	D - Kühmoos (EnBW)	220	485	R1	8276
102.3.2	CH - Laufenburg (EGL Grid)	D - Kühmoos (EnBW)	380	1620	R1	9711
102.4.1	CH - Laufenburg (EGL Grid)	D - Kühmoos (EnBW)	380	1620	R1	2932
102.4.2	CH - Laufenburg (EGL Grid)	D - Kühmoos (EnBW)	380	1580	R1	53862
102.5.1	CH - Laufenburg (EGL Grid)	D - Tiengen (RWE Transportnetz Strom)	380	1158	R1	13772
103.1.1	CH - Beznau (NOK)	D - Tiengen (RWE Transportnetz Strom)	380	1158	R1, R10	8842
103.1.2	D - Tiengen (RWE Transportnetz Strom)	CH - Koblenz (NOK)	220	335	R1	3623
104.1.1	CH - Asphard (Atel/NOK/EnBW)	D - Kühmoos (EnBW)	380	1340	R1	24926
105.1.1	CH - Laufenburg (EGL Grid)	D - Engstlatt (EnBW)	380	1675	R1	2590
111.2.1	A - Bürs (VIW)	D - Herbertingen (RWE Transportnetz Strom)	220	389	R1	6729
111.3.1	A - Bürs (VIW)	D - Dellmingsen (RWE Transportnetz Strom)	220	492	R1	5403
115.5.1	A - St. Peter (Verbund-APG)	D - Altheim (E.ON Netz)	220	301	R1	56383
115.6.1	A - St. Peter (Verbund-APG)	D - Simbach (E.ON Netz)	220	301	R1	2090
115.9.1	A - St. Peter (Verbund-APG)	D - Pirach (E.ON Netz)	220	518	R1	1877
115.10.1	A - St. Peter (Verbund-APG)	D - Pleinting (E.ON Netz)	220	518	R1	1145
116.1.1	A - Westtirol (Verbund-APG)	D - Leupolz (RWE Transportnetz Strom)	380	1316	R1	80266
116.2.1	A - Westtirol (Verbund-APG)	D - Memmingen (RWE Transportnetz Strom)	220	762	R1	5344
117.1.1	A - Sitz (TIRAG)	D - Oberbrunn (E.ON Netz)	220	793	R1	4384
117.1.2	A - Sitz (TIRAG)	D - Oberbrunn (E.ON Netz)	220	793	R1	11996

Reasons: R1, R2 - Planned unavailability

R3 - Overload

R4, R5, R6 - Failed 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]
34942	623										
	16285										222
									13225		
				2762	21						509
	115						556	492			
	162		1155								
1				899							
								2297		532	
								1414	1359		
					4792	4929					
							17999				
							2502				
							7118	7106	2491		
							7139	6987	2350		
		3436								709	
											671
											6327
										7813	
				65					3716	3622	2074
					3359						
	1120										
	2015		540						2042		
750	371			13639							
		1037			16479	476	418	9618	11058		
			5395		33			37		6275	
									5911		
	15	536		1453		23117	278				3398
					15834						
					6224						
					279				1913		
			2059		1002	15434				2159	
						625		4411			
					16414		146			3239	
5100				6300			16473	76	11160		
				773			16473	559		11460	
				2621		5099	2021	38		26437	
				660				43			
								9659	21300		
		437				661			122		
		423									
			407		1855	582					354
			359	3082	4835						
			1950	4011							
			2104		581				3182	498	70
											247
								29803	23808		251
								10865		2399	508
	4967							3213		662	
		2760	594		269						
					11076	13850					
		2065			525						
	840		4796		300	369					424
			4908				375			120	
525		1482		7951	16259	17972	3118	4526		2536	2014
		1500				584			6		
		506							393	978	
180		500								229	236
	57	2259	2643					13	26862	43200	5232
	1127		3726		8		68		157	258	258
			8		68	157			258	314	663
550			496	1859	502	1479			111	227	

R7, R8, R9 - External impacts

R10, R11 - Other reasons

Circuit ID	From substation	To substation	Voltage [kV]	Thermal conventional transmission capacity [MVA]	Major Reason	Time whole year [min]
121.1.1	I - Ponte (GRTN)	CH - Airolo (Atel)	220	257	R1, R3	301
121.2.1	I - Mese (GRTN)	CH - Gorduno (Atel)	220	257	R3, R6	2885
121.3.1	I - Bulciago (GRTN)	CH - Soazza (EGL Grid)	380	1142	R1, R3	5172
121.4.1	I - Musignano (GRTN)	CH - Lavorgo (Atel)	380	1118	R1,R3,R6	5915
122.2.1	I - Sondrio (GRTN)	CH - Robbia (RE)	220	257	R1, R3	780
123.1.1	I - Avise (GRTN)	CH - Riddes (EGL Grid)	220	290	R1, R3	20542
123.2.1	I - Valpelline (GRTN)	CH - Riddes (EGL Grid)	220	290	R1, R3	16756
132.1.1	I - Soverzene (GRTN)	A - Lienz (Verbund-APG)	220	257	R1, R3	24371
141.1.1	CH - Y-Rehag (NOK)	A - Meiningen (VKW-ÜN)	220	501	R1, R10	13088
142.1.1	CH - Pradella (EGL Grid)	A - Westtirol (Verbund-APG)	380	1340	R1	1560
142.2.1	CH - Pradella (EGL Grid)	A - Westtirol (Verbund-APG)	380	1340	R1	975
151.1.1	E - Hermani (REE)	F - Argia (RTE)	380	1136	R11	6457
151.2.1	E - Irún (REE)	F - Errondenia (RTE)	132	59	R1	6611
151.3.1	E - Arkale (REE)	F - Argia (RTE)	220	340	R1, R7	1109
151.4.1	E - Biescas (REE)	F - Pragnères (RTE)	220	247	R8	138067
152.1.1	E - Benós (REE)	F - Lac d'Oo (RTE)	110	76	R1	32878
153.1.1	E - Vic (REE)	F - Baixas (RTE)	380	1105	R1, R10	2577
161.1.1	D - Flensburg (E.ON Netz)	DK - Ensted (ELSAM)	220	332	R1	2369
161.2.1	D - Flensburg (E.ON Netz)	DK - Kassø (ELSAM)	220	332	R1	331
162.1.1	D - Bentwisch (VE Transmission)	DK - Bjæverskov (ELKRAFT)	400	600	R1, R2	65495
171.1.1	A - Bisamberg (Verbund-APG)	CZ - Sokolnice (CEPS)	220	269	R1, R10	9509
171.2.1	A - Bisamberg (Verbund-APG)	CZ - Sokolnice (CEPS)	220	269	R1, R10	10090
172.1.1	A - Dümrohr (Verbund-APG)	CZ - Slavetice (CEPS)	380	1711	R1	8061
181.1.1	A - Obersielach (Verbund-APG)	SLO - Podlog (ELES)	220	351	R1	2334
182.1.1	A - Kainachtal (Verbund-APG)	SLO - Maribor (ELES)	380	1514	R1	2189
182.2.1	A - Kainachtal (Verbund-APG)	SLO - Maribor (ELES)	380	1514	R1	7219
191.4.1	D - Bauler (RWE Transportnetz Strom)	L - Flebour (CEGEDEL)	220	490	R1	661
191.4.2	D - Bauler (RWE Transportnetz Strom)	L - Roost (CEGEDEL)	220	490	R1	1244
192.1.1	D - Trier (RWE Transportnetz Strom)	L - Heisdorf (CEGEDEL)	220	490	R1, R10	2853
192.2.1	D - Quint (RWE Transportnetz Strom)	L - Heisdorf (CEGEDEL)	220	490	R1	6604
201.1.1	I - Redipuglia (GRTN)	SLO - Divaca (ELES)	380	1712	R1, R3, R10	4540
201.2.1	I - Padriciano (GRTN)	SLO - Divaca (ELES)	220	330	R1, R3, R10	4977
205.1.1	I - Galatina (GRTN)	GR - Arachthos (HTSO)	380	500	R1, R3, R10	84396
211.1.1	A - Wien Süd-Ost (Verbund-APG)	H - Győr (MAVIR)	220	305	R1	19988
211.1.2	A - Neusiedl (Verbund-APG)	H - Győr (MAVIR)	220	305	R1	17239
212.1.1	A - Wien Süd-Ost (Verbund-APG)	H - Győr (MAVIR)	380	1514	R1	8495
221.1.1	F - Mandarins (RTE)	GB - Sellindge (National Grid)	270		R1, R6	5914
221.2.1	F - Mandarins (RTE)	GB - Sellindge (National Grid)	270		R10	866
231.1.1	E - Las Conchas (REE)	P - Lindoso (REN)	132	90	R1	10289
232.1.1	E - Aldeadávila (REE)	P - Bemposta (REN)	220	268	R1	46667
232.2.1	E - Aldeadávila (REE)	P - Pocinho (REN)	220	268	R1	24561
232.3.1	E - Saucelle (REE)	P - Pocinho (REN)	220	268	R1	4961
233.1.1	E - Cedillo (REE)	P - Falagueira (REN)	380	707	R7	1024
234.1.1	E - Cartelle (REE)	P - Alto Lindoso (REN)	380	1036	R1	3357
241.1.1	GR - Thessaloniki (HTSO)	FYROM - Dubrovo (ESM)	380	1300	R1	2515
242.1.1	GR - Amyndeo (HTSO)	FYROM - Bitola (ESM)	150	120	R1	7460
245.1.1	CZ - Lieskovec (CEPS)	PL - Kopanina (PSE SA)	220	400	R1, R10	16403
246.1.1	CZ - Lieskovec (CEPS)	PL - Bujaków (PSE SA)	220	400	R1	12252
251.2.1	HR - Donji Miholjac (HEP)	H - Siklos (MAVIR)	120	114	R1	938
251.3.1	HR - Tumbri (HEP)	H - Hévíz (HEP)	380	1246	R2, R7	3221
261.2.1	SCG - Sip (EPS)	RO - Guravai (TRANSELECTRICA)	110	90	R10	525600
262.1.1	SCG - Kikinda 1 (EPS)	RO - Temisvar (TRANSELECTRICA)	110	90	R10	525600
263.1.1	SCG - Kusijak (EPS)	RO - Ostrovo Mare (TRANSELECTRICA)	110	257	R10	480960
270.1.1	CZ - Lieskovec (CEPS)	SK - Pov. Bystrica (SEPS)	220	269	R1	17739
271.1.1	SCG - Niš (EPS)	BG - Sofija Zapad (NEK)	380	1264	R1	2553
272.1.1	SCG - HE Vrla 1 (EPS)	BG - Breznik (NEK)	110	90	R10	525600
273.1.1	SCG - Zajecar (EPS)	BG - Kula (NEK)	110	90	R10	525600
277.1.1	RO - Tântareni (TRANSELECTRICA)	BG - Kozlodui (NEK)	400	1450	R1	15302
277.1.2	RO - Tântareni (TRANSELECTRICA)	BG - Kozlodui (NEK)	400	1450	R1	14656
280.1.1	CZ - Sokolnice (CEPS)	SK - Senica (SEPS)	220	318	R1	55593
281.1.1	SCG - Podgorica (EP CG)	AL - Vau i Dejës (KESH)	220	311	R1, R4	3924
282.1.1	SCG - Prizren (EPS)	AL - Fierza (KESH)	220	311	R2, R4	7372
291.1.1	GR - Kardias (HTSO)	AL - Elbassan (KESH)	400	1300	R1	486
301.1.1	GR - Thessaloniki (HTSO)	BG - Blagoevgrad (NEK)	400	1300	R6, R11	4030

Reasons: R1, R2 - Planned unavailability

R3 - Overload

R4, R5, R6 - Failed 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]
			168					133			
				710			377	1798			
							5100	72			
		789						111	5015		
								201		579	
262	2721	444			16507			284		324	
					16495			261			
		118		1568		12	22080	590	3		
638		8899		20	594	2639		298			
			128	342		1090					
				343		632					
								6277			180
			6182								429
				569						89	451
1381	40320	44640	43200	8266							260
						765			32110		
			1677	229				671			
								1959			410
											331
34987	39				60			22619	7790		
226					4982		148	250	3559		344
2860					4944		150		2136		
						5301	908			1852	
				874					1460		
	1499	400						290			
	985		6183							51	
	407		9							196	49
						519				687	38
			1036					1817			
						6100			504		
		3360		1542		703	2160	135			
				1550				67			
41291	39960	2340						805			
	100	64		2018		17223	583				
						17239					
	289						348	1310	6548		
		1646					124		3906	238	
29	60	30		110		405		108	70		54
			62		10227						
									16722	29945	
							72		23916	573	
					109					4852	
			3333			24					
				2477	10			28			
				7434		26					
1052	1070		11759		1581			850			91
274	428		1195		1580			8684			91
				938							
				1091	48	1950	132				
44640	40320	44640	43200	44640	43200	44640	44640	43200	44640	43200	44640
44640	40320	44640	43200	44640	43200	44640	44640	43200	44640	43200	44640
	40320	44640	43200	44640	43200	44640	44640	43200	44640	43200	44640
	247				11375	5648	7				462
				2442						111	
44640	40320	44640	43200	44640	43200	44640	44640	43200	44640	43200	44640
44640	40320	44640	43200	44640	43200	44640	44640	43200	44640	43200	44640
		1022					14280				
		856					13800				
							12542	37000	6051		
233	428		11	307	225	2720					
662					24	117	21	1003			5545
				486							
	28			482			20		1731	1769	

R7, R8, R9 - External impacts

R10, R11 - Other reasons

Circuit ID	From substation	To substation	Voltage [kV]	Thermal conventional transmission capacity [MVA]	Major Reason	Time whole year [min]
321.1.1	CZ - Hradec (CEPS)	D - Etzenricht (E.ON Netz)	400	1639	R1	18705
321.1.2	CZ - Prestice (CEPS)	D - Etzenricht (E.ON Netz)	380	1645	R1	6219
322.1.1	CZ - Hradec (CEPS)	D - Röhrsdorf (VE Transmission)	380	1476	R1, R3, R10	7318
322.1.2	CZ - Hradec (CEPS)	D - Röhrsdorf (VE Transmission)	380	1476	R1, R6, R9	14676
331.1.1	SCG - Subotica 3 (EPS)	H - Sándorfalva (MAVIR)	380	1246	R1	43234
351.1.1	SLO - Divaca (ELES)	HR - Melina (HEP)	380	1264	R6	189
351.2.1	SLO - Divaca (ELES)	HR - Pehlin (HEP)	220	366	R10	2068
351.3.1	SLO - Koper (ELES)	HR - Buje (HEP)	110	89	R1	417
351.4.1	SLO - Ilirska Bistrica (ELES)	HR - Matulji (HEP)	110	53	R10	635
352.1.1	SLO - Krško (ELES)	HR - Tumbri (HEP)	380	1316	R1	414
352.1.2	SLO - Krško (ELES)	HR - Tumbri (HEP)	380	1316	R1	15196
352.2.1	SLO - Cirkovce (ELES)	HR - Mraclin (HEP)	220	297	R1, R10	3207
352.3.1	SLO - Formin (ELES)	HR - Nedeljanec (HEP)	110	115	R2	188
361.1.1	BiH - Mostar (JPCC)	HR - Konjsko (HEP)	400	1316	R1	4406
361.2.1	BiH - Mostar (JPCC)	HR - Zakucac (HEP)	220	311	R11	5898
361.3.1	BiH - Grahovo (JPCC)	HR - Knin (HEP)	110	90	R11	3934
361.7.1	BiH - Grude (JPCC)	HR - Gracac (HEP)	110	120	R1	476
362.2.1	BiH - Prijedor (JPCC)	HR - Meduric (HEP)	220	297	R1	292
363.5.1	BiH - Neum (JPCC)	HR - Ston (HEP)	110	76	R1	145
364.5.1	BiH - Orasje (JPCC)	HR - Zupanja (HEP)	110	76	R10	15860
371.1.1	HR - Ernestinovo (HEP)	SCG - Mladost (EPS)	380	831	R10	525600
371.2.1	HR - Nijemci (HEP)	SCG - Sid (EPS)	110	76	R10	262688
371.3.1	HR - Beli Manastir (HEP)	SCG - Apatin (EPS)	110	78	R10	306676
381.1.1	BiH - Trebinje (JPCC)	SCG - Podgorica (EP CG)	380	1264	R1, R4	35987
381.2.1	BiH - Trebinje (JPCC)	SCG - Perucica (EP CG)	220	311	R1, R4	8451
381.3.1	BiH - Trebinje (JPCC)	SCG - Herceg Novi (EP CG)	110	90	R1, R4	1174
381.4.1	BiH - Bileca (JPCC)	SCG - Vilusi (EP CG)	110	84	R1, R4	1228
382.1.1	BiH - Sarajevo 20 (JPCC)	SCG - Piva (EP CG)	220	366	R1, R4	11807
383.2.1	BiH - Bijeljina (JPCC)	SCG - Lešnica (EPS)	110	123	R1, R3, R5	568
383.3.1	BiH - Zvornik (JPCC)	SCG - HE Zvornik (EPS)	110	123	R1	1827
383.4.1	BiH - Višegrad (JPCC)	SCG - Potpec (EPS)	110	123	R1	1272
391.1.1	FYROM - Skopje 1 (ESM)	SCG - Kosovo A (EPS)	220	311	R10	484514
391.2.1	FYROM - Skopje 1 (ESM)	SCG - Kosovo A (EPS)	220	311	R10	524159
391.3.1	FYROM - Skopje 4 (ESM)	SCG - Kosovo B (EPS)	380	1264	R1	54765
401.1.1	D - Herrenwyk (E.ON Netz)	S - Kruseberg (Sydkraft/Vattenfall)	450	600	R1, R10	21257
404.1.1	CZ - Nošovice (CEPS)	SK - Varin (SEPS)	400	1465	R10	8640
424.1.1	CZ - Sokolnice (CEPS)	SK - Krizovany (SEPS)	400	1503	R1	51196
440.1.1	SK - V.Kapusany (CEPS)	WEST_UA - Mukacevo (NPC Ukrenergo)	400	1186	R1	8009
443.1.1	CZ - Albrechtice (CEPS)	PL - Dobrzyń (PSE SA)	400	1212	R1	42377
444.1.1	CZ - Nošovice (CEPS)	PL - Wielopole ()	400	1212	R1	20184
497.1.1	CZ - Sokolnice (CEPS)	SK - Stupava (SEPS)	400	1711	R1	18880
501.1.1	D - Vierraden (VE Transmission)	PL - Krajinik (PSE SA)	220	392	R1, R10	95976
501.1.2	D - Vierraden (VE Transmission)	PL - Krajinik (PSE SA)	220	392	R1, R10	50974
502.1.1	D - Hagenwerder (VE Transmission)	PL - Mikulowa (PSE SA)	380	1427	R1	1909
502.1.2	D - Hagenwerder (VE Transmission)	PL - Mikulowa (PSE SA)	380	1427	R1	2204
601.1.1	E - Pinar del Rey (REE)	MA - Melloussa (ONE)	380	730	R1	23761
700.1.1	PL - Krosno Iskrzynia (PSE SA)	SK - Lemešany (SEPS)	400	1434	R2, R9	54600
700.1.2	PL - Krosno Iskrzynia (PSE SA)	SK - Lemešany (SEPS)	400	1434	R2, R9	54713
702.1.1	PL - Zamosc (PSE SA)	WEST_UA - Dobrotvor (NPC Ukrenergo)	220	168	R1	1755
703.1.1	PL - Białystok (PSE SA)	BY - Ros (Grodnoenergo)	220	154	R1	6160
704.1.1	PL - Slupsk (PSE SA)	S - Stämo (SvK)	450	600	R1	14918
710.1.1	H - Győr (MAVIR)	SK - Gabčíkova (SEPS)	400	1246	R1, R10	8957
711.1.1	H - Göd (MAVIR)	SK - Levice (SEPS)	400	1246	R1	7603
720.1.1	H - Albertirsa (MAVIR)	WEST_UA - Zahidno Ukrainka (NPC Ukrenergo)	750	4000	R1	62839
721.1.1	H - Sajószöged (MAVIR)	WEST_UA - Mukacevo (NPC Ukrenergo)	400	1635	R1	2558
722.1.1	H - Kisvarda (MAVIR)	WEST_UA - Mukacevo (NPC Ukrenergo)	220	275	R1	15128
722.1.2	H - Tiszalök (MAVIR)	WEST_UA - Mukacevo (NPC Ukrenergo)	220	275	R1	40761
730.1.1	H - Sándorfalva (MAVIR)	RO - Arad (TRANSELECTRICA)	400	1246	R1	43739
740.1.1	RO - Rosiori (TRANSELECTRICA)	WEST_UA - Mukacevo (NPC Ukrenergo)	400	1400	R1	4980
741.1.1	RO - Isaccea (TRANSELECTRICA)	WEST_UA - Niwnitschnoi Ukrainka (NPC Ukrenergo)	750	4000	R1	12600
750.1.1	RO - Slăncă (TRANSELECTRICA)	MD - Costesti (Moldenergo)	110	90	R10	131040
751.1.1	RO - Husi (TRANSELECTRICA)	MD - Cioara (Moldenergo)	110	90	R10	131040
752.1.1	RO - Husi (TRANSELECTRICA)	MD - Ungheeni (Moldenergo)	110	90	R10	131040

Reasons: R1, R2 - Planned unavailability

R3 - Overload

R4, R5, R6 - Failed 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]
							601	18035	69		
		540	421		6219						
	470		432	305	1099	5242	6743	385			
			43200								34
				189							
					3	2065					
								1			416
						480			155		
							19		395		
							19		15177		
		15		2441	21	28		210	228	264	
						188					
								430	3532	444	
										14	5884
											3934
						38		47		391	
										292	
									145		
								2401	13459		
44640	40320	44640	43200	44640	43200	44640	44640	43200	44640	43200	44640
44640	40320	44640	43200	44640	43200	1447			601		
44640	40320	44640	43200	44640	43200	44640		1396			
152	35			16	19	28610		6352	693	110	
69				3				2125		6254	
31				613		482	5			43	
97	332	282	15				311				191
79	290					7	1923	7368	257	1512	371
		99				31		19		419	
				10						1817	
9				7						1256	
44640	40320	44640	43200	44640	3555	43920	44640	43200	44640	42479	44640
44640	40320	44640	43200	44640	42479	43920	44640	43200	44640	43200	44640
144		201	5021		42479	260	101		6472		87
								18755	2502		
				8640							
			8652	2227		258	216	28298	9460	2085	
	8009										
					15879		23569	650		2279	
							19623			561	
					16632						2248
								32581	44640	18347	408
				987	44640			5234			113
			1909								
			2204								
					738		796	5474	9554	7199	
1016	12506	21826				16754			398		2100
1081	12485	21769				16754			562		2062
	23					12	1365	355			
584					1484	31	2851		314		896
250	851			4318	91	25		9356	27		
229								3266	3483	1979	
	102					597	6329			575	
			2341		21276	27960		10835		173	254
		23	2122					413			
								14814	314		
				11		5390	34525	676	159		
					780					16919	26040
								960	480		
							2880		9720		
			43200	44640	43200						
			43200	44640	43200						
			43200	44640	43200						

R7, R8, R9 - External impacts

R10, R11 - Other reasons

Country	Circuit length (km)				Transformers 400kV → 220kV		
					in the network		
	220 kV	of which cable	400 kV	of which cable	Number	Capacity GVA	
B	415	0	1298	0	6	2,1	
D ¹	17500	20	18700	60	89	52,8	
E	16244	110	16951	15	81	44,0	
F	26256	910	20966	2	209	107,0	
GR	11078	166	4459	160	39	10,4	
I	11705	857	9891	204	51	20,5	
SLO ³	328	0	510	0	3	1,2	
HR	1248	0	1159	0	4	1,6	
BiH	1507	0	766	0	7	3,0	
FYROM ³	166	0	371	0	0	0,0	
SCG	2589	0	1814	0	12	4,8	
L	236	6	0	0	0	0,0	
NL	683	6	2003	0,4	4	2,5	
A ²	3765	5	2474	56	17	10,8	
P	2692	12	1403	0	7	3,2	
CH	5031	15	1641	0	19	9,5	
CZ	1923	0	3422	0	4	1,9	
H	1188	0	2090	0	3	1,5	
PL	7887	0	4830	245	15	6,7	
SK	962	0	1753	0	3	1,4	
RO	4132	0	4630	0	22	8,9	
BG	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	
UCTE	117535	2107	101131	742	595	293,7	
West UA ⁴	552	0	142	0	3	1,2	

¹ Values transformers of power units as of 2000

² Values as of December 31, 2000

³ Values as of December 31, 2002

⁴ West UA represents the so-called Burshtyn Island synchronously with UCTE

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	2,7	14	8,4	26	12,5
111	31,0	438	82,1	100	62,0	190	54,7
0	0,0	0	0,0	0	0,0	53	14,0
260	30,0	1164	107,0	211	86,0	55	13,0
71	7,2	367	15,4	16	5,0	0	0,0
112	23,0	151	25,0	116	34,8	212	54,4
0	0,0	10	1,1	0	0,0	4	1,2
8	1,5	22	3,3	2	0,3	4	1,2
15	2,0	15	2,0	3	1,0	7	2,0
0	0,0	4	0,6	0	0,0	6	1,8
23	4,6	51	7,7	11	4,9	13	3,8
11	1,8	19	2,7	0	0,0	0	0,0
9	3,2	25	4,6	6	3,6	35	16,1
64	7,1	67	11,5	3	1,2	13	3,9
62	4,0	62	7,5	16	3,3	16	4,5
101	4,7	149	13,9	8	4,3	2	0,4
5	1,1	20	4,0	33	11,3	41	11,1
0,0	0,0	26	4,2	0,0	0,0	20	4,2
57	12,5	107	17,1	24	8,2	36	9,6
8	1,5	13	2,6	20	4,1	19	5,0
46	9,3	90	17,5	13	5,3	20	10,0
n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
966	145,3	2817	332,5	596	243,8	772	223,4
7	1,8	14	1,9	0	0,0	0	0,0

	F	I	SLO	HR	BiH	FY ROM	SCG	L	NL	A	P	CH	CZ	H	PL	SK	RO	BG	West UA
B	-							2	1										
	2							2	-										
	2							-	4										
D	-							-	-	22		1	-		-				
	2							8	-	11		5	-		2				
	4							-	6	3		7	4		2				
E	2										1								
	2										3								
	2										2								
F	-											1							
	1											5							
	3											5							
GR	-					1													
	-					-													
	1					1												1	
I	-									-		1							
	1									1		6							
	1									-		2							
SLO																			
			3																
			2																
HR																			
SCG																			
A																			
CZ																			
H																			
PL																			
SK																			
RO																			

<220 kV
220 kV
380 kV

As of 31.12.2003

Country	Name of line	Designed for	Equipped for	Operated with
Germany	Beerfelden - Großgartach	1 x 220 kV	2 x 220 kV	1 x 220 kV 1 x 110 kV
	Wehrendorf - Hanekenfähr	1 x 380 kV	2 x 380 kV 2 x 220 kV	1 x 380 kV 1 x 220 kV
France	Tavel - Tricastin	2 x 280 kV	2 x 380 kV	2 x 380 kV
	Chevalet - Gavrelle	2 x 380 kV	1 x 380 kV	1 x 380 kV