



CURRENT WORLD WIDE EXPERIENCE WITH LONG LENGTH AC CABLE LINKS



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Long length AC links by Country

No	Country	Number of Links	Link Length km	Total Cable circuit length km
1	Australia	2	116	116
2	Belgium	2	94	94
3	Canada	2	76	114
4	China	1	32	32
5	Denmark	5	308	355
6	France	6	214	279
7	Germany	4	229	229
8	Italy	2	173	221
9	Japan	9	267	590
10	Korea	1	22	66
11	Netherlands	2	122	244
12	Norway	4	399	399
13	Saudi Arabia	5	246	317
14	Spain	5	296	422
15	Sweden	3	162	162
16	Tanzania	1	75	75
17	Thailand	1	55	55
18	Tunisa	1	25	25
19	Qatar	1	102	203
20	United Emirates	1	42	42
21	U.K.	14	646	1157
22	U.S.A.	7	207	245
23	Vietnam	1	56	56
	Total	80	3964	5498
	* Projects commissioned since 1967 or planned to be in commission by 2019			

Long length high voltage links by AC insulated power cables in Australia, Belgium, Canada & China

Item (Seq.) No	Country of the link	System	Power Voltage Length	Cable type & line characteristics	Comments & Compensation
1 (16)	Australia NSW	Transgrid (2000)	600MW 330 kV 27 km	1600mm ² Cu SCFF	2000 In WG 1.07 report
2 (36)	Australia Victoria	Victorian Desalination supply 2010	>130 MW 245 kV 88 km	400 & 500 mm ² Cu XLPE	Completed in 2012 2 x 52 Mvar, One 38km and other 75km from the desalination plant.
3 (33)	Belgium	Belwind – windfarm	165 MW 150 kV 52 km	500/630 mm ² Cu. 3 X1 Core XLPE	2010
4 (41)	Belgium	Northwind	400MVA 225 kV 42 km	1000/1200mm ² Cu. # core XLPE	2012
5 (11)	Canada	BC Hydro Vancouver	1200MW 525 kV 38 km	2 Circuits 1600mm ² Cu 3 x1 SCFF	1984
6 (28)	Canada	Vancouver Island Transmission Reinforcement	600MW 242 kV	1 Circuit 1600mm ² Cu 3 x1 SCFF	2008
7 (32)	China	Hainan-Guangdong	740 MVA (Cosφ=0.98) 525 kV 31km	800 mm ² SCFF cable Charging current: 22.8A/km	2009 320 Mvar at each end.

Long length high voltage links by AC insulated power cables in Denmark

Item (Seq.) No	System	Power Voltage Length	Cable type & line characteristics	Comments & Compensation
8 (12)	Copenhagen Southern Route	800MW/975 MVA 400 kV 22km	1600mm ² Cu XLPE	1997
9 (18)	Horns Rev	160 MW 150 kV 21 +34 = 55 km	630 mm ² Cu 3 Core XLPE – Submarine 1200mm ² Al 3 X 1 Core	2003
10 (31)	Horns Rev 2	209 MW 150 kV 42 +2 + 55 = 100 km	630 mm ² Cu 3 Core XLPE – Submarine 1200mm ² Al 3 X 1 Core	2009 80 Mvar between land and Submarine cable
11 (34)	Lolland-Zealand	200 MW 145 kV 4.6 + 28 +14.6 km = 47km total	Landmm ² Al. XLPE Submarinemm ² Al XLPE Dble-crt, XLPE, land+sub	2010
12 (45)	Connection of the Anholt Wind Farm to the grid (land cable)	400 MW 235 kV 59 + 24.5 = 84 km	Land 2000 mm ² Al, 5 sectors XLPE (0,226 μF/km). Submarine 1600 mm ² AL (Solid) XLPE - Submarine	2012 Compensation at both ends.

Long length high voltage links by AC insulated power cables in France

Item (Seq.) No	System	Power Voltage Length	Cable type & line characteristics	Comments & Compensation
13 (29)	RTE Suburb of Paris Nanterre - Nourottes	530 MW 225 kV 21 km	1600 mm ² Cu - XLPE L = 500 μH/km C = 230 nF/km	In service since October 2009. No compensation.
14 (59) (60)	RTE Southeast area, Boutre -Trans	620 MW 225 kV 65 km	2000/2500 mm ² CuE - XLPE	Commission planned early 2015. Cables generate 280 MVar. Partial compensation with 80 MVar shunt reactor at each end. (Cigré Paper 2014 B1-301)
15 (60)	Frejus- Biancon	TBA 225 kV 25 km	2000/2500 mm ² CuE - XLPE	
16 (61)	RTE West area, Merlatière - Recouvrance	450 MVA 225 kV 38 km	2000/2500mm ² Al - XLPE	Commission planned late 2015.
17 (72)	Saint Nazaire Windfarm	480 MW 225 kV 33 km	2 Circuits 3 core XLPE	To be commissioned 2018
18 (73)	Bale de saint Briec Windfarm	496 MW 225 kV 32 km	2 Circuits 3 core XLPE	To be commissioned 2018

Long length high voltage links by AC insulated power cables in Germany & Italy

Item (Seq.) No	Country of the link	System	Power Voltage Length	Cable type & line characteristics	Comments & Compensation
19 (26)	Germany	Alpha Ventus Windfarm connection	60 MW 110kV 60 km	240mm ² Cu 3 Core XLPE Submarine	2008 T.B.A.
20 (38)	Germany	Baltic 1 Windfarm connection	260 MVA 150 kV 61 km	1200mm ² Cu 3 Core XLPE Submarine	2011 T.B.A.
21 (46)	Germany	Baltic 2 Windfarm connection	260 MVA 150 kV 57 km	1200mm ² Cu 3 Core XLPE Submarine	2013 T.B.A.
22 (53)	Germany	Riffgat Windfarm connection	113 MW 155 kV 51 km	630mm ² Cu 3 Core XLPE Submarine	2014 T.B.A.
23 (55)	Italy	Malta - Sicily Interconnection	225 MW 230 kV 1 +100+25 = 126 km	20 km land - 2500 mm ² Al XLPE (single-core) 100 km sub. 1500 mm ² Cu 3-core XLPE – submarine.	Line-connected. 225 Mvar Sicily, 60 -120 Mvar Malta (ratings @245 kV) Currently under construction
24 (64)	Italy	“Sorgente-Rizziconi” (Calabria-Sicily) Grid connection	2000 MW 380 kV 2 +28+3 = 47 km 2 Circuits	2 circuits . 38 km sub - 1500 mm ² Cu, SCFF PPL 5 km land - 2500 mm ² Al - XLPE (single core)	Line-connected. Each cct: 285 Mvar at each terminal (ratings @420 kV) Currently under construction

Long length high voltage links by AC insulated power cables in Japan

Item (Seq.) No	System	Power Voltage Length	Cable type & line characteristics	Comments & Compensation
25 (17)	Shin-Toyosu Line (TEPCO)	1800 MW (900MW/cct.) final power 1200MW/cct) 500 kV 40 km	2 circuits (final circuits 3) 2500mm ² Cu XLPE	2000 See WG 1.07 SP 13 2 x 300 Mvar at both ends
26 (21)	NishiOsaka-Ozone Line by KEPCO 1995 & 2005	322MW 275kV 19.0km	1 Circuit , 1500mm ² Cu XLPE	1995 Compensation
27 (22)	Matsushima-Narao Line by Kyushu	60MW/circuit 66kV 53km	2 Circuits - 325mm ² Cu. 3 core XLPE - Submarine	2005
28 (57)	Chiba-Katsunan Line (TEPCO)	660 & 860MW 275 kV 30 km	2 Circuits , 1 of 2000 mm ² and 1 of 2500mm ² Cu XLPE	2012 & 2014 300 Mvar/ct.
29 (70)	Kawasaki-Toyosu Line (TEPCO) 2012 – 2015 & 2016	1710 MW 275 kV 22 km	3 circuits each 2500mm ² Cu XLPE	2012,2014 & 2016 450 Mvar/ct.

Long length high voltage links by AC insulated power cables in Japan (cont.) & Korea

Item (Seq.) No	Country of the link	System	Power Voltage Length	Cable type & line characteristics	Comments & Compensation
30 (76)	Japan	Katsunan - Setagaya Line (TEPCO)	480 MW/ cct.= 1380 MW (final power) 275 kV 32.5 km	3 circuits 1200,1400,1600mm ² Cu XLPE	T.B.A. 450 Mvar/ct
31 (77)	Japan	Yokohama-Kohoku Line (TEPCO)	2220MW 275 kV 20km	3circuits)&16km (1circuit) 2000,2500mm ² Cu XLPE	T.B.A. 450 Mvar/ct
32 (78)	Japan	South- Route by CEPCO (Chubu)	590 MW/ct. 275 kV 26.8 KM	2 Circuits, 2,500 mm ² Cu XLPE	T.B.A. 450 Mvar/ct
33 (79)	Japan	West-Route by CEPCO	640 MW/ct. 275 kV 23.1 km	2 circuits , 2,500 mm ² Cu XLPE	T.B.A. 450 Mvar/ct
34 (75)	Korea	Nam Pusan – Buk Pusan Grid Connection	520 MW 345 kV 22 km	3 Circuits , 2000mm ² Cu SCOF	T.B.A. 2 x 200 Mvar

Long length high voltage links by AC insulated power cables In Netherlands and Norway

Item (Seq.) No	Country of the link	System	Power Voltage Length	Cable type & line characteristics	Comments & Compensation
35 (58)	Netherlands	Randstad Grid	2 x 2,640 MVA 380 kV 20 km	Double circuit hybrid .Total length 20 km and 2 cable/phase 2,500 mm ² Cu. XLPE	2015 Both ends 3 x 100 Mvar, (compensation at 50kV) Reported at WETS 11
36 (68)	Netherlands	Gemini Windfarm connection	600 MW 220 kV 102 km	2 circuits 800mm ² –1200mm ² Cu 3 Core XLPE	To be commissioned 2016 T.B.A.
37 (35)	Norway	Gjoa Platform connection	40 MW 115 kV 100 km	240 mm ² Cu 3 Core XLPE – submarine,	2010
38 (49)	Norway	Goliat Platform connection	75 MW 123 kV 107 km	300mm ² Cu 3 core XLPE - submarine	2013
39 (66)	Norway	Martin Linge Platform connection	55 MW 145 kV 162 km	300mm ² Cu 3 core XLPE submarine	2015
40 (71)	Norway	Kollsnes – Mongstad Grid	300 MVA 420 kV 21+9 = 30 km	1200mm ² Cu 3 core XLPE submarine	For 2015 200 Mvar @ one end

Long length high voltage links by AC insulated power cables Middle East

Item (Seq.) No	Country of the link	System	Power Voltage Length	Cable type & line characteristics	Comments & Compensation
41 (24)	Saudi Arabia - Bahrain	GCC – GRID Interconnection	1200 MVA 400 kV 2 +39 + 6 = 47 km	2 circuits - 2000 mm ² Cu SCFF - 8 km Land + 39 km Submarine	2006
42 (50)	Saudi Arabia	Oil Platform	155 MVA 230 kV 45 km	630 mm ² Cu, 3 Core XLPE - submarine	2013
43 (51)	Saudi arabia	Platform connection Safa 1	62MVA 115kV 43km	400mm ² Cu 3 core XLPE - submarine	2013 No compensation
44 (56)	Saudi Arabia	Island to mainland connection Abuali	140MVA 230kV 2x20km	2 circuits - 400mm ² (Cu) 3 core XLPE - submarine	2014 No compensation Connected to OH lines
45 (57)	Saudi Arabia	Oil Platf Marjanorm (2014)	90MW 115kV 87km	500mm ² (Cu) - 3 core XLPE - submarine	Compensation at one end

Long length high voltage links by AC insulated power cables Spain

Item (Seq.) No	Country of the link	System	Power Voltage Length	Cable type & line characteristics	Comments & Compensation
46 (5)	Spain	Spain – Mallorca & Menorca	80 MW – 100 MVA 132 kV 42 km	1 circuit of 4 x SC 500mm ² Al SCFF submarine	1975
47 (13)	Spain - Morocco	Spain – Morocco 1	700 MW 400 kV 28 km	3 x SC 800mm ² Cu SCFF with Cu armour + 3 x SC 1600mm ² Cu SCFF with SS reinforcement	1997 Currently AC future DC
48 (23)	Spain - Morocco	Spain – Morocco 2	700 MW 400 kV 31 km	3 x SC 800mm ² Cu SCFF with Cu armour + 3 x SC 1600mm ² Cu SCFF with SS reinforcement	2006 Currently AC future DC
49 (65)	Spain Mallorca - Ibiza	Interconnection Red Electrica	118 MVA 132 kV 5+118+4=126 km	2 Circuits - 300 mm ² 3 core XLPE – Submarine with 800mm ² Cu on land	Currently under construction 2015. Longest and Deepest HVAC cable. Compensation at both ends
50 (80)	Spain	Majorca – Minorca 2	118 MVA 132 kV 40+28 = 68 km	300 mm ² 3 core XLPE – Submarine with 800mm ² Cu on land	T.B.A.

Long length high voltage links by AC insulated power cables Sweden

Item (Seq.) No	Country of the link	System	Power Voltage Length	Cable type & line characteristics	Comments & Compensation
51 (6)	Sweden	Aland Interconnection	35 MW 84 kV 55 km	185 mm ² Cu 3 x 1 Core XLPE Submarine (1973)	1973 This was one of the first XLPE submarine cables
52 (10)	Sweden	Bornholm InterconnectionMW 60kV 44 km	240 mm ² Cu 3 core XLPE – Submarine	1979
53 (15)	Sweden	New Aland Interconnection	80 MW 110 kV 63 Km	240mm ² Cu 3 Core XLPE Submarine (2000)	2015

Long length high voltage links by AC insulated power cables Tanzania, Thailand, Tunisia, Qatar, U.A.E. & Vietnam

Item (Seq.) No	Country of the link	System	Power Voltage Length	Cable type & line characteristics	Comments & Compensation
54 (37)	Tanzania	Pemba – Tanga (Zanzibar)	25MVA 33kV 75 km	630mm ² Cu 3 core XLPE - Submarine	2010 Compensation
55 (40)	Thailand	Koh Samui 2	100 MVA 115 kV 53+2 =55 km	500mm ² Cu 3 core XLPE submarine 800 mm ² Cu SC land	2011
56 (20)	Tunisia	Tunis Rades GrombaliaMVA 225 kV 25 km	1000 mm ² Cu XLPE	2005
57 (69)	Qatar	Ras Laffan – Halul Island Interconnection	100MW 132kV 100 + 1.7km	2 Circuits - 500mm ² Cu 3 core XLPE Submarine 800mm ² Cu 3 core XLPE land	Due 2016
58 (25)	UAE	Delma Island Interconnection	100 MVA 145 kV 42 Km	300 mm ² Cu 3 Core XLPE – Submarine	2006
80 (52)	Vietnam	Phu Quoc	131 MVA 110 kV 56 km	400mm ² Cu 3 Core XLPE submarine	2013

Long length high voltage links by AC insulated power cables in U.K.

Item (Seq.) No	System	Power Voltage Length	Cable type & line characteristics	Comments & Compensation
59 (1)	New Cross (2 circuits)	800 MVA 275 kV 22 km	2 Circuits 1613mm ² Cu SCFF	1967
60 (2)	Wimbledon	760 MVA 275 kV 21km	1613mm ² Cu SCFF	1967
61 (14)	Isle of Mann Interconnection	40 MW 90 kV 104 km	300mm ² Cu 3 core XLPE – Submarine	Installed 2000 Compensation at each end. Was the worlds longest AC power cable link.
62 (19)	St Johns Wood	1600MVA 400 kV 26 km	2500mm ² Cu XLPE Tunnelled	2005 Compensation at one end.
63 (30)	Sheringham Shoal (Thanet Wind Farm)	317 MW 132 kV 21+1+21= 43km	2 circuits 630mm ² cu – and 1000m ² - 3 core XLPE Submarine + 1400mm ² Al Land XLPE	2010
64 (39)	Walney Phase 1 Wind Farm	192 MVA 132 kV 43+2.7 = 46 km	630mm ² Cu 3 core XLPE Submarine + 3 SC XLPE Land	2011
65 (42)	Greater Gabbard offshore wind Farm	504MW 132 kV 46km	800mm ² Cu 3 core XLPE Submarine	2012

Long length high voltage links by AC insulated power cables in U.K. (Cont.)

Item (Seq.) No	System	Power Voltage Length	Cable type & line characteristics	Comments & Compensation
66 (43)	Ormonde Wind Farm	158 MVA 132 kV 43 + 3 = 43 km	800mm ² Cu 3 Core XLPE submarine + land	2012
67 (44)	Walney Phase 2 Wind Farm	184 MVA 132 kV 44 + 5 = 49 km	630mm ² Cu 3 core XLPE Submarine + 3 SC Land	2012
68 (47)	Lincs Wind Farm	270MW 132 kV 48 + 12 = 60 km	2 Circuits 630mm ² Cu 3 Core XLPE submarine and 800mm ² Cu. SC land	2013
69 (48)	London Array Phase 1	630 MW 150 kV 55	4 Circuits 630 /800 mm ² 3 core Xlpe Submarine cable	2013
70 (54)	West Duddon Sands Wind Farm	389 MW 155kV 41 + 2.7 = 44 km	2 Circuits 1000mm ² Cu 3 core XLPE – Submarine + 6 x SC land	2014 - 15
71 (62)	Humber Gateway Wind Farm	219 MW 132 kV 14 + 30 km	2 Circuitsmm ² 3Core XLPE Submarine + 6 x SC land	Under Construction
72 (63)	Kintyre - Hunterston	240 MVA 220 KV 41 km	2 Circuits 400mm ² 3 Core XLPE submarine	2015-2016 Compensation at each end

Long length high voltage links by AC insulated power cables in USA

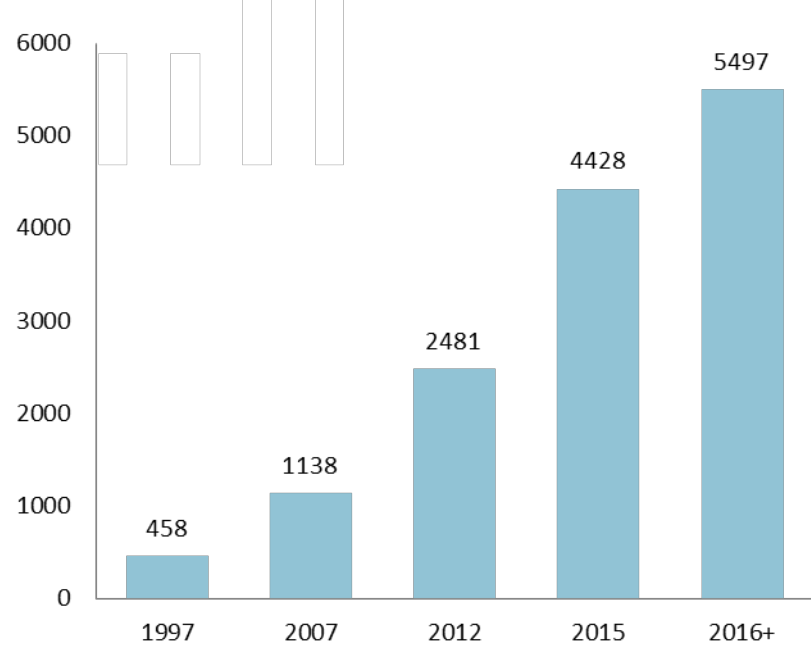
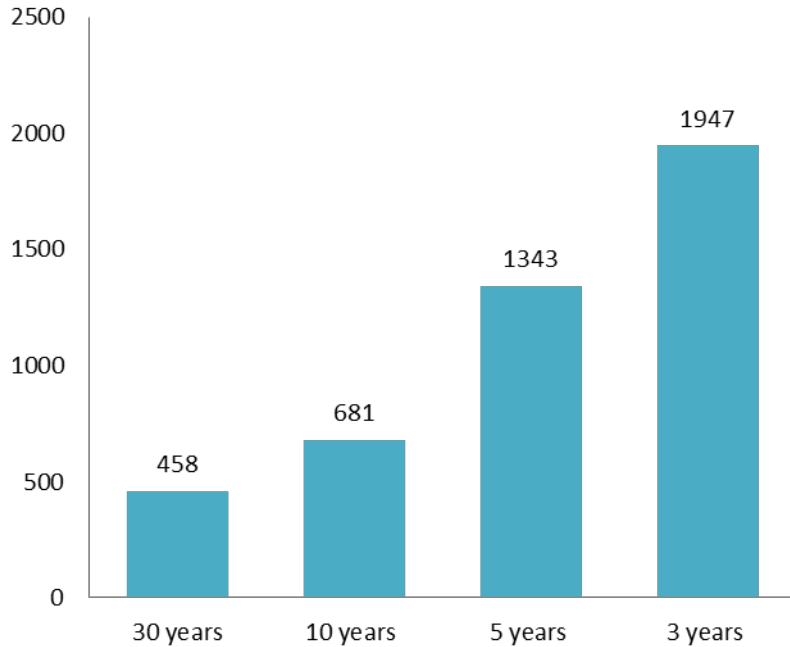
Item (Seq.) No	System	Power Voltage Length	Cable type & line characteristics	Comments & Compensation
73 (3)	NYC -1967	650 MW 345 kV 21 km	1267 mm2 Cu HPFF	1967 150 Mvar Shunt reactor
74 (4)	NYC - 1968	650 MW 345 kV 21 km	1267 mm2 Cu HPFF	1967 150 Mvar Shunt reactor
75 (7)	NYC-1974-1	650 MW 345 kV 28 km	1267 mm2 Cu HPFF	1974 150 Mvar Shunt reactor
76 (8)	NYC-1974-2	650 MW 345 kV 28 km	1267 mm2 Cu HPFF	1974 150 Mvar Shunt reactor
77 (9)	NYC-1978	650 MW 345 kV 29 km	1267 mm2 Cu HPFF	1978 150 Mvar Shunt reactor
78 (27)	Middletown- Norwalk	600 MW 345 kV 38 km	2 Circuits 1500 mm2 Cu S.C. XLPE	2008
79 (74)	Yonkers – East Garden City	693 MW 345 kV 26+17 = 42 km	1267 mm2 Cu HPFF /SCFF	T.B.A.

Long Length AC links by Voltage

Cable Voltage	No of Links	Total Circuit Length km	
		Link	Cable circuit
>33 kV <170 kV	35	2299	3075
>170 kV <380 kV	34	1298	1860
>380 kV <525 kV	11	365	562
Total	80	3962	5497

Progress with the introduction of long length AC cable links

Years		Period	Projects	Link km	Cable circuit km
1967	1997	30 years	13	398	458
1997	2007	10 years	12	537	681
2007	2012	5 years	20	1122	1343
2012	2015	3 years	22	1349	1947
2015	2016+	From 2015	13	556	1069
Total			80	3962	5497



Cable circuit km – 50 years from 1967 – 2017

