World Markets for HV and EHV Cable Ed 2 2021
Chapter Summaries

EXECUTIVE SUMMARY

Chapter 1 - HIGH VOLTAGE CABLE SECTOR DEFINITIONS

Definition of 'High Voltage' and 'Extra High Voltage' and end-use categories, types of cable and voltage, HVAC and HVDC.

Chapter 2 - HIGH VOLTAGE CABLE BASE

Cumulative installed bases of underground and subsea cable, cumulative installed bases of land based underground cable by region and voltage, with regional summary analysis.

Chapter 3 - ANNUAL CONSUMPTION OF EHV AND HV UNDERGROUND AND SUBSEA CABLE

Consumption in km of cable and value 2021 to 2026 by following categories:

1. Interconnections EHV EHV > 220 kV
2. Interconnections HV 35 - 220 kV
3. Export cables EHV/HV > 220 kV
4. Array cables HV/MV < 35-220 kV
5. Offshore OGP HV MV < 35-220 kV
6. Subsea
7. Land UGC EHV > 220 kV
8. Land UGC HV 35 - 220 kV
9. Total UGC

Chapter 4 - LAND BASED UNDERGROUND CABLE BASE

The scale of global undergrounding, partial undergrounding, transmission and distribution undergrounding. Regional and national analysis by regions; each regional section contains the following figures and tables; 68 pages of detailed information and analysis.

1. Length of OHL and UGC in Middle Eastern countries by km, 2020
2. Length of HV, MV & LV underground cable in Middle Eastern countries by km, 2020
3. Penetration of HV, MV & LV underground cable in Middle Eastern countries by km, 2020
4. Length of HV, MV & LV OHL and UGC underground cable in Middle Eastern countries by km, 2020
5. Underground cable by voltage and line length in ckm, Middle East by country, 2020

Regions covered: Europe, CIS, Asia, Pacific, Middle East, Africa, North America, South and Central America. 162 countries are included in the tables and the major countries ae profiled.

Chapter 5 - SUBSEA POWER CABLES – PROJECTS AND MARKETS

The subsea energy markets consist of connections between land masses, wind power and oil & gas exploration and production. These markets require three categories of cable; subsea cable – export and transmission cable EHV, and HV - array cable HV and MV; umbilical cable - MV, trending to HV; topside cable - MV and LV. Current subsea cable installations. Tables of existing and future land-to-land interconnections, wind farms, power-from-shore cables, with subsea and underground cable lengths by km and voltage.

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Chapter 6 - OFFSHORE WIND POWER CABLE

Assessment of the wind power sector and future developments with country analysis, and usage of cable.

Chapter 7 - THE OFFSHORE OIL & GAS POWER CABLE

Assessment of developments and usage of cable and cable types and technology.

Chapter 8 OFFSHORE UMBILICALS

Outline of umbilicals and technology.

Chapter 9 - THE TYPES AND TECHNOLGIES OF EHV AND HV CABLE

High Voltage cables (HVC) are used in three different configurations; overhead (uninsulated) conductors or lines (OHL), underground (insulated) cables (UGC), and subsea (insulated) cables. Each types can be AC or DC. This chapter outlines the technology of each category, for land-based UGC and subsea cable. Four basic categories of cable ; high-pressure, fluid-filled pipe (HPFF), high-pressure, gas-filled pipe (HPGF), self-contained fluid-filled (SCFF), solid cable, cross-linked polyethylene (XLPE) – outlines, diagrams, strengths and applications of each technology - MI, XLPE, EPR.

Chapter 10 - INSTALLATION OF UNDERGROUND HV & EHV LAND CABLES

Methods and applications for each type of installation of UGC.

Chapter 11 - SUBMARINE POWER CABLES AND INSTALLATION

Methods and applications for subsea power cable.

Chapter 12 - ADVANCED TECHNOLOGY, SUPERCONDUCTORS

The development of LTS and HTS SC technology, current status and market.

Chapter 13 - GAS TO WIRE

Brief resume of this new technology for using spare transmission capacity.

Chapter 14 - ENVIRONMENTAL ISSUES - ELECTROMAGNETIC FIELDS IN LAND BASED SYTSTEMS

Environmental issues which impinge on transmsission, with implications for rights of way.

Chapter 15 - COMPANY PROFILES AND CABLE MARKET SHARES

Company profiles and assessment of production capacity; Prysmian, Nexans, NKT High Voltage Cables, Cablel® Hellenic Cables, Southwire, Parker Scanrope, Leoni, Sumitomo, Fujikura, Hitachi Cable, J-Power Systems (JPS), LS Cable & System, Iljin Cable, Finolex J-Power Systems Private Ltd (FJPS), Ningbao Orient Cable, Far East Cable Co Ltd, Wanda Group Holdings Co Ltd, Baosheng High Voltage Cable Co Ltd BHVC, Jiangsu Shangshang Cable Group.

Chapter 16 - GLOSSARY

METHODOLOGY

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1. HIGH VOLTAGE CABLE SECTOR DEFINITIONS

High voltage insulated cables are used for subsea (submarine) cable connections and in land-based underground networks.

Subsea cable

EHV, HV and MV cable is used in four subsea applications:

- Connections between land masses, over short or long distances, mostly EHV and HV.
- Export cables, HV and EHV cables transporting power from off-shore wind farms to shore grids or consumers.
- HV and MV array or inter-array cables connecting wind turbines to a sub-station before stepping voltage up to the voltage of the export cable.
- To transport power to off-shore oil and gas installations.

Underground cable

Underground EHV, HV cable is used:

- To transport EHV and HV power from transmission grids into urban distribution centres, to avoid congestion or when rights of way are too expensive.
- In areas of great natural beauty where overhead towers are unsightly.

'Partial undergrounding' is common, in which relatively short stretches of line in overhead transmission grids are buried underground. Land based underground HV cables are mostly HV;

A much greater length of MV and LV underground cable is used in the distribution segment.

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2. THE HIGH VOLTAGE CABLE BASE

Insulated cables of all voltages are used underground in land-based networks and subsea (or submarine). The technologies of underground and subsea cables are similar, with some mechanical differences. Globally, XX% of land-based EHV and HV transmission lines are overhead and XX% underground, compared with XX% overhead for MV and LV distribution and XX% underground. There is a large disparity in the lengths of transmission and distribution networks, with XX million circuit km of transmission and XX million circuit km of distribution lines. HVDC is more efficient over long distances than HVAC, and most of the HVDC land-based lines are overhead with some underground cable, while all HVDC and HVAC subsea cable is insulated.

There are XX million circuit km of land based underground cable of all voltages, XX cable km of subsea cable installed throughout the world. These proportions do not reflect the market as it is today and in the future. The high proportion of EHV subsea cable includes a large amount of legacy of EHV cable in the interconnectors which has been installed over the last fifty years. The emphasis is now shifting to the offshore wind market, which is growing very rapidly. As the size of the wind farms increases with larger numbers of larger turbines, so the emphasis of the market is shifting to the growing installations of HV and MV array cables, which are themselves moving from 33/35 kV cables to 66 kV cables.

Table XX: Cumulative installed bases of underground and subsea cable, circuit km, 2020

	≥320 kV	220<320 kV	35<220 kV	1<35kV	< 1000 V	Total
Land base						
Subsea						
Total						

Table XX: Cumulative installed bases of land based underground cable by region and voltage, circuit km, 2020

	≥320 kV	220<320 kV	35<220 kV	1<35kV	< 1,000 V	Total
Europe						
CIS						
Middle East						
Africa						
Asia						
Pacific						
LAC						
North America						
World						

Source: Multiple sources

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Table XX: Cumulative installed bases of underground and subsea cable, circuit km, 2020

	≥320 kV	220<320 kV	35<220 kV	1<35kV	< 1000 V	Total
Land base						
Subsea						
Total						

Table XX1: Cumulative installed bases of land based underground cable by region and voltage, circuit km, 2020

	≥320 kV	220<320 kV	35<220 kV	1<35kV	< 1,000 V	Total
Europe						
CIS						
Middle East						
Africa						
Asia						
Pacific						
LAC						
North America						
World						

Source: Multiple sources

Table 2: Global lengths of overhead transmission and distribution lines and underground cables and global shares by region, 2020

	Transmission HV & EHV		Distribution MV & LV		HV & EHV	MV & LV
	OH lines	UG cable	OH lines	UG cable	UG cable	UG cable
Europe						
CIS						
Africa						
Middle East						
China, India, Japan						
RO Asia						
Pacific						
LAC						
North America						
World						

Source: StatPlan Utility Statistics Database

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Table XX: Length of HV, MV & LV OHL and UGC underground cable in European countries by km, 2020

	HV OHL	HV UGC	MV OHL	MV UGC	LV OHL	LV UGC
Albania						
Austria						
Belgium						
Bosnia Herzegovina						
Bulgaria						
Croatia						
Cyprus						
Czech Republic						
Denmark						
Estonia						
Finland						
France						
Germany						
Greece						
Hungary						
Iceland						
Ireland						
Italy						
Latvia						
Lithuania						
Luxembourg						
Macedonia						
Malta						
Netherlands						
Norway						
Poland						
Portugal						
Romania						
Serbia & Montenegro						
Slovakia						
Slovenia						
Spain						
Sweden						
Switzerland						
Turkey						
UK						
Europe						

Source: StatPlan Utility Statistics Database

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Table XX: Global annual demand for EHV and HV and[EB1] MV ≥ 35 kV cable length in km, 2021 to 2026.

		2021	2022	2023	2024	2025	2026	cagr
Interconnections EHV	**EHV > 220 kV**							
Interconnections HV	**HV 35 - 220 kV**							
Export cables EHV/HV	**EHV/HV > 220 kV**							
Array cables HV/MV	**HV/MV < 35-220 kV**							
Offshore OGP HV MV	**HV/MV < 35-220 kV**							
Subsea								
Land UGC	**EHV > 220 kV**							
Land UGC	**HV 35 - 220 kV**							
Total UGC								
Total cable								

Table XX3: Annual demand for EHV and HV and[EB2] MV ≥ 35 kV cable in km by voltage, 2021 to 2026.

	2021	2022	2023	2024	2025	2026
Voltage	**km**	**km**	**km**	**km**	**km**	**km**
Subsea						
≥320 kV						
220<320 kV						
33/35<220 kV						
Subsea						
Land						
≥320 kV						
220<320 kV						
33/35<220 kV						
Land						
Total						
≥320 kV						
220<320 kV						
33/35<220 kV						
Total						

Source: ICF, ENTSOE, Europacable, EIA, SGCC, and multiple sources

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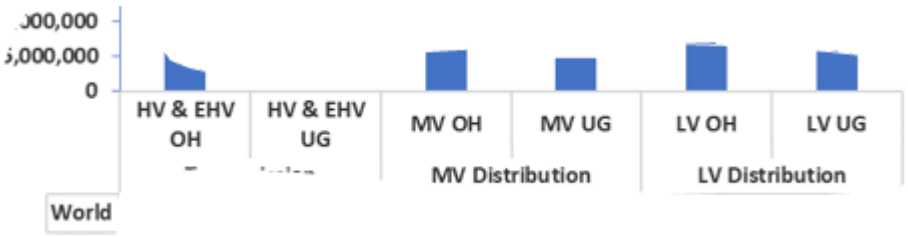
Table XX: Annual demand for EHV and HV and[EB3] MV ≥ 35kV cable length in km by country, 2021 to 2026.

	2021	2022	2023	2024	2025	2026
Region	km	km	km	km	km	km
UK						
Germany						
France						
Italy						
Denmark						
Netherlands						
Rest of Europe						
China						
Japan						
Korea						
Taiwan						
Singapore						
Rest of Asia						
North America						
CIS						
LAC						
Middle East						
Africa						
World						

Source: ICF, ENTSOE, Europacable, EIA, SGCC, and multiple sources

Figure XX: Global lengths of HV & EHV transmission and MV & LV distribution overhead lines and underground cables, circuit km, 2018.



China with XX% and Japan with XX% both have high penetration of HV UGC and given the size of its transmission grid, China has large mileage. The smallest countries have the highest use of HV UGC, Singapore, Macau and Malta, all have 100%. Among medium populations Taiwan has XX% and Korea XX%. In Europe Cyprus has XX%, Netherland XX%, Denmark XX% and the UK XX%.

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Table XX: Subsea installations, Land-to-land interconnections and Power from shore, completed worldwide

Cable name	Countries	Body of water	Power	Voltage	Length	Comm	Config.	Suppliers
			MW	kV	km	year		
EUROPE								
BritNed	UK, Netherlands	North Sea	1,000	450	240	2011	bipolar	Siemens
NorNed	Norway, Netherlands	North Sea	700	450	580	2008	bipolar	ABB/Nexans
SAPEI 1	Italy, Sardinia	Tyrrhenian Sea	1,000	500	420	2011	bipolar	ABB/Prysmian
SACOI 1 3	Italy, Sardinia, Corsica	Tyrrhenian Sea	300	200	121	1968	monopolar	English Electric
HVDC Grita	Italy, Greece	Ionian Sea	500	400	163	2001	monopolar	ABB/Prysmian
East-West Interconnector	UK, Ireland	Irish Sea	500	200	186	2012	monopole	ABB
SwePol	Sweden, Poland	Baltic Sea	600	450	239	2000	monopolar	ABB
Baltic Link	Sweden, Germany	Baltic Sea	600	450	250	1994	monopolar	ABB
Skagerrak I	Denmark, Norway	Baltic Sea	250	250	127	1977	monopolar	ABB
Skagerrak II	Denmark, Norway	Baltic Sea	250	250		1977	monopolar	ABB
Skagerrak III	Denmark, Norway	Baltic Sea	440	350		1993	monopolar	ABB
Skagerrak IV	Denmark, Norway	Baltic Sea	700	500	140	2014	monopolar	ABB/Nexans/Prysmian
Isle of Man Interconnector	England Isle of Man	Irish Sea	40	90	104	2000	monopolar	
Romulo (formerly Cometa HVDC)	Spain, Majorca	Mediterranean	400	250	237	2012	bipolar	Siemens/Prysmian/Nexans
Romulo 2	Spain Balearics	Mediterranean	200	300	240	2018	bipolar	Prysmian/Nexans
Fennoskan 1	Sweden, Finland	Gulf of Bothnia	550	400	200			
Fennoskan 2	Sweden, Finland	Gulf of Bothnia	800					
EstLink 1	Estonia, Finland	Gulf of Finland	350					
EstLink 2	Estonia, Finland	Gulf of Finland	650					

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Table XX: Offshore wind projects

HV PROJECTS	Countries	Body of water	Power	Voltage	Subsea	Comm	Config	Supplier
			MW	kV	km			
Northwester 2	Belgium	North Sea	129	245	52	2020	Export	Nexans
Northwester 2	Belgium	North Sea		33	25	2020	Array	Prysmian
Norther Offshore	Belgium	North Sea	370	220	23	2019	Export	
Norther Offshore	Belgium	North Sea		36	32		Array	Parker Hannefin
Thorntonbank phase 1	Belgium	North Sea	325	150	37	2009	Export	ABB
Thorntonbank phase 2	Belgium	North Sea		33	51	2012	Array	ABB
Belwind 1	Belgium	North Sea	171	165	52	2010	Export	Nexans
Belwind 2	Belgium	North Sea		33		2010	Array	Prysmian
Seamade	Belgium	North Sea	487	220	28		Export	Hellenic Cables
Seamade	Belgium	North Sea		33	76		Array	
Kriegers Flak	Denmark	Baltic		220	100	2021	Export	
Kriegers Flak	Denmark	Baltic		33	155		Array	
Anholt	Denmark	Kattegatt Strait	400	220	25	2013	Export	Nexans
				33			Array	
Horns Rev 1	Denmark	North Sea	160	150	21		Export	
Horns Rev 1	Denmark	North Sea		34	63		Array	