Development and Application of HVDC By SGCC

2015.10.20

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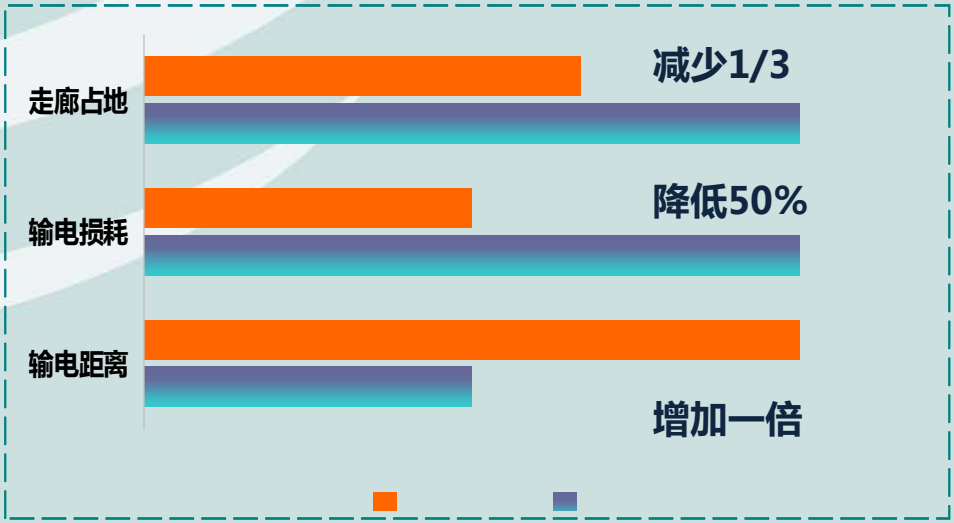
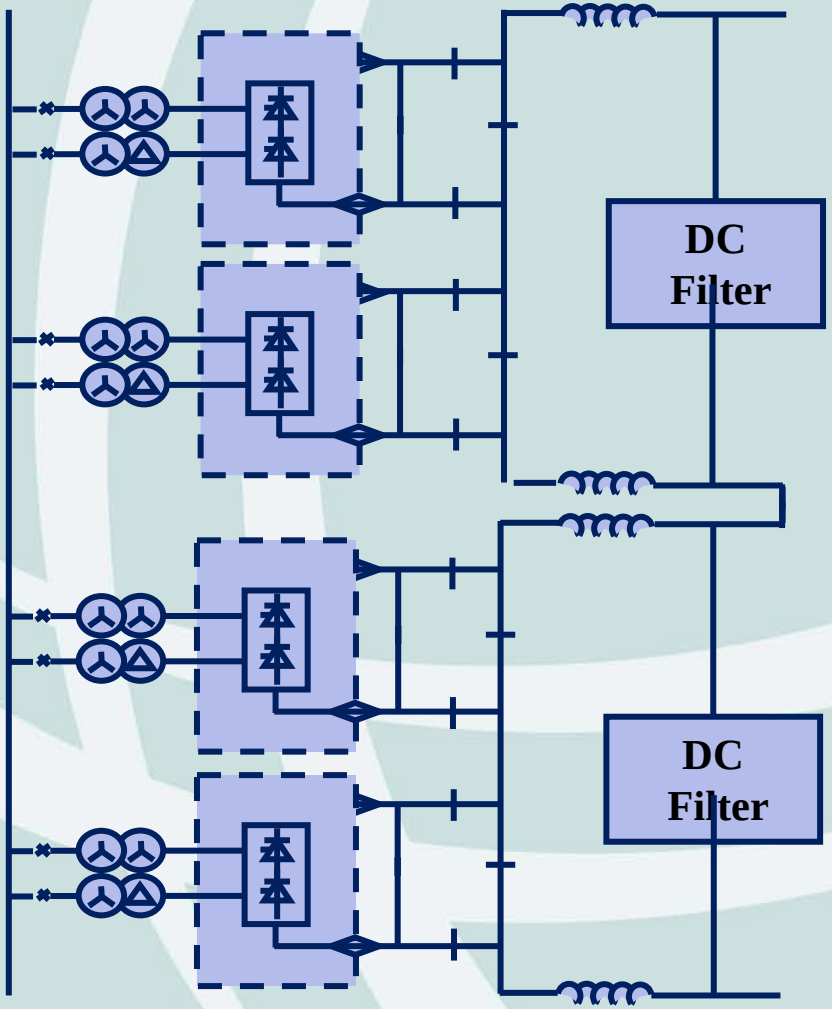
- Technical Overview on HVDC
- HVDC Projects in Operation
- HVDC Projects under Construction
- HVDC Projects under plan

Why UHVDC?

- Increasing electricity demand and Inverse distribution of energy resource and load center in China , UHVDC technology are developed for bulk power and long distance transmission.



Technical Features



- Two converters in serial for each pole with “400kV+400kV” voltage distribution.
- By-pass switches for on-line converter in/out of service.
- Up to 46 operation modes including Crossed “HV against LV” and De-icing function.
- DC filter can be on-line switched in or out.
- Sharing Electrode with other project

Key Equipments---Valves

- The most advanced 6 inch thyristor, electric triggered, air insulated, water cooled thyristors for 800kV/5000A double valves. Maximum converting capacity of single converter reaches 2000MW.

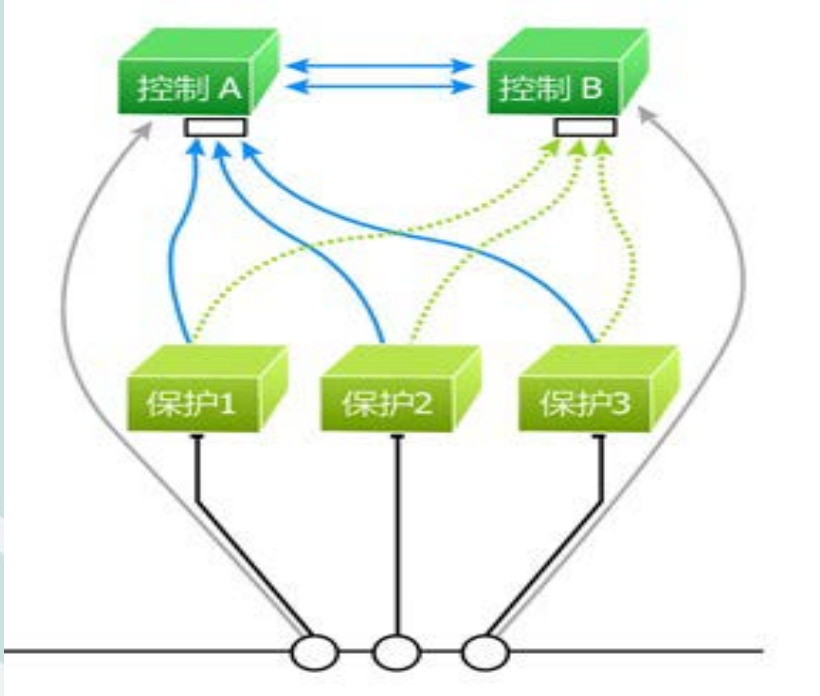
Key Equipments---Converter Transformer

- Single-phase, two-winding, oil insulated, BOX-IN de-voiced converter transformers with capacity up to 406MVA.

Key Equipments---Smoothing Reactor

- 800kV/8000A dry type , air cooling, noise isolation smoothing reactor. 4 smoothing reactors (75mH) for each pole, evenly located on 800kV line and neutral line

Key Equipments---Control and Protection



- Duplicated control and “2 out of 3” protection based on real time platform.

Transmission Line

- Towers along the route, supporting 6×720mm^2 /6×900mm^2 / 8×1250mm^2 overhead conductors.

Reliability

Reliability Index	XS800 UHVDC	Conventional HVDC
Converter forced outage rate	≤ 2 times / (converter*year)	
Monopole forced outage rate	≤ 2 times / (pole*year)	≤ 5 times / (pole*year)
Bipole forced outage rate	≤ 0.05 times / year	≤ 0.1 times / year
Energy unavailability	≤ 0.05 %	≤ 0.5 %

Technical Trend

- DC Current up to 6250A for ±800kV，10000MW
- Connection to grid Voltage 750kV for Northwest power grid and split connection to 500/1000kV in the receiving side
- DC Voltage up to 1100kV with rated power of 12000MW for ultra long distance transmission from Xinjiang to east and central China

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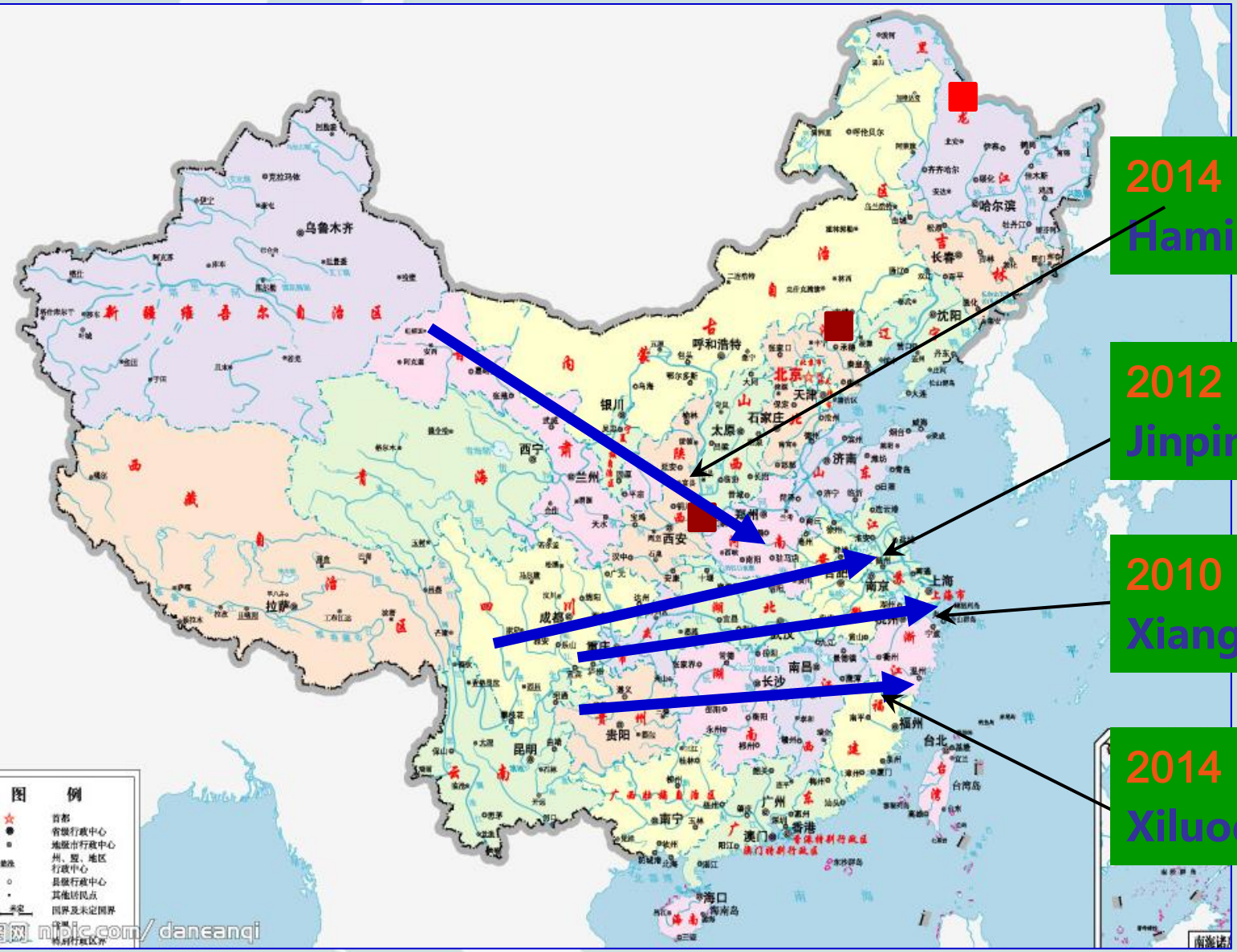
UHVDC Projects in Operation



UHVDC Projects in Operation

Projects	DC voltage （kV）	Rated power (MW)	DC current (A)	Line length (km)
Xiangjiaba-Shanghai	±800	6400	4000	1907
Jinpin-Sunan	±800	7200	4500	2051
Haminan-Zhengzhou	±800	8000	5000	2192
Xiluodu-Zhejiang	±800	8000	5000	1653

HVDC Projects in Operation

NO.	Projects	DC Voltage	Capacity	Distance	Year
1	Ge-nan	±500kV	1200MW	1045km	1990
2	3G-Chang	±500kV	3000MW	860km	2003
3	3G-Guang	±500kV	3000MW	975km	2004
4	Lingbao B to B	120/167kV	360+750MW	0	2005/2009
5	3G-Hu	±500kV	3000MW	1048.6km	2006
6	Gaolin B to B	±125kV	2*750+2*750MW	0	2008/2012
7	De-Bao	±500kV	3000MW	574km	2009
8	Hu-Liao	±500kV	3000MW	908km	2010
9	Ningdong	±660kV	4000MW	1335km	2011
10	3G-Hu II	±500kV	3000MW	1106km	2011
11	Qing-Zang	±400kV	600MW	1038km	2011
12	Nahui Flex.	±30kV	20MW	8.4km	2011
13	Heihe B to B	±125kV	750MW	0	2011

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UHVDC Projects under Construction

Projects	DC voltage （kV）	Rated power (MW)	DC current (A)	Line length (km)
Lingzhou-Shaoxing	±800	8000	5000	2000
Jiuquan-Hunan	±800	8000	5000	2300
Jinbei-Nanjing	±800	8000	5000	1100

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UHVDC Projects under plan

Projects	DC voltage（kV）	Rated power (MW)	Rated DC current (A)	Line length (km)	Operation
Ximeng-Taizhou	±800	10000	6250	1620	2017
Shanghaimiao-Shandong	±800	10000	6250	1235	2017
Zhundong-Wannan	±1100	12000	5500	3340	2018

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UHVDC Projects under plan

Project	Rated DC voltage（kV）	Rated power (MW)	Rated DC current (A)	Line length (km)	Operation
Zhalute-Qingzhou	±800	10000	6250	1450	2018
Yazhong-Nanchang	±800	10000	6250	1400	2018
Zhundong-Chengdu	±1100	12000	5500	2600	2018

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Thanks !