

g features:

Innovative, High Quality and Outstanding Expertise

Zhoushan 5-Terminal VSC-HVDC Pilot Project is the world's first 5-terminal VSC-HVDC project, being an island power network which has the largest number of terminals and the largest capacity of same voltage as well as a most sophisticated operation system. The project has utilized Chinese home-made electric equipment, which is of proprietary intellectual property rights. Via innovation and design optimization, the project has achieved a number of technical indicators which reach the internationally leading status.

Comparison	Zhoushan VSC-HVDC	Similar project globally	Result
Converter terminal	5 terminals	3 terminals	World leader
Converter capacity	1000MW	1000MW	World advanced
DC undersea cable length	141.5km	km 70~100km	World advanced
Single converter cost	CNY500 million	CNY2.00 billion	World leader
Single station MMC converter valve capacity	400MW	400MW	World advanced

The Zhoushan 5-Terminal VSC-HVDC Pilot Project is highly regarded by several leading experts in China. After visiting the project, Qili Huang, an academician and the Director of Division of Energy and Mining Engineering of Chinese Academy of Engineering (CAE) said, "multi-terminal VSC-HVDC technology is a brand-new technology, which is of the flexibility of AC transmission and the cost advantage of DC transmission. It is of strategic significance to the adjustment of energy structure, use of renewable energy, development of marine economy and energy conservation."

Aici Qiu, an academician and the Vice Director of Division of Energy and Mining Engineering of CAE was quoted as saying "Multi-terminal VSC-HVDC technology represents the future orientation of power grid development, standing for a great significance to the new energy access, adjustment of energy structure, improvement to the power quality and environment."

As of the project, 10 national patents are filed and 3 national patents are granted; more than 10 technical papers are published in various publications home and abroad; the project relevant QC team has won the first prize of the "2014 Zhejiang Provincial Survey and Design Oriented QC Award" and the second prize of the "2014 National Engineering (Survey and Design) Oriented QC Award".

The Project design has included an excellence-engineering process to strictly implement the applicable industry standards, such as the *Compulsory Regulation on Power Transmission Project*, the *State Grid Corporation's Quality Control Requirement and Control Measures for Prevention of Common Problems with Power Transmission Project*, the *State Grid Corporation's Power Transmission Project Standard Library (2012 edition)*. Engineering quality is significantly enhanced via stringent monitor and control over the occurrence of common design error and design defect. Up until April 2015, Zhoushan VSC-HVDC Project has accumulatively operated for 183 days among which the longest non-stop, safe and stable operational period lasts for 63days, having transmitted electric power of 180 million KWH and contributed to the economic benefit by CNY90 million approximately.

The project adopts internationally advanced EPC mode. Engineering of the Project has given rise to the application of a large amount of innovative technologies and research achievements. Via the optimized engineering, project cost is much reduced. At present, the cost of a single DC converter station of same voltage and capacity is globally around CNY2.00 billion, but the total cost of the 5 converter stations pertaining to Zhoushan HVDC-Flexible Transmission Project is well controlled around CNY2.10 billion, which is far superior to the current global level.

Transparency and Integrity:

QBS principle is selected and applied to all stages of construction, where transparent, high efficient and competitive tendering is applied to choose supply and service. Bid evaluation process and bid winning decision are conducted under the supervision of governmental auditor and disciplinary supervision department. After the construction contractor is appointed, the owner's personnel designate the project manager and the site manager. If there is any occurrence of corruptness out of the project, the owner's personnel are primarily accountable, the project manager is directly accountable and the site manager managerially accountable.

al works beyond contract scope, work variations are a step-by-step signature endorsement procedure. No increase of works or sub-project is allowed without approval. Site management personnel work diligently on site and strictly monitor the use of materials; prepayments are made only according to the reasonable proportion of completed works and overpayment is avoided; completion acceptance and final settlement procedures are submitted to the owner's personnel and then implemented accordingly.

Sustainability and Environmental Protection:

Zhoushan VSC-HVDC Pilot Project is in line with HSE system, which covers all work safety aspects on the jobsite of the project. Work safety requirement of the national standard and that of the State Grid Corporation are strictly implemented on the jobsite while adhering to the principle of "people-centric" and the safety management policy of "safety first, precaution utmost", this ensures the construction works of the project are free from fatal accident, serious work injury, epidemic disease and environmental pollution. Noise is controlled within the specified range; waste water is discharged into public sewer network only after being treated up to standard in the sedimentation tank, oil separation tank and septic tank; work safety requirement is fully fulfilled on the jobsite, which ensures a smooth going of the construction works.

The equipment and materials used in Zhoushan VSC-HVDC Pilot Project are primarily environment-friendly; equipment installation is optimized by using pre-embedded bolts as much as possible, which greatly reduces welding work on the site, helps to reduce CO² emissions and depletion of o-zone layer, having contributed to the control of urban air pollution noticeably.

The project technically has an outstanding superiority of distributed energy access, having become a preferred access alternative for photovoltaic power, tidal power and offshore wind power.

The project site is selected in a good location with short electric lines being opened or connected; the DC/AC side incoming and outgoing line aisle is arranged in a reasonable manner. The site is optimized so that agricultural land is kept clear; no cultivated land, long run cropland and forest are occupied; meanwhile in view of the scarcity of land in coastal areas, valve hall distribution design is optimized to select novel electric equipment and layout, reducing real estate requirement significantly and saving the non-renewable land resource considerably.



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It is CNY4.00 billion, a considerable amount adding to the project design optimization, energy-saving products are utilized as many as possible; this reduces the workload of site installation and accordingly reduces energy consumption. Meanwhile the concept of life cycle is introduced into the design, where the coastal converter station is designed to have a 60-year enduring service lifetime, plus the strict construction quality control which also ensures a longer service life of the facilities. The project converter station design is optimized in consideration of the complicated geological conditions. Since its operation, the project has been operating satisfactorily and there has been no shutdown due to construction quality failure.

Services rendered by the submitting firm for the project

The nomination submitting firm Zhejiang Electric Power Design Institute (ZEPDI) of Energy China has acted as the lead designer and has undertaken engineering of converter stations, as well as coordination of the overall design of the project. Based upon quality, the submitting firm has always recommended the most appropriate and objective services in the best interests of the owner while taking into account the features of the project and FIDIC contract terms.