onsite
HV SOLUTIONS

OFFSHORE WIND FARMS

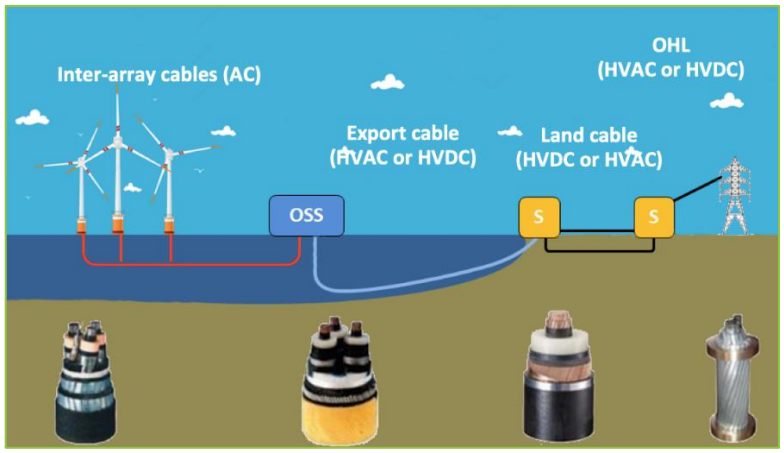
Technical consultancy for investors, insurers & developers with an emphasis on power cable reliability

About Our Team

- Over 30 years of experience in the development and application of technical solutions across various industries working in the field of the electric power delivery, combined with deep practitioner's insights
- Broad experience in developing and delivering industrial solutions and services tailored to individual client needs
- Internationally recognized scientific and applied knowledge in the field of on- and offshore power cables
- Unique personal network of international contacts with electric power companies and academic institutions resulting from many years of active participation in international regulatory bodies such as IEEE, Cigre, IEC and ACPA (former AWEA).

Our Competences in the Field of On- and Offshore Power Cables

- onsite hv solutions ag is a global services and consultancy firm based in Switzerland that has been providing technical advisory services in the field of on- and offshore power cable systems since 2010.
- Our team is comprised of world leading experts who support national and international companies in solving their most complex problems regarding the design, installation testing and service life management of on- and offshore power cable systems
- Within the field of offshore wind farm power cables, we have deep expert knowledge in various aspects of power cable management.



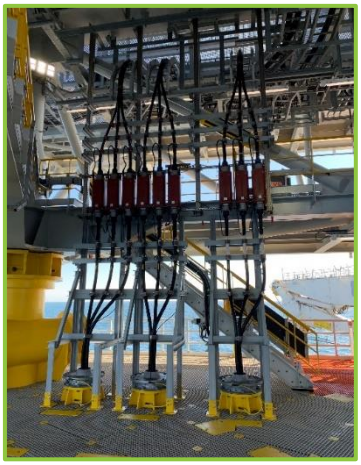
Construction, Design & Laying

- Environmental aspects
- Determination of the cable short-circuit strength
- Current carrying capacity and operating temperature
- Maritime and land cable construction
- Power losses in cable systems
- Reactive power compensation in cable systems
- Cable corridors in sea and on land
- Cable routing systems in the cable line in sea and on land
- The intersection of marine cables (export- and inter array-power cables) with existing infrastructure (formal and technical requirements)
- Ways of securing a cable line and guiding for the point of landfall of the sea cable, and the connection point of marine and land cables.

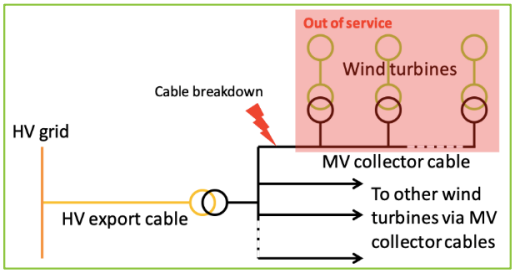
Testing, Installation & Maintenance

- Reliability requirements for power cables and cable accessories
- Electrical requirements during cable design
- Complex cable system tests - types, scope of tests, test procedures, criteria for evaluation of measurement results with e.g. mechanical-, electrical- and non-electrical tests for:
  - Inspection and acceptance tests (FAT)
  - Tests before laying the cable (verification that the cable has not been damaged during loading onto a ship or transport)
  - Inter-operational tests (connections of subsequent cable sections, possibly after other works)
  - Acceptance tests after building the cable line (SAT)
  - Maintenance test during cable line operation lifetime
  - Test in case of a failure during operation.

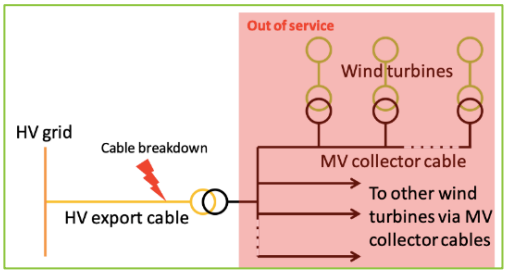
Critical Offshore Windfarm Considerations



- Based on international studies [1] from the past twenty years of offshore wind farm (OWF) operations, power cable failures are responsible for up to 80% of the total financial losses and insurance claims recorded globally
- This fact is much more remarkable and worrisome if one considers the total costs associated with building a windfarm: off-shore power cables typically account for less than 10% of the total capital costs
- Evidence suggests that the costs resulting from downtime or breakdowns during the operation of a wind farm can lead to tens of millions of euros per case, often carried by operators, owners, investors or insurers
- Due to the elimination or reduction of technological and qualitative risks, only such an approach can provide certainty of rational management of financial resources of such large investments
- Failure to apply such a critical approach may result in:
  - randomness of applied solutions dictated by price and time table optimizations
  - numerous disputes regarding the compensation for improper technical performance or defects during the warranty period
  - unacceptable lack of reliability in the national energy production system
- Mindlessly implementing low-cost solutions is highly inadvisable and risky. To avoid this, it is necessary to establish a clear set of rules and guidelines to ensure the qualification of investors, suppliers, contractors and operators.



Example of failure consequences: (left) in case of a failure in the HV export cable, (right) in case of a failure of a inter-array cable section that is a part or the complete string of wind turbines



Bankability versus Reliability & Maintainability of OWF Power Cables

Aspects	Expectations	Our Expertise could be helpful
Availability of financing "bankability" of investment projects	"Investment bankability" will be when financing institutions and insurers, in cooperation with their technical advisers, are able to confirm that the reliability of proposed technological solution is satisfactory.	1. Create criteria and instruments for assessing the quality of projects 2. Monitor the implementation of the solutions proposed by domestic and international suppliers 3. In order to maintain the CAPEX and OPEX values, the creation of criteria for the assessment of the methodology of asset management of infrastructure in operation
Technological reliability	Based on international best practices, solutions have to be used that increase the reliability and lifetime of OWF cables installations.	1. Analyze of installation and operation problems that have occurred so far in the world 2. Take into account the technological risks of doubling the power generated by the new generation wind turbines 3. Apply recommendation and verification criteria for the assessment of technologies and solutions proposed by domestic and international suppliers
Efficient country local supply chains	To keep long-term maintainability of the OWF infrastructures, the country's local contribution to the offshore wind infrastructure has to be as optimal as possible.	1. Maximize the use of existing domestic raw material and technological resources for the construction and maintenance of cable infrastructure 2. Create an own base for building and maintaining cable infrastructure 3. Optimize construction costs and maximize investment returns

[1] Renewable and Sustainable Energy Reviews_151._*Discussion of electrical and thermal aspects of offshore wind farms power cables reliability*.

onsite hv solutions ag
Töpferstrasse 5
6004 Lucerne
Switzerland
Member of ***Electrosuisse***

Phone: +41 41 500 0550
Fax: +41 41 500 0551

onsite hv solutions Central Europe Sp. z o. o.
Ciasna 6
00-232 Warsaw
Poland

Phone: +48 693 491 444
Fax: +48 895 264 485

onsite hv solutions Benelux B.V.
Van der Kunstraat 10
4251 LN Werkendam
The Netherlands

Phone: +31 183 304 012
Fax: +31 183 302 008

MasterGrid
2 rue de la Neva
38000 Grenoble
France

Phone: +33 4 56 59 35 12
Email: clients@mastergrid.com
Web: www.mastergrid.com

Email: info@onsitehv.com
Web: www.onsitehv.com

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Member of **Onsite HV** Group