Dedicated Cable Testing and Diagnosis Solution to Support a Reliable Renewable Energy Generation

Rogier **JONGEN**, onsite hv solutions ag, Lucerne, Switzerland, r.jongen@onsitehv.com
Jaroslaw **PARCIAK,** onsite hv solutions Central Europe Sp. z o.o., Warsaw, Poland, j.parciak@onsitehv.com
Edward **GULSKI** Łódź University of Technology, Łódź, Poland, edward.gulski@p.lodz.pl

ABSTRACT

Onshore and offshore HVAC power cable installations in wind farms, typically have considerable lengths. Unlike traditional network power cable connections of a few kilometers, those systems typically have substantially higher repair and higher costs for unsupplied energy as a result of system failures. This paper discusses the technical difficulties of the field testing of long-length power cable systems using a damped AC testing method and also discusses the best practical applications for the testing and diagnosis of these wind farm HVAC cable systems in order to support the quality assurance of newly installed cable systems as well as to establish a solid foundation for condition-based maintenance during service operation.

KEYWORDS

Onshore and Offshore Wind Farms, Inter-Array Cables, Export Cables, After-laying Testing, Partial Discharge Diagnosis.

INTRODUCTION

For power generation with on- and offshore wind parks, as shown in Fig. 1, the distribution and transmission power cable circuits are the strategic elements of renewable generation.

Fig. 1: The energy generated by large onshore- and offshore wind farms requires energy to be transported by power cables over long distances between the wind farm and the utility grid.

It is known that about 12% of all on-site acceptance tests executed on newly installed on-shore circuits resulted in breakdowns mostly in cable joints and terminations. Moreover 80% of these failures are related to the local installation defects in cable joints and terminations. The majority of the problems are caused by poor workmanship during assembling, including:

- Wrong assembling dimensions,
- Wrong materials or tools used,
- Missing or wrongly applied electric field distribution elements of joints and terminations, e.g.: spacers, fillers, semi-conductive materials, insulating tapes, defects of deflectors and so on.

Moreover, the past experiences show for newly installed XLPE cables with a voltage level of 66 kV to 230 kV, that the highest number of failures appears within the first 3 years of service operation.
The Capital Expenditures (CapEx) for the erection of wind parks, as made by the investors and stakeholders, are direct related to the Operational Expenditures (OpEx), that in its turn are fundamental to keep the electric power supply reliability on an agreed level. This is always a balancing act, see Fig. 2.

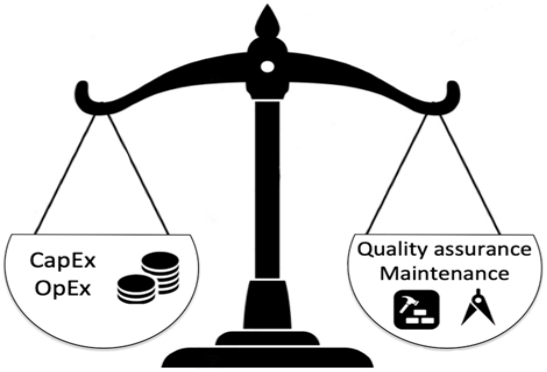

Fig. 2: The balance of financial values and costs versus quality assurance of newly installed and maintenance of service aged cable circuits is important for reliable operation of on- and offshore power cable systems.

In this contribution, the practical testing aspects, supported by field examples, are discussed to achieve higher reliability and consequently, lower downtime costs of the power cable connections in on- and offshore wind farms.
With a goal of a better quality control of newly installed and in service cable circuits, of onshore- and offshore cables, experiences of applied methods and approaches for maintaining the cable quality over the life-time will be discussed in this paper.

TESTING CONSIDERATIONS

For the post-installation testing and quality assurance requirements in [1-3] is pointed out that considering long length of on- and offshore power cables, special attention needs to be paid, but these publications do not provide any specific proposals, e.g.:

1. How to generate the requested powers onsite to over-