Large Offshore Wind Harmonics Mitigation

Publieke samenvatting / Public summary

Background

The increased scale of offshore wind power plants (OWPPs) and longer distances to the onshore grid connection points requires longer cable connections of larger capacity, which increases the susceptibility of the OWPPs and the offshore and onshore transmission systems to harmonics.
The presence of harmonics can reduce the reliability and efficiency of the electricity generation. This is a matter of concern, considering OWPPs will gradually replace conventional power plants and their reliability will be of importance to guarantee of the quality of supply.
To take effective mitigation measures, more insight is needed in the complex interactions between harmonics sources and their detrimental effects on component integrity and system performance.
The need for mitigating harmonics resonances is acknowledged increasingly by OWPP developers as well as by TenneT TSO. It is therefore vital for the Dutch offshore wind sector to develop the required design expertise on harmonics mitigation, facilitated by clear design guidelines.

Objective

The objective of this project is to develop a methodology to design lean measures to mitigate adverse effects of harmonics in the electrical infrastructure of offshore wind energy.
The cost reduction potential lies in the large design margins that are still applied and additional filters and modifications that are often needed afterward. This is because the current state of the art is that harmonics issues are not accurately predicted in the

Projectinformatie / Project information

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Algemene informatie / General information

Penvoerder / Secretariat
Nederlandse Organisatie voor toegepast-natuurwetenschappelijk onderzoek TNO

Publicaties en materialen / Publications and attachments

- **06.09.2021**

  Eindrapport TEWZ117001

Links

- Large offshore Wind Harmonics Mitigation (Article, TU Delft)
- ECN Offshore Wind Energy (Article, Ocean Energy Resources, 2017)

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design phase, leading to less optimal and non-future proof solutions that need redesign in case of grid modifications.
In a broader context, the objective is therefore to increase reliability and to reduce costs of the electrical infrastructure of offshore wind energy.

Short description of activities
The project focuses on the development, evaluation and implementation of a design methodology that can accurately predict complex harmonic interactions in large scale offshore wind farms and in which the measures to reduce harmonics issues become an integral part of the design.
The obtain this objective, the following project approach is implemented:

- Analysis of current bottlenecks in electrical infrastructure design with regard to harmonics control
- Development of an improved design methodology
- Evaluation using case studies
- Implement learnings

A strong and balanced consortium has been formed: TenneT, Energy Solutions and CG-Power Systems. The knowledge institutes: TU-Delft, TU-Eindhoven and ECN

Results

1. Increased knowledge on the emission and propagation of harmonics from OWPPs (report based on literature study current design practice and foreseeable grid and technology developments)
2. Design methodology to mitigate adverse effects of harmonics, verification report based on three representative cases
3. Interface requirements on the point of common coupling
4. Measurement requirements for validation purposes
5. Formulation of best practices for standardization purposes

In general, this project will contribute to the

development of the offshore wind energy by reducing costs and improving reliability of the electrical infrastructure. Indirectly, onshore cost reductions are also expected in the measures the TSO takes to connect offshore wind to the national grid.

De data in deze applicatie is afkomstig van de Rijksdienst voor Ondernemend Nederland (RVO) en wordt in samenwerking met de Topsector Energie ontsloten.
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