Project proposal form

THE MSC-STUDENT – TOGETHER WITH THE HOST INSTITUION OFFERING AN MSC-PROJECT - HAVE TO FILL IN THE FORM AND SEND IT FOR APPROVAL TO Postgraduate Programme Renewable Energy at UNIVERSITY OF OLDENBURG <www.ppre.de>.

The Project Proposal

Project Title | "Determination of the required Power Response of Inverters to provide fast Frequency Support in Power Systems with low Synchronous Inertia"

Objective and methodology:

- Introduction to set the context and reason for the development of the project (max. 150 words):

Decommissioning of conventional power plants and the installation of inverter-based renewable energy technologies decreases overall power system inertia. This reduction in system inertia has an impact in the power system frequency response when an unbalance between generation and load occurs, increasing the rate of change of frequency of the system. In a future scenario where renewables are predominant in power systems and due to the natural variability of the resource, unbalances of 40 percent or more are prompt to happen, which combined with low inertia may lead to frequency collapse.

- Objectives - 4-6 measurable activities to meet the aims (max. 150 words)

The requirements of inverters to provide an effective fast reserve response will be investigated. In this way, inverters are intended to reduce the rate of change of frequency so enough time is provided to activate the primary power reserve. Needed power rate under different inverter time responses and different rates of change of frequency is analyzed.

- Proposed scientific methodology – how are you going to solve the problem and meet the objectives (max. 150 words)

Different inverter reaction times will be simulated, from activation at the moment of the unbalance event in different shares of renewables. Required power rates will be obtained for each scenario. In the worst case scenarios where low frequency load shedding limit is reached, the addition of the inverter power rate response should be enough to avoid this limit.

Additionally, the obtained results will be verified with the simulation of the IEEE 9 bus system in the Real Time Simulator in the Grid Laboratory with the implementation of inverters providing inertia response according to the obtained results.

- Main expected outcomes of the project (max. 150 words)

It is expected to find a mathematical expression relating reaction time, ROCOF and inverter power rate and an assessment of the capability of current inverters to determine whether current frequency measuring techniques and power electronics are able to meet future grid needs.

- References 2 or 3 peer review journal articles related to the topic under investigation (when applicable)

1. ENTSOE (2018): Rate of Change of Frequency (RoCoF) withstand capability. Available online at www.entsoe.eu.
2. Dreidy, Mohammad; Mokhlis, H.; Mekhilef, Saad (2017): Inertia response and frequency control techniques for renewable energy sources: A review. In *Renewable and Sustainable Energy Reviews* 69, pp. 144–155. DOI: 10.1016/j.rser.2016.11.170.

Entity offering project | DLR Institut für Vernetzte Energiesysteme

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