**Theme**: **Smart-Grid Communications**

**Number of students:** minimum 2 students

**Project duration**: 3 to 12 months

**Project frame**: Bachelor, Masters Research project with 4 to 6 months

**Work load: 12 to 30 ECTS**

**Background:**

* Decentralized electric power generation using renewable energy sources is becoming increasingly popular. As a consequence, decentralized electrical energy sources such as photovoltaic (PV) are connected to the low voltage (LV) or medium voltage (MV) power grids as shown in Figure 1. Simply connecting renewable energy to the high voltage HV grid is not cost-effective and an increasing number of renewable energy sources have to be connected to MV and LV grids. In general, it is difficult to predict the power utilization in MV/LV grids: both generation and consumption.
* This change requires dedicated and coordinated control of loads and power generation to realize the necessary intelligent power management. Such power management has to guarantee the full and safe operation of the available power transmission capacity in LV and MV grids.
* Therefore, the next generation of power grid automation has to account for devices in the low-voltage domain, such as smart meters, phasor sensors, etc, and should mainly rely on communication among those smart devices. Here the main research question is:

***Which communication technologies meet the requirements for smart grid communication in the MV/LV grids?***



Figure 1: Overview of HV, MV and LV power grids

**The challenge:**

The robust and reliable smart grid communication heavily depends on the wireless communication technologies to communicate data within LV/MV power grids. The main objective of this project is to form student groups to evaluate the performance of communication networks used in low voltage grids. The tasks include:

* + Understanding of application requirements, the state-of-the-art technologies and protocols used in smart grid communication
  + Evaluation of smart grid communication requirements using simulations, emulations or small-scale testbeds
  + Evaluation of smart grid communication requirements on large scale scenarios using mathematical models

**The company:**

* Projects might be carried out in collaboration with companies and/or as a research project including researchers from AAU and TUHH. The relevant company would depend on the setting
* A company[[1]](#footnote-1) is able to provide lots of valuable data to create simulations and mathematical modelling.

**Supervisors:**

* Leonard Fisser (leonard.fisser@tuhh.de) and Koojana Kuladinithi (koojana.kuladinithi@tuhh.de), Hamburg University of Technology

**Candidate background:**

* The project can be tailored to students of any background, as long as they are interested in performance evaluations using testbeds, simulators (like OMNeT++ /NS-3 and MATLAB). Basic knowledge of TCP/IP and good programming skills are a clear advantage.

**References and complementary description:**

[1] “60255-118-1-2018 - IEEE/IEC International Standard”, IEEE, IEEE 2018

[2] “Gutachten Digitalisierung der Energiewende Topthema 3: TK-Netzinfrastruktur und TK- Regulierung”, Dr. Bernd Sörries and Prof. Dr.-Ing. Christian Wietfeld et. al., BMWi 2019

[3] K. Kuladinithi, H. Fielitz, M. Mühleisen, C. Becker and Andreas Timm-Giel, „Communication Requirements for Optimal Utilization of LV Power Distribution Systems", Proceedings of the 8th International Conference on Mobile Networks and Management (MONAMI 2016) Abu Dhabi, United Arab Emirates

[4] “Performance Comparison of LTE FDD and TDD Based Smart Grid Communications Networks for Uplink Biased Traffic”, Jason Brown and Jamil Y. Khan, IEEE SmartGridComm 2012 Symposium

1. We are in the process of contacting some companies to contribute for this project [↑](#footnote-ref-1)