

Master thesis for _____

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Analysis of regulatory constraints of distributed energy resources for provision of frequency control in virtual power plants

Achieving a sustainable and environmental-friendly electrical energy supply requires the integration of many Distributed Energy Resources (DERs). Virtual Power Plants (VPPs) are used as one of the aggregation technologies to minimize costs and achieve an efficient and simple integration of DERs. VPPs aggregate small DERs for participating in different markets, like energy markets and frequency control markets. In this case, simultaneous participation in several markets seems to be the most economical solution. However, a challenge is the applicability of various DER technologies in such VPPs when considering the regulatory requirements for frequency control, which may differ for some technologies significantly.

This work is about analyzing the applicability of different DER technologies (e.g. Run-of-River Hydropower, Combined Heat and Power, Photovoltaic, Battery Storages, Heat Pumps, etc.) for the provision of frequency control services in a VPP pool. Firstly, a literature-based research should determine which frequency control services can be provided by a VPP (Frequency Containment Reserve, Fast Frequency Response, and Instantaneous Reserve). Later, the relevant regulatory constraints (Requirements for Generators, Demand Connection Code, relevant Connection Requirements on national level) should be identified to describe the operational conditions of the DER types. Finally, a working example can show, how this analysis results can be applied in a method to select a pool of feasible DERs within a virtual power plant.

The following structure of the work is proposed:

- Literature research: Frequency control schemes, DER regulations, VPP
- Selection of relevant types of frequency control and DERs
- Concept development of a pooling function, based on regulatory constraints
- Working example of the concept
- Qualitative Analysis of the developed concept and working example results
- Documentation

At the end of this thesis work, the results achieved should be presented to a wider audience along with open discussions. The thesis is available immediately to students of electrical engineering/information technology, industrial engineering, computer science or Automation and Robotics as a master thesis.

Contacts:

Simon Uhlenbrock, M.Sc.

simon.uhlenbrock@tu-dortmund.de

Kiran Borse, M.Sc.

kiran.borse@tu-dortmund.de