

Master/ Bachelorthesis

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## **Identification of potential actuator positions for the area-wide control of distribution grids**

Distribution grids will play an increasingly important role in the electrical energy system of the future. On the one hand, renewable energy resources (RES) predominantly decentralized infeed into the medium and low voltage level, while on the other hand, increasing electrification of the mobility sector is accompanied by an additional burden on the grids. As a result, voltage violations or equipment overloads are inevitable. Therefore, secure grid operation can no longer be guaranteed. In order to avoid these limit violations, flexibilities as photovoltaic plants or battery storages can be used. For this purpose, the power can be adjusted so that voltage and current values are within their limits.

With an increased penetration rate of flexibilities the question comes up which of these should be used to control the grid. One possibility is to apply flexibilities in places that repeatedly lead to limit value violations. Another possibility is to apply those which are located at positions with high sensitivities to several critical points. Thus, flexibility interventions could be used to influence as many network points as possible, which would mean that less flexibility assets would have to be applied for a smart grid system.

Within the scope of this work, the different technologies that can be used as flexibilities for a grid-related application are to be shown first. For this purpose, an extensive literature research is to be carried out. Following this, the different technologies with all their characteristics will be compared. The second major work package within this thesis will deal with the identification of potential locations for flexibilities. Thereby it is irrelevant whether flexibilities are not yet available or if they are already installed, but not control-connected at these locations. For this purpose, algorithms will be researched which allow an analysis of the network considering possible operating points. With the help of the analysis, recommendations for reasonable positions for flexibilities shall be given as a result of the algorithm. The method is to be implemented in a suitable development environment. For this, an environment developed at the institute ie<sup>3</sup> in the programming language Matlab can be used. Subsequently, the simulation results from an exemplary application shall be presented.

The following structuring of the work is proposed:

- Literature research on the subject area
- Listing and qualitative evaluation of different technologies as flexibilities
- Research of algorithms for identification of relevant positions for flexibilities
- Implementation of a suitable algorithm in a development environment preferably Matlab or Python
- Application on an exemplary grid and times series

Following this work, the results are to be reported in a presentation.

This thesis is now available as a master thesis for students of electrical/information technology and industrial engineering. Parts of the thesis can also be assigned as bachelor thesis.

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