Synthetic Generation of the Chicago Metropolitan Area Distribution Grid based on High Resolution Load Profiles

Motivation
Distribution grid models are essential for the advancement of the power distribution system analysis and the evaluation of novel concepts that are necessary for a consequent energy transition. Especially in combination with real-world granular load profiles, the practical applicability of theoretical concepts often fails due to a mismatch between model and reality. Detailed models are often not available due to security concerns and confidentiality restriction.

Within our current research project, novel real-time-pricing concepts are evaluated. With a large data set from the Chicago metropolitan area at hand, which includes load profiles, zip-codes, weather as well as census data, a synthetic distribution grid model is now needed to proof practical applicability of our concepts.

Goals and workflow
The goal of this project is the synthetic generation of a distribution grid model (of parts) of the Chicago Metropolitan Area based on a large dataset that encompasses detailed load-profiles of 3.8 million consumers over two years. Several frameworks based on load flow calculation and Open Street Map (OSM) data have already been identified. Based on this current state, the research workflow could look as follows:

- In-depth literature research on grid synthetization frameworks and selection/adaption of suitable framework
- Identification and selection of the research region (zip-code areas), e.g. suburban scenario
- Analysis of OSM meta-data and load allocation to building types within zip-code areas
- Application of chosen framework to the dataset and region
- Validation of the model based on a case study

Prerequisites
- Experience in Python (preferred) or MATLAB
- Experience with GIS-Tools is a plus (e.g. QGIS)
- Knowledge of power systems is a plus
- Ability to work independently and to bring in own ideas

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