Optimal location and sizing of small hybrid systems in micro-grid system using Volunteer Geographic Information

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This study presents an optimization model for the optimal location and sizing of small hybrid systems in simulated micro-grids. By using an optimization model - in combination with COSMO-REA2 weather data - various micro-grids local energy systems are simulated using the Calliope energy simulation model. The Calliope optimization and simulation model is fed with GIS-data from different Volunteered Geographic Information projects, including OpenStreetMap. These allow to automatically allocate specific demand profiles to diverse OpenStreetMap building categories. Moreover, based on the characteristics of the OpenStreetMap data, a set of possible distributed energy resources (including renewables and fossil fueled generators) are defined for each building category. The optimization model is applied for a set of scenarios based on different electricity prices and technological characteristics. This allows to assess the impact and profitability of the different technological options on the micro-grid configuration. Moreover, in order to assess the impact of each of the scenarios on the current distribution infrastructure, the results of the simulations are included on an existing model of the low and medium voltage network for Lower Bavaria, Germany. Finally, to facilitate their dissemination, the results of the simulation are stored in a PostgreSQL database, before they are delivered by a RESTful Laravel Server and displayed in an Angular Web-Application.