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Data Article

An open data repository for steady state analysis of a 100-node electricity distribution network with moderate connection of renewable energy sources

Stavros Lazarou*, Vasiliki Vita, Lambros Ekonomou

Department of Electrical and Electronic Engineering Educators, School of Pedagogical & Technological Education (ASPETE), Heraklion Attikis, 141 21 Athens, Greece

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ABSTRACT

The data of this article represent a real electricity distribution network on twenty kilovolts (20 kV) at medium voltage level of the Hellenic electricity distribution system [1]. This network has been chosen as suitable for smart grid analysis. It demonstrates moderate penetration of renewable sources and it has capability in part of time for reverse power flows. It is suitable for studies of load aggregation, storage, demand response. It represents a rural line of fifty-five kilometres (55 km) total length, a typical length for this type. It serves forty-five (45) medium to low voltage transformers and twenty-four (24) connections to photovoltaic plants. The total installed load capacity is twelve mega-volt-ampere (12 MVA), however the maximum observed load is lower. The data are ready to perform load flow simulation on Matpower [2] for the maximum observed load power on the half production for renewables. The simulation results and processed data for creating the source code are also provided on the database available at http://dx.doi.org/10.7910/DVN/1I6MKU.

* Corresponding authors.
E-mail addresses: stavros@lazarou.eu (S. Lazarou), vasvita@aspete.gr (V. Vita), leekonomou@aspete.gr (L. Ekonomou).

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Specifications Table

Subject area	*Electrical Engineering*
More specific subject area	*Power System analysis*
Type of data	*Processed data on.m format, tables*
How data was acquired	*The data represent a real part of the electricity grid.*
Data format	*MATPOWER, MATLAB format.m files, excel file*
Experimental factors	*The data are ready to perform loaf flow simulation for the maximum observed load power on the half production for connected renewables.*
Experimental features	*The data are based on Matpower format for load flow, power system analysis.*
Data source location	*The line on which these data are based is located in Greece*
Data accessibility	*The data are available on Harvard Dataverse*: http://dx.doi.org/10.7910/DVN/1I6MKU

Value of the data

- The source code represents a real distribution network of moderate but adequate size. It is ready to perform steady state analysis. The data are suitable for studies in load aggregation, storage, demand response and consequently for the optimal design of distribution grid's topology. Their format on Matlab [3] allows for quick and easy integration with emerging technologies and/or proven scientific methods.
- The fact that these data are based on a real distribution grid enhances the applicability of the research to be conducted. The dimensioning of the lines, loads and generators currently corresponds to an operational network. Consequently, the results of the upcoming research using these data have the prerequisites to be also technically suitable to be applied by a network operator.
- The bibliography provides a wide selection of open source data for power system applications. CIGRE [4] and IEEE [5,6] networks are regularly used but they are focused to high voltage transmission lines even if they provide examples on the distribution. Smart grids are regularly deployed to distribution level and a wide selection of networks could contribute to their implementation. This dataset seeks to cover the gap providing only line data on this voltage level additionally to the data already available.
- Our open source data are available for performing steady state, load flow analysis of the given network. However, further enhancement in terms of line and generators data could facilitate short-circuit and dynamic calculations and consequently to support protection and stability studies. This is part of future work but further information is required to increase results accuracy.

1. Data

1.1. General information

On the technical level, smart grids as such are considered an advanced discipline. The scientific community and the industry have allocated resources in describing and solving the main challenges as far as the interconnection of several types of facilities to the distribution level are concerned. However, additional effort needs to be allocated in achieving homogeneity in conducting smart grid simulations. This approach requires taking into consideration the specifics of each system and requires the accessibility to real networks to perform the research. Several organisations offer open source data of electricity grids. CIGRE [4] and IEEE [5,6] networks are the commonly used. There are

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