

Data Descriptor

Dataset for Scheduling Strategies for Microgrids Coupled with Natural Gas Networks

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Received: 30 December 2018; Accepted: 02 February 2019; Published: 5 February 2019

Abstract: Datasets are significant for researchers to test the functionality of their proposed strategies for the microgrid dispatch. This article presents a dataset to help researchers in testing their algorithms related to the dispatch problem of microgrids coupled with natural gas networks. This preliminary release of a microgrid dispatch dataset contains data related to microgrid components (like solar PV, wind turbine, fuel cell and batteries) and natural gas network elements connected with the microgrid (e.g., micro gas turbine). It also includes the data associated with the authors' proposed scheduling strategy and its dispatch results. The provided dataset can be used to reproduce the authors' proposed strategy. The presented dataset further can be used for comparisons of other researchers' proposed strategies. These comparisons will make a strategy's features more evident.

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Keywords: power scheduling strategy data; distribution networks; renewable energy sources; optimal power dispatch; dataset

1. Summary

The primary energy networks are transforming from centralized to distributed, and developing into more interconnected networks [1,2], for example, the electricity grid and natural gas network. Furthermore, these two networks have started coupling to support each other and overcome their problems. A micro gas turbine (MT) works as a coupling gear between these two energy networks. Nowadays, distributed electricity grids have more different types of energy sources (including MT), which make the electric power dispatch more challenging [3,4]. Many researchers focused on this dispatch problem and proposed a number of new dispatch strategies. Datasets play a significant role in measuring efficiency and accuracy of a microgrid. Testing and comparing a proposed strategy are crucial parts of the research process. Most researchers claimed that their proposed dispatch strategy is the most efficient one. Some of these claims are based on a vague comparison. Most of the researchers did not provide such a piece of detailed information related to their claims, which are essential to verify and compare the strategy with other proposed strategies. Here, the significance of a commonly accessible dataset arises so that one can test its dispatch algorithm in the same transparent conditions. This will make their algorithms' comparison more evident and significant. In this data descriptor article, the authors provided the dataset and mathematical models related to different components of microgrids, and a proposed strategy's results. The dataset, mathematical models and proposed strategy's results can be useful in multiple ways. The dataset can be used in

testing and measuring other dispatch algorithms' efficiency and accuracy. The models can be used in preparing new algorithms.

The aforesaid dataset contains hourly readings of metrological information for renewable energy sources (RESs), microgrid components' mathematical models and the proposed strategy's results.

2. Data Description

This dataset contains hourly power produced by PV, a wind turbine, micro gas turbine and fuel cell. It also contains these power generation sources' mathematical models, which can be used to calculate the power produced according to provided input information. The description of the provided files is given in Table 1.

Table 1. Dataset's file names and descriptions.

File Name	Description
Basic_input.m	Basic input about metrological and price info
Bat.m	Battery's function
Cost_calculator.m	Microgrids' one-day cost calculator
Dispatch_all.mat	Hourly power flow from all microgrid players
FuelCell.m	Fuel cell output power and cost calculation
Gas_dispatch.m	Natural gas dispatch for microturbines
max60.m	Current generated by solar PV
micro_gas_turbine.m	Micro gas turbine power and cost calculation
MicroGrid_Dispatch.m	The main function for power dispatch
PandO.m	Solar PV maximum power point tracking
Pwt.m	Power generation calculation by wind turbine
Micro_grid_parameter.m	Microgrid's DER and load parameters

The file's content is given at the start of each file. Some of these files are about the basic input values, which are further used by microgrids' components models. These components' models are able to calculate the respective power curves and cost curves.

3. Methods

MATLAB software is used in preparing the dataset. All the microgrid's components' models are coded in MATLAB. The presented models and their coefficients are based on [5,6], which further refer to [7–9]. Furthermore, the Fuel Cell model is deduced from [10] and the Micro Turbine model is deduced from [11,12]. The pollution treatment cost and other cost-related equations and coefficients are based on [13,14]. The authors proposed a dispatch strategy in their previous study [3]. The final result of the authors' proposed strategy is also given in the MATLAB data format in file "Dispatch_all.mat" (Figure 1). In this data file, the 24-hour dispatch solution and power flow from all the components of the microgrid are given. This dispatch solution is calculated as per the input information related to electric grids and natural gas network, which is also provided in the MATLAB file named "Basic_input.m".

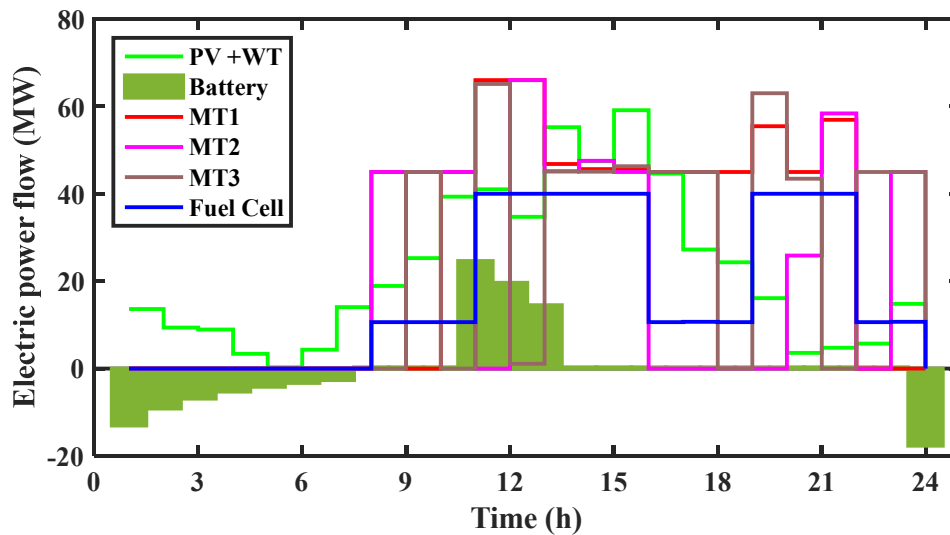


Figure 1. Graphical representation of the data in file “Dispatch_all.mat”.

The components’ models related to the microgrid are coded as MATLAB functions so that they can be reused or integrated easily. The PV-related model also contains the MPPT algorithm which can be replaced by a preferred technique. The approach to code the components’ models as MATLAB functions will result in enhanced readability and reusability of the dataset.

4. User Notes

Three different sets of hourly wind speeds are provided in the file “Basic_input.m”. Each set of these wind speeds corresponds to the seasonal pattern. The accuracy of these wind speed sets is up to 2 decimal points. Along with wind speed data, three sets of solar radiations corresponding to the seasonal pattern are also present in the file. The main file of the coded models is “MicroGrid_Dispatch.m” which calls (is linked with) other models’ functions and also contains the code related to plotting graph results.

Limitations and Recommendations

Along with the dataset, this article also presents two more things; the mathematical models and the results of the authors’ proposed strategy. As all of these things are coded in MATLAB, direct use of the dataset is limited to MATLAB software. However, one can export the dataset into other-software-readable formats, as MATLAB has supported the exporting of data in a number of different formats. One can substitute any of these offered parts of the dataset and compare its results. This will not only make the comparison easier, but also make the implementation of a new technique easier due to provided coded models.

Abbreviations

RES	Renewable Energy Source
DER	Distributed Energy Source
FC	Fuel cell
MPPT	Maximum Power Point Tracking
PV	Photovoltaic
MATLAB	MATrix LABoratory software developed by MathWorks

Supplementary Materials: The following are available online at www.mdpi.com/xxx/s1, Figure S1: title, Table S1: title, Video S1: title.

Author Contributions: Conceptualization and methodology, M.Y. and Q.A.; software, and data curation, M.Y. and Y.G.; writing—original draft preparation, M.Y.; writing—review and editing, M.Y., W.A.W., R.H. and Z.J.; supervision and funding acquisition, Q.A.

Funding: This work was supported by National Natural Science Foundation of China (U1866206).

Conflicts of Interest: The authors declare no conflict of interest.

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