Modified IEEE 123-Bus Test Power Distribution System for Hierarchical Energy Storage Operation

The IEEE 123-bus test power distribution system[1] is slightly modified and a tie-switch between buses 16 and 95 is added to the original network, in order to provide enough reconfiguration options. The system is divided to 6 zones, as shown in Fig. 1, where each zone has its own energy storage (ES) and photovoltaic (PV) unit, with the data given in Table 1.

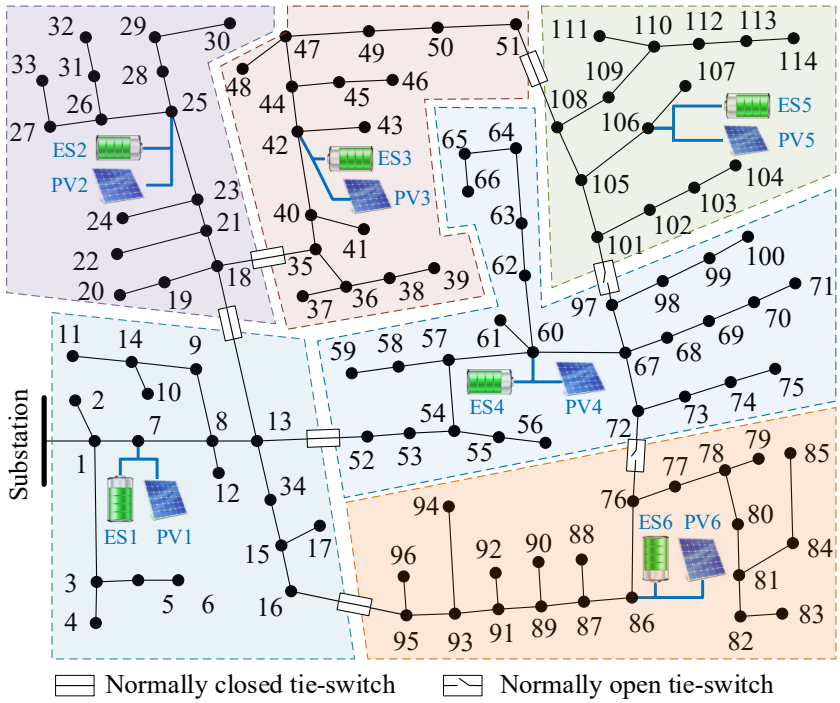

Fig. 1: Modified IEEE 123-bus test power distribution system divided to 6 operational zones

Table 1: ES and PV capacity data for each zone of the system

Zone	1	2	3	4	5	6
ES capacity (kWh)	1000	1000	2000	2000	1000	2000
ES power rate (kW)	250	250	500	500	250	500
PV power rate (kW)	130	125	250	300	125	250

All data are provided in the accompanying database file *DB_123bus_Hierarchical_ES.xlsx*, which include the following data tabs:

1. https://site.ieee.org/pes-testfeeders/resources/

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Find this data file online at: https://usmart.ece.utah.edu/datasets/

- Historical data
  - Date and hour
  - Operational zone
  - Load
  - Load forecast
  - Locational Marginal Price (LMP)
  - LMP forecast
  - Solar generation
  - Solar generation forecast
- 123Bus System Line Data
  - Line resistance
  - Line reactance
  - Line capacity
  - Per unit values
- 123Bus System Load Data
  - Active demand of buses
  - Reactive demand of buses

For the real-time and 24-hour forecast of load and LMP (data Load, Load forecast, LMP and LMP forecast in the data file), the NYISO 2017-2018 hourly data[2] obtained for six of its operational zones are used. The load profiles to zones 1 to 6 of the 123-bus test system are assigned respectively, and are normalized to the total demand in each zone.

For solar generation data, the National Solar Radiation DataBase (NSRDB)[3] is used to extract hourly Global Horizontal Irradiation (GHI) index in 2017-2018 in Manhattan, NY, by which a solar generation profile is created and normalized for each zone based on its PV power rate given in Table I. The solar generation forecast data are generated assuming a normal distribution for the solar generation forecast error with $\mu = 0, \sigma = 5$. The data from 2017 is used for training the intelligent controller, which is then tested on 24 randomly selected days of 2018.

2. http://https://www.nyiso.com/energy-market-operational-data
3 . https://maps.nrel.gov/nsrdb-viewer/

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