Modified IEEE 123-Bus Test Power Distribution System for Hierarchical Operation of Integrated Hybrid Resources

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 system, in order to provide enough reconfiguration options. The system is divided into six integrated hybrid resources (IHR) zones, where each IHR has its own set of distributed energy resources as presented in Table 1.
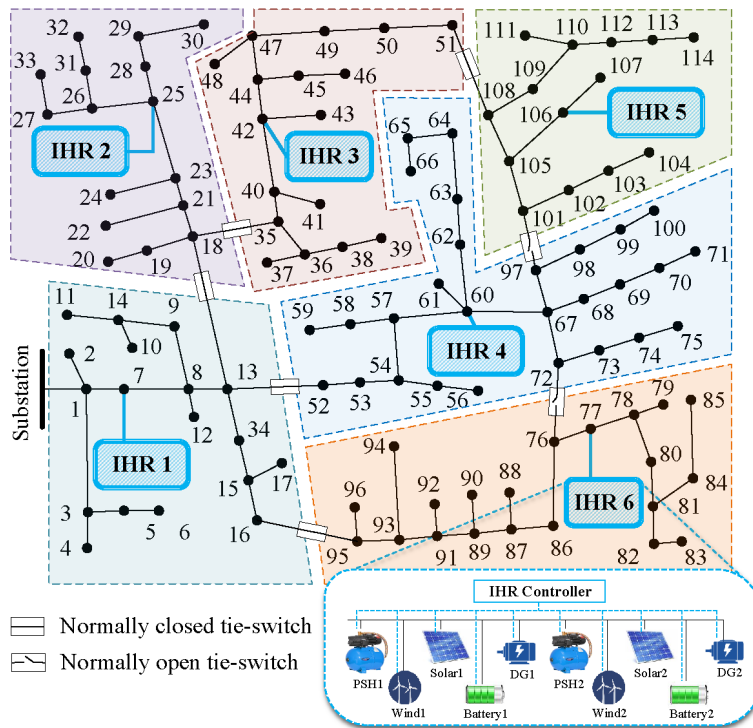

Fig. 1: Modified IEEE 123-bus test power distribution system divided into six IHRs

Table 1: Set of resources in each IHR

		Wind	Solar	DG	PSH	Battery
IHR 1	Rating (kW)	50	35	35	50	35
	Capacity (kWh)	-	-	-	300	210
IHR 2	Rating (kW)	45	30	30	45	30
	Capacity (kWh)	-	-	-	270	180
IHR 3	Rating (kW)	95	65	65	95	65
	Capacity (kWh)	-	-	-	570	390
IHR 4	Rating (kW)	115	75	75	115	75
	Capacity (kWh)	-	-	-	690	450

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

IHR 5	Rating (kW)	40	25	25	40	25
	Capacity (kWh)	-	-	-	240	150
IHR 6	Rating (kW)	95	60	60	95	60
	Capacity (kWh)	-	-	-	570	360

All data are provided in the accompanying database file *DB_123bus_Hierarchical_IHR.xlsx*, which include the following data tabs:

- Historical data
    - Date and hour
    - Operational zone
    - Load
    - Load forecast
    - Locational Marginal Price (LMP)
    - LMP forecast
    - Solar generation
    - Solar generation forecast
    - Wind speed
    - Wind power generation
- 123Bus System Line Data
    - Line resistance
    - Line reactance
    - Line capacity
    - Per unit values
- 123Bus System Load Data
    - Active installed load
    - Reactive installed load

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 $\mu = 0, \sigma = 5$. Also, wind generation data are extracted based on historical wind speed in New York City[4]. The data from 2017 is used for training the intelligent controller, which is then tested on 24 randomly selected days of 2018.

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2. http://https://www.nyiso.com/energy-market-operational-data
3 . https://maps.nrel.gov/nsrdb-viewer/
4. https://www.kaggle.com/selfishgene/historical-hourly-weather-data