Important Simulation Parameters

This document presents the system control parameters, DER/load capacity specifications and their connection locations, the predicted and actual power curves for PV and load, system frequency performance under maximum load disturbance, and the architectural framework of the IEEE 39-bus system with integrated the DER cluster.

The system and control parameters are shown in Table I:

TABLE I

SYSTEM AND CONTROL PARAMETERS

Parameter Name	Value
Optimization period in topology reconfiguration for FRC enhancement	4h
Optimization time scale in topology reconfiguration for FRC enhancement	15min
Optimization period in FRC adaptive correction	5min
Augmented dimension of the incomplete dimension-lifting PF model	20
Augmented dimension of the topology-adaptive PF meta-model	20
Number of hidden layers in the DNN	2
Number of neurons per hidden layer	30
Number of topology samples for data-driven training	500
Number of topology samples for testing	100
Maximum unbalanced power in power system	$0.1S_{sys}$
System equivalent inertia constant	5
System equivalent droop coefficient	20.8
System equivalent reheater time constant	8.8s
System equivalent high-pressure turbine coefficient	0.24
System load damping constant	2

S_{sys}: The base power of the power system.

The capacity parameters of PV/ES converters and loads are listed in Table II:

TABLE II

PARAMETERS OF PV /ES CONVERTERS AND LOADS

Resources	Nodes	Capacity/MVA
Energy Storage Converter	2, 4, 5, 8, 10, 11, 13, 14, 16, 20, 22, 23, 25, 26, 28, 29, 31, 33	0.4
Photovoltaic Converter	7、10、11、17、18、24、26、27、30、31	0.15
	8、9、14、20、25、28、33	0.30
	3、6、12、15、21、32	0.60
	2、4、13、19、23、	0.90

Load	2, 3, 4, 5, 6, 7, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 29, 30, 31, 32, 33	0.05
	5, 6, 7,10, 11, 12, 14, 15, 16, 17, 18, 20, 25, 26, 27, 29, 30, 33	0.10
	2, 3, 4, 9, 13, 19, 21, 22, 23, 24, 31, 32	0.18

The 24-hour electricity supply and demand profile for a typical summer day, presented in this paper, is derived from power forecasting and scheduling plans, as shown in Fig. 1.

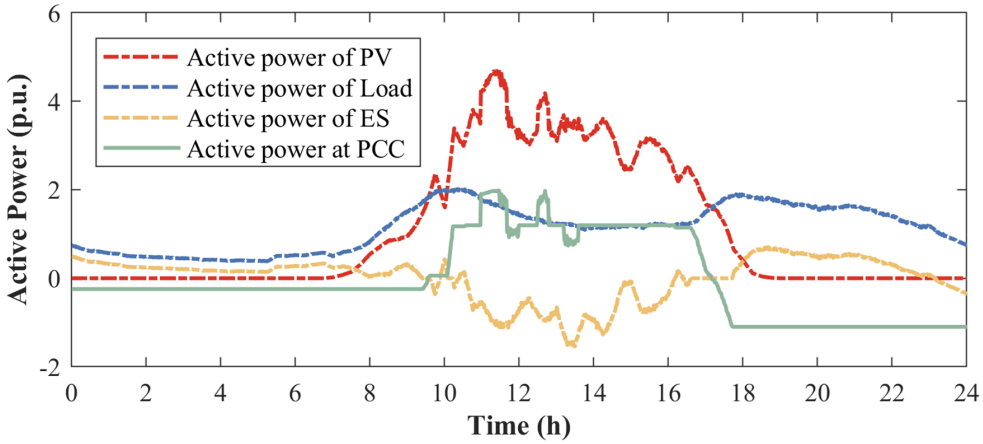
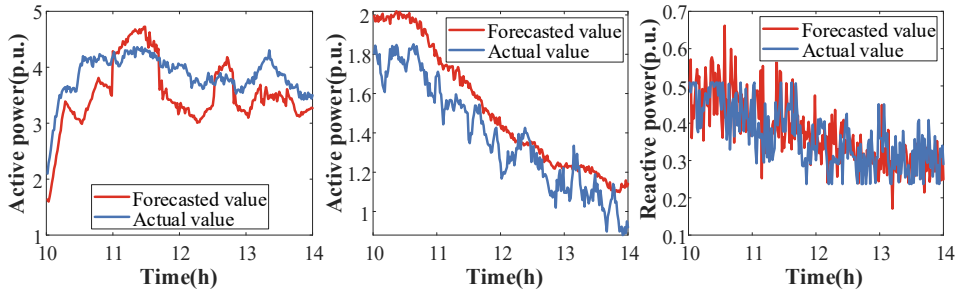


Fig. 1. 24-hour profiles for a typical summer day.

Hours 10-14 are selected as the test period, during which the predicted and actual curves for PV active power and load active/reactive power are shown in Fig. 2.



(a) (b) (c)

Fig. 2. Predicted and actual curves for PV and load power.

(a) PV active power; (b) Load active power; (c) Load reactive power.

The frequency variation curve under maximum unbalanced power is shown in Fig. 3, with a minimum frequency of 49.5 Hz.

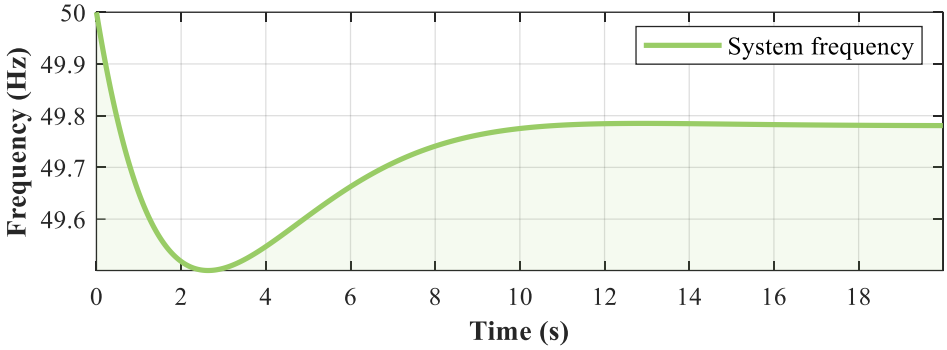


Fig. 3. Frequency variation curve under maximum unbalanced power.

The architectural framework of the IEEE 39-bus system integrating the DER cluster is shown in Fig. 4.

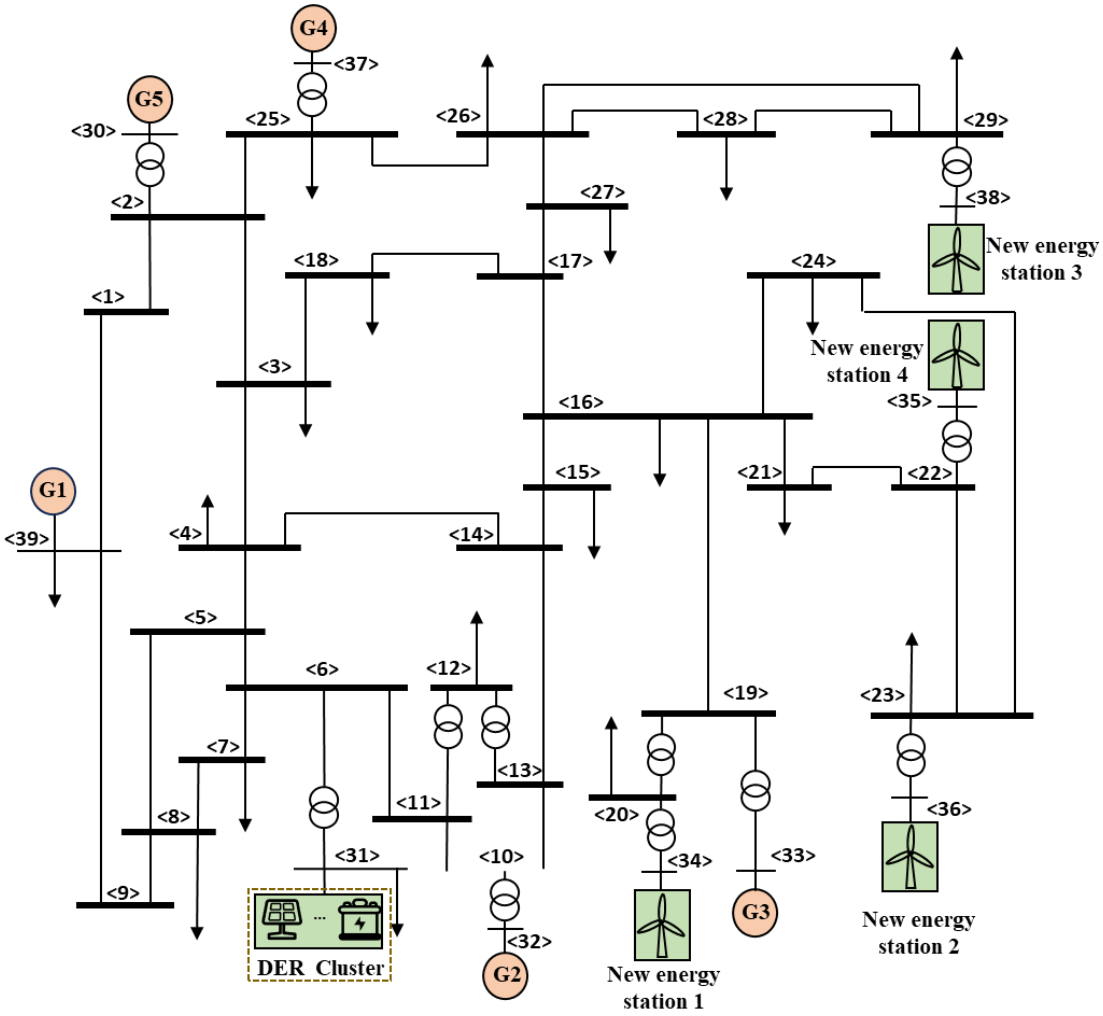


Fig. 4. The architectural framework of the IEEE 39-bus system