The expectation of inelastic load, RES generation, and RTP are given in Table 1- Table 6, respectively. The parameters of flexible devices are presented in Table 7- Table 12, respectively. The forecast errors in training samples and testing samples follow the same distributions. Specifically, forecast errors of loads, RES, and RTP are assumed to follow the normal distribution $N(0,0.01^2)$. Assume that DRA in DSO and MG consists 100 and 50 electric vehicles and charging behaviors of EVs follow the data in [1].

Table 1 Expectation of inelastic electricity load of DSO

Time-slot	1	2	3	4	5	6
Active power (kW)	720.2	780.3	840.3	870.3	876.4	840.3
Reactive power (kVAR)	338.7	367.0	395.1	409.2	412.1	395.1
Time-slot	7	8	9	10	11	12
Active power (kW)	780.3	757.5	753.9	744.2	739.5	737.1
Reactive power (kVAR)	367.1	356.2	354.5	350.1	347.7	346.6
Time-slot	13	14	15	16	17	18
Active power (kW)	732.3	720.3	660.3	540.2	480.2	420.2
Reactive power (kVAR)	344.3	338.7	310.5	254.0	225.8	197.6
Time-slot	19	20	21	22	23	24
Active power (kW)	450.2	510.2	570.3	600.4	660.3	690.3
Reactive power (kVAR)	211.7	239.9	268.1	282.2	310.5	324.6

Table 2 Load ratio of distribution networks

Bus No.	1	2	3	4	5	6
Load ratio	0	0.0269	0.0142	0.0323	0.0162	0.0162
Bus No.	7	8	9	10	11	12
Load ratio	0.0538	0.0538	0.0102	0.0162	0.0121	0.0162
Bus No.	13	14	15	16	17	18
Load ratio	0.0162	0.0323	0.0162	0.0082	0.0162	0.0142
Bus No.	19	20	21	22	23	24
Load ratio	0.0242	0.0242	0.0242	0.0242	0.0242	0.1131
Bus No.	25	26	27	28	29	30
Load ratio	0.1131	0.0162	0.0162	0.0162	0.0323	0.0538
Bus No.	31	32	33			
Load ratio	0.0204	0.0565	0.0102			

Table 3 Expectation of RES generation in DSO and MGs (kW)

Time-slot	1	2	3	4	5	6
DSO	50	75	125	150	160	150
MG	10	15	25	30	32	35
Time-slot	7	8	9	10	11	12
DSO	160	150	125	70	50	75
MG	32	30	25	14	10	5

Time-slot	13	14	15	16	17	18
DSO	75	85	75	100	110	130
MG	0	0	0	0	0	0
Time-slot	19	20	21	22	23	24
DSO	150	160	165	110	100	50
MG	0	0	0	0	0	0

Table 4 Expectation of RES generation in DSO and MGs (kW)

Time-slot	1	2	3	4	5	6
DSO	50	75	125	150	160	150
MG	10	15	25	30	32	35
Time-slot	7	8	9	10	11	12
DSO	160	150	125	70	50	75
MG	32	30	25	14	10	5
Time-slot	13	14	15	16	17	18
DSO	75	85	75	100	110	130
MG	0	0	0	0	0	0
Time-slot	19	20	21	22	23	24
DSO	150	160	165	110	100	50
MG	0	0	0	0	0	0

Table 5 Expectation of RTP

Time-slot	1	2	3	4	5	6
RTP ($)	0.0891	0.1134	0.1395	0.1585	0.1623	0.1721
Time-slot	7	8	9	10	11	12
RTP ($)	0.1697	0.1623	0.1601	0.1565	0.1600	0.1669
Time-slot	13	14	15	16	17	18
RTP ($)	0.1689	0.1688	0.1613	0.1500	0.1387	0.1238
Time-slot	19	20	21	22	23	24
RTP ($)	0.1069	0.0937	0.0844	0.0731	0.0769	0.0844

Table 6 Expectation of inelastic electricity/thermal load of MG (kW)

Time-slot	1	2	3	4	5	6
Electricity power	17.26	17.87	18.47	18.77	18.84	18.47
Thermal power	14.67	15.61	16.23	16.54	16.23	15.82
Time-slot	7	8	9	10	11	12
Electricity power	17.87	17.64	17.60	17.50	17.45	17.43
Thermal power	15.48	15.14	15.14	15.11	15.01	14.98
Time-slot	13	14	15	16	17	18
Electricity power	17.38	17.26	16.66	15.44	14.84	14.23
Thermal power	14.67	14.05	12.49	11.55	10.93	10.62
Time-slot	19	20	21	22	23	24
Electricity power	14.54	15.14	15.75	16.05	16.66	16.96
Thermal power	10.71	11.05	11.40	12.36	12.80	13.74

Table 7 Parameters of BS in DSO

$P_{\mathrm{c,max}}^{\mathrm{BS}}$	100kW	$P_{\mathrm{d,max}}^{\mathrm{BS}}$	100kW	$\eta_{\mathrm{BS,c}}$	0.95

$P_{\mathrm{c,min}}^{\mathrm{BS}}$	0kW	$P_{\mathrm{d,min}}^{\mathrm{BS}}$	0kW	$\eta_{\mathrm{BS,d}}$	0.95
$E_{\mathrm{max}}^{\mathrm{BS}}$	300kWh	$E_{\mathrm{min}}^{\mathrm{BS}}$	0kWh	β_{BS}	\$0.0001/kW

Table 8 Parameters of BS in MG

$P_{\mathrm{c,max}}^{\mathrm{BS}}$	30kW	$P_{\mathrm{d,max}}^{\mathrm{BS}}$	30kW	$\eta_{\mathrm{BS,c}}$	0.95
$P_{\mathrm{c,min}}^{\mathrm{BS}}$	0kW	$P_{\mathrm{d,min}}^{\mathrm{BS}}$	0kW	$\eta_{\mathrm{BS,d}}$	0.95
$E_{\mathrm{max}}^{\mathrm{BS}}$	90kWh	$E_{\mathrm{min}}^{\mathrm{BS}}$	0kWh	β_{BS}	\$0.0001/kW

Table 9 Parameters of TS in MG

$H_{\mathrm{c,max}}^{\mathrm{TS}}$	30kW	$H_{\mathrm{d,max}}^{\mathrm{TS}}$	30kW	$\eta_{\mathrm{TS,c}}$	0.95
$H_{\mathrm{c,min}}^{\mathrm{TS}}$	0kW	$H_{\mathrm{d,min}}^{\mathrm{TS}}$	0kW	$\eta_{\mathrm{TS,d}}$	0.95
$E_{\mathrm{max}}^{\mathrm{TS}}$	100kWh	$E_{\mathrm{min}}^{\mathrm{TS}}$	0kWh	β_{TS}	\$0.0001/kW
$\eta_{\mathrm{TS,dc}}$	0.99				

Table 10 Parameters of RC

$P_{\mathrm{max}}^{\mathrm{RC}}$	150kW	$P_{\mathrm{min}}^{\mathrm{RC}}$	0kW
β_{RC}	\$0.1/kW	η_{RC}	0.80

Table 11 Parameters of TS in MG

$P_{\mathrm{max}}^{\mathrm{DG}}$	100kW	$P_{\mathrm{min}}^{\mathrm{DG}}$	100kW	$\beta_{\mathrm{DG,a}}$	\$0.001/kW^2
$Q_{\mathrm{max}}^{\mathrm{DG}}$	100kVar	$Q_{\mathrm{min}}^{\mathrm{DG}}$	0kVar	$\beta_{\mathrm{DG,b}}$	\$0.08/kW
$\beta_{\mathrm{DG,c}}$	0				

Table 12 Other Parameters in case studies

β_{DRA}	0.001	$P_{\mathrm{max}}^{\mathrm{MG}}$	200kW	$P_{\mathrm{min}}^{\mathrm{MG}}$	-200kW

[1] Z. Pan, T. Yu, L. Chen, B. Yang, B. Wang, and W. Guo, Real-time stochastic optimal scheduling of large-scale electric vehicles: A multidimensional approximate dynamic programming approach, International Journal of Electrical Power and Energy Systems, 2020;216.

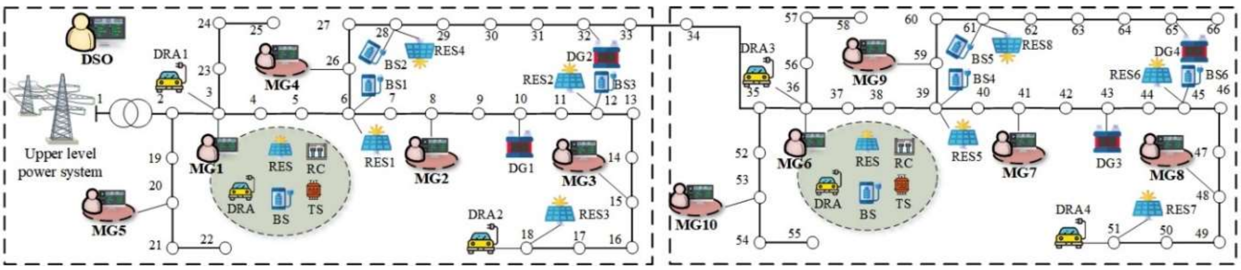

Fig. 1. 66-bus distribution networks with 10 networked MGs.

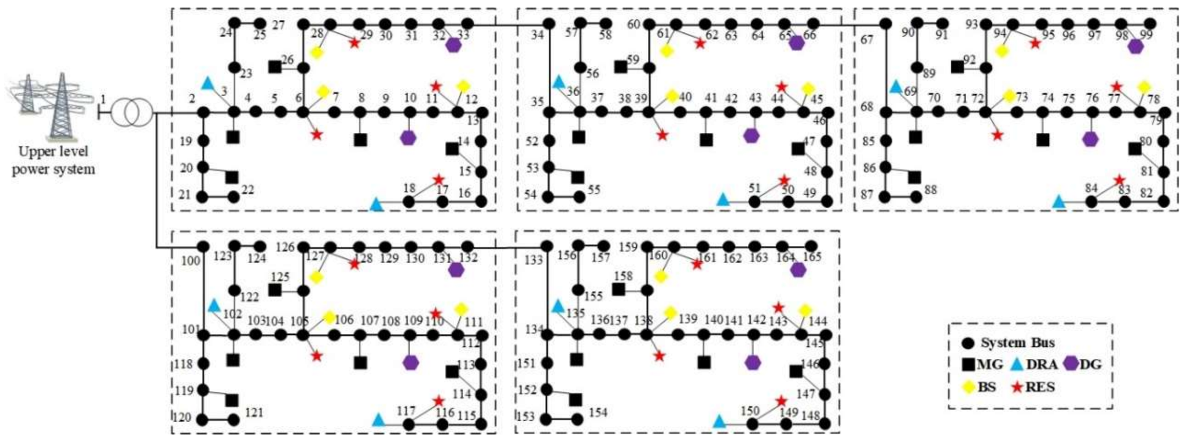

Fig. 2. 165-bus distribution networks with 25 networked MGs.

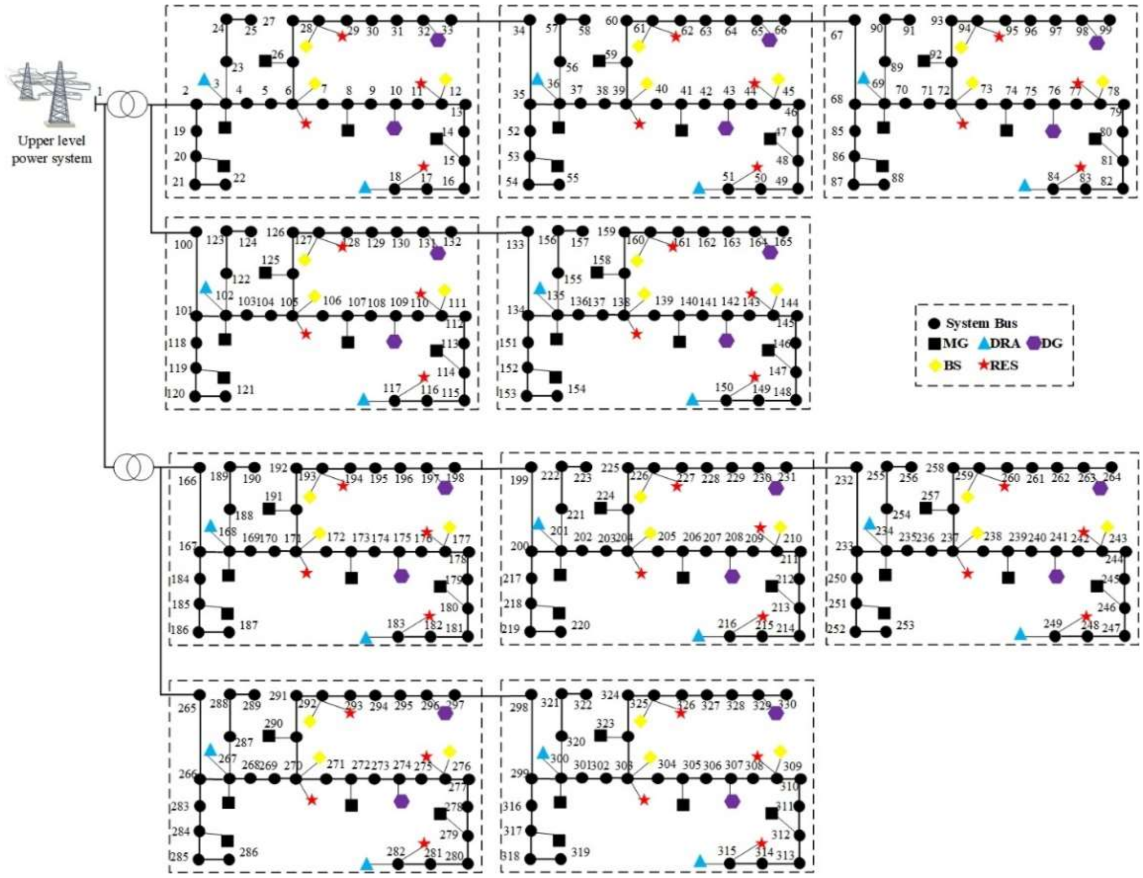

Fig. 3. 330-bus distribution networks with 50 networked MGs.