Data of the multi-area power grid

1、

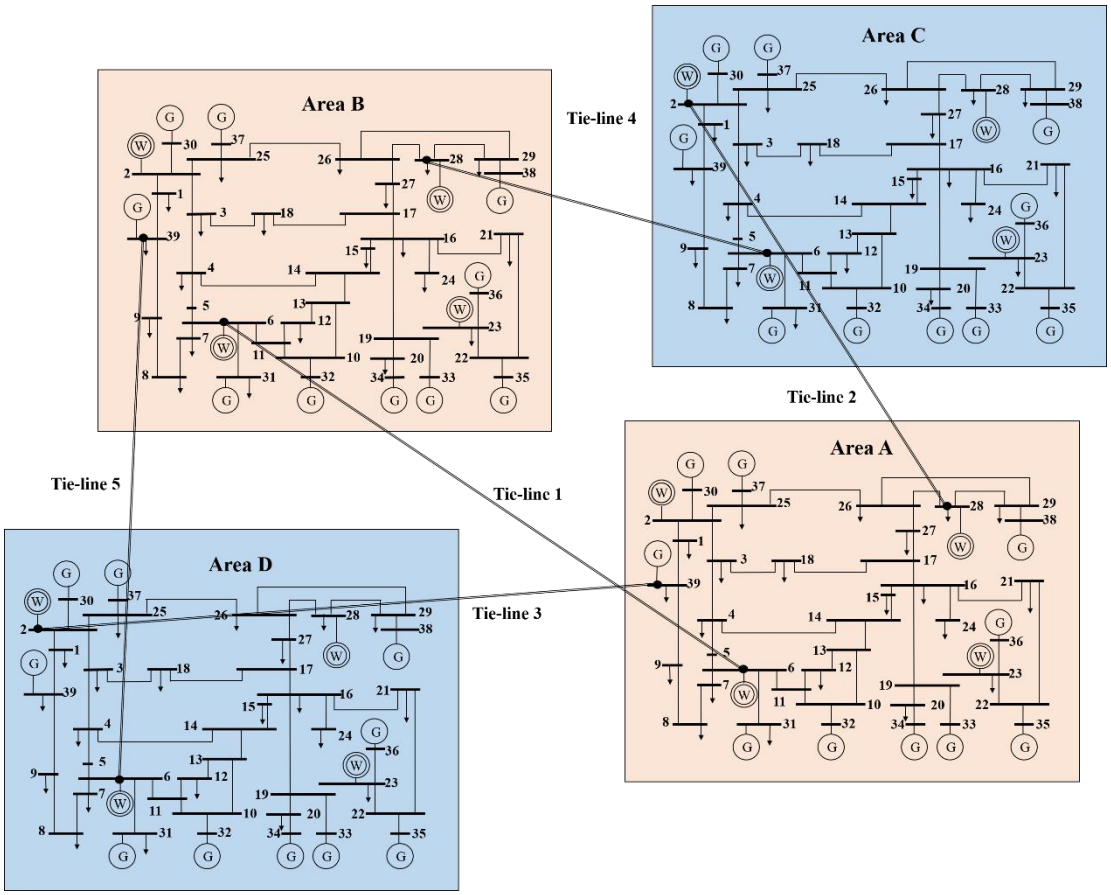

Figure 1 the topology of the test multi-area power grid

2、

Table I Parameters of the inter-regional tie-lines.

Tie-line	ATC(MW)	Transmission loss rate (%)	Transmission tariff ($/MWh)
1	400	1.5	4.76
2	1000	7	8.9
3	800	1.5	4.76
4	1000	7	8.9
5	1000	5	8.9

Data of the intra-regional electricity market

1、The physical parameters of fossil fuel-fired generation units and wind generation units

The parameters of fossil fuel-fired generation units can refer to the Ref [1].

The parameters of wind generation units at different nodes in one area are assumed to be the same. Therefore, the parameters of total wind generation capacities of different areas are given in Table II.

Table II Parameters of the wind generation capacities in different areas.

Area	Generation Capacity (MW)
A	1080
B	1080
C	1944
D	1944

2、The bids of fossil fuel-fired generation units and wind generation units

The bidding prices of fossil fuel-fired generation units is piece-wise function of generation cost, which can refer to the Ref [1]. The bidding prices of wind generation units are set much lower than the fuel-fired generation units to achieve maximum consumption.

Table III Bidding blocks of the fossil fuel-fired generation units (MW)

NO	Block 1	Block 2	Block 3	Block 4	Block 5
G1	50	50	50	50	50
G2	136	136	136	136	134
G3	130	130	130	130	130
G4	126	126	126	126	128
G5	102	102	102	102	100
G6	130	130	130	130	130
G7	112	112	112	112	112
G8	108	108	108	108	108
G9	166	166	166	166	166
G10	200	200	200	200	200

Table IV Bidding prices of the fossil fuel-fired generation units ($/MWh)

NO	Block 1	Block 2	Block 3	Block 4	Block 5
G1	7.95	8.14	16.48	25.01	33.73
G2	8.98	9.93	20.81	32.64	45.90
G3	7.63	8.88	19.01	30.40	43.04
G4	6.56	6.88	14.09	21.62	29.14
G5	6.24	6.73	13.96	21.67	30.30
G6	6.22	7.05	14.93	23.64	33.18
G7	6.83	8.02	17.23	27.62	39.21
G8	8.60	8.90	18.40	28.20	38.40
G9	6.17	6.90	14.82	23.48	32.96
G10	8.48	9.05	18.67	28.86	39.62

3、The parameters of transmission lines

The physical parameters of transmission lines in each area can refer to the standard IEEE 39-node system in Ref [2].

4、The parameters of loads in different areas

The loads of different areas under normal condition can refer to Ref [3] and are modified in Table.

Table I Electricity demands of receiving-end area A (MW)

Time	1	2	3	4	5	6	7	8	9	10	11	12
Loads	5953	5693	5452	5286	5158	5049	5385	5985	6646	7199	7414	6923
Time	13	14	15	16	17	18	19	20	21	22	23	24
Loads	6478	6720	6944	6489	6635	6986	6579	6493	7070	6785	6388	5974

Table I Electricity demands of receiving-end area B (MW)

Time	1	2	3	4	5	6	7	8	9	10	11	12
Loads	5953	5693	5452	5286	5158	5049	5385	5985	6646	6399	6614	6923
Time	13	14	15	16	17	18	19	20	21	22	23	24
Loads	6478	6720	6944	7289	7435	6986	7379	7293	7070	6785	6388	5974

Table I Electricity demands of sending-end area C and D (MW)

Time	1	2	3	4	5	6	7	8	9	10	11	12
Loads	3691	3460	3246	3098	2985	2888	3186	3720	4307	4799	4990	4554
Time	13	14	15	16	17	18	19	20	21	22	23	24
Loads	4158	4374	4572	4879	5009	4610	4959	4882	4685	4431	4078	3710

Reference

[1] R. Moreno, J. Obando-Ceron, and G. Gonzalez, "An integrated OPF dispatching model with wind power and demand response for day-ahead markets," International Journal of Electrical and Computer Engineering (IJECE), vol. 9, p. 2794, 2019.

[2] https://matpower.org/docs/ref/matpower5.0/case39.html

[3] J. Lin, M. Bao, Z. Liang, S. Maosheng, and Y. Ding, "Spatio-temporal evaluation of electricity price risk considering multiple uncertainties under extreme cold weather," *Applied Energy,* vol. 328, p. 120090, 2022.