Dataset of "Frequency-Constrained Planning for Integrated Electricity-Heat Microgrids Considering Synthetic Inertia Resources"

I. Configurations of Test System I

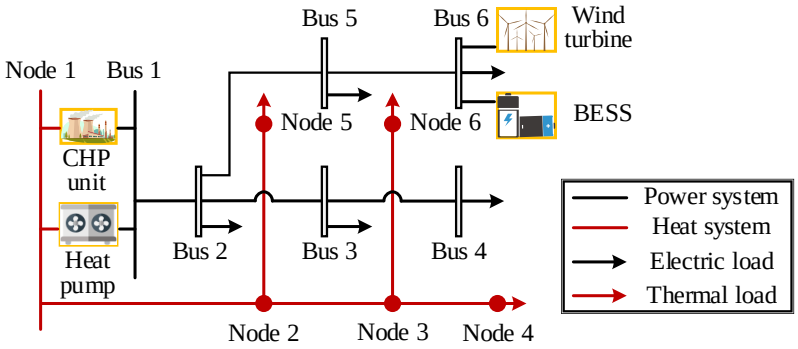

Fig. 1 Topology of Test System I

TABLE I BUS DATA OF THE 6-BUS POWER GRID

Bus No.	Active power (MW)	Reactive power (MVar)
1	0	0
2	0.4410	0.1125
3	0.7000	0.1785
4	1.4000	0.3570
5	0.4410	0.1125
6	1.4000	0.3570
Total	4.3820	1.1175

TABLE II BRANCH DATA OF THE 6-BUS POWER GRID

Branch No.	From bus	To bus	Resistance (p.u.)	Reactance (p.u.)
1	1	2	0.7766	0.7596
2	2	3	0.6716	0.6569
3	3	4	0.4827	0.4722
4	2	5	0.8744	0.5898
5	5	6	1.1554	0.7793

TABLE III NODE DATA OF THE 6-NODE THERMAL NETWORK

Bus No.	Heat power (MW)
1	0
2	0
3	0
4	1.0000
5	1.0000
6	1.0000
Total	3.0000

TABLE IV PIPELINE DATA OF THE 6-NODE THERMAL NETWORK

Branch No.	From bus	To bus	Length (m)	Diameter (m)	Conductivity (W/(m°C))	Mass flow rate (kg/s)
1	1	2	2500.00	0.25	0.25	35.00
2	2	3	1200.00	0.20	0.25	20.00
3	3	4	500.00	0.15	0.25	10.00
4	2	5	850.00	0.17	0.25	15.00
5	3	6	700.00	0.15	0.25	10.00

II. Configurations of Test System II

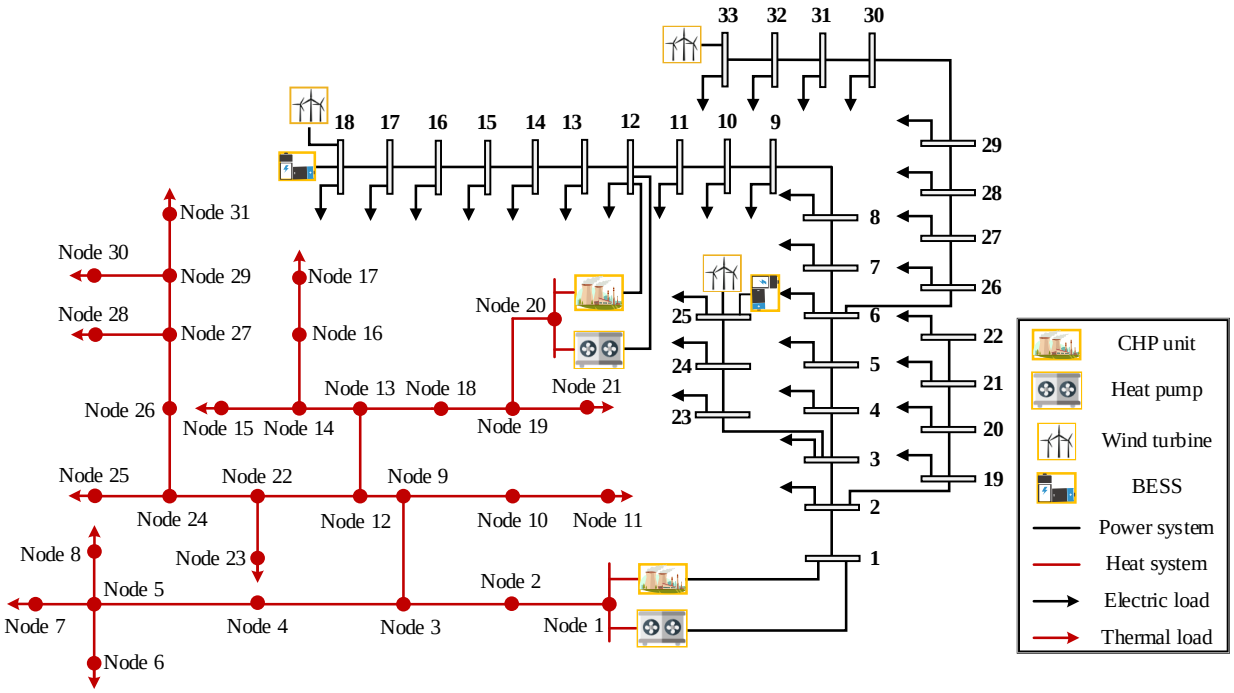

Fig. 2 Topology of Test System II

TABLE V BUS DATA OF THE 33-NODE POWER GRID

Bus No.	Active power (MW)	Reactive power (MVar)
1	0	0
2	0.6667	0.3000
3	0.6000	0.2000
4	0.8000	0.4000
5	0.4000	0.1500
6	0.4000	0.1000
7	1.3333	0.5000
8	1.3333	0.5000
9	0.4000	0.1000
10	0.4000	0.1000
11	0.3000	0.1500
12	0.4000	0.1750
13	0.4000	0.1750
14	0.8000	0.4000
15	0.4000	0.0500

Bus No.	Active power (MW)	Reactive power (MVar)
16	0.4000	0.1000
17	0.4000	0.1000
18	0.6000	0.2000
19	0.6000	0.2000
20	0.6000	0.2000
21	0.6000	0.2000
22	0.6000	0.2000
23	0.6000	0.2500
24	2.8000	1.0000
25	2.8000	1.0000
26	0.4000	0.1250
27	0.4000	0.1250
28	0.4000	0.1000
29	0.8000	0.3500
30	1.3333	3.0000
31	1.0000	0.3500
32	1.4000	0.5000
33	0.4000	0.2000
Total	24.7666	11.5000

TABLE VI BRANCH DATA OF THE 33-NODE POWER GRID

Branch No.	From bus	To bus	Resistance (p.u.)	Reactance (p.u.)
1	1	2	0.0922	0.0470
2	2	3	0.4930	0.2511
3	3	4	0.3660	0.1864
4	4	5	0.3811	0.1941
5	5	6	0.8190	0.7070
6	6	7	0.1872	0.6188
7	7	8	1.7114	1.2351
8	8	9	1.0300	0.7400
9	9	10	1.0440	0.7400
10	10	11	0.1966	0.0650
11	11	12	0.3744	0.1238

Branch No.	From bus	To bus	Resistance (p.u.)	Reactance (p.u.)
12	12	13	1.4680	1.1550
13	13	14	0.5416	0.7129
14	14	15	0.5910	0.5260
15	15	16	0.7463	0.5450
16	16	17	1.2890	1.7210
17	17	18	0.7320	0.5740
18	2	19	0.1640	0.1565
19	19	20	1.5042	1.3554
20	20	21	0.4095	0.4784
21	21	22	0.7089	0.9373
22	3	23	0.4512	0.3083
23	23	24	0.8980	0.7091
24	24	25	0.8960	0.7011
25	6	26	0.2030	0.1034
26	26	27	0.2842	0.1447
27	27	28	1.0590	0.9337
28	28	29	0.8042	0.7006
29	29	30	0.5075	0.2585
30	30	31	0.9744	0.9630
31	31	32	0.3105	0.3619
32	32	33	0.3410	0.5302
33	21	8	2.0000	2.0000
34	9	15	2.0000	2.0000
35	12	22	2.0000	2.0000
36	18	33	0.5000	0.5000
37	25	29	0.5000	0.5000

TABLE VII NODE DATA OF THE 31-NODE THERMAL NETWORK

Bus No.	Heat power (MW)
1	0
2	0
3	0
4	0
5	0
6	2.3228
7	0.8013
8	1.1074
9	0
10	0
11	1.2852
12	0
13	0
14	0
15	1.6198
16	0
17	0.8905
18	0
19	0
20	0
21	1.1028
22	0
23	1.4013
24	0
25	1.1392
26	0
27	0
28	1.0754
29	0
30	1.3349
31	1.2573
Total	15.3379

TABLE VIII PIPELINE DATA OF THE 31-NODE THERMAL NETWORK

Branch No.	From bus	To bus	Length (m)	Diameter (m)	Conductivity (W/(m℃))	Mass flow rate (kg/s)
1	1	2	70.00	0.313	0.480	81.00
2	2	3	591.00	0.313	0.480	81.00
3	3	4	235.00	0.313	0.480	27.00
4	4	5	831.00	0.313	0.426	27.00
5	5	6	95.00	0.185	0.426	9.00
6	5	7	383.00	0.107	0.285	9.00
7	5	8	583.00	0.185	0.426	9.00
8	3	9	607.00	0.313	0.480	54.00
9	9	10	154.00	0.313	0.480	9.00
10	10	11	82.00	0.210	0.432	9.00
11	9	12	40.00	0.263	0.413	45.00
12	12	13	231.00	0.263	0.413	0
13	13	14	51.00	0.210	0.432	18.00
14	14	15	18.00	0.185	0.426	9.00
15	14	16	318.00	0.185	0.426	9.00
16	16	17	434.00	0.083	0.272	9.00
17	18	13	320.00	0.132	0.329	18.00
18	19	18	155.00	0.107	0.285	18.00
19	20	19	331.00	0.070	0.257	27.00
20	19	21	72.00	0.107	0.285	9.00
21	12	22	138.00	0.185	0.426	45.00
22	22	23	130.00	0.107	0.285	9.00
23	22	24	154.00	0.159	0.389	36.00
24	24	25	40.00	0.107	0.285	9.00
25	24	26	136.00	0.132	0.329	27.00
26	26	27	91.00	0.132	0.329	27.00
27	27	28	25.00	0.107	0.285	9.00
28	27	29	30.00	0.107	0.285	18.00
29	29	30	73.00	0.070	0.257	9.00
30	29	31	215.00	0.107	0.285	9.00

III. Parameters

TABLE IX PARAMETERS IN SIMULATION

Symbol	Value	Symbol	Value
a_1, a_2, a_3, a_4, a_5	-0.1120, 0.1015, 5.0906, -41.2200, 2.6340	b_1, b_2, b_3, b_4	0.0106, 1.9099e-5, 5.0611e-4, 2.8648e-5
B^{C}	0.234 t(CO_2)/MWh	c^{C}	30 \$/t(CO_2)
c_G^{I}	1000000 \$/MW	c_H^{I}	450000 \$/MW
c_W^{I}	1000000 \$/MW	c_B^{I}	342000 \$/MW
c_B^{O}	10 \$/MWh	$c_H^{O,fix}$, c_H^{O}	0, 10\$/MWh
c_B^{R}	25 \$/(MW/h)	c_W^{R}	5.8 \$/(MW/h)
c_G^{R}	21 \$/(MW/h)	c_H^{R}	20 \$/(MW/h)
f_0	50 Hz	I^{G}	5 s
I^{B}	1.5 s	L	20 years
N_s, N_t	6, 24	r	0.07
RU^{G}, RD^{G}	0.9, 0.9	$RoCoF^{max}$	0.5 Hz/s
$\tan\beta_1^{G}$, $\tan\beta_2^{G}$, β_3^{G}	0.46, 0.12, 0.4	t_G^{DB}, t_W^{DB}, t_H^{DB}, t_B^{DB}	0.5 s, 0, 0, 0
T_G, T_W, T_H, T_B	7 s, 4 s, 15 s, 2s	α_1^{H}, α_2^{H}	14.6141e-6, -0.2297e-6
α_1^{W}, α_2^{W}	4.2662, 0.0597	$\alpha_{G,1}^{O}$, $\alpha_{G,2}^{O}$, $\alpha_{G,3}^{O}$	15 \$/h, 45 \$/MW, 20 \$/MW
γ^{B}	0.04	η^{B+}, η^{B-}	0.95, 0.95
ε^{W}	0.05	υ^{B}	0.4
χ^{E}, χ^{H}	0.32 t(CO_2)/MWh, 0.51 t(CO_2)/MWh	ψ^{W}	0.05
Δf^{max}	0.8 Hz	Δt	1 h
Φ^{on}, Φ^{off}	2h, 1h		