

Data Set of

1 Parameters

Table 1: Parameters of Generators, BES, WT, and Unit Costs in Simulation

Symbol	Value	Symbol	Value
$\eta_g^{\text{comb}}/\eta_g^{\text{steam}}$	0.88 / 0.40	$c_g^{\text{NH}_3}$	5 CNY/kg
$T_g^{\text{on/off}}$	3 / 3 h	c_g^{up}	1250 CNY
$\underline{P}_g/\overline{P}_g$	4.5 / 12; 2 / 6 MW	$c_{g/e/b}^{\text{PFR}}$	200 CNY/MWh
$R_g^{\text{PFR,lim}}$	$0.25 \overline{P}_g$	$c_{g/e/b}^{+/-}$	200 CNY/MWh
$R_g^{+,lim}/R_g^{-,lim}$	$0.05 \overline{P}_g$	$c_e^{\text{H}_2}$	32.9 CNY/MWh
H_g	3 s	$c_e^{\text{up/down}}$	800 / 0 CNY
k_w^{deload}	0.1	c_e^{VI}	200 CNY/MWh
$E_b^{\text{min}}/E_b^{\text{max}}$	0.1 / $0.9 \overline{P}_b$		
$\eta_b^{\text{C}}/\eta_b^{\text{D}}$	0.9 / 0.95		
H_b	1 MW·s ²		
$\underline{V}_i/\overline{V}_i$	0.95 / 1.05 p.u.		

Table 2: Parameters of Electrolyzers (AWE and PEM)

Symbol	AWE Value	Symbol	PEM Value
C_e^{heat}	$7.8 \times 10^7 \text{ J}/^\circ\text{C}$	C_e^{heat}	$2.0 \times 10^7 \text{ J}/^\circ\text{C}$
a_e^{cool}	$17 \text{ kW}/^\circ\text{C}$	a_e^{cool}	$17 \text{ kW}/^\circ\text{C}$
n_c/A	$313 / 4 \text{ m}^2$	n_c/A	$273 / 1 \text{ m}^2$
$\underline{T}/\overline{T}$	$25 / 80 \text{ }^\circ\text{C}$	$\underline{T}/\overline{T}$	$25 / 80 \text{ }^\circ\text{C}$
$T^{\text{cool}}/\eta_e^{\text{cool}}$	$5 \text{ }^\circ\text{C} / 4$	$T^{\text{cool}}/\eta_e^{\text{cool}}$	$5 \text{ }^\circ\text{C} / 4$
$\underline{I}/\overline{I}$	$2.30 / 7.99 \text{ kA}$	$\underline{I}/\overline{I}$	$0.55 / 2.29 \text{ kA}$
V_{tn}	1.23 V	V_{tn}	1.23 V

2 Configurations of the test systems

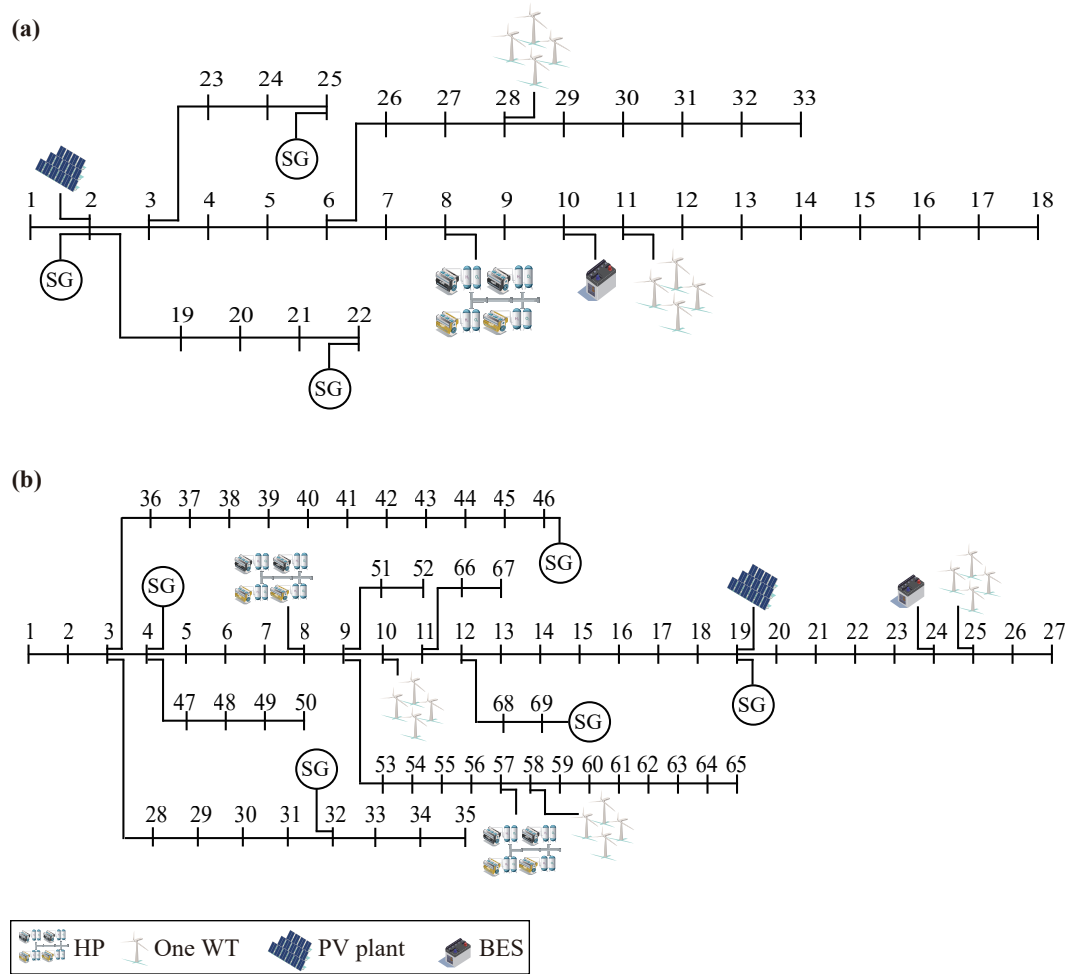


Figure 1: Topology of the test system. (a) IEEE 33-Bus System. (b) IEEE 69-Bus System.

Table 3: Network Parameters of IEEE 33-Bus System

Line	From Bus	To Bus	r (Ω)	x (Ω)	Node	Load Active Power (MW)
1	1	2	0.7766	0.7596	2	0.430083
2	2	3	0.6716	0.6569	3	0.888955
3	3	4	0.4827	0.4722	4	0.950050
4	4	5	0.8744	0.5898	5	0.644665
5	5	6	1.1554	0.7793	6	0.605592
6	6	7	0.9680	0.6529	7	0.497819
7	7	8	1.4677	0.9900	8	0.757402
8	8	9	0.6245	0.4213	9	0.684679
9	9	10	0.7182	0.4844	10	0.914473
10	10	11	1.0305	0.6951	11	0.881127
11	11	12	1.4052	0.9478	12	0.626955
12	12	13	1.1554	0.7793	13	0.897517
13	13	14	1.2803	0.8636	14	0.362905
14	14	15	0.6870	0.4634	15	0.830295
15	15	16	0.7766	0.7596	16	0.331334
16	16	17	0.6716	0.6569	17	0.542075
17	17	18	0.4827	0.4722	18	0.739143
18	18	19	0.8744	0.5898	19	0.918003
19	19	20	1.1554	0.7793	20	0.557811
20	20	21	0.9680	0.6529	21	0.514324
21	21	22	1.4677	0.9900	22	0.816708
22	22	23	0.6245	0.4213	23	1.018143
23	23	24	0.7182	0.4844	24	0.613426
24	24	25	1.0305	0.6951	25	0.417128
25	25	26	1.4052	0.9478	26	0.929603
26	26	27	1.1554	0.7793	27	0.966561
27	3	28	1.2803	0.8636	28	0.534781
28	28	29	0.6870	0.4634	29	0.650228
29	29	30	0.7766	0.7596	30	0.435274
30	30	31	0.6716	0.6569	31	0.343476
31	31	32	0.4827	0.4722	32	0.530993
32	32	33	0.8744	0.5898	33	1.003119
33	33	34	1.1554	0.7793	34	0.665357

Table 4: Network Parameters of IEEE 69-Bus System

Line	From Bus	To Bus	r (Ω)	x (Ω)	Node	Load Active Power (MW)
1	1	2	0.0050	0.0012	2	0.473354
2	2	3	0.0050	0.0012	3	0.459962
3	3	4	0.0015	0.0036	4	0.469525
4	4	5	0.0251	0.0294	5	0.055088
5	5	6	0.3660	0.1864	6	0.017018
6	6	7	0.3811	0.1941	7	0.286008
7	7	8	0.0922	0.0470	8	0.277601
8	8	9	0.0493	0.0251	9	0.615129
9	9	10	0.8190	0.2707	10	0.015612
10	10	11	0.1872	0.0691	11	0.206053
11	11	12	0.7114	0.2351	12	0.013868
12	12	13	1.0300	0.3400	13	0.214413
13	13	14	1.0440	0.3450	14	0.340874
14	14	15	1.0580	0.3496	15	0.076174
15	15	16	0.1966	0.0650	16	0.242482
16	16	17	0.3744	0.1238	17	0.030276
17	17	18	0.0047	0.0016	18	0.018030
18	18	19	0.3276	0.1083	19	0.062054
19	19	20	0.2106	0.0696	20	0.177433
20	20	21	0.3416	0.1129	21	0.081311
21	21	22	0.0140	0.0046	22	0.245593
22	22	23	0.1591	0.0526	23	0.044019
23	23	24	0.3463	0.1145	24	0.361870
24	24	25	0.7488	0.2475	25	0.241596
25	25	26	0.3089	0.1021	26	0.129117
26	26	27	0.1732	0.0572	27	0.082118
27	3	28	0.0044	0.0108	28	0.089252
28	28	29	0.0640	0.1565	29	0.015175

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Line	From Bus	To Bus	r (Ω)	x (Ω)	Node	Load Active Power (MW)
29	29	30	0.3978	0.1315	30	0.035367
30	30	31	0.0702	0.0232	31	0.134930
31	31	32	0.3510	0.1160	32	0.076526
32	32	33	0.8390	0.2816	33	0.248904
33	33	34	1.7080	0.5646	34	0.139492
34	34	35	1.4740	0.4873	35	0.046845
35	3	59	0.0044	0.0108	59	0.090782
36	59	60	0.0640	0.1565	60	0.126313
37	60	61	0.1053	0.1230	61	0.067696
38	61	62	0.0304	0.0355	62	0.063380
39	62	63	0.0018	0.0021	63	0.173046
40	63	64	0.7283	0.8509	64	0.058465
41	64	65	0.3100	0.3623	65	0.262587
42	65	66	0.0410	0.0478	66	0.273841
43	66	67	0.0092	0.0116	67	0.213440
44	67	68	0.1089	0.1373	68	0.014378
45	68	69	0.0009	0.0012	69	0.223282
46	4	36	0.0034	0.0084	36	0.266650
47	36	37	0.0851	0.2083	37	0.220914
48	37	38	0.2898	0.7091	38	0.055138
49	38	39	0.0822	0.2011	39	0.063188
50	8	40	0.0928	0.0473	40	0.032631
51	40	41	0.3319	0.1114	41	0.069769
52	9	42	0.1740	0.0886	42	0.004162
53	42	43	0.2030	0.1034	43	0.032950
54	43	44	0.2842	0.1447	44	0.258916
55	44	45	0.2813	0.1433	45	0.786707
56	45	46	1.5900	0.5337	46	0.110953
57	46	47	0.7837	0.2630	47	0.055923

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Line	From Bus	To Bus	r (Ω)	x (Ω)	Node	Load Active Power (MW)
58	47	48	0.3042	0.1006	48	0.078313
59	48	49	0.3861	0.1172	49	0.071143
60	49	50	0.5075	0.2585	50	0.025523
61	50	51	0.0974	0.0496	51	0.213291
62	51	52	0.1450	0.0738	52	0.270885
63	52	53	0.7105	0.3619	53	0.296866
64	53	54	1.0410	0.5302	54	1.045440
65	11	55	0.2012	0.0611	55	0.414771
66	55	56	0.0047	0.0014	56	0.323851
67	12	57	0.7394	0.2444	57	0.205449
68	57	58	0.0047	0.0016	58	0.116660