

Data set for Manuscript “Integrated Microgrid Planning in Electricity Market with Uncertainty”

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I. DATA OF NUMERICAL EXAMPLE FOR THE SIX-BUS SYSTEM

Fig. 1 demonstrates a network representation of the six-bus test system. The existing line and candidate line data is shown in Table I and Table II. The existing and candidate units and COMG data is illustrated in Table III. The load distributions for buses are presented in Table IV. Table V presents the load blocks in the base year. Table VI shows the weight of each scenario after reduction.

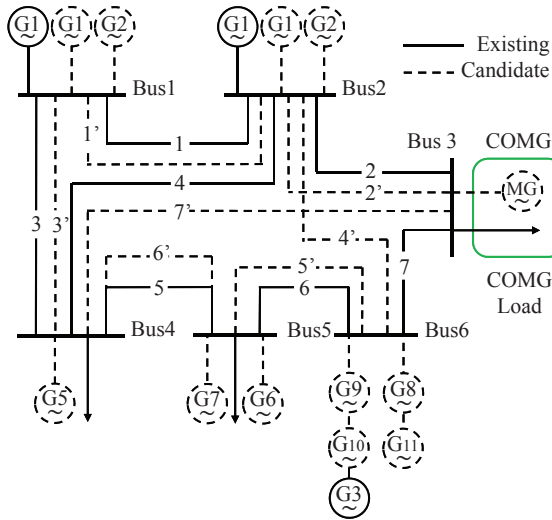


Fig. 1. The six-bus system

TABLE I
EXISTING LINE DATA

Line	From bus	To bus	React. (pu)	Capacity (MW)	FOR (%)	Opr. cost (\$/MWh)
1	1	2	0.17	10	0.1	1
2	2	3	0.037	7	1	1
3	1	4	0.258	7	1	1
4	2	4	0.197	7	1	1
5	4	5	0.037	7	1	1
6	5	6	0.14	7	1	1
7	3	6	0.018	7	1	1

TABLE II
CANDIDATE LINE DATA

Line	From bus	To bus	React. (pu)	Cap. (MW)	FOR (%)	Opr. cost (\$/MWh)	Inv. cost (\$/kW/year)
1	1	2	0.17	10	0.5	1	5
2	2	3	0.037	7	0.5	1	8
3	1	4	0.258	7	0.5	1	12
4	2	4	0.14	7	0.5	1	10
5	4	5	0.14	7	0.5	1	7
6	5	6	0.14	7	0.5	1	5
7	3	6	0.14	7	0.5	1	6

TABLE III
EXISTING AND CANDIDATE GENERATION UNIT AND COMG DATA

Unit/MG	At bus	Capacity (MW)	Opr. cost (\$/MWh)	FOR (%)	Inv. cost (\$/kW/year)
GE1	1	10	15	3	N/A
GE2	2	10	18	3	N/A
GE3	6	5	23	3	N/A
GC1	1	10	15	3	100
GC2	1	7	15	3	80
GC3	2	5	21	5	60
GC4	2	3	24	3	30
GC5	4	3	15	5	40
GC6	5	5	15	5	70
GC7	5	3	21	3	35
GC8	6	10	24	3	110
GC9	6	8	15	3	85
GC10	6	5	15	5	50
GC11	6	2	21	1	15
MG	3	2	10	1	150

TABLE IV
LOAD DISTRIBUTION BY BUS

Bus	1	2	3	4	5	6
Distribution	0.0	0.0	0.4	0.3	0.3	0.0

TABLE V
LOAD BLOCKS IN BASE YEAR

Block	1	2	3	4
Duration (%)	1	29	50	20
Load (MW)	25	23	20	18

TABLE VI
PROBABILITY OF EACH SCENARIO AFTER SCENARIO REDUCTION

Scenario	1	2	3	4	5
Probability	0.077	0.080	0.074	0.086	0.111
Scenario	6	7	8	9	10
Probability	0.100	0.083	0.080	0.180	0.129

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II. DATA OF NUMERICAL EXAMPLE FOR THE 118-BUS SYSTEM

The existing and candidate line data is shown in Table VII and Table VIII, respectively. The COMG and candidate and existing units data is illustrated in Tables IX- XI. Table XII presents the load blocks in the base year.

TABLE VII
EXISTING LINE DATA

Line	From bus	To bus	React. (pu)	Capacity (MW)	FOR (%)	Opr. cost (\$/MWh)
1	1	2	0.0999	100	1	10
2	1	3	0.0424	100	1	10
3	4	5	0.00798	500	1	10
4	3	5	0.108	100	1	10
5	5	6	0.054	100	1	10
6	6	7	0.0208	100	1	10
7	8	9	0.0305	500	1	10
8	8	5	0.0267	500	1	10
9	9	10	0.0322	500	1	10
10	4	11	0.0688	100	1	10
11	5	11	0.0682	100	1	10
12	11	13	0.0731	100	1	10
13	13	15	0.2444	100	1	10
14	14	15	0.195	100	1	10
15	15	17	0.0437	500	1	10
16	16	17	0.1801	100	1	10
17	17	18	0.0505	100	1	10
18	18	19	0.0493	100	1	10
19	19	20	0.117	100	1	10
20	15	19	0.0394	100	1	10
21	20	21	0.0849	100	1	10
22	21	22	0.097	100	1	10
23	22	23	0.159	100	1	10
24	23	24	0.0492	100	1	10
25	23	25	0.08	500	1	10
26	26	25	0.0382	500	1	10
27	25	27	0.163	500	1	10
28	27	28	0.0855	100	1	10
29	28	29	0.0943	100	1	10
30	30	17	0.0388	500	1	10
31	8	30	0.0504	100	1	10
32	26	30	0.086	500	1	10
33	17	31	0.1563	100	1	10
34	29	31	0.0331	100	1	10
35	23	32	0.1153	100	1	10
36	31	32	0.0985	100	1	10
37	27	32	0.0755	100	1	10
38	15	33	0.1244	100	1	10
39	19	34	0.247	100	1	10
40	35	36	0.0102	100	1	10
41	35	37	0.0497	100	1	10
42	33	37	0.142	100	1	10
43	34	36	0.0268	100	1	10
44	34	37	0.0094	500	1	10
45	38	37	0.0375	500	1	10
46	37	39	0.106	100	1	10
47	37	40	0.168	100	1	10
48	30	38	0.054	100	1	10
49	39	40	0.0605	100	1	10
50	40	41	0.0487	100	1	10
51	40	42	0.183	100	1	10
52	41	42	0.135	100	1	10
53	43	44	0.2454	100	1	10
54	34	43	0.1681	100	1	10

Line	From bus	To bus	React. (pu)	Capacity (MW)	FOR (%)	Opr. cost (\$/MWh)
55	44	45	0.0901	100	1	10
56	45	46	0.1356	100	1	10
57	46	47	0.127	100	1	10
58	46	48	0.189	100	1	10
59	47	49	0.0625	100	1	10
60	42	49	0.323	100	1	10
61	42	49	0.323	100	1	10
62	45	49	0.186	100	1	10
63	48	49	0.0505	100	1	10
64	49	50	0.0752	100	1	10
65	49	51	0.137	100	1	10
66	51	52	0.0588	100	1	10
67	52	53	0.1635	100	1	10
68	53	54	0.122	100	1	10
69	49	54	0.289	100	1	10
70	49	54	0.291	100	1	10
71	54	55	0.0707	100	1	10
72	54	56	0.00955	100	1	10
73	55	56	0.0151	100	1	10
74	56	57	0.0966	100	1	10
75	50	57	0.134	100	1	10
76	56	58	0.0966	100	1	10
77	51	58	0.0719	100	1	10
78	54	59	0.2293	100	1	10
79	56	59	0.251	100	1	10
80	56	59	0.239	100	1	10
81	55	59	0.2158	100	1	10
82	59	60	0.145	100	1	10
83	59	61	0.15	100	1	10
84	60	61	0.0135	500	1	10
85	60	62	0.0561	100	1	10
86	61	62	0.0376	100	1	10
87	63	59	0.0386	500	1	10
88	63	64	0.02	500	1	10
89	64	61	0.0268	500	1	10
90	38	65	0.0986	500	1	10
91	64	65	0.0302	500	1	10
92	49	66	0.0919	500	1	10
93	49	66	0.0919	500	1	10
94	62	66	0.218	100	1	10
95	62	67	0.117	100	1	10
96	65	66	0.037	500	1	10
97	66	67	0.1015	100	1	10
98	65	68	0.016	500	1	10
99	47	69	0.2778	100	1	10
100	49	69	0.324	100	1	10
101	68	69	0.037	500	1	10
102	69	70	0.127	500	1	10
103	24	70	0.4115	100	1	10
104	70	71	0.0355	100	1	10
105	24	72	0.196	100	1	10
106	71	72	0.18	100	1	10
107	71	73	0.0454	100	1	10
108	70	74	0.1323	100	1	10
109	70	75	0.141	100	1	10
110	69	75	0.122	500	1	10
111	74	75	0.0406	100	1	10
112	76	77	0.148	100	1	10
113	69	77	0.101	100	1	10
114	75	77	0.1999	100	1	10
115	77	78	0.0124	100	1	10
116	78	79	0.0244	100	1	10
117	77	80	0.0485	500	1	10
118	77	80	0.105	500	1	10
119	79	80	0.0704	100	1	10
120	68	81	0.0202	500	1	10
121	81	80	0.037	500	1	10
122	77	82	0.0853	100	1	10
123	82	83	0.03665	100	1	10

Line	From bus	To bus	React. (pu)	Capacity (MW)	FOR (%)	Opr. cost (\$/MWh)
124	83	84	0.132	100	1	10
125	83	85	0.148	100	1	10
126	84	85	0.0641	100	1	10
127	85	86	0.123	500	1	10
128	86	87	0.2074	500	1	10
129	85	88	0.102	100	1	10
130	85	89	0.173	100	1	10
131	88	89	0.0712	500	1	10
132	89	90	0.188	500	1	10
133	89	90	0.0997	500	1	10
134	90	91	0.0836	100	1	10
135	89	92	0.0505	500	1	10
136	89	92	0.1581	500	1	10
137	91	92	0.1272	100	1	10
138	92	93	0.0848	100	1	10
139	92	94	0.158	100	1	10
140	93	94	0.0732	100	1	10
141	94	95	0.0434	100	1	10
142	80	96	0.182	100	1	10
143	82	96	0.053	100	1	10
144	94	96	0.0869	100	1	10
145	80	97	0.0934	100	1	10
146	80	98	0.108	100	1	10
147	80	99	0.206	100	1	10
148	92	100	0.295	100	1	10
149	94	100	0.058	100	1	10
150	95	96	0.0547	100	1	10
151	96	97	0.0885	100	1	10
152	98	100	0.179	100	1	10
153	99	100	0.0813	100	1	10
154	100	101	0.1262	100	1	10
156	92	102	0.0559	100	1	10
157	101	102	0.112	100	1	10
158	100	103	0.0525	500	1	10
159	100	104	0.204	100	1	10
160	103	104	0.1584	100	1	10
161	103	105	0.1625	100	1	10
162	100	106	0.229	100	1	10
163	104	105	0.0378	100	1	10
164	105	106	0.0547	100	1	10
165	105	107	0.183	100	1	10
166	105	108	0.0703	100	1	10
167	106	107	0.183	100	1	10
168	108	109	0.0288	100	1	10
169	103	110	0.1813	100	1	10
170	109	110	0.0762	100	1	10
171	110	111	0.0755	100	1	10
172	110	112	0.064	100	1	10
173	17	113	0.0301	100	1	10
174	32	113	0.203	500	1	10
175	32	114	0.0612	100	1	10
176	27	115	0.0741	100	1	10
177	114	115	0.0104	100	1	10
178	68	116	0.00405	500	1	10
179	75	118	0.0481	100	1	10
180	76	118	0.0544	100	1	10

TABLE VIII
CANDIDATE LINE DATA

Line	From bus	To bus	React. (pu)	Capacity (MW)	FOR (%)	Opr. cost (\$/MWh)	Inv. cost (\$/kW/year)
1	30	38	0.054	100	1	10	300
2	77	82	0.0853	100	1	10	300
3	110	111	0.0755	100	1	10	300
4	20	21	0.0849	100	1	10	300
5	17	113	0.0301	100	1	10	300

TABLE IX
COMG DATA

MG	At bus	Capacity (MW)	Opr. cost (\$/MWh)	FOR (%)	Inv. cost (\$/kW/year)
1	10	200	15	1	600/800/2000
2	12	200	15	1	600/800/2000
3	25	200	15	1	600/800/2000
4	26	200	15	1	600/800/2000
5	80	200	15	1	600/800/2000
6	89	200	15	1	600/800/2000
7	17	200	15	1	600/800/2000
8	18	200	15	1	600/800/2000
9	32	200	15	1	600/800/2000
10	54	200	15	1	600/800/2000
11	55	200	15	1	600/800/2000
12	56	200	15	1	600/800/2000
13	74	200	15	1	600/800/2000
14	94	200	15	1	600/800/2000
15	96	200	15	1	600/800/2000
16	103	200	15	1	600/800/2000
17	113	200	15	1	600/800/2000

TABLE X
CANDIDATE GENERATION UNIT DATA

Unit	At bus	Capacity (MW)	Opr. cost (\$/MWh)	FOR (%)	Inv. cost (\$/kW/year)
1	18	100	18	4	120
2	32	100	18	4	120
3	55	100	18	4	120
4	56	100	18	4	120
5	62	100	18	4	120
6	74	20	38	4	50
7	74	20	38	4	50
8	90	20	38	4	50
9	103	20	38	4	50
10	103	20	38	4	50

TABLE XI
EXISTING GENERATION UNITS DATA

Unit	At bus	Capacity (MW)	Opr. cost (\$/MWh)	FOR (%)
1	4	30	27	4
2	6	30	27	4
3	8	30	27	4
4	10	200	15	4
5	15	30	27	4
6	18	100	18	4
7	19	30	27	4
8	24	30	27	4
9	25	200	15	4
10	26	200	15	4
11	27	30	27	4
12	31	30	27	4
13	32	100	18	4
14	34	30	27	4
15	36	100	18	4
16	40	30	27	4
17	42	30	27	4
18	46	100	18	4
19	49	200	15	4
20	54	200	15	4
21	55	100	18	4
22	56	100	18	4
23	59	300	15	4
24	61	300	15	4

Unit	At bus	Capacity (MW)	Opr. cost (\$/MWh)	FOR (%)
25	62	100	18	4
26	65	200	15	4
27	66	200	15	4
28	69	200	15	4
29	70	100	18	4
30	72	30	27	4
31	73	30	27	4
32	74	20	38	4
33	76	100	18	4
34	77	100	18	4
35	80	200	15	4
36	82	100	18	4
37	85	30	27	4
38	87	200	15	4
39	89	200	15	4
40	90	20	38	4
41	91	50	23	4
42	92	200	15	4
43	99	200	15	4
44	100	200	15	4
45	103	20	38	4
46	104	100	18	4
47	105	100	18	4
48	107	20	38	4
49	110	50	23	4
50	111	100	18	4
51	112	100	18	4
52	113	100	18	4
53	116	50	23	4

TABLE XII
LOAD BLOCKS IN BASE YEAR

Block	1	2	3	4
Duration (%)	1	29	50	20
Load (MW)	1250	1150	1000	900