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

Aida Khayatian, *Student Member, IEEE,* Masoud Barati, *Member, IEEE,* and Gino J. Lim *Member, IEEE*

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 data and Candidate line data are shown in Table I and Table II. The existing and candidate units and COMG data are 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.

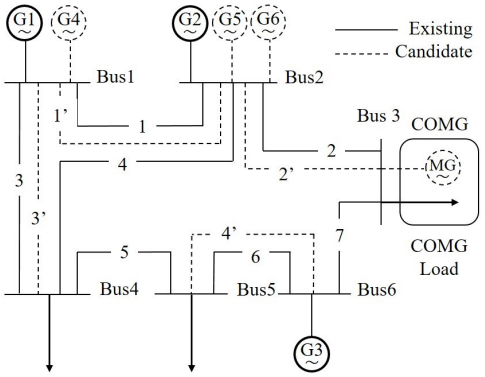

Fig. 1. The six-bus system

TABLE I
Existing Line Data

Line	From bus	To bus	React. (pu)	Capacity (MW)	FOR (%)	Opr. cost ($/MWh)
1	1	2	0.17	80	3	2
2	2	3	0.037	70	3	6
3	1	4	0.258	140	1	8
4	2	4	0.197	100	1	1
5	4	5	0.037	50	1	0
6	5	6	0.14	140	1	4
7	3	6	0.018	130	1	0

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	80	1	5	20
2	2	3	0.037	70	1	9	24
3	1	4	0.258	140	1	11	30
4	5	6	0.14	140	3	2	14

TABLE III
Existing and Candidate Generation unit and COMG Data

Unit/ MG	At bus	Capacity (MW)	Opr. cost ($/MWh)	FOR (%)	Inv. cost ($/kW/year)
G1	1	100	15	2	N/A
G2	2	100	18	2	N/A
G3	6	50	23	2	N/A
G4	1	100	15	1	200
G5	2	80	21	1	270
G6	2	60	24	8	250
MG	3	50	5	0	300

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

A. Khayatian and G. J. Lim are with the Department of Industrial Engineering, University of Houston, TX 77204 USA (e-mail: akhayatian@uh.edu; ginolim@uh.edu). M. Barati is with the Department of Electrical and Computer Engineering, University of Houston, TX 77004 USA (e-mail: mbarati@uh.edu).

TABLE V
Load Blocks in Base Year

Block	1	2	3	4
Duration (%)	1	29	50	20
Load (MW)	150	138	120	108

TABLE VI
Probability of Each Scenario After Scenario Reduction

Scenario	1	2	3	4	5
Probability	0.122	0.08	0.117	0.101	0.075
Scenario	6	7	8	9	10
Probability	0.09	0.116	0.108	0.112	0.079

II. Data of Numerical Example for the 118-bus system

The existing and candidate line data are shown in Table II and Table VIII, respectively. The existing and candidate units and COMG data are illustrated in Table X, Table IX, and Table XI ,respectively. 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

Line	From bus	To bus	React. (pu)	Capacity (MW)	FOR (%)	Opr. cost ($/MWh)
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
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
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

Line	From bus	To bus	React. (pu)	Capacity (MW)	FOR (%)	height	Opr. cost ($/MWh)
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
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 X
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
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 XI
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 XII
LOAD BLOCKS IN BASE YEAR

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