

30-Bus system data

TABLE 1 GENERATING UNITS CHARACTERISTICS

GENCO	ID	Capacity(MW)	Bus	Existing or Candidate	Operation Cost (\$/MWh)	Overnight Construction Cost (billion dollar)
1	1	400	1	E	18.67	0
	2	200	2	E	24.26	0
	3	450	5	E	16.35	0
	4	300	4	C	20.69	0.2
2	5	450	8	E	16.43	0
	6	300	11	E	20.23	0
	7	300	12	C	20.69	0.2
	8	400	16	C	18.66	0.22
	9	400	17	C	18.66	0.22
	10	200	20	C	22.16	0.15
	11	200	20	C	22.16	0.165
	12	400	20	C	18.66	0.22
3	13	500	13	E	14.16	0
	14	300	19	E	20.38	0
	15	200	18	C	22.16	0.18
	16	200	18	C	22.16	0.15
	17	400	18	C	18.66	0.22
4	18	100	23	C	26.88	0.08
	19	100	23	C	26.88	0.08
	20	200	23	C	24.16	0.15
	21	100	24	C	26.88	0.088
	22	100	24	C	26.88	0.088
	23	200	24	C	24.16	0.15
	24	100	25	C	26.88	0.096
	25	100	25	C	26.88	0.096
	26	200	25	C	24.16	0.15
5	27	100	27	C	26.88	0.08
	28	100	27	C	26.88	0.08
	29	200	27	C	22.16	0.15

TABLE 2 TRANSMISSION LINE CHARACTERISTICS

ID	From	To	Max Cap	X
1	1	2	300	0.0575
2	1	3	300	0.1852
3	2	4	300	0.1737
4	3	4	300	0.0379
5	2	5	300	0.1983
6	2	6	300	0.1763
7	4	6	300	0.0414
8	5	7	300	0.0116
9	6	7	300	0.082
10	6	8	300	0.042
11	6	9	300	0.208
12	6	10	300	0.556
13	9	11	300	0.208
14	9	10	300	0.11
15	4	12	300	0.256
16	12	13	250	0.14
17	12	14	300	0.2559
18	12	15	300	0.1304
19	12	16	300	0.1987
20	14	15	300	0.1997
21	16	17	300	0.1932
22	15	18	300	0.2185
23	18	19	300	0.1292
24	19	20	300	0.068
25	10	20	300	0.209
26	10	17	300	0.0845
27	10	21	300	0.0749
28	10	22	300	0.1499
29	21	22	300	0.0236
30	15	23	300	0.202
31	22	24	300	0.179
32	23	24	300	0.27
33	24	25	300	0.3292
34	25	26	300	0.38
35	25	27	300	0.2087
36	27	28	300	0.396
37	27	29	300	0.4153
38	27	30	300	0.6027
39	29	30	300	0.4533
40	8	28	300	0.2
41	6	28	300	0.0599
42	26	29	300	0.2144
43	3	13	300	0.412
44	4	11	300	0.649

TABLE 3 LOAD DISTRIBUTION BY BUS

Bus	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Distribution	0	0.06	0.06	0.07	0.05	0	0.06	0.05	0	0.08	0	0.05	0	0.03	0.04
Bus	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Distribution	0.03	0.04	0.06	0.05	0.04	0.04	0	0.05	0.04	0	0.08	0	0	0.03	0.04

TABLE 4 FORECASTED LOAD

Year	1	2	3	4	5	6	7	8
Peak Load(MW)	2000	2100	2205	2315	2431	2553	2680	2814
Energy(GWh)	9636	10118	10624	11155	11713	12298	12913	13559
Year	9	10	11	12	13	14	15	
Peak Load(MW)	2955	3103	3258	3421	3592	3771	3960	
Energy(GWh)	14237	14949	15696	16481	17305	18170	19079	

** Calculation of bus load*

In the proposed model, a planning year is divided into multiple subperiods which have fixed loads. The number of subperiods could vary depending on the planning requirements or load pattern. For example, we can use 4 subperiods to represent seasonal load or 12 subperiods for monthly loads. Load at each subperiod is calculated based on the given yearly peak load, yearly energy demand. The subperiod load calculation via linear transformation of base year's corresponding subperiod load is as follows:

$$L_{bt} = a \times L_{b0} + b$$

where

$$a = (E_t - H \times P_t) / (E_0 - H \times P_0)$$

$$b = (P_t \times E_0 - P_0 \times E_t) / (E_0 - H \times P_0)$$

L_{bt} = Load at subperiod b in year t

L_{b0} = Load at subperiod b in base year

E_t = Energy demand in year t

P_t = Peak load in year t

P_0 = Peak load in base year

E_0 = Energy demand in base year

A load distribution factor multiplied by a subperiod load provides bus loads at the subperiod.