Table I Market price

Hour	Energy Price ($/MWh)	Spinning reserve ($/MWh)	Non-spinning reserve ($/MWh)
1	29.225	2	2
2	26.397	1.7	1.7
3	22.47	1.27	1.27
4	21.07	1.12	1.12
5	23.163	1.35	1.35
6	30.863	2.18	2.18
7	31.556	2.17	2.17
8	47.39	2.34	2.34
9	49.7	2.51	2.51
10	52.1	2.69	2.69
11	55.35	2.94	2.94
12	55.5	2.95	2.95
13	57.01	2.77	2.77
14	54.42	2.87	2.87
15	63.12	2.92	2.92
16	65.59	3.32	3.32
17	67.24	3.23	3.23
18	63.87	2.97	2.97
19	55.61	2.96	2.96
20	52.55	2.73	2.73
21	47.55	2.35	2.35
22	39.69	1.76	1.76
23	37	1.57	1.57
24	30.51	1.16	1.16

Table II Fossil Unit Data

Unit	Bus No	Pmin (MW)	Pmax (MW)	Qmin (MW)	Qmax (MW)	Min ON (Hour)	Min OFF (Hour)	Ramp Up (MW/Hour)	Ramp Down (MW/Hour)	qsc (MW)	MSR (MW/min)	IniT (Hour)	St Mbtu	Fuel Type	Fuel Price ($/Mbtu)	Ems Coef (lbs/Mbtu)	af (Mbtu/MW^{2}h)	bf (Mbtu/MWh)	cf (Mbtu/h)
1001	4	5	30	-300	300	1	1	15	15	30	1	1	40	Gas	1	0	0.06966	26.2438	31.67
1002	6	5	30	-13	50	1	1	15	15	30	1	1	40	Gas	1	0	0.06966	26.2438	31.67
1003	8	5	30	-300	300	1	1	15	15	30	1	1	40	Gas	1	0	0.06966	26.2438	31.67
1004	10	150	300	-147	200	8	8	150	150	0	3	8	440	Coal	1	0	0.01088	12.8875	6.78
1005	12	100	300	-35	120	8	8	150	150	0	3	8	110	Coal	1	0	0.01088	12.8875	6.78
1006	15	10	30	-10	30	1	1	15	15	30	1	1	40	Gas	1	0	0.06966	26.2438	31.67
1007	18	25	100	-16	50	5	5	50	50	0	1	5	50	Coal	1	0	0.01280	17.8200	10.15
1008	19	5	30	-8	24	1	1	15	15	30	1	1	40	Gas	1	0.35	0.06966	26.2438	31.67
1009	24	5	30	-300	300	1	1	15	15	30	1	1	40	Gas	1	0.35	0.06966	26.2438	31.67
1010	25	100	300	-47	140	8	8	150	150	0	3	8	100	Coal	1	0.35	0.01088	12.8875	6.78
1011	26	100	350	-1000	1000	8	8	175	175	0	3.5	8	100	Coal	1	0.35	0.00300	10.7600	32.96
1012	27	8	30	-300	300	1	1	15	15	30	1	1	40	Gas	1	0	0.06966	26.2438	31.67
1013	31	8	30	-300	300	1	1	15	15	30	1	1	40	Gas	1	0	0.06966	26.2438	31.67
1014	32	25	100	-14	42	5	5	50	50	0	1	5	50	Coal	1	0	0.01280	17.8200	10.15
1015	34	8	30	-8	24	1	1	15	15	30	1	1	40	Gas	1	0.3	0.06966	26.2438	31.67
1016	36	25	100	-8	24	5	5	50	50	0	1	5	50	Coal	1	0.3	0.01280	17.8200	10.15
1017	40	8	30	-300	300	1	1	15	15	30	1	1	40	Gas	1	0.3	0.06966	26.2438	31.67
1018	42	8	30	-300	300	1	1	15	15	30	1	1	40	Gas	1	0.3	0.06966	26.2438	31.67
1019	46	25	100	-100	100	5	5	50	50	0	1	5	59	Coal	1	0	0.01280	17.8200	10.15
1020	49	50	250	-85	210	8	8	125	125	0	2.5	8	100	Coal	1	0	0.00240	12.3299	28.00
1021	54	50	250	-300	300	8	8	125	125	0	1	8	100	Coal	1	0.25	0.00240	12.3299	28.00
1022	55	25	100	-8	23	5	5	50	50	0	1	5	50	Coal	1	0.25	0.01280	17.8200	10.15
1023	56	25	100	-8	15	5	5	50	50	0	1	5	50	Coal	1	0.25	0.01280	17.8200	10.15
1024	59	50	200	-60	180	8	8	100	100	0	2	10	100	Coal	1	0.25	0.00440	13.2900	39.00
1025	61	50	200	-100	300	8	8	100	100	0	2	10	100	Coal	1	0	0.00440	13.2900	39.00
1026	62	25	100	-20	20	5	5	50	50	0	1	5	50	Coal	1	0	0.01280	17.8200	10.15
1027	65	100	420	-67	200	10	10	210	210	0	4.2	10	250	Coal	1	0	0.01059	8.3391	64.16
1028	66	100	420	-67	200	10	10	210	210	0	4.2	10	250	Coal	1	0.2	0.01059	8.3391	64.16
1029	69	80	300	-9999	9999	8	8	150	150	0	3	10	100	Coal	1	0.2	0.01088	12.8875	6.78
1030	70	30	80	-10	32	4	4	40	40	0	1	4	45	Coal	1	0.2	0.04592	15.4708	74.33
1031	72	10	30	-100	100	1	1	15	15	30	1	1	40	Oil	1	0.2	0.06966	26.2438	31.67
1032	73	5	30	-100	100	1	1	15	15	30	1	1	40	Oil	1	0.15	0.06966	26.2438	31.67

1033	74	5	20	-6	9	1	1	10	10	20	1	1	30	Oil	1	0.15	0.02830	37.6968	17.95
1034	76	25	100	-8	23	5	5	50	50	0	1	5	50	Coal	1	0.15	0.01280	17.8200	10.15
1035	77	25	100	-20	70	5	5	50	50	0	1	5	50	Coal	1	0.15	0.01280	17.8200	10.15
1036	80	150	300	-165	280	8	8	150	150	0	3	10	440	Coal	1	0.15	0.01088	12.8875	6.78
1037	82	25	100	-900	900	5	5	50	50	0	1	5	50	Coal	1	0	0.01280	17.8200	10.15
1038	85	10	30	-8	23	1	1	15	15	30	1	1	40	Oil	1	0	0.06966	26.2438	31.67
1039	87	100	300	-100	1000	8	8	150	150	0	3	10	440	Coal	1	0	0.00300	10.7600	32.96
1040	89	50	200	-210	300	8	8	100	100	0	2	10	400	Coal	1	0	0.01088	12.8875	6.78
1041	90	8	20	-300	300	1	1	10	10	20	1	1	30	Oil	1	0	0.02830	37.6968	17.95
1042	91	20	50	-100	100	1	1	25	25	50	1	1	45	Oil	1	0	0.00977	22.9423	58.81
1043	92	100	300	-3	9	8	8	150	150	0	3	8	100	Coal	1	0	0.01088	12.8875	6.78
1044	99	100	300	-100	100	8	8	150	150	0	3	8	100	Coal	1	0	0.01088	12.8875	6.78
1045	100	100	300	-50	155	8	8	150	150	0	3	8	110	Coal	1	0	0.01088	12.8875	6.78
1046	103	8	20	-15	40	1	1	10	10	20	1	1	30	Oil	1	0	0.02830	37.6968	17.95
1047	104	25	100	-8	23	5	5	50	50	0	1	5	50	Coal	1	0	0.01280	17.8200	10.15
1048	105	25	100	-8	23	5	5	50	50	0	1	5	50	Coal	1	0	0.01280	17.8200	10.15
1049	107	8	20	-200	200	1	1	10	10	20	1	1	30	Oil	1	0	0.02830	37.6968	17.95
1050	110	25	50	-8	23	2	2	25	25	50	1	2	45	Oil	1	0	0.00977	22.9423	58.81
1051	111	25	100	-100	1000	5	5	50	50	0	1	5	50	Coal	1	0	0.01280	17.8200	10.15
1052	112	25	100	-100	1000	5	5	50	50	0	1	5	50	Coal	1	0	0.01280	17.8200	10.15
1053	113	25	100	-100	200	5	5	50	50	0	1	5	50	Coal	1	0	0.01280	17.8200	10.15
1054	116	25	50	-1000	1000	2	2	25	25	50	1	2	45	Oil	1	0	0.00977	22.9423	58.81

Table III Combined Cycle Unit Data

Unit	Bus No	Total # of CT	Total # of ST	Total # Config	qsc (MW)	MSR (MW/min)	CT St Mbtu	ST St Mbtu	Ems Coef (lbs/Mbtu)	Init Config	IniT (Hour)
4001	12	2	1	5	50	4	30	15	0.1	0	3
4002	61	2	1	5	50	4	120	60	0.1	0	3
4003	62	2	1	5	50	4	320	160	0.1	0	3
4004	66	2	1	5	70	5	40	20	0.1	0	3
4005	49	2	1	5	50	4	80	40	0.1	0	3
4006	49	2	1	5	50	4	200	100	0.1	0	3
4007	59	2	1	5	70	5	120	60	0.1	0	3
4008	61	2	1	5	70	5	120	60	0.1	0	3
4009	80	2	1	5	70	5	120	60	0.1	0	3
4010	111	2	1	5	70	5	40	20	0.1	0	3
4011	100	2	1	5	70	5	40	20	0.1	0	3
4012	89	2	1	5	70	5	200	100	0.1	0	3

Table IV Combined Cycle Unit Configuration Data

Unit	Config #	CT	ST	Pmin (MW)	Pmax (MW)	Qmin (MW)	Qmax (MW)	Tmin (Hour)	Ramp Up (MW/Hour)	Ramp Down (MW/Hour)	af ($Mbtu/MW^2h$)	bf (Mbtu/MWh)	cf (Mbtu/h)
4001	0	0	0	0.0	0.0	0.0	0.0	3	0.0	0.0	0.02533	16.5420	34.3891
4001	1	1	0	5.0	25.0	-4.0	20.0	2	25.0	25.0	0.02533	16.5420	34.3891
4001	2	2	0	10.0	50.0	-8.0	40.0	2	50.0	50.0	0.01266	16.5420	68.7782
4001	3	1	1	7.5	37.5	-6.0	30.0	2	37.5	37.5	0.01359	14.3272	61.2980
4001	4	2	1	15.0	75.0	-12.0	60.0	2	75.0	75.0	0.00962	13.5073	134.1259
4002	0	0	0	0.0	0.0	0.0	0.0	3	0.0	0.0	0.01059	13.1083	70.0288
4002	1	1	0	5.0	25.0	-4.0	20.0	2	25.0	25.0	0.01059	13.1083	70.0288
4002	2	2	0	10.0	50.0	-8.0	40.0	2	50.0	50.0	0.00530	13.1083	140.0576
4002	3	1	1	7.5	37.5	-6.0	30.0	2	37.5	37.5	0.00876	10.8416	112.3179
4002	4	2	1	15.0	75.0	-12.0	60.0	2	75.0	75.0	0.00267	9.3016	189.6272
4003	0	0	0	0.0	0.0	0.0	0.0	3	0.0	0.0	0.00505	10.6121	130.0021
4003	1	1	0	5.0	25.0	-4.0	20.0	2	25.0	25.0	0.00505	10.6121	130.0021
4003	2	2	0	10.0	50.0	-8.0	40.0	2	50.0	50.0	0.00253	10.6121	260.0042
4003	3	1	1	7.5	37.5	-6.0	30.0	2	37.5	37.5	0.00278	9.8416	190.1760
4003	4	2	1	15.0	75.0	-12.0	60.0	2	75.0	75.0	0.00143	7.5121	406.9102
4004	0	0	0	0.0	0.0	0.0	0.0	3	0.0	0.0	0.01736	14.4921	58.1310
4004	1	1	0	8.0	35.0	-6.4	28.0	2	35.0	35.0	0.01736	14.4921	58.1310
4004	2	2	0	16.0	70.0	-12.8	56.0	2	70.0	70.0	0.00866	14.4921	116.2620
4004	3	1	1	12.0	50.0	-9.6	40.0	2	50.0	50.0	0.01328	12.5752	72.6481
4004	4	2	1	25.0	100.0	-20.0	80.0	2	100.0	100.0	0.00588	11.0800	129.7552
4005	0	0	0	0.0	0.0	0.0	0.0	3	0.0	0.0	0.01288	13.7154	55.5959
4005	1	1	0	5.0	25.0	-4.0	20.0	2	25.0	25.0	0.01288	13.7154	55.5959

4005	2	2	0	10.0	50.0	-8.0	40.0	2	50.0	50.0	0.00644	13.7154	111.1918
4005	3	1	1	7.5	37.5	-6.0	30.0	2	37.5	37.5	0.00823	11.9637	98.6485
4005	4	2	1	15.0	75.0	-12.0	60.0	2	75.0	75.0	0.00473	10.7367	184.3879
4006	0	0	0	0.0	0.0	0.0	0.0	3	0.0	0.0	0.00528	11.4073	122.0021
4006	1	1	0	5.0	25.0	-4.0	20.0	2	25.0	25.0	0.00528	11.4073	122.0021
4006	2	2	0	10.0	50.0	-8.0	40.0	2	50.0	50.0	0.00264	11.4073	244.0042
4006	3	1	1	7.5	37.5	-6.0	30.0	2	37.5	37.5	0.00343	10.0031	200.3179
4006	4	2	1	15.0	75.0	-12.0	60.0	2	75.0	75.0	0.00199	8.8616	323.5475
4007	0	0	0	0.0	0.0	0.0	0.0	3	0.0	0.0	0.01059	13.1083	70.0288
4007	1	1	0	8.0	35.0	-6.4	28.0	3	35.0	35.0	0.01059	13.1083	70.0288
4007	2	2	0	16.0	70.0	-12.8	56.0	3	70.0	70.0	0.00530	13.1083	140.0576
4007	3	1	1	12.0	50.0	-9.6	40.0	3	50.0	50.0	0.00876	10.8416	112.3179
4007	4	2	1	25.0	100.0	-20.0	80.0	3	100.0	100.0	0.00267	9.3016	189.6272
4008	0	0	0	0.0	0.0	0.0	0.0	3	0.0	0.0	0.01059	13.1083	70.0288
4008	1	1	0	8.0	35.0	-6.4	28.0	3	35.0	35.0	0.01059	13.1083	70.0288
4008	2	2	0	16.0	70.0	-12.8	56.0	3	70.0	70.0	0.00530	13.1083	140.0576
4008	3	1	1	12.0	50.0	-9.6	40.0	3	50.0	50.0	0.00876	10.8416	112.3179
4008	4	2	1	25.0	100.0	-20.0	80.0	3	100.0	100.0	0.00267	9.3016	189.6272
4009	0	0	0	0.0	0.0	0.0	0.0	3	0.0	0.0	0.01059	13.1083	70.0288
4009	1	1	0	8.0	35.0	-6.4	28.0	3	35.0	35.0	0.01059	13.1083	70.0288
4009	2	2	0	16.0	70.0	-12.8	56.0	3	70.0	70.0	0.00530	13.1083	140.0576
4009	3	1	1	12.0	50.0	-9.6	40.0	3	50.0	50.0	0.00876	10.8416	112.3179
4009	4	2	1	25.0	100.0	-20.0	80.0	3	100.0	100.0	0.00267	9.3016	189.6272
4010	0	0	0	0.0	0.0	0.0	0.0	3	0.0	0.0	0.01736	14.4921	58.1310
4010	1	1	0	8.0	35.0	-6.4	28.0	2	35.0	35.0	0.01736	14.4921	58.1310
4010	2	2	0	16.0	70.0	-12.8	56.0	2	70.0	70.0	0.00866	14.4921	116.2620
4010	3	1	1	12.0	50.0	-9.6	40.0	2	50.0	50.0	0.01328	12.5752	72.6481
4010	4	2	1	25.0	100.0	-20.0	80.0	2	100.0	100.0	0.00588	11.2800	129.7552
4011	0	0	0	0.0	0.0	0.0	0.0	3	0.0	0.0	0.01736	14.4921	58.1310
4011	1	1	0	8.0	35.0	-6.4	28.0	2	35.0	35.0	0.01736	14.4921	58.1310
4011	2	2	0	16.0	70.0	-12.8	56.0	2	70.0	70.0	0.00866	14.4921	116.2620
4011	3	1	1	12.0	50.0	-9.6	40.0	2	50.0	50.0	0.01328	12.5752	72.6481
4011	4	2	1	25.0	100.0	-20.0	80.0	2	100.0	100.0	0.00588	11.2800	129.7552
4012	0	0	0	0.0	0.0	0.0	0.0	3	0.0	0.0	0.00528	11.4073	122.0021
4012	1	1	0	8.0	35.0	-6.4	28.0	4	35.0	35.0	0.00528	11.4073	122.0021
4012	2	2	0	16.0	70.0	-12.8	56.0	4	70.0	70.0	0.00264	11.4073	244.0042
4012	3	1	1	12.0	50.0	-9.6	40.0	4	50.0	50.0	0.00343	10.0031	200.3179
4012	4	2	1	25.0	100.0	-20.0	80.0	4	100.0	100.0	0.00199	8.8616	323.5475

Table V Cascaded Hydro Unit Topology Data

Link Index	Catchment Index	Upstream Unit	Downstream Unit	Discharge Delay (Hour)
1	1	6001	6003	2
2	1	6002	6003	2
3	1	6003	6004	2
4	1	6004	-999	2
5	2	6005	6007	2
6	2	6006	6007	2
7	2	6007	-999	2

Table VI Cascaded Hydro Unit Data

Unit	Bus No	Lower Limit Reservoir Volume (Hm^3)	Upper Limit Reservoir Volume (Hm^3)	Initial Reservoir Volume (Hm^3)	Terminal Reservoir Volume (Hm^3)	Natural Inflow (Hm^3/h)	Lower Limit Discharge (Hm^3/h)	Upper Limit Discharge (Hm^3/h)	af ($MWh^2/(Hm^3)^2$)	bf (MWh/Hm^3)	cf (MW)	Min ON (Hour)	Min OFF (Hour)	IniT (Hour)	St Cost ($)
6001	19	70	150	100	100	4.00	1.0	10	-0.420	11.30	-1.82	1	1	-1	300
6002	24	40	130	80	80	3.00	1.0	10	-0.300	10.63	-6.00	1	1	-1	450
6003	25	100	240	170	170	2.00	1.3	20	-0.125	7.88	-7.26	1	1	-1	540
6004	89	70	160	110	110	0.25	1.5	20	-0.310	15.51	-7.50	1	1	-1	660
6005	90	60	160	100	100	3.00	1.0	10	-0.388	12.18	-2.64	1	1	-1	250
6006	91	50	140	90	90	2.00	1.0	10	-0.312	9.84	-7.23	1	1	-1	400
6007	103	120	300	180	180	1.22	1.5	20	-0.144	8.55	-6.45	1	1	-1	700

Table VII Pumped-Storage Unit Data

Unit	Uphill Reservoir				Downhill Reservoir				Lower Limit Discharge (Hm^3/h)	Upper Limit Discharge (Hm^3/h)
	Lower Limit Volume (Hm^3)	Upper Limit Volume (Hm^3)	Initial Volume (Hm^3)	Terminal Volume (Hm^3)	Lower Limit Volume (Hm^3)	Upper Limit Volume (Hm^3)	Initial Volume (Hm^3)	Terminal Volume (Hm^3)		
7001	50	150	55	55	350	450	445	445	5	15
7002	50	150	55	55	350	450	445	445	5	15
7003	60	200	80	80	400	400	500	500	7	20
Unit	**Bus No**	**af ($MWh^2/(Hm^3)^2$)**	**bf (MWh/Hm^3)**	**cf (MW)**	**Min ON (Hour)**	**Min OFF (Hour)**	**IniS**	**IniT (Hour)**	**Gen St Cost ($)**	**Pump St Cost ($)**
7001	36	-0.033	2.50	0.00	1	1	0	1	75	100
7002	77	-0.033	2.50	0.00	1	1	0	1	75	100
7003	69	-0.025	2.50	0.00	1	1	0	1	150	400