

ECE 558 - Project 6 Solutions

- 120 MW installed capacity, 82 MW load at 100% load factor
Calculate probability, frequency, duration risk indices

Cap Out	Ind Prob	NegDep	PosDep	Ind Freq	
0	8.2609e-01	9.0	0.0	7.4349e+00	
40	1.6296e-01	6.0	45.6	8.4126e+00	
80	1.0715e-02	3.0	91.3	1.0099e+00	
120	2.3485e-04	0.0	136.9	3.2145e-02	
Cap Out	Ind Prob	Ind Freq	Cum Prob	Cum Freq	
0	8.2609e-01	7.4349e+00	1.0000e+00	-8.8818e-16	
40	1.6296e-01	8.4126e+00	1.7391e-01	7.4349e+00	
80	1.0715e-02	1.0099e+00	1.0950e-02	9.7773e-01	
120	2.3485e-04	3.2145e-02	2.3485e-04	3.2145e-02	

Continuous 82 MW load (100% load factor) is (partially) curtailed whenever capacity outage is more than 38 MW. So, cumulative probability and cumulative frequency at cap out 40 MW are the prob and freq risk values. The duration risk value is CumProb/CumFreq.

Probability of curtailment = 0.17391

Frequency of curtailment = 7.4349 occurrences/year

Duration of curtailment = 2.3391e-02 years or 8.5377 days

- 75 MW installed generation capacity
80 MW installed transmission capacity
50 MW load at 100% load factor
Calculate probability, frequency, duration risk indices

Generator subsystem prob & freq cap out table

Cap Out	Ind Prob	NegDep	PosDep	Ind Freq	
0	7.9383e-01	21.9	0.0	1.7385e+01	
25	1.9052e-01	14.6	91.2	2.0167e+01	
50	1.5242e-02	7.3	182.5	2.8929e+00	
75	4.0644e-04	0.0	273.8	1.1126e-01	
Cap Out	Ind Prob	Ind Freq	Cum Prob	Cum Freq	
0	7.9383e-01	1.7385e+01	1.0000e+00	-7.1054e-15	
25	1.9052e-01	2.0167e+01	2.0617e-01	1.7385e+01	
50	1.5242e-02	2.8929e+00	1.5648e-02	2.7816e+00	
75	4.0644e-04	1.1126e-01	4.0644e-04	1.1126e-01	

Transmission subsystem prob & freq cap out table

Cap Out	Ind Prob	NegDep	PosDep	Ind Freq	
0	9.9909e-01	2.0	0.0	1.9982e+00	
40	9.1241e-04	1.0	2190.0	1.9991e+00	

80	2.0831e-07	0.0	4380.0	9.1241e-04	
Cap Out	Ind Prob	Ind Freq	Cum Prob	Cum Freq	
0	9.9909e-01	1.9982e+00	1.0000e+00	0.0000e+00	
40	9.1241e-04	1.9991e+00	9.1262e-04	1.9982e+00	
80	2.0831e-07	9.1241e-04	2.0831e-07	9.1241e-04	

Full model capacity outage probability and frequency table

Avail	State Prob	NegDep	PosDep	State Freq
75	7.9311e-01	23.900	0.000	1.8955e+01
40	7.2430e-04	22.900	2190.000	1.6028e+00
0	1.6537e-07	21.900	4380.000	7.2792e-04
50	1.9035e-01	16.600	91.250	2.0529e+01
40	1.7383e-04	15.600	2281.250	3.9927e-01
0	3.9688e-08	14.600	4471.250	1.7803e-04
25	1.5228e-02	9.300	182.500	2.9207e+00
25	1.3907e-05	8.300	2372.500	3.3109e-02
0	3.1750e-09	7.300	4562.500	1.4509e-05
0	4.0607e-04	2.000	273.750	1.1197e-01
0	3.7084e-07	1.000	2463.750	9.1403e-04
0	8.4667e-11	0.000	4653.750	3.9402e-07

Capacity outage probability and frequency table w/o internal transitions

Avail	State Prob	NegDep	PosDep	State Freq
75	7.9311e-01	23.900	0.000	1.8955e+01
40	7.2430e-04	1.000	2190.000	1.5869e+00
0	1.6537e-07	0.000	4380.000	7.2430e-04
50	1.9035e-01	16.600	91.250	2.0529e+01
40	1.7383e-04	15.600	2190.000	3.8340e-01
0	3.9688e-08	0.000	4380.000	1.7383e-04
25	1.5228e-02	7.300	182.500	2.8902e+00
25	1.3907e-05	8.300	182.500	2.6534e-03
0	3.1750e-09	0.000	4380.000	1.3907e-05
0	4.0607e-04	0.000	273.750	1.1116e-01
0	3.7084e-07	0.000	273.750	1.0152e-04
0	8.4667e-11	0.000	0.000	0.0000e+00

Final reduced model: prob and freq capacity outage table

Avail	State Prob	NegDep	PosDep	State Freq
75	7.9311e-01	23.900	0.000	1.8955e+01
50	1.9035e-01	16.600	91.250	2.0529e+01
40	8.9813e-04	3.826	2190.000	1.9703e+00
25	1.5242e-02	7.301	182.500	2.8929e+00
0	4.0665e-04	0.000	275.853	1.1218e-01
Avail	State Prob	State Freq	Cum Prob	Cum Freq
75	7.9311e-01	1.8955e+01	1.0000e+00	-7.1054e-15
50	1.9035e-01	2.0529e+01	2.0689e-01	1.8955e+01

40	8.9813e-04	1.9703e+00	1.6546e-02	4.7460e+00
25	1.5242e-02	2.8929e+00	1.5648e-02	2.7825e+00
0	4.0665e-04	1.1218e-01	4.0665e-04	1.1218e-01

Continuous 50 MW load (100% load factor) is (partially) curtailed whenever available capacity drops below 50 MW. So, cumulative probability and cumulative frequency at 40 MW are the prob and freq risk values. The duration risk value is CumProb/CumFreq.

Probability of curtailment = 0.016546

Frequency of curtailment = 4.7460 occurrences/year

Duration of curtailment = 3.4863e-03 years or 1.2725 days