APPENDIX

Capacity Outage Probability Table

Example 1

The generation system consists of three units. Unit A has 50 MW with 6% FOR. Unit B has 100 MW with 5% FOR. Unit C has 250 MW with 4% FOR.

Solution

This system has 8 states of available capacity. The COPT calculation is shown in Table A.1 and Table A.2.

Table A.1 The COPT calculation of Example 1.

State	Unit			Capacity Outage (X) (MW)	Probability $p(X)$ (MW)
	A	B	C		
1	Up	Up	Up	0	= 0.94×0.95×0.96
2	Down	Up	Up	50	=0.06×0.95×0.96
3	Up	Down	Up	100	=0.94×0.05×0.96
4	Down	Down	Up	150	=0.06×0.05×0.96
5	Up	Up	Down	250	=0.94×0.95×0.04
6	Down	Up	Down	300	=0.06×0.95×0.04
7	Up	Down	Down	350	=0.94×0.05×0.04
8	Down	Down	Down	400	=0.06×0.05×0.04

Table A.2 The COPT of Example 1.

Capacity Outage (X) (MW)	Probability $p(X)$ (MW)
0	0.857280
50	0.054720
100	0.045120
150	0.002880
250	0.035720
300	0.002280
350	0.001880
400	0.000120

The COPT can be also obtained by using a recursive technique. The COPT calculation using recursive technique is shown in Table A.3.

Table A.3 The COPT calculation of Example 1 by using a recursive technique.

Capacity Outage (X) (MW)	Cumulative Probability of the capacity outage state of X MW			Probability $p(X)$ (MW)
	Add Unit A (50 MW)	Add Unit B (100 MW)	Add Unit C (250 MW)	
0	1	1	1	0.857280
50	0.060	0.107	0.14272	0.054720
100		0.050	0.08800	0.045120
150		0.003	0.04288	0.002880
200			0.04000	0.000000
250			0.04000	0.035720
300			0.00428	0.002280
350			0.00200	0.001880
400			0.00012	0.000120

Example 2

The generation system consists of three units. Each unit has generation capacity of 250 MW with 6% FOR.

Solution

This system has 4 states of available capacity. The COPT calculation is shown in Table A.4.

Table A.4 The COPT calculation of Example 2.

State	Unit	Capacity Outage (X) (MW)	Probability $p(X)$ (MW)	
1	3U	0	= 1×(0.94×0.94×0.94)	0.830584
2	1D, 2U	250	= 3×(0.06×0.94×0.94)	0.159048
3	2D,1U	500	= 3×(0.06×0.06×0.94)	0.010152
4	3D	750	= 1×(0.06×0.06×0.06)	0.000216

Note that: U is "Up" unit status and D is "Down" unit status.

The COPT can also be obtained by using a recursive technique. The COPT calculation using a recursive technique is shown in Table A.5.

Table A.5 The COPT calculation of Example 2 by using a recursive technique.

Capacity Outage (X) (MW)	Cumulative Probability of the capacity outage state of X MW			Probability $p(X)$ (MW)
	Add Unit A (250 MW)	Add Unit B (250 MW)	Add Unit C (250 MW)	
0	1	1	1	0.830584
250	0.06	0.1164	0.169416	0.159048
500	0	0.0036	0.010368	0.010152
750		0	0.000216	0.000216

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