

## Appendix

Table 1 Planning schemes of DS with different cases in the 33-node system

Planning year	Case	Capacity of substation (MW)	Type of lines									
			Line-1	Line-2	Line-3	Line-4	Line-5	Line-6	Line-7	Line-8	Line-9	Line-10
1	Case-1	10.09	8	7	5	5	5	2	2	2	2	2
	Case-2	8.65	4	4	3	3	2	1	1	1	1	1
	Case-3	8.53	4	4	3	3	2	1	1	1	1	1
2	Case-1	1.01	9	-	6	6	6	3	-	-	-	-
	Case-2	0.84	5	-	-	-	3	-	-	-	-	-
	Case-3	0.85	5	-	-	-	3	-	-	-	-	-
3	Case-1	1.11	-	9	7	-	-	-	3	-	-	-
	Case-2	0.95	6	5	-	-	-	2	-	-	-	-
	Case-3	0.94	6	5	-	-	-	2	-	-	-	-
4	Case-1	1.22	-	-	-	7	7	-	-	3	-	-
	Case-2	1.04	-	6	4	-	-	-	-	-	-	-
	Case-3	1.03	-	6	4	-	-	-	-	-	-	-
5	Case-1	1.34	-	-	-	-	-	4	-	-	3	-
	Case-2	1.15	7	-	-	4	4	-	2	-	-	-
	Case-3	1.14	7	-	-	4	4	-	2	-	-	-
Planning year	Case	line-11	line-12	line-13	line-14	line-15	line-16	line-17	line-18	line-19	line-20	line-21
1	Case-1	1	1	1	1	1	1	1	1	1	1	1
	Case-2	1	1	1	1	1	1	1	1	1	1	1
	Case-3	1	1	1	1	1	1	1	1	1	1	1
2	Case-1	2	-	-	-	-	-	-	-	-	-	-
	Case-2	-	-	-	-	-	-	-	-	-	-	-
	Case-3	-	-	-	-	-	-	-	-	-	-	-
3	Case-1	-	-	-	-	-	-	-	-	-	-	-
	Case-2	-	-	-	-	-	-	-	-	-	-	-
	Case-3	-	-	-	-	-	-	-	-	-	-	-
4	Case-1	-	2	-	-	-	-	-	2	-	-	-
	Case-2	-	-	-	-	-	-	-	-	-	-	-
	Case-3	-	-	-	-	-	-	-	-	-	-	-
5	Case-1	-	-	-	-	-	-	-	-	-	-	-
	Case-2	-	-	-	-	-	-	-	-	-	-	-
	Case-3	-	-	-	-	-	-	-	-	-	-	-
Planning year	Case	line-22	line-23	line-24	line-25	line-26	line-27	line-28	line-29	line-30	line-31	line-32
1	Case-1	1	1	1	2	2	1	1	1	1	1	1
	Case-2	1	1	1	1	1	1	1	1	1	1	1
	Case-3	1	1	1	1	1	1	1	1	1	1	1
2	Case-1	-	-	-	-	-	2	-	-	-	-	-
	Case-2	-	-	-	-	-	-	-	-	-	-	-
	Case-3	-	-	-	-	-	-	-	-	-	-	-
3	Case-1	2	-	-	-	-	-	2	-	-	-	-
	Case-2	-	-	-	-	-	-	-	-	-	-	-
	Case-3	-	-	-	-	-	-	-	-	-	-	-
4	Case-1	-	-	-	-	-	-	-	-	-	-	-
	Case-2	-	-	-	-	-	-	-	-	-	-	-
	Case-3	-	-	-	-	-	-	-	-	-	-	-
5	Case-1	-	-	-	3	-	-	-	-	-	-	-

Case-2	2	-	-	2	-	-	-	-	-	-	-
Case-3	2	-	-	2	-	-	-	-	-	-	-

Table 2 Planning schemes of ES with different cases in the 33-node system

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3	Case-3	-	-	-	-	-	-	-	-	-	-	-
	Case-1	-	-	7	-	-	-	-	-	-	-	-
	Case-2	-	-	3	-	-	-	-	-	-	-	-
4	Case-3	-	-	3	-	-	-	-	-	-	-	-
	Case-1	-	-	-	-	-	-	-	7	-	-	-
	Case-2	-	-	-	-	-	-	-	3	-	-	-
5	Case-3	-	-	-	-	-	-	-	3	-	-	-
	Case-1	-	-	8	-	-	-	-	-	-	-	-
	Case-2	-	-	-	-	-	-	-	-	-	-	-
	Case-3	-	-	-	-	-	-	-	-	-	-	-
Planning year	Case	line-33	line-34	line-35	line-36	line-37	line-38	line-39	line-40	line-41	line-42	line-43
1	Case-1	1	1	1	1	3	3	3	1	3	2	1
	Case-2	1	1	1	1	1	1	1	1	1	1	1
	Case-3	1	1	1	1	1	1	1	1	1	1	1
2	Case-1	-	-	-	-	-	-	-	-	-	3	-
	Case-2	-	-	-	-	-	-	-	-	-	-	-
	Case-3	-	-	-	-	-	-	-	-	-	-	-
3	Case-1	-	-	-	-	-	-	-	-	-	-	-
	Case-2	-	-	-	-	-	-	-	-	-	-	-
	Case-3	-	-	-	-	-	-	-	-	-	-	-
4	Case-1	-	-	-	-	4	4	4	-	4	-	-
	Case-2	-	-	-	-	-	-	-	-	-	-	-
	Case-3	-	-	-	-	-	-	-	-	-	-	-
5	Case-1	-	-	-	-	5	5	-	-	-	4	-
	Case-2	-	-	-	-	2	2	2	-	-	-	-
	Case-3	-	-	-	-	2	2	2	-	-	-	-
Planning year	Case	line-44	line-45	line-46	line-47	line-48	line-49	line-50	line-51	line-52	line-53	line-54
1	Case-1	1	1	2	1	1	1	1	1	1	5	5
	Case-2	1	1	1	1	1	1	1	1	1	3	3
	Case-3	1	1	1	1	1	1	1	1	1	3	3
2	Case-1	-	-	-	2	-	-	-	-	-	6	6
	Case-2	-	-	-	-	-	-	-	-	-	-	-
	Case-3	-	-	-	-	-	-	-	-	-	-	-
3	Case-1	-	-	-	-	2	2	-	-	-	-	-
	Case-2	-	-	-	-	-	-	-	-	-	4	4
	Case-3	-	-	-	-	-	-	-	-	-	4	4
4	Case-1	-	-	-	-	-	-	-	-	-	7	7
	Case-2	-	-	-	-	-	-	-	-	-	-	-
	Case-3	-	-	-	-	-	-	-	-	-	-	-
5	Case-1	-	-	-	-	-	-	-	-	-	-	-
	Case-2	-	-	-	-	-	-	-	-	-	5	5
	Case-3	-	-	-	-	-	-	-	-	-	5	5
Planning year	Case	line-55	line-56	line-57	line-58	line-59	line-60	line-61	line-62	line-63	line-64	line-65
1	Case-1	1	4	4	1	4	1	1	4	1	3	1
	Case-2	1	3	3	1	3	1	1	2	1	2	1
	Case-3	1	3	3	1	3	1	1	2	1	2	1
2	Case-1	-	5	5	-	5	-	-	-	-	4	-
	Case-2	-	-	-	-	-	-	-	3	-	3	-
	Case-3	-	-	-	-	-	-	-	3	-	3	-
3	Case-1	-	6	6	-	-	-	-	5	-	-	-

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4	Case-1	2	-	-	-	-	-	-	-	-	-	-	-	-
	Case-2	-	-	-	-	-	-	-	-	-	-	-	-	-
	Case-3	-	-	-	-	-	-	-	-	-	-	-	-	-
5	Case-1	-	-	-	-	-	-	-	-	-	-	-	-	-
	Case-2	-	-	-	-	-	-	-	-	-	-	-	-	-
	Case-3	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 4 Planning schemes of ES with different cases in the 99-node system

Planning year		1			2			3			4			5		
Case		Case-1	Case-2	Case-3	Case-1	Case-2	Case-3	Case-1	Case-2	Case-3	Case-1	Case-2	Case-3	Case-1	Case-2	Case-3
Capacity	ACC (MW)	\	6.14	8.15	\	0.61	2.83	\	0.67	0.90	\	0.75	0.99	\	0.81	1.08
	CST (MW·h)	\	40.25	39.52	\	4.03	3.22	\	4.44	4.35	\	4.89	4.78	\	5.14	5.26

Table 5 Planning schemes of DS with different confidence levels in the 33-node system

Confidence level	Capacity of substation (MW)	Type of lines									
		Line-1	Line-2	Line-3	Line-4	Line-5	Line-6	Line-7	Line-8	Line-9	Line-10
90%	10.09	8	7	5	5	5	2	2	2	2	2
80%	9.91	8	7	5	5	5	2	2	2	2	2
70%	9.83	8	7	5	5	5	2	2	2	2	2
60%	9.78	8	7	5	5	5	2	2	2	2	1
50%	9.74	7	7	5	5	5	2	2	2	2	1
Confidence level	line-11	line-12	line-13	line-14	line-15	line-16	line-17	line-18	line-19	line-20	line-21
90%	1	1	1	1	1	1	1	1	1	1	1
80%	1	1	1	1	1	1	1	1	1	1	1
70%	1	1	1	1	1	1	1	1	1	1	1
60%	1	1	1	1	1	1	1	1	1	1	1
50%	1	1	1	1	1	1	1	1	1	1	1
Confidence level	line-22	line-23	line-24	line-25	line-26	line-27	line-28	line-29	line-30	line-31	line-32
90%	1	1	1	2	2	1	1	1	1	1	1
80%	1	1	1	2	2	1	1	1	1	1	1
70%	1	1	1	2	2	1	1	1	1	1	1
60%	1	1	1	2	2	1	1	1	1	1	1
50%	1	1	1	2	1	1	1	1	1	1	1

Table 6 Planning schemes of DS with different confidence levels in the 99-node system

Confidence level	Capacity of substation (MW)	Type of lines									
		Line-1	Line-2	Line-3	Line-4	Line-5	Line-6	Line-7	Line-8	Line-9	Line-10
90%	17.23	9	1	1	1	1	1	1	1	1	1
80%	16.93	9	1	1	1	1	1	1	1	1	1
70%	16.79	9	1	1	1	1	1	1	1	1	1
60%	16.70	9	1	1	1	1	1	1	1	1	1
50%	16.64	9	1	1	1	1	1	1	1	1	1
Confidence level	line-11	line-12	line-13	line-14	line-15	line-16	line-17	line-18	line-19	line-20	line-21
90%	9	1	9	1	8	2	1	1	1	1	1
80%	9	1	9	1	8	2	1	1	1	1	1
70%	9	1	8	1	8	2	1	1	1	1	1
60%	9	1	8	1	8	2	1	1	1	1	1
50%	9	1	8	1	8	2	1	1	1	1	1
Confidence level	line-22	line-23	line-24	line-25	line-26	line-27	line-28	line-29	line-30	line-31	line-32

90%	1	1	6	1	1	1	1	5	1	1	1
80%	1	1	6	1	1	1	1	5	1	1	1
70%	1	1	6	1	1	1	1	5	1	1	1
60%	1	1	6	1	1	1	1	5	1	1	1
50%	1	1	5	1	1	1	1	5	1	1	1
Confidence level	line-33	line-34	line-35	line-36	line-37	line-38	line-39	line-40	line-41	line-42	line-43
90%	1	1	1	1	3	3	3	1	3	2	1
80%	1	1	1	1	3	3	3	1	3	2	1
70%	1	1	1	1	3	3	3	1	3	2	1
60%	1	1	1	1	3	3	3	1	3	2	1
50%	1	1	1	1	3	3	3	1	3	2	1
Confidence level	line-44	line-45	line-46	line-47	line-48	line-49	line-50	line-51	line-52	line-53	line-54
90%	1	1	2	1	1	1	1	1	1	5	5
80%	1	1	1	1	1	1	1	1	1	5	5
70%	1	1	1	1	1	1	1	1	1	5	5
60%	1	1	1	1	1	1	1	1	1	5	5
50%	1	1	1	1	1	1	1	1	1	5	5
Confidence level	line-55	line-56	line-57	line-58	line-59	line-60	line-61	line-62	line-63	line-64	line-65
90%	1	4	4	1	4	1	1	4	1	3	1
80%	1	4	4	1	4	1	1	3	1	3	1
70%	1	4	4	1	4	1	1	3	1	3	1
60%	1	4	4	1	4	1	1	3	1	3	1
50%	1	4	4	1	4	1	1	3	1	3	1
Confidence level	line-66	line-67	line-68	line-69	line-70	line-71	line-72	line-73	line-74	line-75	line-76
90%	3	1	1	1	1	3	1	2	1	2	1
80%	3	1	1	1	1	3	1	2	1	2	1
70%	3	1	1	1	1	3	1	2	1	2	1
60%	3	1	1	1	1	3	1	2	1	2	1
50%	3	1	1	1	1	3	1	2	1	2	1
Confidence level	line-77	line-78	line-79	line-80	line-81	line-82	line-83	line-84	line-85	line-86	line-87
90%	2	1	1	1	1	1	1	1	1	1	1
80%	2	1	1	1	1	1	1	1	1	1	1
70%	2	1	1	1	1	1	1	1	1	1	1
60%	2	1	1	1	1	1	1	1	1	1	1
50%	2	1	1	1	1	1	1	1	1	1	1
Confidence level	line-88	line-89	line-90	line-91	line-92	line-93	line-94	line-95	line-96	line-97	line-98
90%	1	1	1	1	1	1	1	1	1	1	1
80%	1	1	1	1	1	1	1	1	1	1	1
70%	1	1	1	1	1	1	1	1	1	1	1
60%	1	1	1	1	1	1	1	1	1	1	1
50%	1	1	1	1	1	1	1	1	1	1	1

Table 7 Planning schemes of different methods in the 33-node system

Method	Capacity of substation (MW)	Type of lines									
		Line-1	Line-2	Line-3	Line-4	Line-5	Line-6	Line-7	Line-8	Line-9	Line-10
P-DRO	10.09	8	7	5	5	5	2	2	2	2	2
D-DRO	9.06	7	6	5	4	4	2	2	2	2	1
SO	8.85	7	6	5	4	4	2	2	2	2	1
Method	line-11	line-12	line-13	line-14	line-15	line-16	line-17	line-18	line-19	line-20	line-21

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Table 8 Planning schemes of different methods in the 99-node system

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