Appendix

Appendix												
		Table 1 Plann	ing schen	nes of DS	with dif	ferent ca	ses in th	e 33-nod	e system			
Planning year	Case	Capacity of					Type o	of lines				
Training year	Casc	substation (MW)	line-1	line-2	line-3	line-4	line-5	line-6	line-7	line-8	line-9	line-10
1	Case-1	5.22	4	3	2	2	2	1	1	1	1	1
1	Case-2	4.68	3	3	2	2	2	1	1	2	2	2
2	Case-1	5.59	-	4	3	-	-	-	-	-	-	-
2	Case-2	5.01	4	-	-	-	-	-	-	-	-	-
3	Case-1	5.98	5	-	-	3	3	-	-	-	-	-
3	Case-2	5.35	-	-	-	-	-	-	-	-	-	-
4	Case-1	6.40	-	-	-	-	-	-	-	-	-	-
·	Case-2	5.63	-	4	3	3	-	-	-	-	-	-
5	Case-1	6.84	6	5	-	-	-	2	-	-	-	-
	Case-2	5.82	5	-	-			-	-	-	-	-
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	2	2	2	2	2	2	1	1	1	1	1
2	Case-1	-	-	-	-	-	-	-	-	-	-	-
	Case-2	-	-	-	-	-	-	-	-	-	-	-
3	Case-1	-	-	-	-	-	-	-	-	-	-	-
	Case-2	-	-	-	-	-	-	-	-	-	-	-
4	Case-1	-	-	-	-	-	-	-	-	-	-	-
	Case-2	-	-	-	-	-	-	-	-	-	-	-
5	Case-1	-	-	-	-	-	-	-	-	-	-	-
Planning year	Case-2 Case	line-22	line-23	line-24	line-25	line-26	line-27	line-28	line-29	line-30	line-31	line-32
r ranning year	Case-1	1	1	1	1	1	1	1	1	1	1	1
1	Case-1	1	1	1	1	1	1	1	1	1	1	1
	Case-1	1	1	1	1	1	1	_	1	-	1	1
2	Case-1		_	_	_	_	_	_	_	_	_	_
	Case-1	_	_	_	_	_	_	_	_	_	_	_
3	Case-2	_	_	_	_	_	_	_	_	_	_	_
	Case-1	_	_	_	_	_	_	_	_	_	_	_
4	Case-2	_	_	_	_	_	_	_	_	_	_	_
_	Case-1	_	_	_	_	_	_	_	_	_	_	_
5	Case-2	_	_	_	_	_	_	_	_	-	_	_
*The symbol		that the line is not inves	ted.									
The symbol	nieuns (Table 2 Plann		nes of DS	with dif	ferent ca	ses in th	e 99-nod	e svstem			
		Capacity of	8				Type o		<u> </u>			
Planning year	Case	substation (MW)	line-1	line-2	line-3	line-4	line-5	line-6	line-7	line-8	line-9	line-10
	Case-1	8.39	3	1	1	1	1	1	1	1	1	1
1	Case-1	8.01	3	1	1	1	1	1	1	1	1	1
	Case-2	9.03	4	-	_	_	-	-	-	_	-	_
2	Case-1	8.57	-	_	_	_	_	_	_	_	-	-
	Case-1	9.62	_	_	_	_	_	-	-	_	_	_
3	Case-1	9.02	4	_	_	_	_	_	_	_	-	-
	Case-1	10.32	5	_	_	_	_	-	-	_	_	_
4	Case-1	9.73	-	_	_	_	_	_	_	_	_	_
	Case-1	11.03	_	_	_	_	_	-	-	_	_	_
5	Case-2	10.72	5	_	_	_	_	_	_	_	_	_

	Case-2	8.57	-	-	-	-	-	-	-	-	-	-
3	Case-1	9.62	-	-	-	-	-	-	-	-	-	-
3	Case-2	9.17	4	-	-	-	-	-	-	-	-	-
4	Case-1	10.32	5	-	-	-	-	-	-	-	-	-
4	Case-2	9.73	-	-	-	-	-	-	-	-	-	-
5	Case-1	11.03	-	-	-	-	-	-	-	-	-	-
3	Case-2	10.72	5	-	-	-	-	-	-	-	-	-
Planning year	Case	line-11	line-12	line-13	line-14	line-15	line-16	line-17	line-18	line-19	line-20	line-2
1	Case-1	3	1	3	1	3	1	1	1	1	1	1
1	Case-2	3	1	3	1	3	1	1	1	1	1	1
2	Case-1	-	-	-	-	-	-	-	-	-	-	-
2	Case-2	-	-	-	-	-	-	-	-	-	-	-
3	Case-1	4	-	-	-	-	-	-	-	-	-	-
3	Case-2	-	-	-	-	-	-	-	-	-	-	-
4	Case-1	-	-	4	-	4	-	-	-	-	-	-
4	Case-2	-	-	-	-	-	-	-	-	-	-	-
5	Case-1	-	-	-	-	-	-	-	-	-	-	-
	Case-2	4	-	4	-	4	-	-	-	-	-	-
Planning year	Case	line-22	line-23	line-24	line-25	line-26	line-27	line-28	line-29	line-30	line-31	line-3
1	Case-1	1	1	2	1	1	1	1	2	1	1	1

	Case-2	1	1	2	1	1	1	1	2	1	1	1
	Case-1	-	-	-	-	-	-	-	-	-	-	-
2	Case-2	-	-	-	-	-	-	-	-	-	-	-
2	Case-1	-	-	_	_	_	-	_	_	-	_	-
3	Case-2	-	-	-	-	-	-	-	-	-	-	-
4	Case-1	-	-	-	-	-	-	-	-	-	-	-
4	Case-2	-	-	-	-	-	-	-	-	-	-	-
5	Case-1	-	-	-	-	-	-	-	-	-	-	-
5	Case-2	-	-	3	-	-	-	-	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	1	1	1	1	1	1	1
1	Case-2	1	1	1	1	1	1	1	1	1	1	1
2	Case-1	-	-	-	-	-	-	-	-	-	-	-
2	Case-2	-	-	-	-	-	-	-	-	-	-	-
3	Case-1	-	-	-	-	-	-	-	-	-	-	-
3	Case-2	-	-	-	-	-	-	-	-	-	-	-
4	Case-1	-	-	-	-	-	-	-	-	-	-	-
·	Case-2	-	-	-	-	-	-	-	-	-	-	-
5	Case-1	-	-	-	-	-	-	-	-	-	-	-
	Case-2	-		-		- 10	- 10					
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	1	1	1	1	1	1	1	3	3
	Case-2	1	1	1	1	1	1	1	1	1	3	2
2	Case-1	-	-	-	-	-	-	-	-	-	-	- 2
	Case-2 Case-1	-	-	-	-	-	-	-	-	-	-	3
3	Case-1 Case-2	-	-	-	-	-	-	-	-	-	-	-
	Case-2 Case-1	-	-	-	-	-	-	-	-	-	-	-
4	Case-1	-	_	_	-	_	-	-	-	_	-	-
	Case-1		_	_	_	_	_	_	_	_	_	_
5	Case-2	-	_	_	-	_	-	_	_	_	_	-
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
	Case-1	1	2	2	1	2	1	1	2	1	2	1
1	Case-2	1	2	2	1	2	1	1	2	1	2	1
_	Case-1	-	-	-	-	-	-	-	-	-	-	-
2	Case-2	_	_	_	_	_	_	_	_	_	_	-
2	Case-1	-	3	3	-	3	_	_	_	-	-	-
3	Case-2	-	3	3	-	3	-	-	-	-	-	-
4	Case-1	-	-	-	-	-	-	-	3	-	-	-
4	Case-2	-	-	-	-	-	-	-	3	-	-	-
5	Case-1	-	-	-	-	-	-	-	-	-	3	-
	Case-2	-	-	-	-	-	-	-	-	-	3	-
Planning year	Case	line-66	line-67	line-68	line-69	line-70	line-71	line-72	line-73	line-74	line-75	line-76
1	Case-1	2	1	1	1	1	2	1	1	1	1	1
1	Case-2	2	1	1	1	1	2	1	1	1	1	1
2	Case-1	-	-	-	-	-	-	-	2	-	-	-
~	Case-2	-	-	-	-	-	-	-	2	-	-	-
3	Case-1	-	-	-	-	-	-	-	-	-	2	-
-	Case-2	-	-	-	-	-	-	-	-	-	2	-
4	Case-1	-	-	-	-	-	-	-	-	-	-	-
	Case-2	-	-	-	-	-	-	-	-	-	-	-
5	Case-1 Case-2	3 3	-	-	-	-	-	-	-	-	-	-
Planning year	Case-2	line-77	line-78	line-79	line-80	line-81	line-82	line-83	line-84	line-85	line-86	line-87
1 familing year	Case-1	1	1	1	1	1	1	1	1	1	1	1
1	Case-1	1	1	1	1	1	1	1	1	1	1	1
	Case-2	-	-	-	-	-	-	-	-	-	-	-
2	Case-1	-	_	_	_	_	_	_	_	_	_	_
_	Case-1	-	_	_	_	_	_	_	_	_	_	_
3	Case-2	-	_	_	_	_	_	_	_	_	_	-
	Case-1	-	_	_	_	_	_	_	_	_	_	-
4												
		-	-	-	-	-	-	-	-	-	-	-
~	Case-2	-	-	-	-	-	-	-	-	-	-	-
5		- - -	- - -	- - -	- - -	- -	-	- - -	- - -	- -	- -	- - -
	Case-2 Case-1 Case-2	- - - line-88	- - - line-89	- - - line-90	- - - line-91	- - - line-92	- - - line-93	- - - line-94	- - - line-95	- - - line-96	- - - line-97	- - - line-98
5 Planning year	Case-2 Case-1	- - - line-88	- - - line-89	- - - line-90	- - - line-91	- - - line-92	- - - line-93	- - - line-94	- - - line-95	- - - line-96	- - - line-97	- - - line-98

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

Table 3 Planning schemes of DS with different uncertainty methods in the 33-node system

Case	Capacity of		Type of lines									
	substation (MW)	line-1	line-2	line-3	line-4	line-5	line-6	line-7	line-8	line-9	line-10	
SO	6.58	6	5	3	3	3	1	1	1	1	1	
DRO	6.89	6	5	3	3	3	1	1	1	1	1	
RO	7.32	6	5	3	3	3	2	1	1	1	1	
Case	line-11	line-12	line-13	line-14	line-15	line-16	line-17	line-18	line-19	line-20	line-21	
SO	1	1	1	1	1	1	1	1	1	1	1	
DRO	1	1	1	1	1	1	1	1	1	1	1	
RO	1	1	1	1	1	1	1	1	1	1	1	
Case	line-22	line-23	line-24	line-25	line-26	line-27	line-28	line-29	line-30	line-31	line-32	
SO	1	1	1	2	2	1	1	1	1	1	1	
DRO	1	1	1	2	1	1	1	1	1	1	1	
RO	1	1	1	1	1	1	1	1	1	1	1	

Table 4 Planning schemes of DS with different uncertainty methods in the 99-node system

	Capacity of					Туре	of lines				
Case	substation (MW)	line-1	line-2	line-3	line-4	line-5	line-6	line-7	line-8	line-9	line-10
SO	10.50	5	1	1	1	1	1	1	1	1	1
DRO	10.72	5	1	1	1	1	1	1	1	1	1
RO	11.66	6	1	1	1	1	1	1	1	1	1
Case	line-11	line-12	line-13	line-14	line-15	line-16	line-17	line-18	line-19	line-20	line-21
SO	4	1	4	1	4	1	1	1	1	1	1
DRO	4	1	4	1	4	1	1	1	1	1	1
RO	5	1	5	1	5	1	1	1	1	1	1
Case	line-22	line-23	line-24	line-25	line-26	line-27	line-28	line-29	line-30	line-31	line-32
SO	1	1	2	1	1	1	1	2	1	1	1
DRO	1	1	3	1	1	1	1	2	1	1	1
RO	1	1	3	1	1	1	1	3	1	1	1
Case	line-33	line-34	line-35	line-36	line-37	line-38	line-39	line-40	line-41	line-42	line-43
SO	1	1	1	1	1	1	1	1	1	1	1
DRO	1	1	1	1	1	1	1	1	1	1	1
RO	1	1	1	1	1	1	1	1	1	1	1
Case	line-44	line-45	line-46	line-47	line-48	line-49	line-50	line-51	line-52	line-53	line-54
SO	1	1	1	1	1	1	1	1	1	3	3
DRO	1	1	1	1	1	1	1	1	1	3	3
RO	1	1	1	1	1	1	1	1	1	3	3
Case	line-55	line-56	line-57	line-58	line-59	line-60	line-61	line-62	line-63	line-64	line-65
SO	1	3	3	1	3	1	1	3	1	3	1
DRO	1	3	3	1	3	1	1	3	1	3	1
RO	1	3	3	1	3	1	1	3	1	3	1
Case	line-66	line-67	line-68	line-69	line-70	line-71	line-72	line-73	line-74	line-75	line-76
SO	3	1	1	1	1	2	1	2	1	2	1
DRO	3	1	1	1	1	2	1	2	1	2	1
RO	3	1	1	1	1	2	1	2	1	2	1
Case	line-77	line-78	line-79	line-80	line-81	line-82	line-83	line-84	line-85	line-86	line-87
SO	1	1	1	1	1	1	1	1	1	1	1
DRO	1	1	1	1	1	1	1	1	1	1	1
RO	1	1	1	1	1	1	1	1	1	1	1
Case	line-88	line-89	line-90	line-91	line-92	line-93	line-94	line-95	line-96	line-97	line-98
SO	1	1	1	1	1	1	1	1	1	1	1
DRO	1	1	1	1	1	1	1	1	1	1	1
RO	1	1	1	1	1	1	1	1	1	1	1

Table 5 Planning schemes of DS with different decentralized solution methods in the 33-node system

Case	Capacity of	Type of lines										
Case	substation (MW)	line-1	line-2	line-3	line-4	line-5	line-6	line-7	line-8	line-9	line-10	
ATC	4.68	3	3	2	2	2	1	2	2	2	2	
ADMM	4.68	3	3	2	2	2	1	2	2	2	2	
Case	line-11	line-12	line-13	line-14	line-15	line-16	line-17	line-18	line-19	line-20	line-21	
ATC	2	2	2	2	2	2	1	1	1	1	1	
ADMM	2	2	2	2	2	2	1	1	1	1	1	
Case	line-22	line-23	line-24	line-25	line-26	line-27	line-28	line-29	line-30	line-31	line-32	
ATC	1	1	1	1	1	1	1	1	1	1	1	
ADMM	1	1	1	1	1	1	1	1	1	1	1	

	Table 6 Plannin	ig schemes	s of DS wit	th differer	t decentr	alized solı	ıtion metl	ods in the	e 99-node	system	
Case	Capacity of					Туре	of lines				
Case	substation (MW)	line-1	line-2	line-3	line-4	line-5	line-6	line-7	line-8	line-9	line-10
ATC	8.44	4	1	1	1	1	1	1	1	1	1
ADMM	8.44	4	1	1	1	1	1	1	1	1	1
Case	line-11	line-12	line-13	line-14	line-15	line-16	line-17	line-18	line-19	line-20	line-21
ATC	3	1	3	1	3	1	1	1	1	1	1
ADMM	3	1	3	1	3	1	1	1	1	1	1
Case	line-22	line-23	line-24	line-25	line-26	line-27	line-28	line-29	line-30	line-31	line-32
ATC	1	1	2	1	1	1	1	2	1	1	1
ADMM	1	1	2	1	1	1	1	2	1	1	1
Case	line-33	line-34	line-35	line-36	line-37	line-38	line-39	line-40	line-41	line-42	line-43
ATC	1	1	1	1	1	1	1	1	1	1	1
ADMM	1	1	1	1	1	1	1	1	1	1	1
Case	line-44	line-45	line-46	line-47	line-48	line-49	line-50	line-51	line-52	line-53	line-54
ATC	1	1	1	1	1	1	1	1	1	3	3
ADMM	1	1	1	1	1	1	1	1	1	3	3
Case	line-55	line-56	line-57	line-58	line-59	line-60	line-61	line-62	line-63	line-64	line-65
ATC	1	2	2	1	2	1	1	2	1	2	1
ADMM	1	2	2	1	2	1	1	2	1	2	1
Case	line-66	line-67	line-68	line-69	line-70	line-71	line-72	line-73	line-74	line-75	line-76
ATC	2	1	1	1	1	2	1	1	1	1	1
ADMM	2	1	1	1	1	2	1	1	1	1	1
Case	line-77	line-78	line-79	line-80	line-81	line-82	line-83	line-84	line-85	line-86	line-87
ATC	1	1	1	1	1	1	1	1	1	1	1
ADMM	1	1	1	1	1	1	1	1	1	1	1
Case	line-88	line-89	line-90	line-91	line-92	line-93	line-94	line-95	line-96	line-97	line-98
ATC	1	1	1	1	1	1	1	1	1	1	1
ADMM	1	1	1	1	1	1	1	1	1	1	1