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SINTEF

Analysis of Power System Scenarios for Norway 2030 using the Fundamental Market Model FanSi

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Objective

Which parametrizations are optimal when running FanSi and will this vary for different scenarios?

FanSi

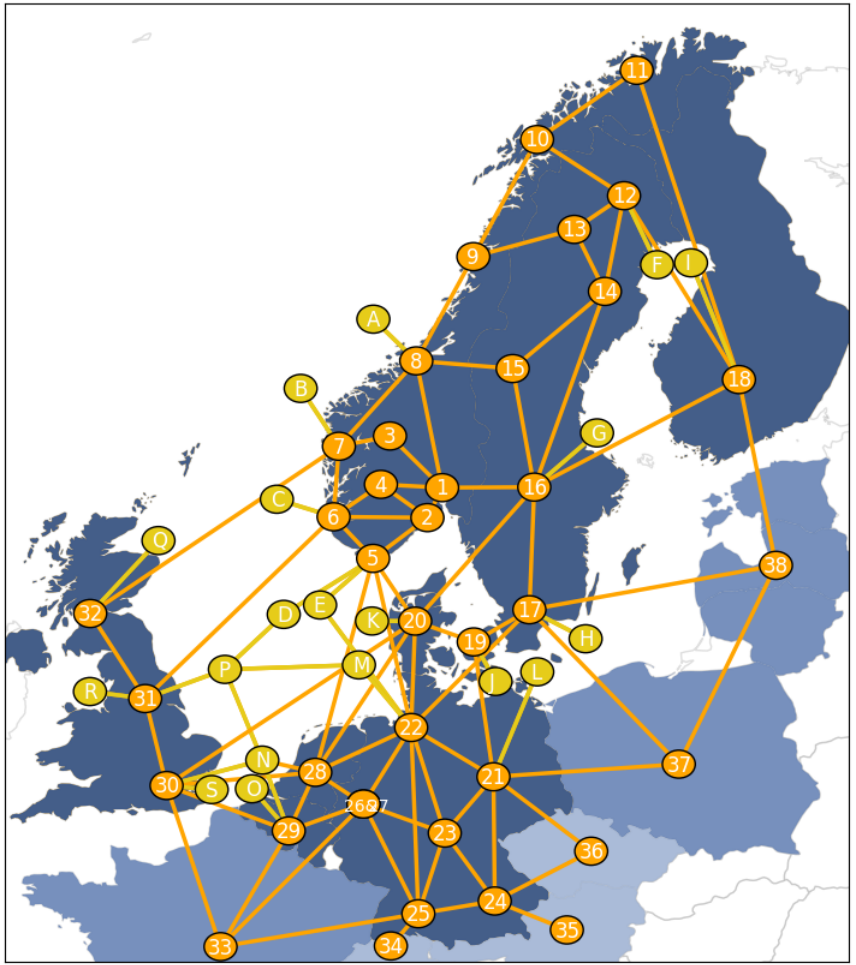
- Long-term hydro-thermal scheduling model developed by SINTEF Energy Research
- Historical inflow to represent future uncertainty
- Stochastic linear programming
- Individual water values for each reservoir

Dataset

Average annual power production:

Total:
Thermal (incl nuclear): 1075 TWh
Bio: 222 TWh
Hydro: 317 TWh
Wind: 495 TWh
Solar: 204 TWh

Norway:
Hydro: 128 TWh
Wind: 23 TWh
Solar: 2 TWh



Cases

4 different scenarios:

A - Base scenario

B - High fuel prices

C - Removing all subsea cables connected to Norway

D - Increased capacity to Great Britain

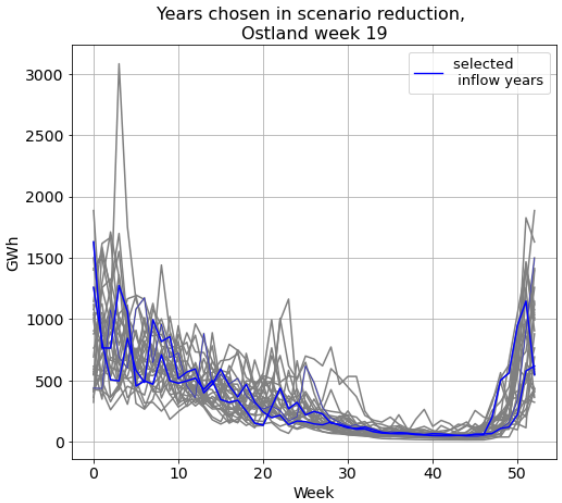
Parametrizations

- 5 + 1 different parametrizations

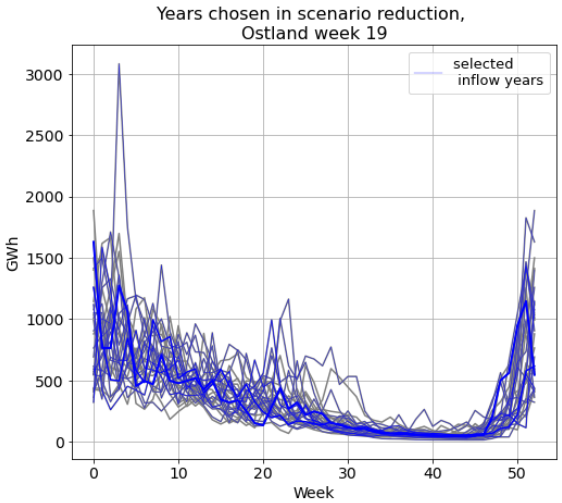
Parametrization	Default	+Increased scenarios		+Increased scenario length		+Increase in both scenarios and scenarios length
Cases	1	2	3	4	5	6
NWEEK	52	52	52	104	156	104
NSCEN	4	10	20	4	4	20

Inflow representation

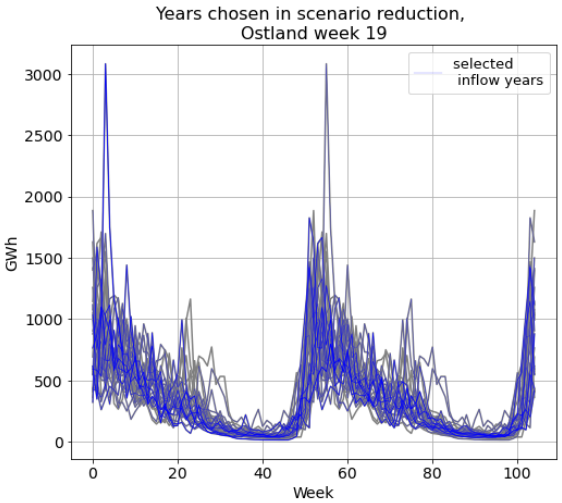
4 scenarios



10 scenarios



20 scenarios



Social welfare

A - Base scenario

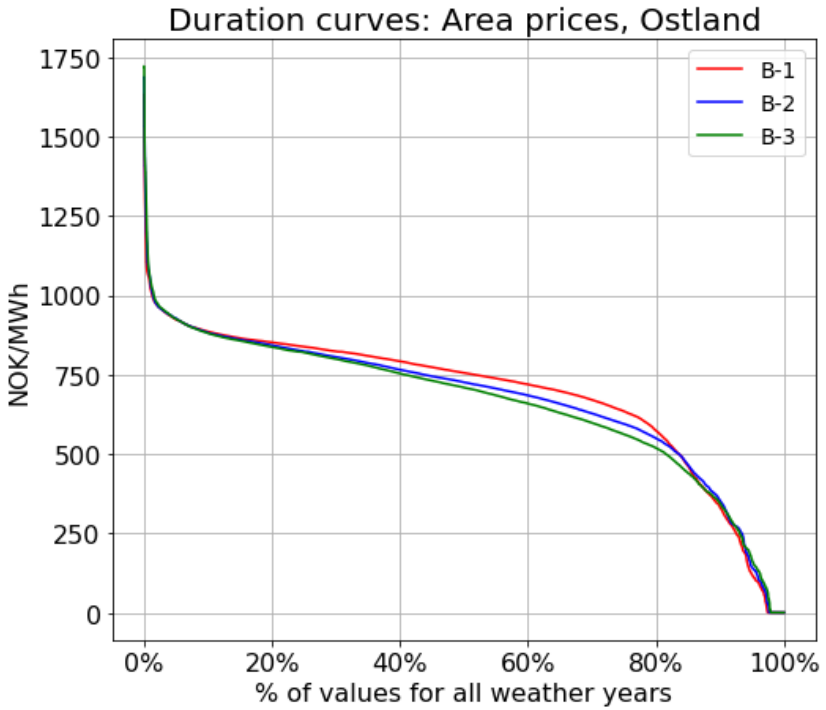
B - High fuel prices

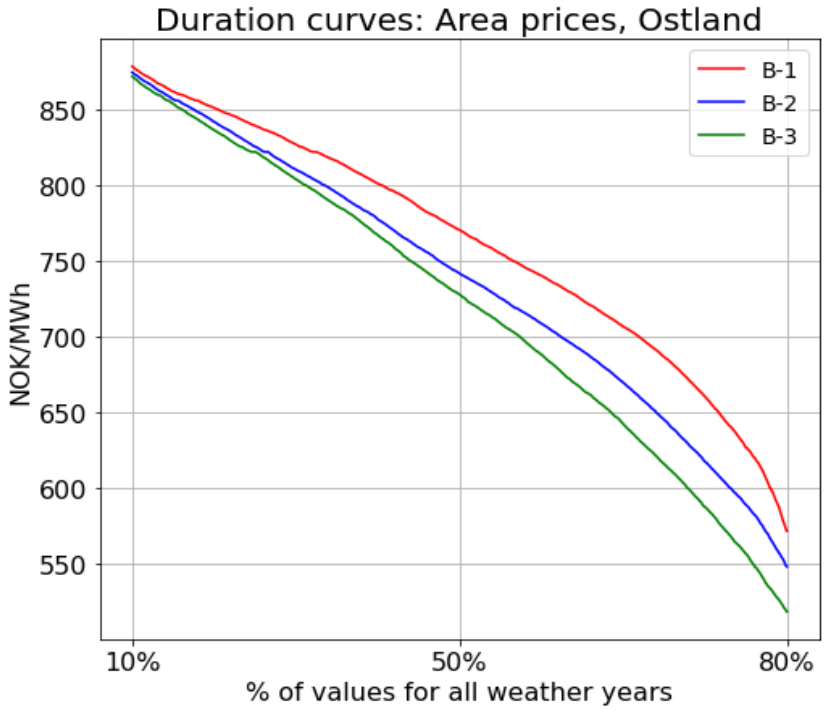
C - Removing all subsea cables connected to Norway

D - Increased capacity to Great Britain

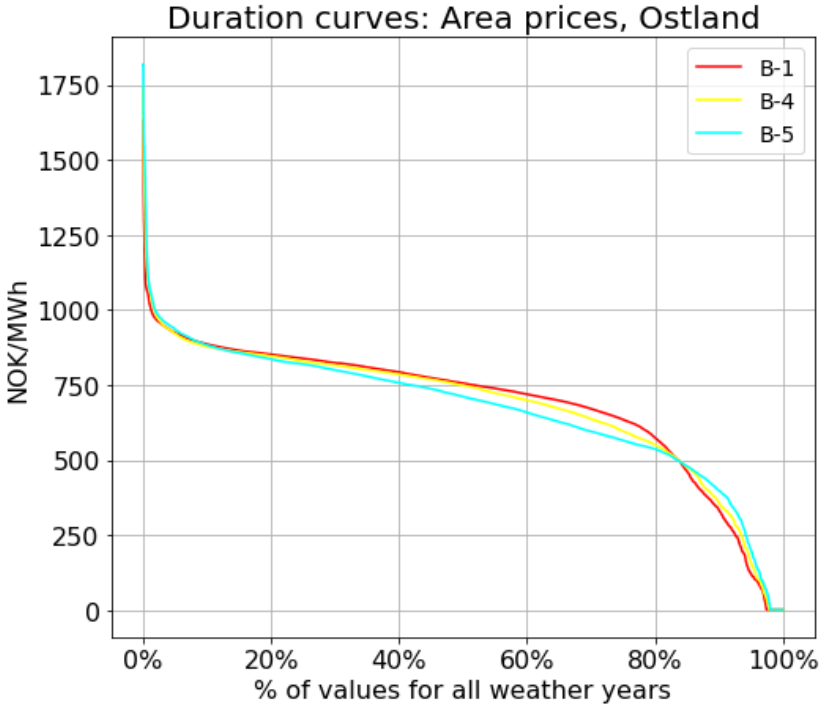
Social welfare [Mkr]					
A-1	**A-2**	**A-3**	**A-4**	**A-5**	**A-6**
64617533,45	+ 221,91	+ 368,83	- 259,79	- 575,42	+ 5,68
B-1	**B-2**	**B-3**	**B-4**	**B-5**	
64240646,29	+ 2087,36	+ 3236,32	+ 836,51	+535,56	
C-1	**C-2**	**C-3**	**C-4**	**C-5**	
64609980,60	+ 243,35	+366,72	-346,85	-758,1	
D-1	**D-2**	**D-3**	**D-4**	**D-5**	
64620567,11	+ 176,55	+319,83	-276,85	-585,7	

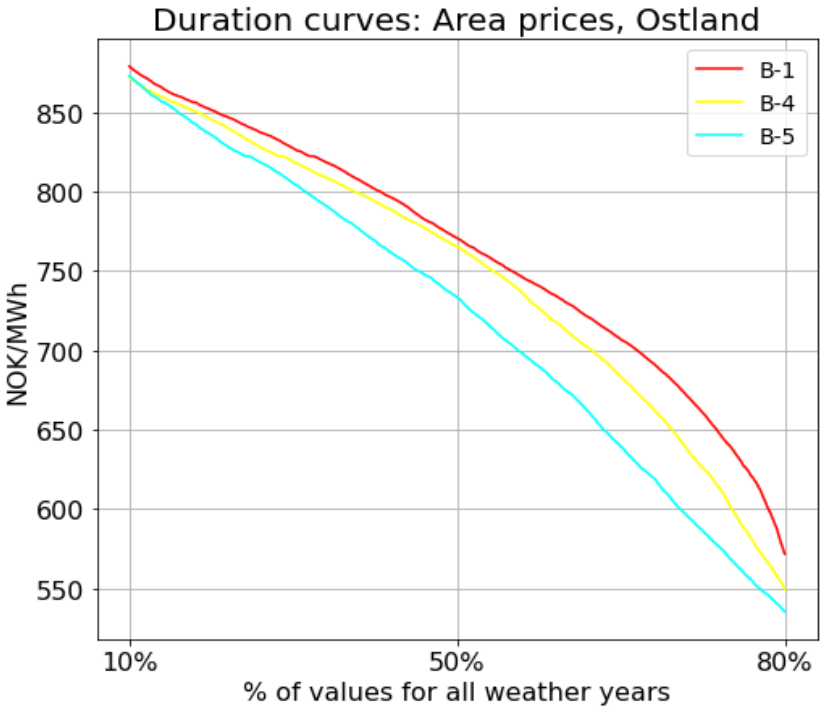
Area prices - Increased scenarios





Area prices - Increased scenario length





Model run time

Model run time					
A-1	**A-2**	**A-3**	**A-4**	**A-5**	**A-6**
40h, 19min	47h, 51min	57h, 25min	107h, 31min	185h, 40min	156h, 37min
B-1	**B-2**	**B-3**	**B-4**	**B-5**	
43h, 32min	53h, 55min	72h, 1min	128h, 56min	231h, 24min	
C-1	**C-2**	**C-3**	**C-4**	**C-5**	
57h, 18min	69h, 8min	59h	113h, 50min	225h, 57min	
D-1	**D-2**	**D-3**	**D-4**	**D-5**	
40h, 47min	51h, 6min	52h, 33min	123h, 24min	200h, 12min	

Conclusion

- Parametrization will mainly affect areas with high shares of hydropower
- Better representation of weather years due to scenarios give less uncertainties in the optimization
- An conclusion cannot be drawn about the effect on social welfare from increasing scenario length
- However, a case where both the number and length of scenarios were increased resulted in higher social welfare

Thanks for listening!