



Energy systems Quantitative analysis of the NordPool electricity system

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Introduction

Electricity system model Simulation results Summary and concluding remarks Outline Methodology

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- Outline
- Methodology

Electricity system model

- Area model
- Production capacities, 2020

Simulation results

- Hydropower
- Thermal production
- Energy balance
- CO₂-emissions



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Summary and concluding remarks

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Outline Methodology





Outline

- Methodology
- Electricity system model in 2020
- Results
 - Hydropower, inflow, production and reservoir handling
 - Thermal power, production
 - Energy balance
 - CO₂ emissions

Analysis methodology

- Simulate operation of the NordPool electricity system with three climatic scenarios
- EMPS-model
 - Water-values and simulation
- Climatic scenarios
 - Reference, Echam, Hadam
 - Data provided by NVE, SMHI and SYKE
- Electricity system model in 2020
 - Predictions made by Eurelectric and Statnett
- Fuel costs in 2020
 - Data provided by EA energy analyses



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Area model Production capacities, 2020

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Area model Production capacities, 2020

Area model, 2020



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Area model Production capacities, 2020

Production capacities in 2020

Nuclear	Thermal	Hydro	Wind	Sum
0.0	8.9	0.0	5.6	14.5
10.0	6.2	16.4	6.0	38.7
5.9	10.8	3.4	1.5	21.5
0.0	1.5	29.5	1.7	32.6
15.9	27.3	49.3	14.8	107.3
	Nuclear 0.0 10.0 5.9 0.0 15.9	Nuclear Thermal 0.0 8.9 10.0 6.2 5.9 10.8 0.0 1.5 15.9 27.3	NuclearThermalHydro0.08.90.010.06.216.45.910.83.40.01.529.515.927.349.3	NuclearThermalHydroWind0.08.90.05.610.06.216.46.05.910.83.41.50.01.529.51.715.927.349.314.8



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Summary and concluding remarks

Hydropower Thermal production Energy balance *CO*₂-emissions

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Hydropower Thermal production Energy balance CO₂-emissions

Average annual inflow, TWh/year



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Hydropower Thermal production Energy balance CO₂-emissions

Annual average reservoir level over the year, GWh





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Hydropower Thermal production Energy balance CO₂-emissions

Annual average hydropower production over the year, GWh





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Hydropower Thermal production Energy balance CO₂-emissions

Annual average hydropower production, GWh



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Hydropower Thermal production Energy balance CO₂-emissions

Average annual thermal production, TWh/year





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Hydropower Thermal production Energy balance CO₂-emissions

Average annual energy balance





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Hydropower Thermal production Energy balance CO₂-emissions

CO₂-emissions in the NordPool region



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Hydropower Thermal production Energy balance CO₂-emissions

CO₂-emissions adjusted for import and export





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Average annual characteristics for the NordPool area



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Average annual energy balance, NordPool





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- \bullet Average annual inflow increase with 12-13 %
- More inflow during winter, less or unchanged during summer
- $\bullet\,$ Higher temperatures causes demand to decrease with 2-3 $\%\,$
- Thermal production is substituted by hydro production
- Less imports from and more export to continental Europe
- CO_2 emissions decrease with 25 (57) %

