Potential of the paper industry as system flexibility provider for an electrical system with high renewable energy share in Chile

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Chile has a very ambitious energy transition agenda and massive challenges ahead to accomplish it. To integrate the high solar energy potential in the north an the high wind power potential of the south of the country, considerable investments in the electrical grid and new balancing mechanism and storage capacities are necessary. This study addresses the potential of individual industries, particularly the paper industry, to provide flexibility to the electrical system on-site. To achieve this, an optimization model that minimizes energy provision costs is proposed. The model considers the demand of a company including its demand side management potential, combined heat and power generation capacities, as well as on-site renewable energy generation location potential from photovoltaics and wind power. The model is computed under multiple parametrization scenarios to estimate under which conditions it would be advantageous for the company to use renewable electricity. This allows to evaluate how much of the renewable electricity produced in high peaks can be used by the company, and in how far, demand side management and combined heat and power can compensate low generation periods of renewable electricity. The model is fed with typical hourly electricity and heat demand profiles of a prototypic paper producing company, which were statistically derived from one and a half years of measurements. Moreover, electricity generation time series from photovoltaics and wind power are derived from physical models that rely on ERA5 reanalysis data. The latter data set allows to compute the model in locations all around Chilean territory in a 30 km x 30 km spatial grid. Results are presented in the form of maps of the shares of renewables that would be enabled at avery location by industries of the same characteristics.