The cost of undisturbed landscapes: on the valuation of wind turbines in Austria

Sebastian Wehrle and Johannes Schmidt
University of Natural Resources and Life Sciences, Vienna

In Europe, the system cost minimizing highly renewable power system set-up predominantly relies on wind energy, with minor shares of photovoltaics.

Yet, minimizing system cost neglects negative externalities of wind turbines, such as their impact on wildlife, noise emissions, landscape aesthetics, manifesting in local economic impacts such as a decline of house prices in the vicinity of wind turbines.

To better understand the trade-off between electricity system cost and the negative externalities from wind turbines, we quantify the increase in electricity system cost when the system cost minimizing deployment of wind turbines is reduced in the favor of photovoltaics.

Methodologically, we rely on the power system model medea, an open, techno-economic, numerical model of hourly dispatch and investment, set up to resemble the electricity market in Austria and its largest electricity trading partner Germany in 2030, when Austria aims to generate 90% of its electricity consumption from domestic renewable sources on annual balance.

Depending on the capital cost of renewable energy technologies, the marginal system cost from displaced wind turbines can reach up to 40,000 EUR per MW and year or approximately 20 EUR per MWh. Moreover, CO2 emissions can increase by up to 1.2 million tons per year when wind energy is fully displaced. Producer surplus could increase by up to 220 million EUR per annum at intermediate wind energy displacement but falls back towards initial levels when wind energy is fully displaced.

These numbers compare to estimates of property price declines between 2% and 16% caused by wind turbines, depending on the proximity to, and the visibility of the turbine. For illustration, adding a 3.5 MW wind turbine to a total installed wind power capacity of 12.6 GW in Austria over its lifetime (assuming a 3% discount rate) would generate sufficient social value to compensate affected property worth between 0.8 and 6.7 million EUR.