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Complementarity for Wind Power in Turkey: A Correlation Analysis Using XGBoost

Generation from resources such as wind power and photovoltaics are highly variable and relatively unpredictable. This variability has its own cost such that when the wind and photovoltaics happen to be low due to weather conditions, some other energy source should substitute them to satisfy the demand via market forces. The question is, to which extent does the thermal leg or the reservoir storage hydropower plants fill or substitute the gap in such cases? This is examined in the literature as the complementarity between the variable renewables and alternative sources of energy. For the purpose of answering this question, using hourly data for the period between 2015 and 2020 from Turkey, generation from the thermal leg and generation from reservoir storage hydropower plants are predicted with XGBoost, a machine learning algorithm, for different price and generation levels of wind power. The results point to a positive correlation between wind and reservoir storage hydropower, which concludes as the absence of complementarity between wind power and reservoir storage hydropower for the Turkish case. We comment that the feed-in-tariff system which guaranteed a price in US dollar terms per kWh of energy from reservoir storage hydropower decreased the incentives for substitution of wind power, cancelling out the balancing function of the reservoir storage hydropower. On the other hand, for positive prices, the natural gas fueled plants seem to substitute %63-%116 of the loss in wind power and the rest of the thermal leg happens to substitute %43-%59 of the loss in wind power, according to our calculations. These results point to a complementarity (over-substitution in this case) between wind power and the thermal leg.

Biography

Gökçe Kurucu is currently working as an assistant professor in Konya Food and Agriculture University, Department of Economics. Semih is currently working as an assistant professor in KTO Karatay University, Department of Computer Engineering.

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