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Climate change impact on photovoltaic potential in Poland

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Due to global warming and the worldwide depletion of fossil fuel resources, there is a growing need to transform the energy system toward greater use of renewable sources. In Poland, poor air quality constitutes an additional argument for the necessity of such transition. High levels of pollutants concentrations in many locations, especially in urban and suburban areas are caused by emissions from individual heating systems running on fossil fuels.

Data from recent years show that renewable generation forms the largest share of the total generation mix in Europe. Regarding new installation, solar and wind energy dominate renewable capacity expansion, jointly accounting for example in 2019 for 90% of all net renewable additions. However, along with the increase in the penetration of these energy sources also increases the sensitivity of the power system to weather and climatic conditions.

The study presents the impact of climate change up to the year 2100 on the photovoltaic power generation potential (Pvpot) in Poland. For determination of Pvpot index a set of high-resolution climate models projections, made available within the EURO-CORDEX initiative was used. Maps showing spatial distribution of absolute values of Pvpot in future climate (30-year average for 2071-2100) and relative changes with respect to current climate (30-year average for 2006-2035) are presented, separately for RCP4.5 and RCP8.5 scenario. The influence of meteorological conditions (temperature, wind and solar radiation) on PV module performance is taken into account by applying two different formula (Ciulla et. al, 2014 and Davy and Troccoli, 2012). Furthermore, two options for module orientation are considered: horizontal and inclined at an optimal angle.