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**LONG-TERM IMPACT OF INCREASING FOSSIL FUEL PRICES AND  
MARKET DESIGN ON THE MARKET VALUES OF WIND AND SOLAR  
POWER**

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### **Overview**

Wholesale prices for fossil fuels have increased dramatically as a result of the present energy crisis and will remain on a higher level in the future, owing to trade restrictions put in place against Russia. Numerous nations have concurrently raised their RES expansion plans to lessen their reliance on fossil fuels in the medium term. Frequently, the average income per MWh realized on the day-ahead market, the so-called market value (MV), plays a significant role in the support mechanisms for renewable energy sources (RES). In many countries, the RES are reimbursed on a mechanism based on the MV. Moreover, MVs above the levelized cost of electricity (LOCE) encourage private-sector investment without the need for subsidies. Analytical calculations were made by (Hirth and Radebach 2016) to determine how RES growth would affect RES MV. Whereas (Ruhnau 2022) used a linear optimization model to study the impact of load flexibility on the long-term growth of RES market values.

### **Methods**

In contrast to these studies, the impact of rising fossil fuel market prices and accelerated RES expansion plans on the MV by 2040 for Germany and some of its neighbors are examined in this research using the agent-based electricity market simulation model (ABM) PowerACE (cf. (Zimmermann et al. 2022; Fraunholz 2021)). This paper compares RES expansion plans and the price of fossil fuels before and after Russia invaded Ukraine. The ABM considers price effects as well as the consequences of rising fuel costs on the investment and dispatch decisions of dispatchable power plants and electric storage facilities. ABMs benefit over pure optimization models because agents can operate according to business considerations rather than pursuing a coordinated goal based on a central planner. RES bid at marginal costs of 0 €/MWh in the market in PowerACE. Market interactions brought on by regulatory changes or investment choices made in certain nations are considered across the entire study area by coupling the market areas. In this case, the available trading capacity between the trading zones is considered, but no intrazonal network limitations are considered. Market region and RES type are taken into account when analyzing RES MVs.

### **(Preliminary) Results**

In this paper, a total of eight different scenarios were examined. The two fuel price and RES expansion scenarios were combined and simulated once in the energy-only market and once considering capacity markets. In the scenarios with increased RES expansion, the market areas with new expansion targets (e.g. Germany and Denmark) have a significantly lower market value for RES. Through trade between the market areas, however, this effect can also be seen in other countries. The approximate average market values in 2040 are 100 EUR/MWh for onshore wind and 60 EUR/MWh for offshore wind and solar power. The increased fuel prices play a subordinate role, which diminishes over time in all scenarios as RES expansion continues. The introduction of capacity markets, e.g. in France, Poland etc. results in lower market values of RES in all investigated market areas due to fewer electricity spot market price peaks. However, the results also reveal that other factors, such as the coal phase-out in certain countries, substantially impact market values within the studied region. These scarcity prices emerge within the simulation when dispatchable capacities are insufficiently replaced under the given boundary conditions. However, it can be expected that, in reality political measures will be taken to have sufficient dispatchable power plant capacities available.

### **(Preliminary) Conclusions**

In most countries, the long-term higher prices do not significantly impact the market values of RES. However, the market values might be high enough to incentivize investments without support. It has been demonstrated that implementing capacity markets to ensure supply security negatively affects the market value of RES. When expanding capacity mechanisms, it is essential to consider its impact on RES MVs to avoid reducing incentives for necessary investments in renewable energy and preventing additional costs for support measures.

### **References**

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