Executive Summary of the manuscript

Auction Schemes, Bidding Strategies and the Cost-Optimal Level of Promoting Renewable Electricity in Germany

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The European Union directive “Guidelines to State aid for environmental protection and energy 2014-2020” calls for the creation of auction-based markets, aiming at controlling the quantity of newly installed renewable energy plants via auctioned capacities. The goal is to achieve a cost-efficient level of remuneration by inducing competition among the different project developers. In Germany, the EU directive was implemented by the Renewable Energies Act 2014 (EEG 2014).

In this study, the German pilot auction scheme for open-field solar photovoltaics is scrutinized which has served as a pilot for the auction and promotion of the major large-scale renewable electricity generation technologies starting in 2017. A core of the analysis is the investigation of the new bidding model, thereby determining the optimal bidding strategy of a player in this market and the resulting project value.

Two auction pricing methods are investigated, pay-as-bid and uniform-pricing. Whereas the pay-as-bid method remunerates every accepted bid with its bidding value, the uniform-pricing method denotes that all tenderers whose bid was accepted get the price of the last accepted bid as remuneration. The analysis shows that no unified auction strategy for producing the best results exists, but that a careful interpretation of the preferred strategy according to the auction modeling and the auction- and technology-specific circumstances is necessary.

Furthermore, single, repeated and multiple bids were investigated. The strategic multiple bidding additionally enables bidders to indirectly place several bids for one project. In the base case results, the optimal bidding strategy consists of a falling bid curve, which means the player participates with a high bid and a low probability of winning in the earlier auction rounds, whereas the bid is slowly reduced towards the end of the auction period in order to increase the probability of winning.

Additionally, an uncertainty analysis of the capital expenditures (CapEx) was conducted and shows that depending on the auction parameters, the uncertainty can either have a positive or negative impact on the project value relative to a situation with certainty. Whereas a reduction of the CapEx can lead to higher profits, the danger of rising CapEx in the case of a winning bid can lead to the drop out from the auction process. The uncertainty regarding the CapEx leads to a negative influence for longer timeframes, whereas the positive impact outweighs the negative ones over shorter timeframes.

In a sensitivity analysis, it is shown how bidding strategy adjustments affect the outcome. More specifically, it is shown how higher uncertainty about the market clearing price increases the project value, because the additional uncertainty can raise the probability of obtaining a higher level of remuneration by an adjusted bidding strategy.

Finally, the pilot auction scheme for open-field PV was compared with the requirements of an auction system for wind farms, pointing out the adjustment needs for the auction procedure. Wind energy projects are characterized by significantly higher capital costs, e.g. resulting from the more cumbersome planning process and longer construction times compared to PV projects. Therefore, the adjustments will require longer implementation periods due to longer construction times or the waiving of auctioning smaller projects of up to 6 MW.

The analysis and experience gained in the real world show that it is indeed possible to successfully award funding authorizations for renewable electricity generation plants via an auction-based process. Still, time will tell whether the successful projects will actually be built or not.