

# ***IMPACT OF THE CAPACITY MARKET ON RENEWABLE ENERGY PROMOTION TAKING THE SPATIAL DIMENSION INTO ACCOUNT***

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## **Overview**

At present, the integration of renewables, and especially wind power plants, in the electricity market, accentuates the role of the capacity market mechanism as an important means for the further diffusion of mature renewable energy technologies. The Capacity market is one of the main solutions for improving supply adequacy. This paper studies the impact of the capacity market on supply adequacy in an advanced long-term electricity market model with a noticeable share of renewable energy, simulating the market by applying a bottom-up approach. In this regard, the entire electricity market of Europe is simulated in the HECTOR model, taking a system dynamics perspective. The model simulates the electricity market of 28 European countries, with a special focus on Germany. In addition, the auctions studied are analyzed on two different spatial levels, the state and the national level. In the state level design, all wind power plants within Germany are assumed to bid within the federal state they are located and the market is cleared at the state level. In the national level design, all wind power plants located in different states bid in a national market, which represents the German market. Comparing the results obtained for the market design reveals the superior spatial platform for the implementation of renewable energy auctions. The results obtained allows identification of the influence of capacity market on the performance of the electricity market and wind generation investment considering detailed and comprehensive categorization of wind power plants. Categorization of wind technologies is based on their regional potential. Furthermore, impacts of capacity market on market performance of neighbouring regions in an interconnected market, considering different spatial platforms will be scrutinized.

## **Methods**

HECTOR is a simulation model which simulates supply side of electricity market of Europe with system dynamics perspective. It consists of five main modules which all of them are executed simultaneously with hourly resolution. Main modules includes: capacity investment, plant bidding logic, decentral production, residual demand and market clearance. The objective function of this long-term model which minimize total system costs subject to a set of constraints is being solved in market clearance module. This function matches supply and residual demand considering regional constraints such as import and export costs and transmission capacities in order to find lowest total system cost. A zooming approach has been used to politically measure the optimal regional resolution in Germany which market performance can be maximized with.

## **Results**

As the database of this study is not completed yet, we just referred to the expected results from our work in progress which will be as follows:

First, a group of results, provides us information about the impacts of capacity market on the installed capacity of wind technologies in different regions of Germany.

Second, the diffusion of renewables in Germany varies with the participation of actors in auctions with different spatial platform. This study will show which spatial the platform granularity can accelerate the promotion of wind technologies most.

Third, impacts of the capacity market on neighboring regions is another important issue which will be analyzed in this paper.

## Conclusions

The main purpose of the capacity market is to make sure that the market has ample installed capacity. It does not account for whether generated electricity is sold or not. This paper studies the German electricity capacity market by taking a system dynamics perspective, analyzing in which regional players have incentives for investments, exploitation and use of wind power technologies depending on the prevailing policies and incentives provided. In conclusion, comparing spatial platforms is done with a zooming approach for the promotion of wind energy technologies. This comparison reveals which regional resolution of the capacity market incentivizes investment in wind energy technologies in Germany in an adequate(optimal) manner.

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