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Looking back on a successful conference

It was a great pleasure to host the 41st IAEE International Conference in Groningen. We can look back at a successful conference with many great speakers and visitors. About 650 delegates from all over the world spoke on a wide variety of subjects within the energy economics field. The central theme of the conference, Transforming Energy Markets, has been discussed in 7 plenary sessions, 6 round tables and 91 concurrent sessions. In addition we offered 3 poster sessions, 3 master classes, 1 doctoral seminar, 2 technical excursions

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PRICE VARIANCE IN EUROPEAN ELECTRICITY SPOT MARKETS – AN IMPACT ASSESSMENT OF INTERMITTENT RENEWABLE ENERGIES

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Overview

Liberalization of electricity markets in the EU and a remarkable growth of intermittent renewable generation in the last decade led to far-reaching price effects in Europe's electricity spot markets. While the current literature generally agrees on the reducing effect of intermittent renewable generation on the price level itself, the impact on the price variance has not yet been fully analyzed. Differences in considered type of technology of renewable generation, market situation and time span lead to heterogeneous findings regarding the price variance in European electricity spot markets. Most studies that have been done on this topic conclude that price variance increases with an increasing share of intermittent renewable generation. However, some authors show that increased shares of intermittent renewable energies can as well decrease electricity price variance.

Questions which are considered in this paper are:

- Which factors do generally have an influence on the variance of spot prices?
- Do spot prices become more fluctuating when higher shares of intermittent renewable energies are fed into the grid?
- Which role does the generation of intermittent renewable energies play regarding the electricity spot price variance?

Methods

For answering those questions, two models - a theoretical and an empirical approach - are developed.

Theoretical model:
In a first methodical step, current literature on the question of price variance is analyzed. The most important impact factors which are considered in comparable studies are the amount of intermittent renewable generation fed into the grid, the variability of this generation, demand levels, and competitiveness of the market. Most studies concluding increased price variance as a consequence of rising levels of intermittent renewable generation concentrate their analysis on wind power. The main basis of the theoretical model is a theoretical framework developed by Wozabal, Graf, & Hirschmann (2016). It identifies two main factors shaping price variance: distribution of residual demand, i.e. distribution of intermittent renewable generation, and shape of the supply curve.

Empirical model:
In a second methodical step, the theoretical model is tested in an empirical approach for Europe. It adds new evidence to the controversy by testing the hypothesis of two main influencing factors – the shape of the supply curve and the distribution of the residual demand - for the year 2015 in an econometric model for 23 countries in Europe. They equal 84 % of installed wind and photovoltaics capacities in the EU. A linear regression model identifies the most important factors shaping price variance. The analysis aims at testing the hypothesis in a broad range of European countries. This enables some general conclusions about electricity spot price variance in Europe like they are already possible for the merit-order effect (Welisch, Ortner, & Resch, 2016).

Results

The results show that there are two main influences impacting spot price variance which can be approved for the majority of countries analyzed: the variance of intermittent renewable generation on the one side, and time-wise correlation and interaction of demand and intermittent renewable generation on the other side. In the empirical model, countries with an intermittent renewable energy share higher than 10 % are analyzed more in detail. Based on the results of those countries, conclusions specifically for countries with a significant share of intermittent renewable generation can be drawn. The variance of the renewable production itself is a major driver for price variance in 67 % of those countries. Time-wise correlation and interplay of intermittent renewable generation and load show a negative impact on price variance in 77 % of those countries in Europe.

The results allow for concluding remarks regarding the effect of the amount of intermittent renewable generation fed into the grid. It can be shown that there is a quadratic influence of the average residual demand, i.e. the average intermittent renewable generation, on the spot price variance. That means that very high as well as very low shares of average intermittent renewable generation can increase price variance significantly. Moderate amounts of intermittent renewable generation though can even lower price variance in the majority of those countries. As a consequence, there exists a phase of lower price variance on the path towards higher renewable generation shares in many countries. During this phase, price variance tends to be lower than at the beginning and towards the end of the expansion of renewable generation shares. This time period can be determined for each country using the empirical model.

Conclusions

In the current market design, price variance is an important trigger for investments to secure network stability like storage facilities, demand-side management, and flexibility measures. With moderate levels of intermittent renewable energies decreasing price variance in Europe, policy measures become necessary in addition to market-based incentives to ensure investments during those times. Otherwise, a sustainable realization of renewable energy targets might be at risk since the results confirm as well that high shares of intermittent renewable energies increase the spot price variance and require, therefore, those investments in network stability.

References

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