THE IMPACT OF CONVENTIONAL CAPACITY PHASE-OUTS ON FUTURE WHOLESALE PRICES IN CWE. ARE ELECTRICITY PRICES ABOUT TO RECOVER?

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Overview

Currently, European electricity markets face depressed wholesale prices as a consequence of (renewable) capacity increases at times with sluggish demand. In several countries, this situation resulted in the creation of generous capacity remuneration mechanisms (CRM), because markets no longer trigger any new investments. However, there are substantial explicit and implicit phase-out scenarios for old nuclear and coal capacity in the next ten years. Especially in Germany and the UK, a significant phase-out of old assets will take place while also smaller countries like Belgium and the Netherlands anounced phase-outs. At the same time, renewable generation capacity is expected to increase significantly as well as interconnection capacity. More countries start to experiment with demand response mechanisms and the share of electric vehicles (EVs) is expected to increase rapidly by 2030. This paper quantitatively estimates the effect of expected conventional capacity phase-outs in a changing landscape on future wholesale prices in Central Western Europe (CWE) . Obviously, general expectations about future electricity prices are of great importance for all involved stakeholders.

The effects of a coal phase-out on future wholesale prices in the Netherlands have already been studied through a similar modeling exercise by Seebregts (2013). Likewise, the market response on the nuclear moratorium in Germany has been examined by Thoenes (2011). However, a cross-national approach examining the future wholesale prices from a broader CWE-perspective seems to be absent in academic literature. Although an earlier study by Özdemir et al. (2008) looked at future wholesale prices in several Northwest European electricity markets, it does not focus on either the 2030 timeframe, or on the implicit and explicit capacity phase-outs that can be expected by then.

The input for our modelling exercise consists of a broad range of publicly available data on installed generation assets in CWE in 2015 as well as historic demand and weather data. For future years, we have gathered available estimates of generation capacity for the period beyond 2015 up to 2030, and complemented these with our own assumptions about the expected phase-outs of coal and nuclear capacity.

In order to construct realistic merit-order curves, we include the current and expected future fuel costs such as coal, gas and uranium, and we use the age of existing installations as a proxy for their relative efficiency (e.g. newer gas plants tend to be more efficient than old ones). To cross-check the accuracy of our marginal production costs, we compare our figures with publicly available material on clean spark spreads and clean dark spreads.

Methods

Our assessment is based on a scenario analysis to create an aggregated merit-order curve – adjusted for changes in interconnection capacity – and demand expectations. A sensitivity analysis is used to highlight the effects of different price affecting trends.

Our model-based assessment is constructed from a bottom-up perspective. First, we create an aggregated merit-order curve for the entire CWE production park (as if it were one large country), alongside aggregate demand. This allows the model to determine the intersections of supply and demand for every 15-minute interval. Each intersection consists of two data points: the quantity of electricity that was traded at that time (in MW), and the price it was traded at (in €/MWh). This rudimentary first step already allows us to test the fundamentals of the model, and generate some preliminary results with regard to the impact of the expected phase-outs.

In subsequent steps, we add more sophisticated details to the model in order to more accurately resemble realistic market behavior. The most important expansion is the modelling of congestions on the studied electricity network, both within CWE countries and between them (on the available interconnectors). Another detail that is added is the role of available storage capacities (mostly the readily available pumped-hydro facilities) on the market functioning within the CWE region.

Results

Our results support the hypothesis that prices are expected to rise as a result of the coal and nuclear phase outs. However, certain scenarios (e.g. weak demand and strong expansion of RES and import capacity) suggest that the price impact of even drastic phase-out plans could be limited.

Although our primary focus is to estimate the price effects of the expected capacity phase-outs, our analysis also results in a data-rich set of interrelated graphs. First and foremost, detailed merit-order curves are generated for any of the future time intervals (i.e. 2020, 2025 or 2030). Moreover, our scenario-based analyses allow us to make an assessment of different merit-order curves (and therefore different market outcomes in terms of quantity and price), according to different variations in assumptions about future fuel prices, installed capacities and levels of interconnection. Second, our model generates price-duration curves for the assessed years. These provide meaningful insight in the distribution of market price levels in specific future years. We compare these price duration curves with those resulting from similar modelling exercises, such as the scenario-based analyses by OECD/NEA (2011). Lastly, the model also generates classic load profiles for different timeframes (e.g. daily or weekly load profiles). These allow the reader to get a visual perspective on the expected typical generation profiles in the future scenarios.

Conclusions

The issue of depressed wholesale prices in CWE is likely to be a temporary phenomenon. The expected conventional capacity phase-outs taking place in the coming decade will have a positive effect on market conditions. Investments in new capacity may therefore be triggered by the market once more, instead of being artificially supported by capacity remuneration schemes.

References

OECD/NEA (2011) "*Nuclear Energy and Renewables. System Effects in Low-carbon Electricity Systems.*" Retrieved at: https://www.oecd-nea.org/ndd/pubs/2012/7056-system-effects.pdf.

Özdemir, Scheepers and Seebregts (2008) "*Future electricity prices. Wholesale market prices in and exchanges between Northwest European electricity markets.*" Energy Research Centre of the Netherlands. Retrieved at: http://refman.et-model.com/publications/1454/download.

Seebregts (2013) "*Effecten van versneld sluiten van de vijf oudste kolencentrales*" (in Dutch). Energy Research Centre of the Netherlands. Retrieved at: https://www.acm.nl/nl/download/bijlage/?id=11544.

Thoenes (2011) "*Understanding the Determinants of Electricity Prices and the Impact of the German Nuclear Moratorium in 2011*" Working Paper. Intsitute of Energy Economics, University of Cologne. Retrieved at: http://www.ewi.uni-koeln.de/fileadmin/user_upload/Publikationen/Working_Paper/EWI_WP_11-06_Understanding_electricity_prices.pdf.