

Analysing effects of short- and long-term uncertainty on capacity expansion in European electricity markets

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The EMPIRE model is a European multiscale power market model with investments towards 2050 as well as representative hours. It is well suited to capture operational uncertainty in generation from intermittent energy sources like wind and sun. In this paper we add long-term uncertainty to the formulation. The resulting models are large scale stochastic multi-stage recourse models with hundred of millions of variables. We present both solution methods and analysis of the most important factors.

In the short-run horizon, typical uncertainty is in load, intermittent generation and inflows to hydro reservoirs. Short-run sources of flexibility are regulated hydropower, storages, fossil generators and demand response. In the long run uncertain factors include learning curves, policy uncertainty, long-term commodity process and demand trends.

We look at the European level and analyze questions like to what extent the demand response potential can facilitate an optimal transition to an European low emission power system and how does long-term uncertainty affect the investments in renewables.