

PRICE DYNAMICS AND CAPACITY MECHANISMS IN A FULLY RENEWABLE POWER SYSTEM

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Extended Abstract

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Abstract Summary

Capacity mechanisms for electricity markets have been discussed extensively in the literature. In light of the power sector transformation to a fully renewable system, such mechanisms are again put on the agenda for systems that have so far relied on an energy-only configuration.

While there exists extensive literature on capacity markets in fossil and nuclear dominated systems, their analysis remains limited in a stochastic setting for fully renewable power systems.

We employ a multi-stage stochastic programming problem to model investments in a fully renewable power system for the target year 2050 in Germany. We then simulate optimal operation based on the actual realizations of historical weather years and compare two market design options to an efficient energy-only-market benchmark:

- An oversized capacity market, where a risk-averse agent procures more firm generation capacity than is efficient
- A capacity reserve where firm capacity is maintained outside of the market.

Contrary to a deterministic model intuition, prices are rather well dispersed regardless of the choice of capacity mechanism. In our model, the reason is that long duration storage operators bid according to their expected opportunity cost rather than marginal cost.

However, we argue that being risk-averse with respect to the procurement of firm generation capacity is not a costly mistake. Even if capacity markets were to enforce a significant over-procurement of firm generation capacity, overall system costs would only differ to a limited extent.

While not having significant impacts from an efficiency point of view, we find that enforcing high amounts of firm generation capacity has a strong cannibalization effect with respect to

short duration energy storage, namely batteries. In light of the limited effects on efficiency, we hence propose that the introduction of capacity mechanisms should be discussed more from a distributional point of view.

Presenting Author Biography

Maria Krzywnicka is a research assistant at TU Berlin.