

Optimal Price Design in the Wholesale Electricity Market

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NON TECHNICAL EXECUTIVE SUMMARY

The electricity market design set up after liberalization at the end of the 1980s has been founded on the principles of the economic merit order of the generation plants and of increasing marginal costs. In this way, plants that are less costly and therefore presumably more efficient are used first to satisfy the demand in every point in time. More costly plants are used only when needed, at times when peak demand occurs.

Such market design was set up when conventional thermal sources (CTS) were predominant in the market and renewable energy sources (RES) were only a small fraction of the total supply. The actual configuration of the electricity markets is profoundly different from the ideal framework envisioned in those times. There is a growing conflict in the market among CTS and RES that goes beyond the desirable degree of competition and risks to endanger the entire market structure. The actual market design is not conducive to catalyzing the correct price signal for future investments and does not take into account welfare considerations.

In this paper, we construct an optimal price design mechanism to determine the equilibrium in the day-ahead electricity market, specifically aimed at solving the uncomfortable conflict between CTS and RES. The optimal design determines the zonal prices in an organized electricity market.

Our proposal for a new market design is based on three main pillars. We state pro-competitive incentives to CTS participation in the market. We take into full account the opportunity cost of RES for society and propose correct price signals on the demand side through an optimal Ramsey pricing scheme.

We propose a new and comprehensive set of rules for determining the efficient equilibrium price in the market, labeled New Electricity market Design (NEMD), accounting simultaneously for the existence of supply market power, line congestion, RES abundance and heterogeneity of buyers' behavior.

The NEMD is centered on the concept that the true long-term opportunity cost of RES for the society should be used to determine the equilibrium market price. We deem that if appropriately computed, the Levelized Cost of Energy (LCOE) can represent such a long-term opportunity cost for each RES.

We simulated our proposed scheme for the Italian market in 2013 and obtained overall savings for the consumer in the order of 10%. This is the most important empirical result, which shows that it is possible to improve the efficiency and welfare of the electricity market. Further research could include the electricity markets of other countries to empirically assess the extent of the benefits accrued to final consumers.

The most important policy implication is that an efficient solution is viable in the energy-only market, disposing of the distorting RES subsidy system. In addition, our results show that there is not necessarily any need to resort to additional market complications, such as the creation of a capacity market.

Finally, our proposal avoids the distorted signal of zero price of RES. We restore the possibility of providing an adequate market signal to guide profitability for both the conventional fossil-fueled generation and new RES development in the long run.