

# **Residual demand models for strategic bidding in European power exchanges: Revisiting the methodology in the presence of a large penetration of renewables**

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**Abstract—** In the deregulated framework in place in most power systems, a significant part of the energy is traded through auctions on day-ahead markets where agents submit bids to either buy or sell energy. When defining a bidding strategy, generators usually resort to models that anticipate and simulate agent interactions. The residual demand curve (RDC), a well-known approach to representing competitor behaviour, enables generators to formulate effective oligopolistic strategies.

One way to estimate and build an RDC is to use information available about other agents' bids on previous and comparable days as a reference. This basic approach to market modelling has proven useful in the past in European power exchanges. In the current context, however, characterised by substantial market penetration on the part of non-dispatchable renewable resources, the suitability of this method of RDC building may need to be tested.

This paper first analyses how the results of day-ahead auctions on European power exchanges have been affected by the growing penetration of renewable energy. It then questions both the use of RDC as an approach in this changing context and the aforementioned simplified estimation method to compute these curves. The discussion is illustrated with empirical evidence from the Iberian market.

**Index Terms—** Electricity market; Power exchange; Strategic bidding; Residual demand curve; MIBEL

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