Justification and Specification of a Maximum Balancing Energy Price

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Requirements on balancing energy markets and prices

- The design of the balancing energy market shall support the „efficient functioning of the market" (EB Regulation, Article 30(2)).
- Balancing energy prices are intended to "give correct price signals and incentives to market participants" (EB Regulation, Article 30(1)(d)).
- Balancing energy prices are the main component for determining imbalance prices (ACER 18-2020 I, Article 9). Imbalance prices are intended to "reflect the real-time value of energy" (Recital 17, EB Regulation).

Demand and supply considerations

1. Balancing energy prices should be allowed to raise at least to the level of prices at the day-ahead and intraday markets.
   - Balancing energy prices below intraday market prices create incentives not to avoid imbalances while attracting little supply of balancing energy.
   - Thus, the maximum balancing energy price should be above the maximum prices at those markets, that is above 9,999 Euro/MWh. (Recital 71 ACER 01-2020 argues similarly.)
2. The demand side should not pay more than the “maximum electricity price that customers are willing to pay to avoid an outage”, i.e., the value of lost load (VoLL) (definition of the VoLL taken from Electricity Regulation 2(9)).
   - Thus, the imbalance price imposed on the BRPs should not exceed the VoLL.
   - The VoLL is to be determined for each bidding zone at least every five years (Electricity Regulation 11(2)).
   - Recent estimates of the average VoLL in European countries suggest a range between 7,500 and 25,000 Euro/MWh (CEPA 2018, VVA et al. 2018).

As a first reference point these two considerations suggest a limit price for balancing energy between 10,000 and 25,000 Euro/MWh.

Auction-theoretic assessment of a limit price

- Identify bidding incentives in the balancing energy market
- Assess the impact of a limit price

Incentives induced by marginal pricing

Marginal pricing leaves room for strategic considerations.

- Marginal pricing is sometimes said to incentivise truthful bidding independent of beliefs, that is, the energy bids are equal to the costs of energy provision and are independent of BSPs' beliefs about their competitors' bids.
- This, however, holds only under the following conditions (Krishna, 2009; Haufe and Ehrhart, 2018), which do not apply to balancing energy markets (Ocker et al., 2018):
  - lowest-rejected-bid pricing rule,
  - goods are homogenous,
  - each bidder supplies a single unit (i.e., submits one bid),
  - the auction is a one-shot game.

Therefore, balancing energy auctions do not incentivise truthful bidding, optimal balancing energy bids are belief-dependent, and bids will be sensitive to details of the design.

Rational motives for exaggeratedly high balancing energy bids

Rational motives for exaggeratedly high energy bids in balancing energy auctions:

(1) **Multi-unit-supply BSPs**: BSPs that participate with several generation units have an incentive to exaggerate in their bids the costs of their expensive generation units to increase the marginal price. This particularly applies to multi-unit BSPs with a large market share (Ehrhart et al., 2021; Haufe and Ehrhart, 2018; Ausubel et al., 2014).
This incentive is enhanced if the bids for the more expensive units have a less attractive merit order position in a pricing period due to the lower activation probability.
Because the incentive to exaggerate differs for a BSP's bids, this bidding behaviour promotes inefficiency (Noussair, 1995; Engelbrecht-Wiggans and Kahn, 1998).

(2) **Regular repetition of the balancing energy auctions under similar conditions and short validity period of bids (15 min.)**: These factors incentivise tacit collusion: submission of exaggeratedly high bids in order to coordinate the regularly participating BSPs on a high bid level (Berninghaus and Ehrhart, 1998; Fudenberg and Maskin, 1986; van Damme, 1991). Tacit collusion is eased by the short validity period of bids because the negative effect for the BSP if the high bid is not awarded or is not/rarely activated is weaker than with a long validity period (Ehrhart et al., 2021).

Such bids put efficiency of the market at risk and prevent that prices reflect the real-time value of energy.

Further rational motives for high balancing energy bids

Opportunities or restrictions due to other markets, regulations, or technical requirements can incentivise high bids:

- Costs for **capacity provision** (including costs for must run, ramping costs, opportunity costs) may increase balancing energy bids of BSPs that did not participate in a capacity market (including the case that a capacity market does not exist).
- **Release of non-awarded energy bids** (design option in EB Regulation, not mandated): This feature creates opportunity costs and incentivizes the BSPs to increase their energy bids above the level without this feature (Ehrhart et al., 2021).
- **Desire for low or no activation** for operational reasons. High bids are submitted in order to be at the end of the merit order.

Positive effects of mitigating exaggerated bids for balancing energy by a limit price

A limit price for energy bids

- reduces incentives to raise bids far above costs of energy provision,
- reduces the financial risk for the BRPs,
- is an appropriate means to reduce incentives for tacit collusion and the exertion of market power,
- thereby contributes to giving correct price signals and incentives to market participants (as required by EB Regulation, Article 30(1)(d)) and
- can have a positive influence on efficiency (as required by EB Regulation, Article 30(2)). The positive effect on efficiency realises if inefficiencies caused by non-monotonic distortions of bids relative to the underlying costs are reduced (Bresky, 2013).
- Additionally, a (temporary) limit price may help to alleviate transition problems of the new balancing energy markets by providing a security against the negative effects. Examples:
  - IT problems when determining and implementing the merit order, resulting in a loss or replacement of bids in the merit order.
  - Outage of generation units that should be activated.
  - Exaggeratedly high bids submitted by inexperienced bidders (Hortaçsu and Puller, 2008).

Negative effect of imposing a limit price on bids for balancing energy

- A limit price for balancing energy bids may reduce participation by BSPs that instead make use of their outside option of participating in a different market or stay out of all markets. To the extent that the capacity put out to tender cannot be fully awarded, this may decrease efficiency.

Evaluating the trade-off of positive and negative effects

The positive effects appear to predominate because the negative effect of reduced participation can be countered by the following two arguments:

- Very high bids are unlikely to be due to high physical costs of energy provision. Thus, non-participation by BSP with low capacity provision costs like extra-marginal generation units, which do not have opportunity costs, is not to be expected.
- The risk of having low participation in the balancing energy market is mitigated by the existence of balancing capacity markets. If high bids in the balancing energy market are due to a large share of BSPs with high capacity provision costs (such as opportunity costs), these BSPs should participate in the balancing capacity market, which is better suited for the remuneration of capacity provision (Ocker et al., 2018).

Thus, if exaggeratedly high bids put efficiency of the market at risk and prevent that prices reflect the real-time value of energy, a limit price will have a positive effect. The risk that the negative effect on efficiency materialises is low and can be mitigated by a capacity market.

Choosing a limit price

- In theory and practice of auctions, a limit price is an established means to implement the principle of optimisation between overall efficiency and lowest total cost, which is mandated in EB Regulation, Article 3(2)(c).
- We considered a range for a maximum balancing energy price of 10,000 to 25,000 Euro/MWh.
- For the auction-theoretic reasons and considerations on the trade-offs given before, the positive effects of an ambitious limit price appear to outweigh the risks that the negative effects may materialize.
- Therefore, an ambitious limit price in the lower half of the above range, that is, a limit price between 10,000 Euro/MWh and 17,500 Euro/MWh, is recommended.

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