

Bidding and Investment in Wholesale Electricity Markets

Pay-as-Bid Versus Uniform-Price Auctions

Bert Willems¹ Yueting Yu²

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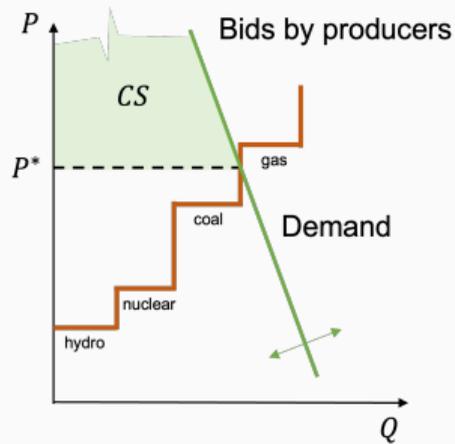
¹Tilburg University, Toulouse School of Economics and CERRE

²Tilburg University

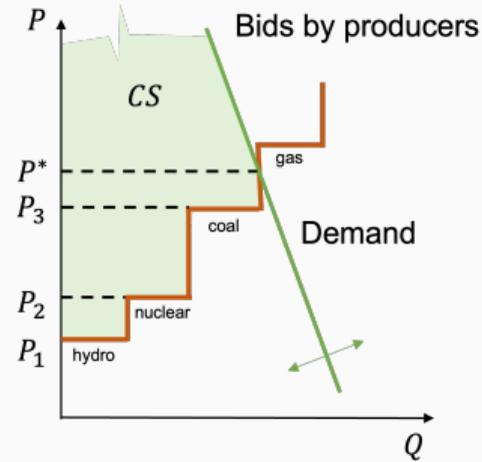
Wholesale Electricity Markets

- Some policy makers suggest to change design of day-ahead market

(a) A uniform-price (UP) auction
(Pay as Clear)



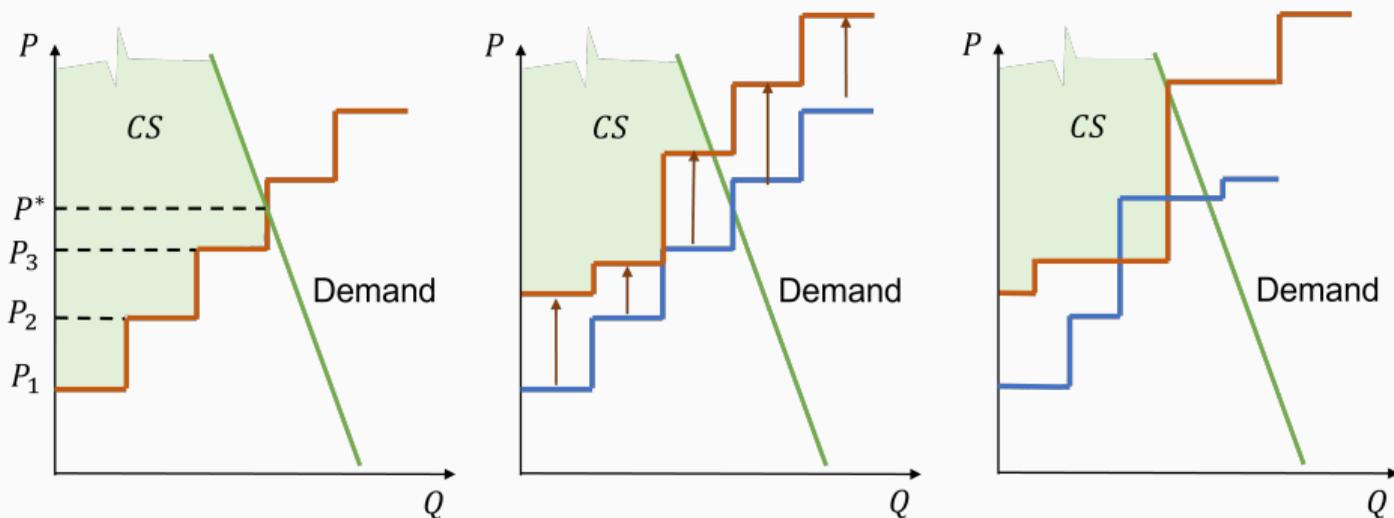
(b) A pay-as-bid (PAB) auction.



- PAB lowers payments and increases CS?
- PAB decouples payments from cost of marginal technology?

This is not obvious

- Players adjust strategies
 - Bids above marginal cost
 - Investments change



- Single good: Revenue equivalence. We need a model for multiple goods.

We compare Uniform and Pay-as-bid pricing.

- We construct a variant of a **monopolistic competition** model
 - Atomistic firms face trade-off between profit margin and being in the market
 - Free entry: all firms make zero profit in long run
 - Cost heterogeneity: continuum of generation technologies (from base-load to peak-load).
 - Uncertain and elastic demand and long-lived bids
- Results:
 - PAB: bid = levelized cost ($MC + FC/\text{capacity factor}$)
 - UPA: bid = marginal cost (MC)
 - Lower CS under PAB
 - Less baseload capacity but same total capacity
- Robustness:
 - Inelastic demand or short-lived bids \rightarrow PAB = UPA

- Uniform price auctions have other benefits than modeled above:
 - Liquid reference price for financial contracts,
 - Easier to bid (firms only need to know their own cost),
 - No benefits for larger firms with informational advantage.
- Empirical evidence on spot market outcomes. What matters?
 - Market fundamentals (technology, demand elasticity, costs),
 - Market structure (horiz.= number of firms, vert. = long-term contracts),
 - NOT market design → no effect.
 - (Evans and Green, 2005, Borenstein et al., 2008)

- Discussion on UPA is not new → economists need to reeducate politicians and journalists
 - England and Wales market (2001): Ofgem considered switching to pay-as-bid in New Electricity Trading Arrangement (NETA).
 - California Power Exchange (2000) assessed whether implementing pay-as-bid in day-ahead market could combat the high price: introduce inefficiency in dispatch and weaken competition.
- Instead of spot market design, discuss long-term contracts
 - True decoupling of energy bills.
 - Conjecture: Differences in spot market design matter less.
 - Benefits on market power in spot market

Are there any good arguments left for Pay-as-bid?

- **Illiquid and immature markets:** pay-as-bid provides more predictability and legal certainty to bidders. BUT: trust in auctioneer can be solved with transparency.
- **Heterogeneous goods:** Pay-as-bid is often used in **balancing market** to allow for out-of-merit activation. However, there exist uniform price auctions that take into account imperfect substitutes (cf. flow-based market coupling), and out-of-merit activation might lead to the missing money problem.
- **Continuous trading:** For fast adjustment to news, but only after a uniform price auction sets the reference price at opening of market and often with market makers that guarantee liquidity.
- **Market Power:** PAB might reduce abuse of market power, if demand uncertainty is large, demand elasticity small and bids are long-lived. However, there might be better measures to deal with market power (contracting, monitoring, bid mitigation, horizontal measures, remove entry barriers).

Recommendations for a Future-Proof Electricity Market Design

with Catherine Banet, Chloé Le Coq, Nils-Henrik von der Fehr, Michael Pollitt, Bert Willems

Brussels - 16 December 2022 - Hybrid

<https://cerre.eu/events/future-proofing-europes-electricity-market/>