

A more efficient procurement mechanism for reserve capacity

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The German electricity market

- Spot- and Forward markets
 - Gate Closure (t-45min)
 - Balancing market
- Procurement auctions for reserve capacity

Introduction

Literature

Pay-as-bid VS Uniform

Vickrey

Conclusion

Procurement auctions for reserve capacity

- TSO specifies amount of capacity (in MW)
- Suppliers submit bids (in €/MW)
- TSO chooses lowest bids
- Suppliers are paid their bid

→ Pay-as-bid design is inefficient!

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Selected Articles

- H. Chao, R. Wilson, „Multi-Dimensional Procurement Auctions for Power Reserves“ , *Journal of Regulatory Economics*, 22(2), 2002
- L.M. Ausubel, P.R. Milgrom, „The lovely but lonely Vickrey auction“ , in: *Combinatorial Auctions*, MIT Press, 2006
- A.E. Kahn, P. Cramton, R.H. Porter, R.D. Tabors, „Uniform Pricing or pay-as-bid pricing: A dilemma for California and beyond“ , *The Electricity Journal*, 14(6), 2001
- D. Harbord, C. McCoy, „Mis-designing the UK electricity market?“ , *European Competitive Law Review*, 21(5), 2000

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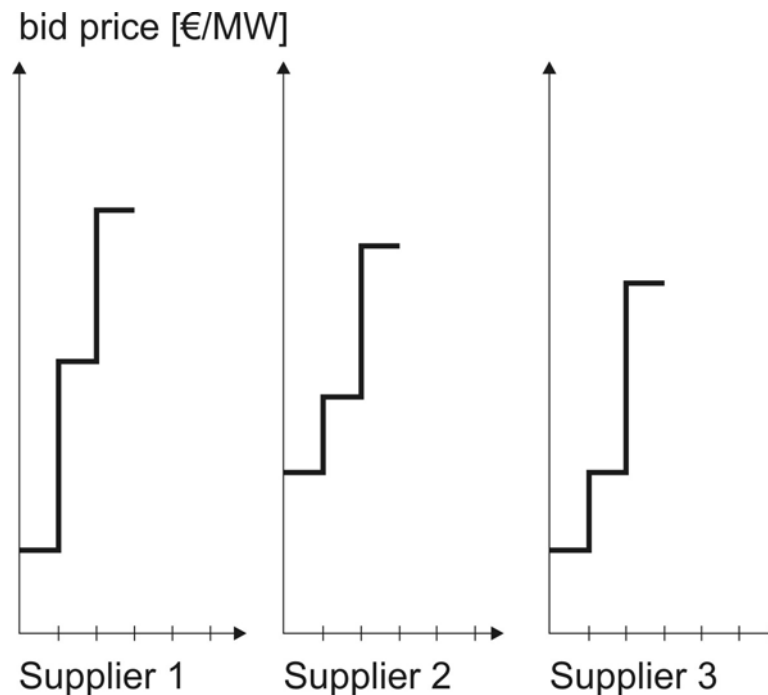
Conclusion

The pay-as-bid auction

- Every winning bidder receives his own bid
- Pro-Arguments
 - Low revenues to the bidders = low procurement cost to the TSOs
 - Market power (no system price)

The pay-as-bid auction

- An example: TSO wants to procure 5 MW, 3 bidders, 3 bids each



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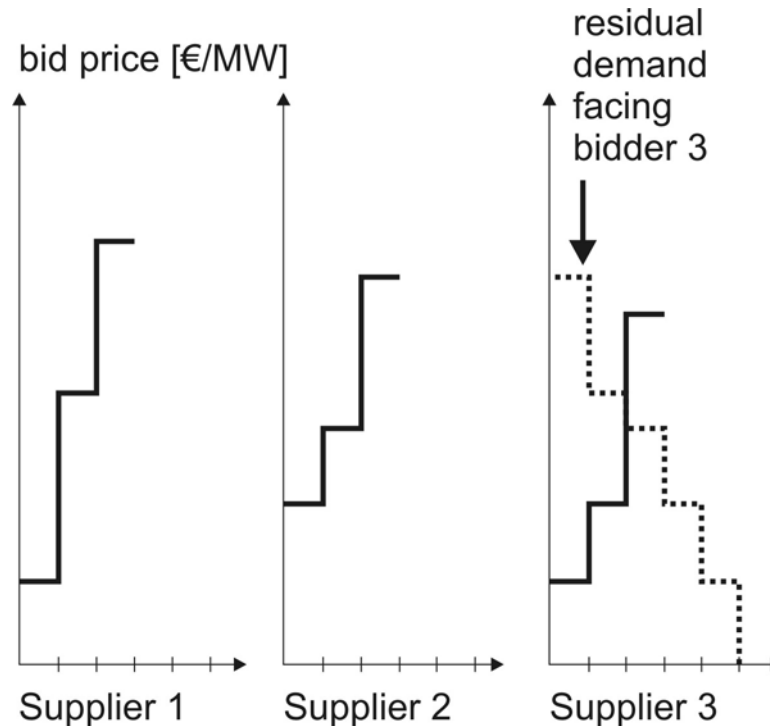
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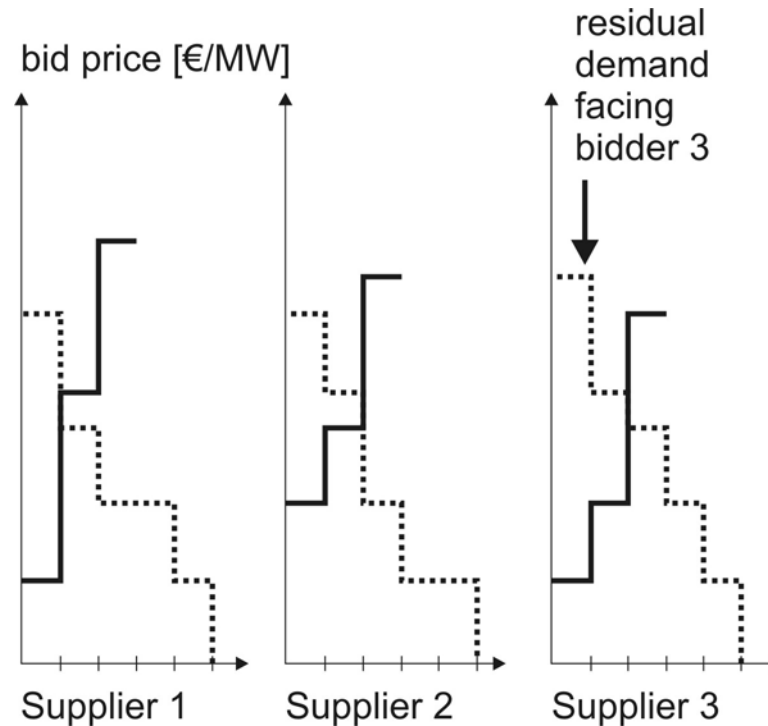
The pay-as-bid auction

- An example: TSO wants to procure 5 MW, 3 bidders, 3 bids each



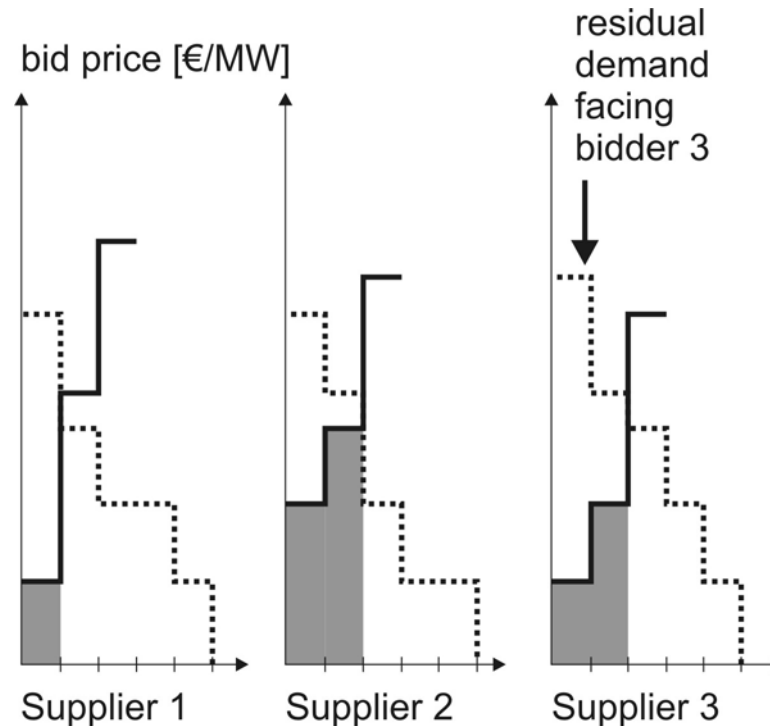
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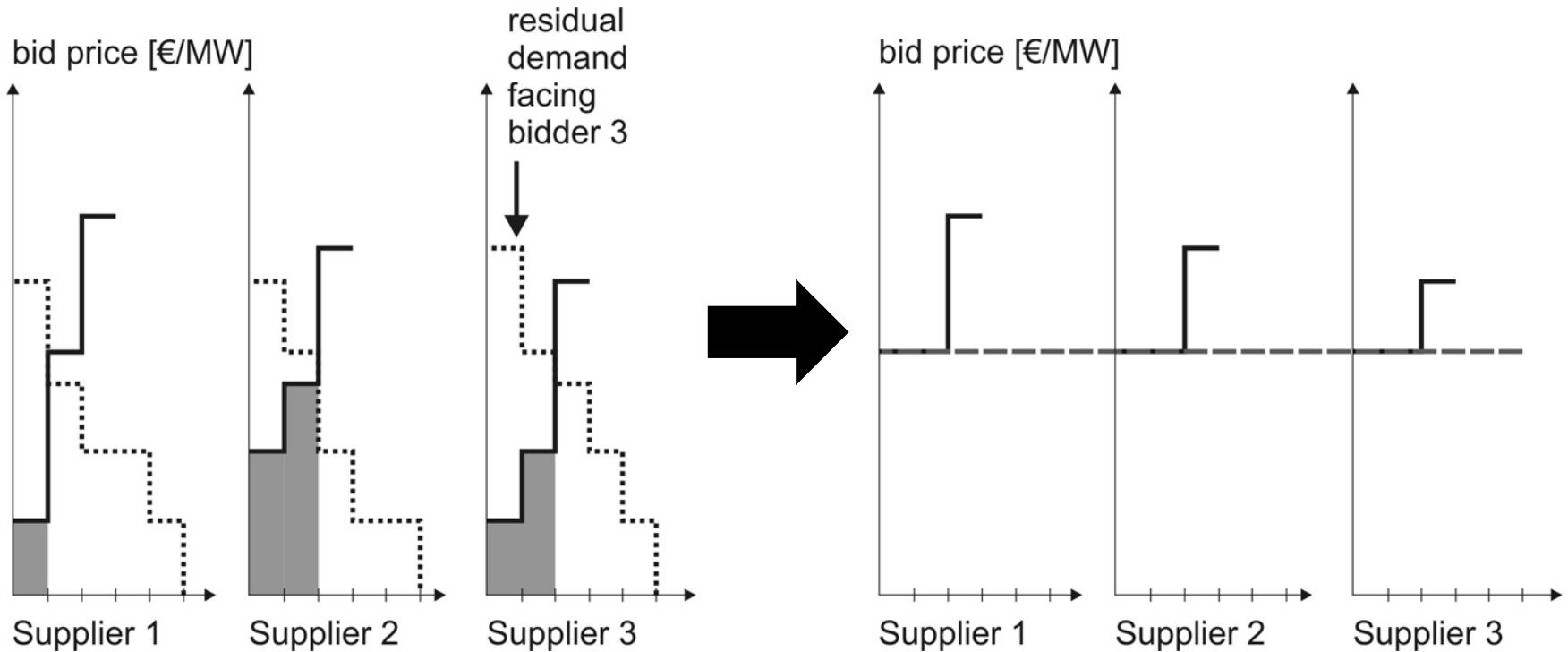
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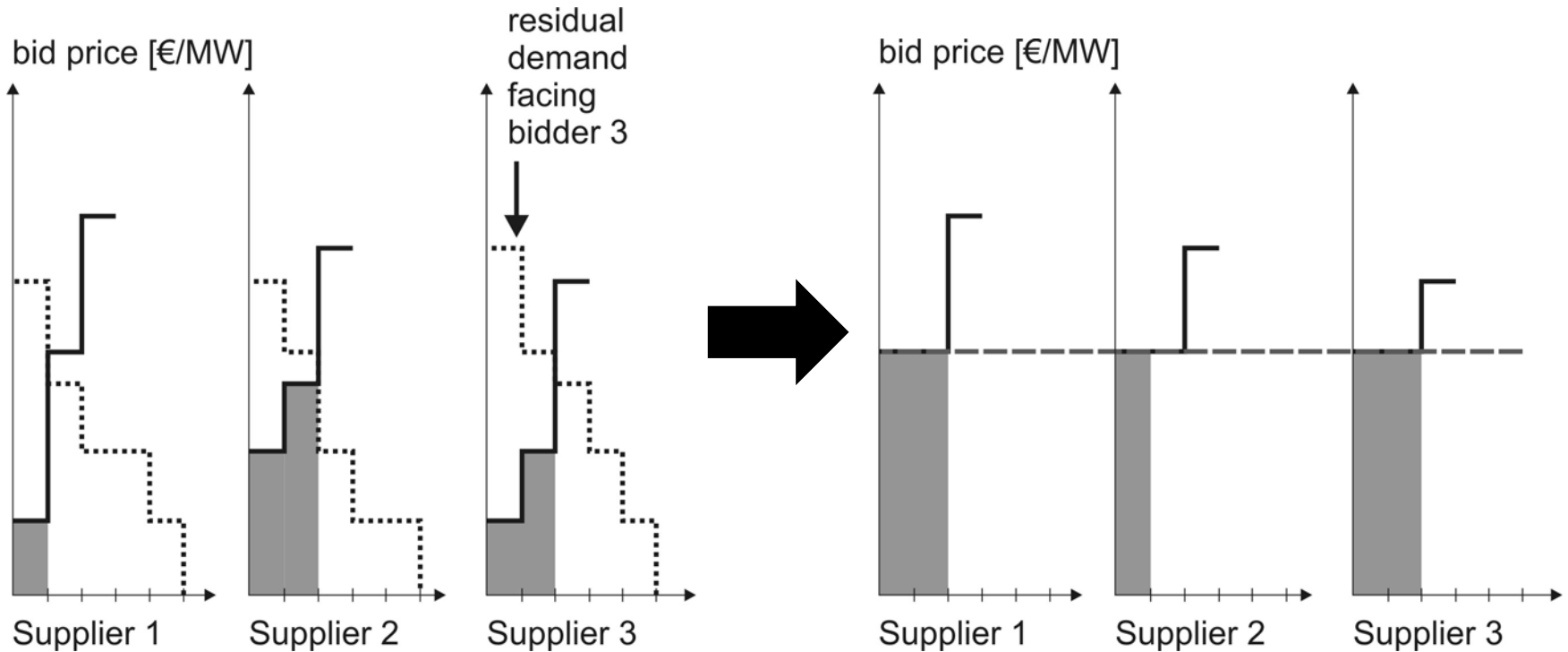
The pay-as-bid auction

- Certainty



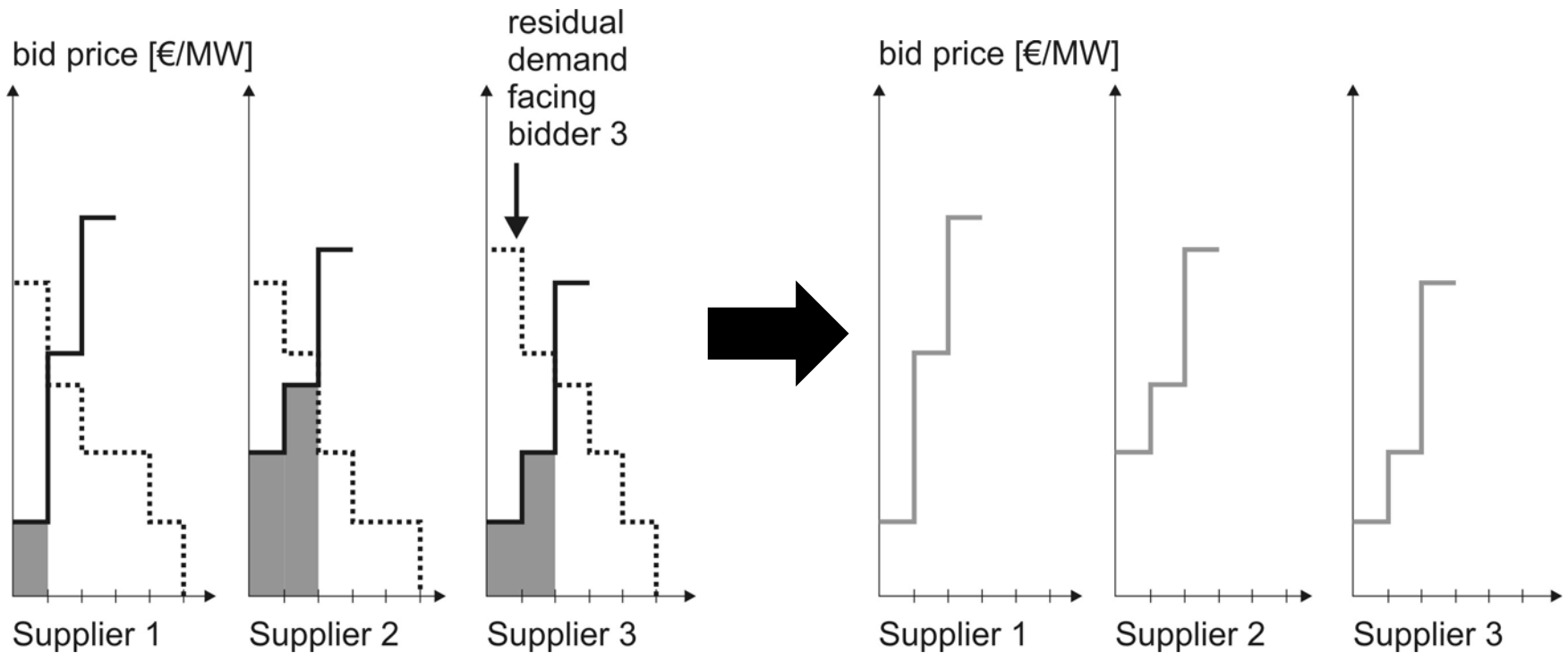
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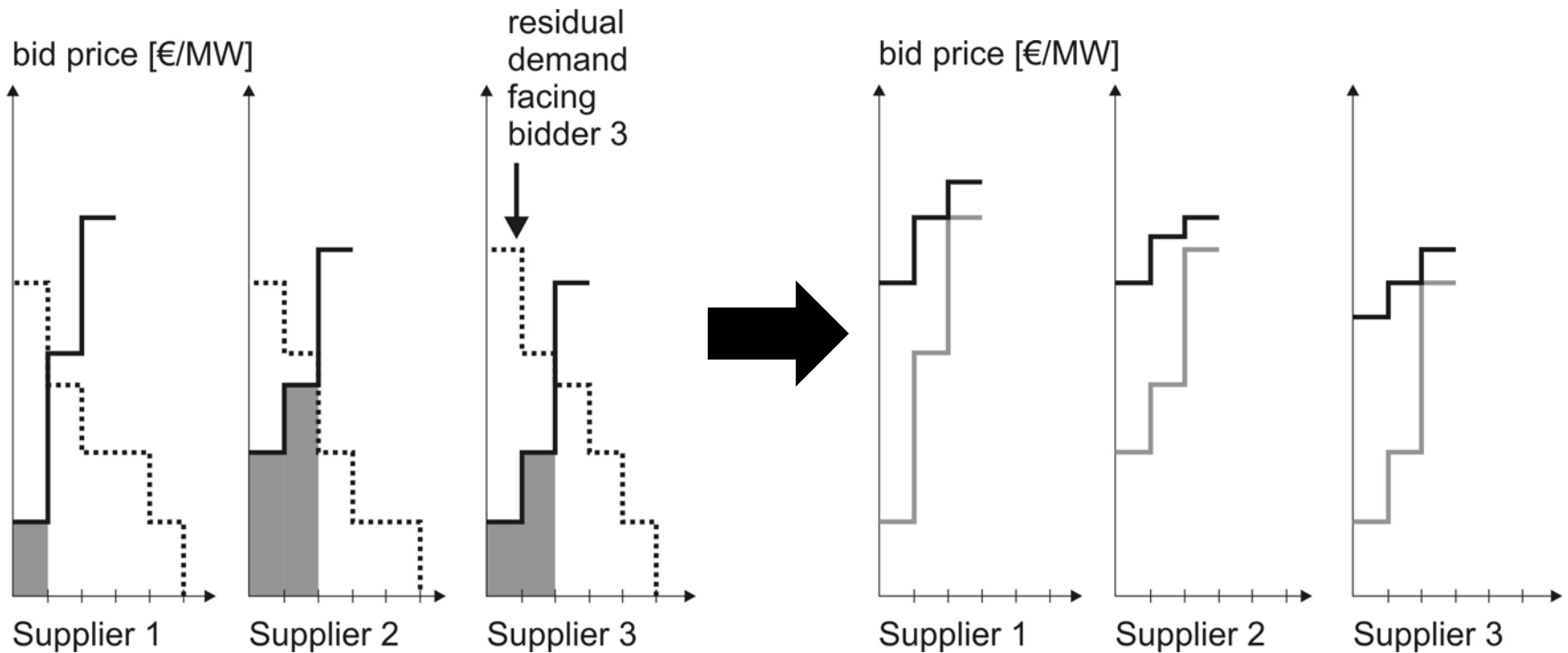
The pay-as-bid auction

- Uncertainty



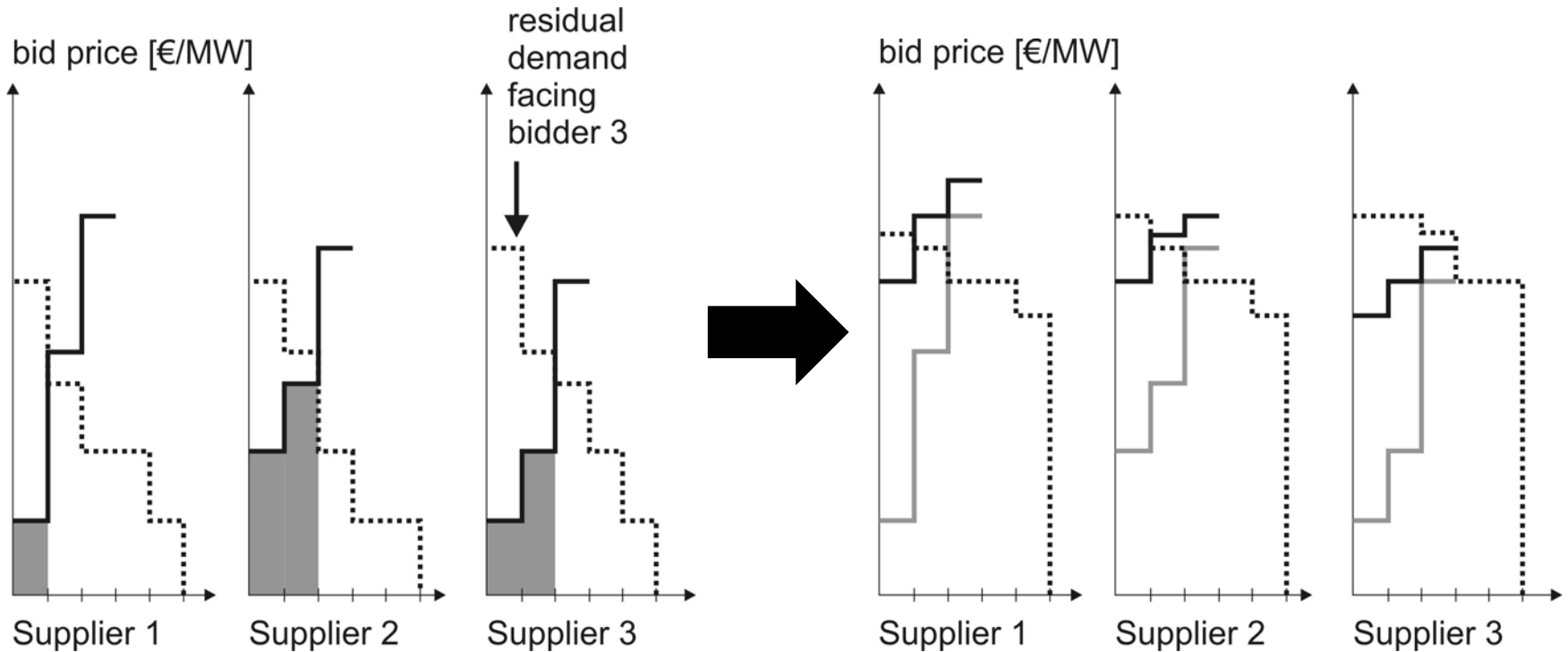
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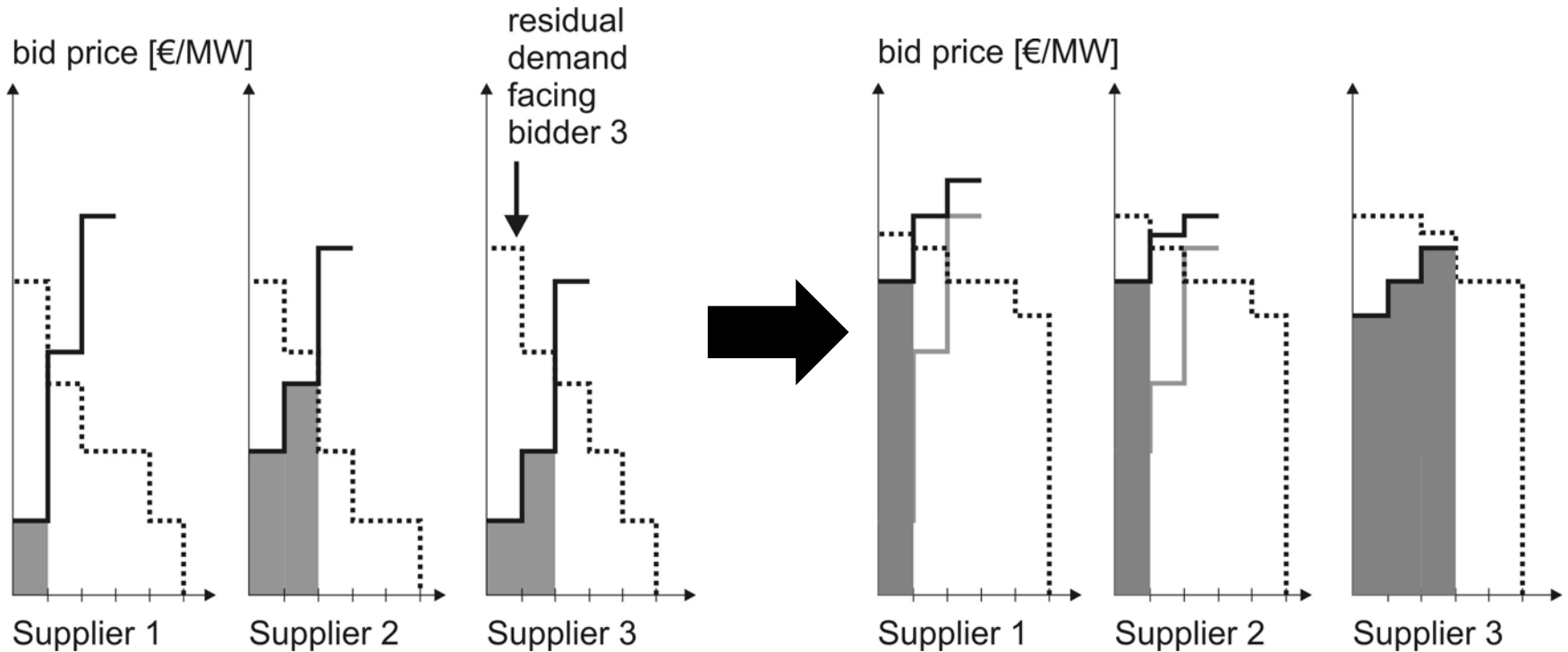
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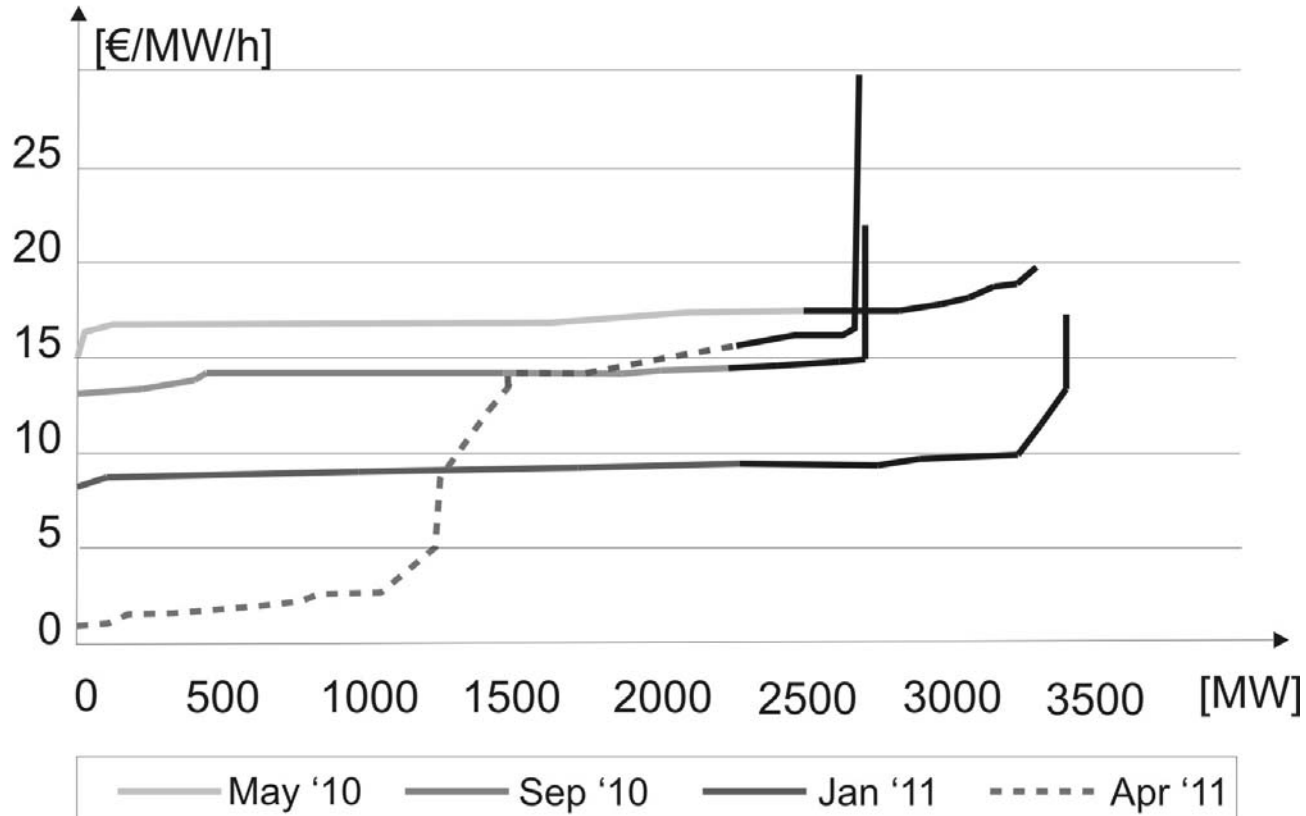
The pay-as-bid auction

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The pay-as-bid auction

- Historical Observations: Pos. secondary, peak time



The pay-as-bid auction

Conclusion

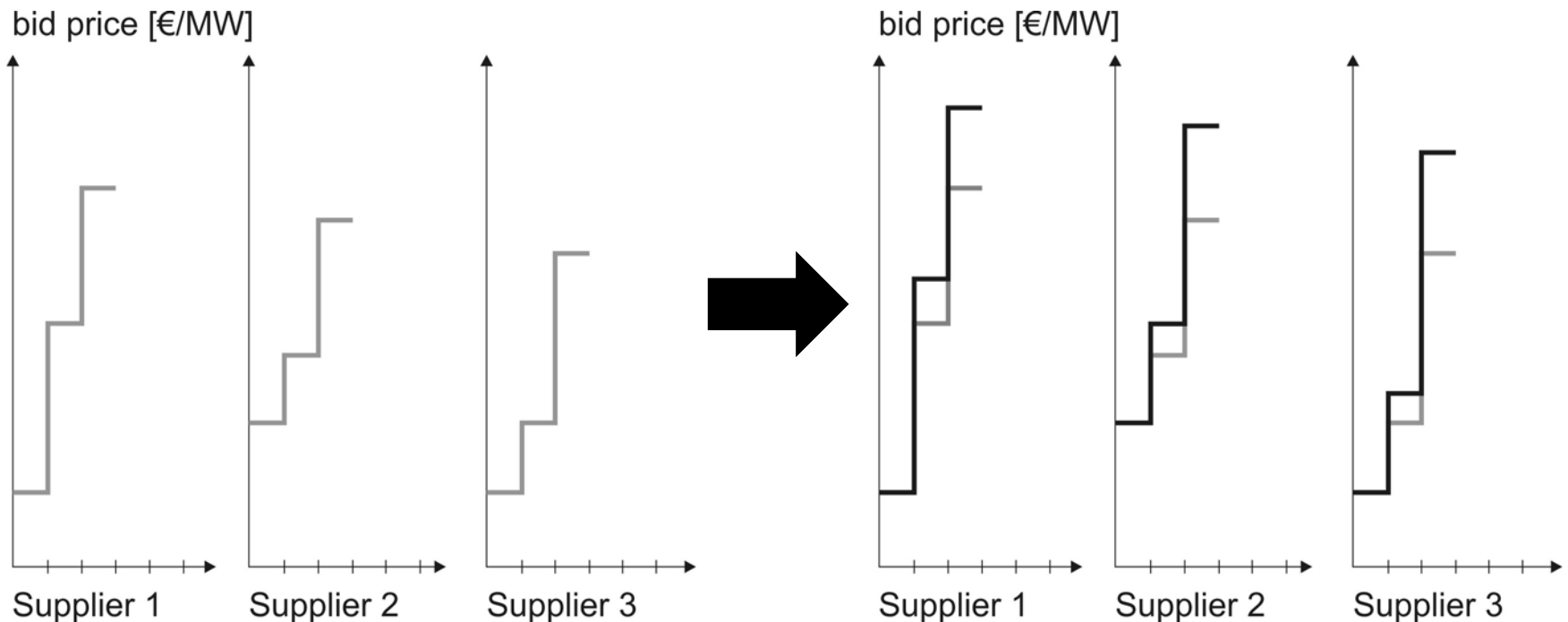
- Bidders need bidding strategy for each bid in each auction
- Strategizing is expensive!
- Inefficient allocation
- Procurement cost: All bids above actual costs
- Market power: Large bidders have economies of scale (strategizing, portfolio optimization)

The uniform-price auction

- Every winning bidder receives the marginal bid
- Gaming is possible, since own (rejected) bid may be system price
- Strategy: Truthful reporting for first item, shading for subsequent items

The uniform-price auction

- Every winning bidder receives the marginal bid



The uniform-price auction

- Every winning bidder receives the marginal bid
- Gaming is possible, since own (rejected) bid may be system price
- Strategy: Truthful reporting for first item, shading for subsequent items
- Procurement cost: System price manipulated
- Market power: Large suppliers can manipulate system price, but small bidders benefit, too.

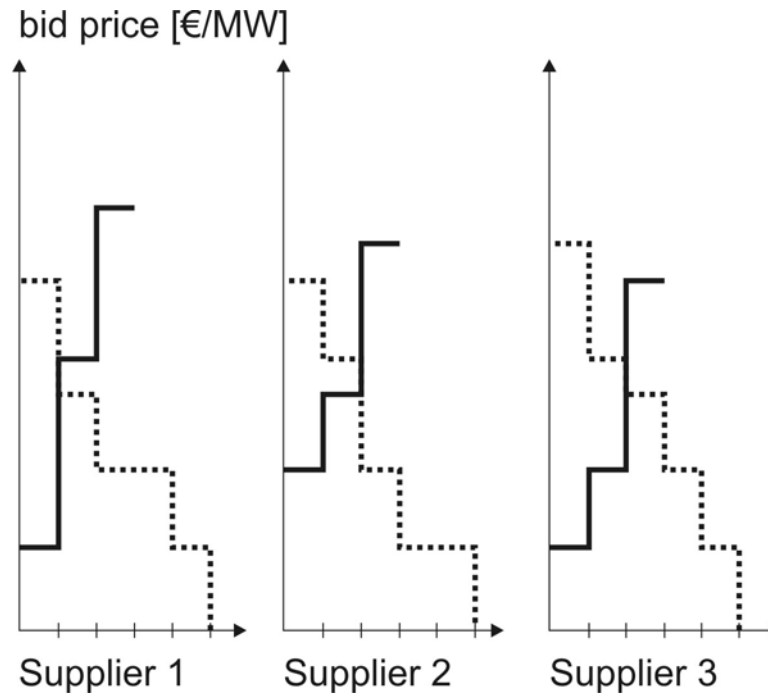
Pay-as-bid VS. uniform-price auction

Conclusion

- Efficiency: Neither efficient, ranking ambiguous (Ausubel/Cramton 2002)
- Procurement Cost: No significant difference (Malvey/Archibald 1998)
- Market power: Ranking ambiguous (Kahn/Cramton/Porter/Tabor 2001)

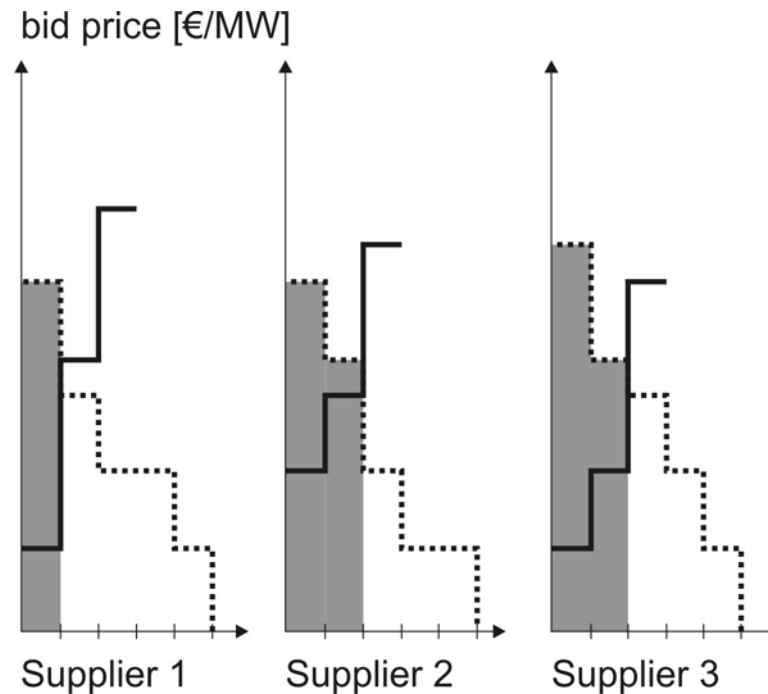
The Vickrey auction

- Every winning bid is paid the bid it has beaten



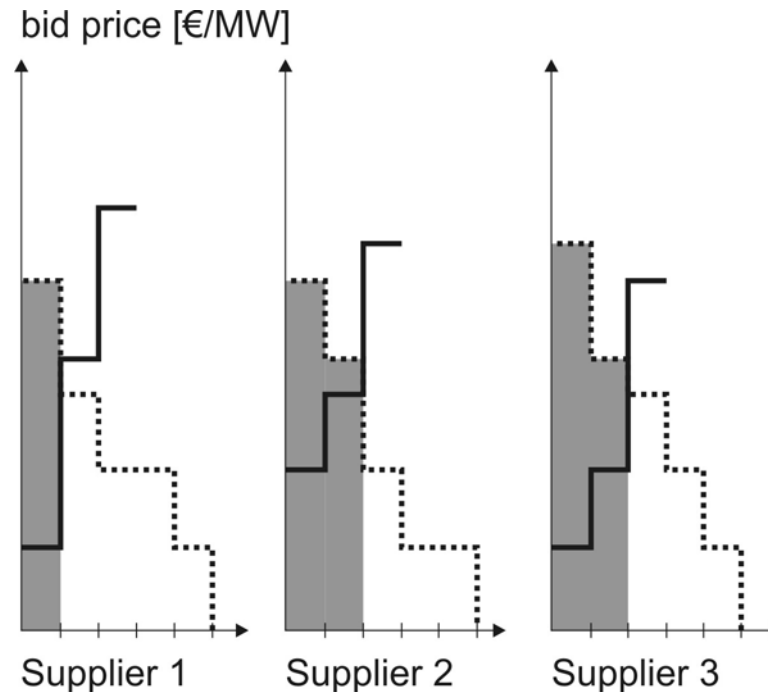
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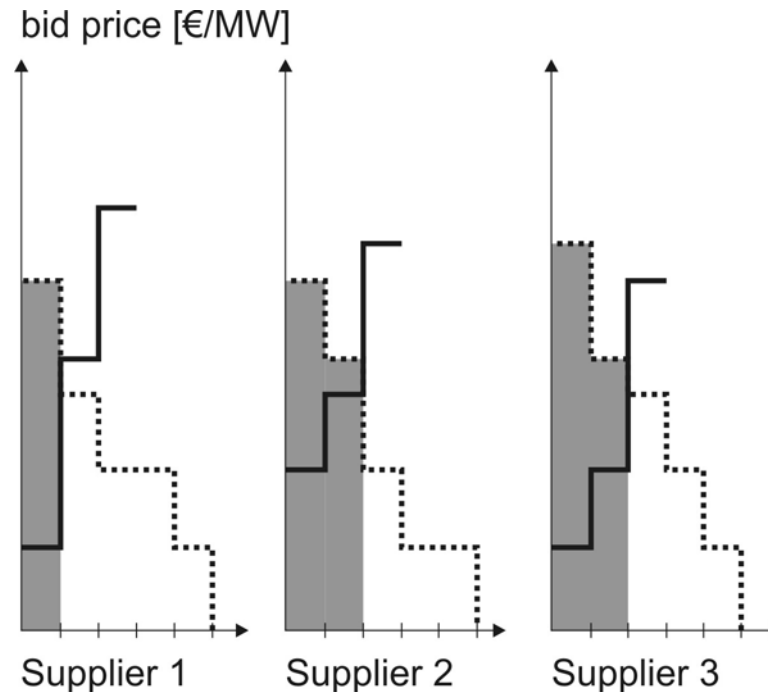
The Vickrey auction

- Why is it efficient?
 - Revenue is not affected by own bids



The Vickrey auction

- Why is it just?
 - Every bidder is awarded the amount saved by his participation



The Vickrey auction

- How to implement it?
 - Just change payment rule from PAB to Vickrey
- What the critics say
 - High revenue to big suppliers (pivotal suppliers?) → Would be a problem in current design, too
- Why is it rarely used?
 - Critical assumptions (n.p. in reserve procurement auction)
 - Auction theory rather new subject (Milton Friedman wrongly inferred that multi-unit, uniform-price auctions were efficient)

Conclusion

- PAB: Play „guess the marginal price“ or bid aggressively
- Uniform: Play „manipulate marginal price“
 - Inefficient allocation
 - Resources wasted due to strategizing
 - Market power issues
- Vickrey
 - Efficient allocation
 - No cost for strategizing
 - Fair distribution, but possibly (not certainly) higher procurement costs

Thank you very much!

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