

# The role of smart bids in the development of demand-response in spot markets

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# Background on electricity markets

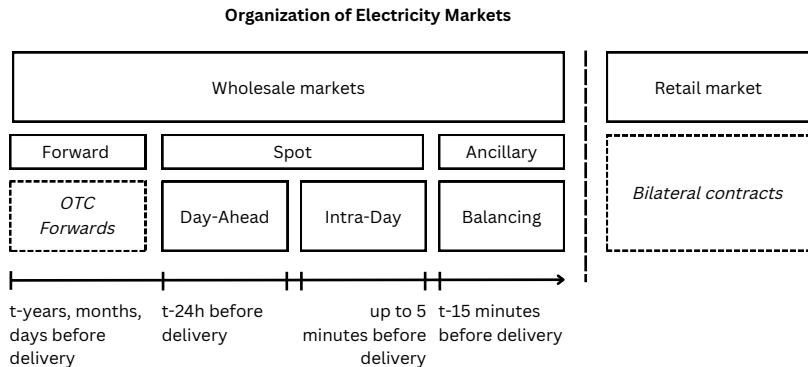


Figure: Organization of European electricity markets

# Motivation

1. Demand-side participants are assumed almost inelastic in the wholesale market. In Liu, Holzer & Ferris (2015), 98% of bids submitted by demand-side participants are price-taking bids, i.e., inflexible bids.<sup>1</sup>
2. A market design is complete (perfect) if there is a product and market for every possible state of nature, fitting participants' preferences perfectly. Electricity markets are inherently incomplete: the choice of bids and markets is limited (Wilson, 2002).

To what extent is this inelasticity inherent to consumers, rather than due to the impossibility for consumers to express their flexibility?

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<sup>1</sup>In most of US spot markets, simple or block bids with a price cap are the only other accepted type of bid.

## Research Question

There are two factors necessary to observe flexibility on the market:

- ▶ Participants can convey (and value) their willingness to be flexible to the market, only if they are able to *communicate* it to the market operator using the bid format (Nisan, 2005).
- ▶ It must be *profitable* for them to do it.

Electricity markets are organized as combinatorial auctions, i.e., it is possible to submit a joint bid for several hours of the day. In theory, it enables consumers to convey the *complementarity* of their consumption across a day. Furthermore, the implementation of smart bids enables consumers to convey the *substitutability* of their consumption across a day (ex 2).

Research question: What bids are demand-side participants using on the spot market? What is the "latent" flexibility and to what extent is it enabled by the current offer of by types?

Relevance: market efficiency, improved price signals, market power mitigation (Strbac et al., 1996).

## Example of a smart bid

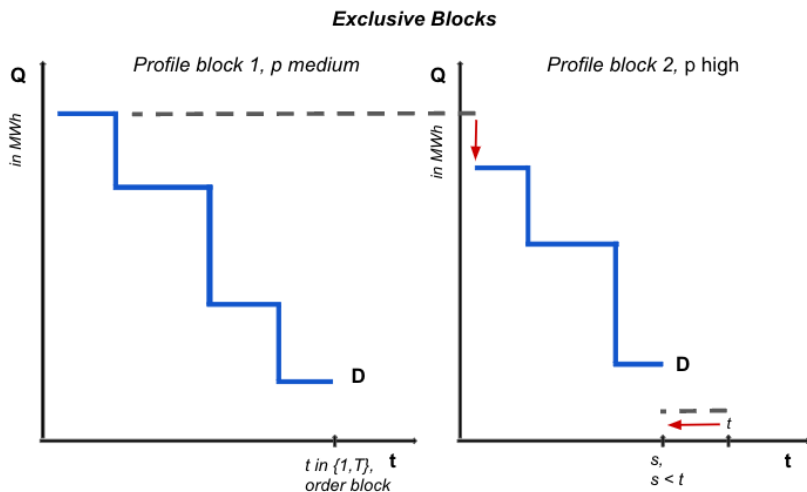


Figure: Exclusive Blocks

At most one of these profile blocks is accepted by the algorithm. The criteria is welfare maximization, including consumer surplus.

# Identification strategy for DSF potential I

Empirical strategy: observation of bidding behavior by demand-side participants on the spot and balancing market.

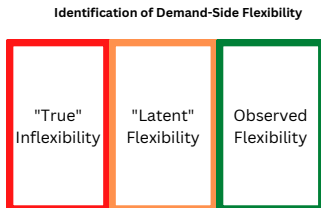


Figure: Identification of DSF potential

- ▶ Use existing smart bids to identify profitable flexible strategies for consumers, given current market design.
- ▶ However, only partial identification of true DSF possible, as we cannot observe profitable strategies for bid types not available on the market.
- ▶ Differentiation between true inflexibility, latent and observed flexibility using bids in simultaneous markets.

## Identification strategy for DSF potential II

Daily auctions for day-ahead and balancing (FCR, aFRR, mFRR), in which large consumers can participate (since 2018 for balancing).

In balancing, large consumers indicate their flexibility (ramping constraints, maximal consumption reduction/increase<sup>2</sup>) for the next day.

- ▶ Consumers participating in balancing auctions reveal their flexibility for the next day.
- ▶ If those consumers participate in the spot market as well, the difference in flexibility expressed in the spot market might be identified as latent potential.
- ▶ To attribute it to an incomplete market design, I need to evaluate the profitability of expressing this flexibility using existing bids.

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<sup>2</sup>Only one product remunerates for consumption reduction.



# Conclusion

To what extent is this inelasticity inherent to consumers, rather than due to the impossibility for consumers to express their flexibility?

Identification of the potential for demand-side flexibility relies on:

- ▶ Inherent elasticity: Identification of "true" inflexibility by analyzing consumption and bidding behavior during price spikes in 2021-2022. Controlling for long-term hedging is necessary.
- ▶ Identification of latent flexibility due to missing bid types by comparing profitability of "new" or modified bid types, conditional on balancing participation.

Another path of research is to consider the impact of the introduction of smart bids between 2014 and 2018 on consumers' bidding behavior.

Further research into market entry from large consumers is also relevant (selection of flexible consumers on observables).

Thank you for your attention!

Any Questions?

## References

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