CHAIRE EUROPEAN ELECTRICITY MARKETS

Working group C - International Benchmark

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CHAIRE EUROPEAN ELECTRICITY MARKETS

Lessons from Experience with Renewables Tenders in Europe: Emerging Trends and Best Practices in Auction Design

(Some initial observations)

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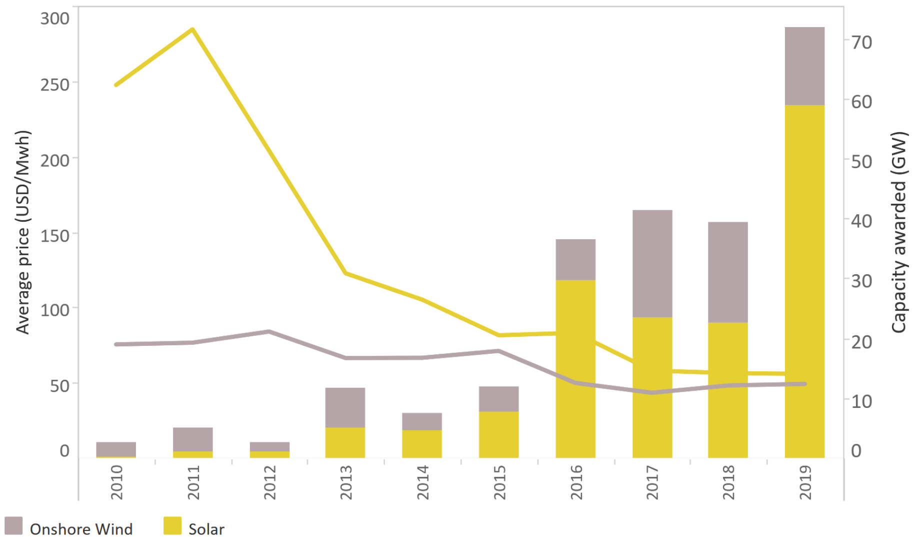
Context

- Auction schemes have become a standard policy for stimulating investment in renewable energy (RES-E):
  - In Europe: 20 countries have implemented an auction for RES development
  - In 2019: 34% of the PV capacities (ground-mounted) have been installed through auctions in the world (IEA-PVPS, 2021)
  - Besides, there is an increasing trend in RES auctions:



Source: IRENA Database, n.d., based on BNEF, 2019a and PSR, n.d.

Context

- Auctions have become the main support policy for two reasons:
  1. The RES-E are not competitive compared to the conventional power plants. An additional and secured support is needed to trigger RES-E development and so, to reach the RES-E national developments goals
  2. The need to develop these technologies in a cost-efficient way by allocating the contracts to the most competitive actors

- Auction as a hybrid scheme: the government sets the volume auctioned and designs the auction to meet a specific goal

- If well designed, auctions:
  – Avoid asymmetric information: dynamic of generation costs
  – Increase competitive pressure, hence reduce the rents to the generators of renewable energy
  – Facilitate entry of new players

Context

- The ultimate question: do renewable energy auctions deliver an efficient outcome?

- **A ”proper” cost-benefit analysis** requires to go through the nitty-gritty auction design details

  -For example, under-bidding could be limited by screening participants and imposing financial and physical pre-qualification requirements and penalties

  -or allowing under-bidding could be a way to stimulate entry

- **The choice in auction design** has a critical impact on the outcome and depends on trade-offs (del rio, 2017; IRENA, 2015):
  - Allocative efficiency vs cost-efficiency
  - Entry barriers vs competition

- **An wrong design** can lead to strategic behaviour:
  - Underbidding in case of low auction volumes with low prequalifications and a high grace period (Matthaüs, 2021)
  - Overbidding in case of high auction volumes and frequency (Haelg, 2020)

Project

- **Our research question**:
  - Which are the designs currently in place and for which targets?
  - Which similar features across auction design patterns?
  - What are the impacts of the auction design on the bidders?

- **Method**:
  - Auction design in Europe: cluster analysis through regression trees
  - Impact of the auction design on the bidders: literature review, empirical analysis (still in debate)

- **Data**: AURES database contains auction design in Europe from 2011 to 2020

Auction design

- 2 categories of design elements:
  - Elements associated to the product auctioned: auction product/ single vs multi-techno / location specificity / Size specificity
  - Elements related to the allocation process and the contract

➡ We focus on the second category because they have an impact on the bidders

Element design of an auction (based on Haelg, 2020)

Auction Scope					
Auction product	Auction volume and frequency	Single vs multi-unit auction	Technology focus	Location specificity	Size specificity
Qualification requirement					
Material prequalifications	Financial prequalifications	Bid bond	Completion bond		
Allocation process					
Auction format	Pricing rule	Award criteria	Ceiling/Floor price	Quotas	Boni/Mali & Favourable treatment
Contract design					
Remuneration Scheme	Support duration	Specific limit	Penalty	Realization period	

Literature review

Impact of auction design on:

- effectiveness and cost-efficiency:
  - Del rio (2017); Haelg (2020): analyze trade-off for each design element on different criteria (effectiveness, cost-efficiency, competitiveness, actor diversity…)
  - Kreiss et al. (2017) focus on the prequalifications and penalties
  - Haufe and Erhart (2018) focus on pricing rule (pay-as-bid vs pay-as-clear)

- strategic behaviour
  - Matthäus et al. (2021): optimal bidding strategy considering real option approach
  - Voss and Madler (2017): Compare optimal bidding between pay-as-bid and uniform pricing

- financial conditions and cost-of-capital:
  - Dukan and Kitzing (2021): perform interview to assess impact of auction design on bidders
  - Neuhoff et al. (2018): impact of the remuneration scheme on risk investment

Literature review on auction design

Auction volume and frequency	High levels lead to a lack of competition (submitted/awarded capacities) and high bids. Can be mitigated with low ceiling price	(del Río, 2017)
	Increase probability of winning and higher competition levels	(Kreiss et al., 2017)
Prequalifications (material and financial) and guarantees	Discourage some actors and increase costs of participation. But can increase competition by favoring stronger bidders	(del Río, 2017)
	An average increase of about 40 percentage points in realization rates when introducing one or both pre-qualification types	(Matthäus, 2020)
Ceiling price	Higher participation but weaker actors	(del Río, 2017)
Realization period	Underbidding if there are no penalties	(del Río, 2017)
	Underbidding because lower expected costs	(Matthäus et al., 2021)
Penalties	Lower participation	(del Río, 2017)
	Increase effectiveness	(Matthäus, 2020; Matthäus et al., 2021)

Gap in the literature

- Focusing on each element design seems insufficient to evaluate the whole impact of the auction design on the bidders.
- The negative impact associated to an element design can be offset by other elements.
- Our aim is to have a deep understanding of the impact of the design elements on each other.
- At the moment, we have focused on 3 potential groups:

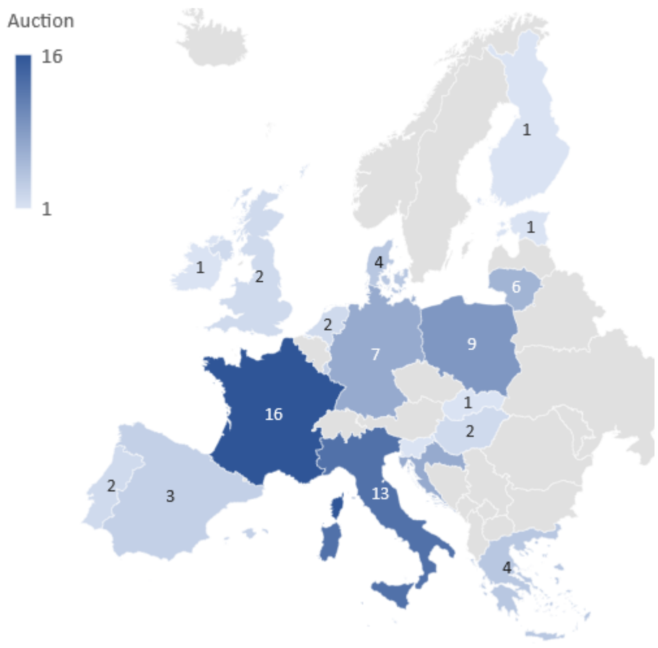
Group	Design elements	Impact on bidders	References
1	Auction volume Auction frequency Ceiling price level	Participation	(del Río, 2017)
2	Guarantee level Penalty Realization period	Participation and costs	(Đukan and Kitzing, 2021) (Matthäus et al., 2021)
3	Remuneration scheme Support duration Limits on support	Financial conditions	(Kitzing, 2014; Neuhoff et al., 2017)

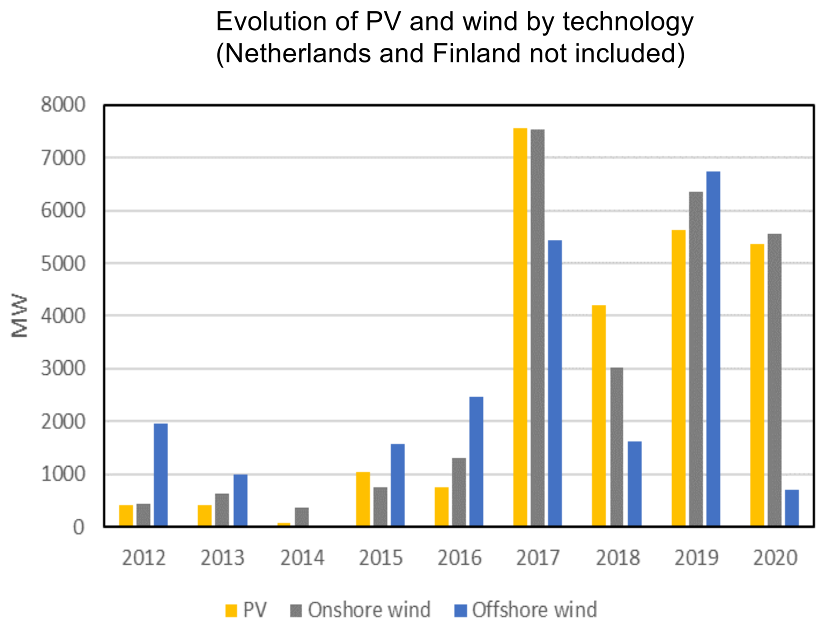
AURES Database

- more than 30 design elements for 20 European countries from 2011 to 2020 :
  - **Auction scope**: auction volume (MW, MWh, €) / format / techno specificity / auction schedule
  - **Qualification requirements** : material / financial / bid bond
  - **Allocation process**: pricing rule / ceiling price / award criteria (price or multi-criteria)
  - **Contract design**: remuneration scheme / support duration / penalties
- Observations on submitted/awarded capacities and price, as well as min and max price
- 26 technologies are available:
  - PV + onshore wind = 53% of the observations
  - Few observations for biomass, wave, wind and hydropower (repowered), bioliquid…

Descriptive Statistics

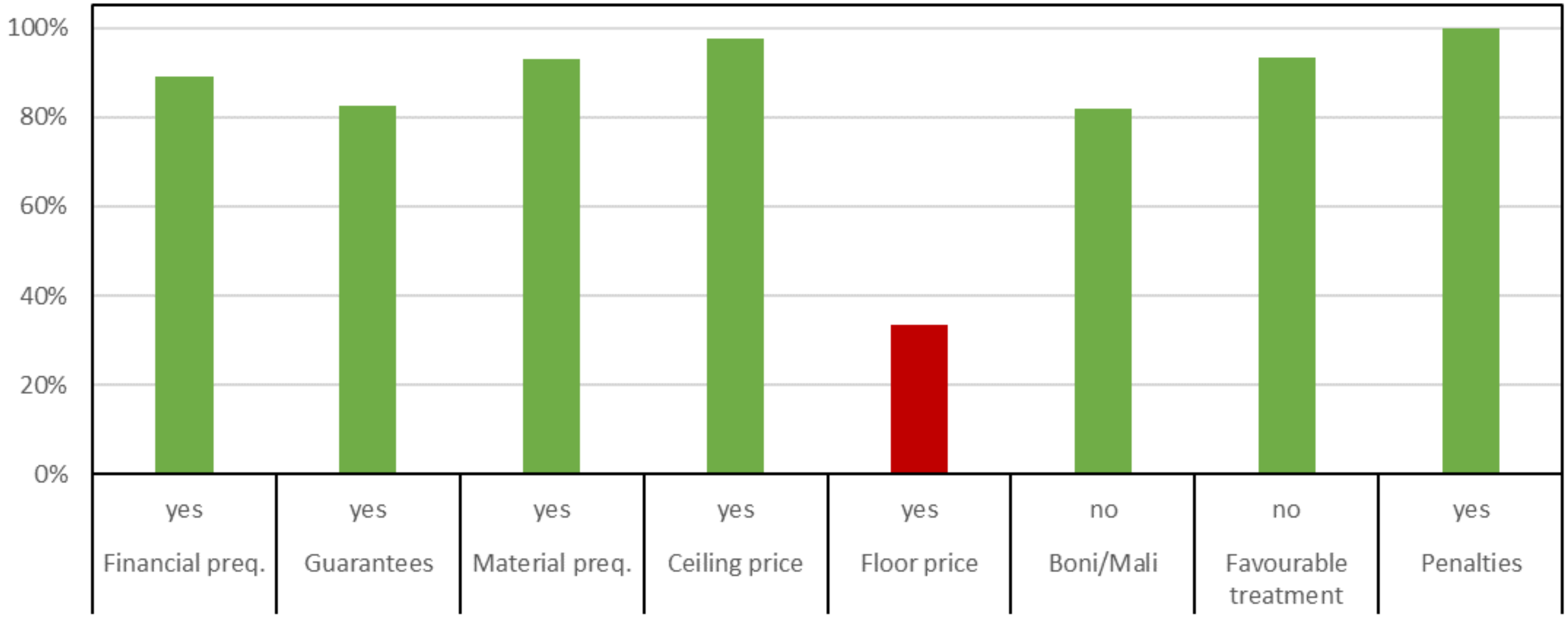
- Auction definition: specific technology and specific size band for a given country. We do not consider all the rounds because it would bias the auction design comparison.
- There are 86 auctions, the frontrunners being Netherlands, France (2011), Italy (2012) and Lituhania (2013). The auctions mainly involve PV and Onshore wind.





Common design elements in EU's auctions

- The choice in design elements is similar in Europe (except floor price)

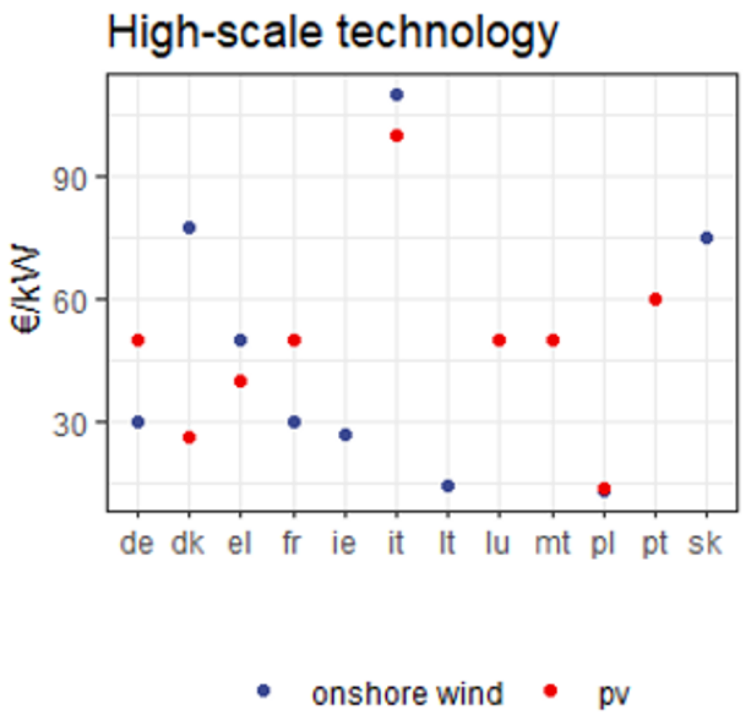


But the level of the design elements diverges between countries

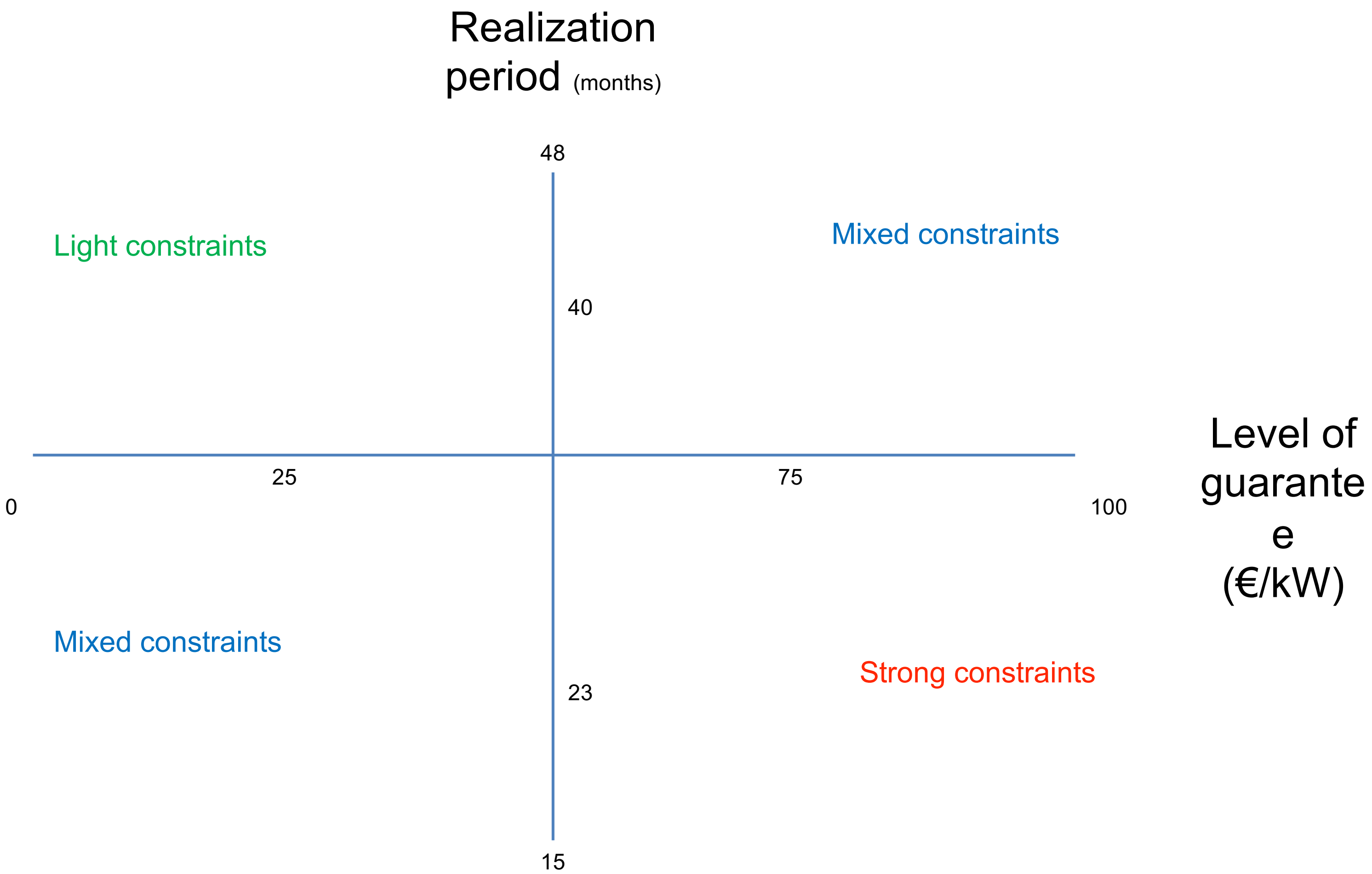
- Even if the choice in design elements is the same, there is a discrepancy in the levels of those elements.

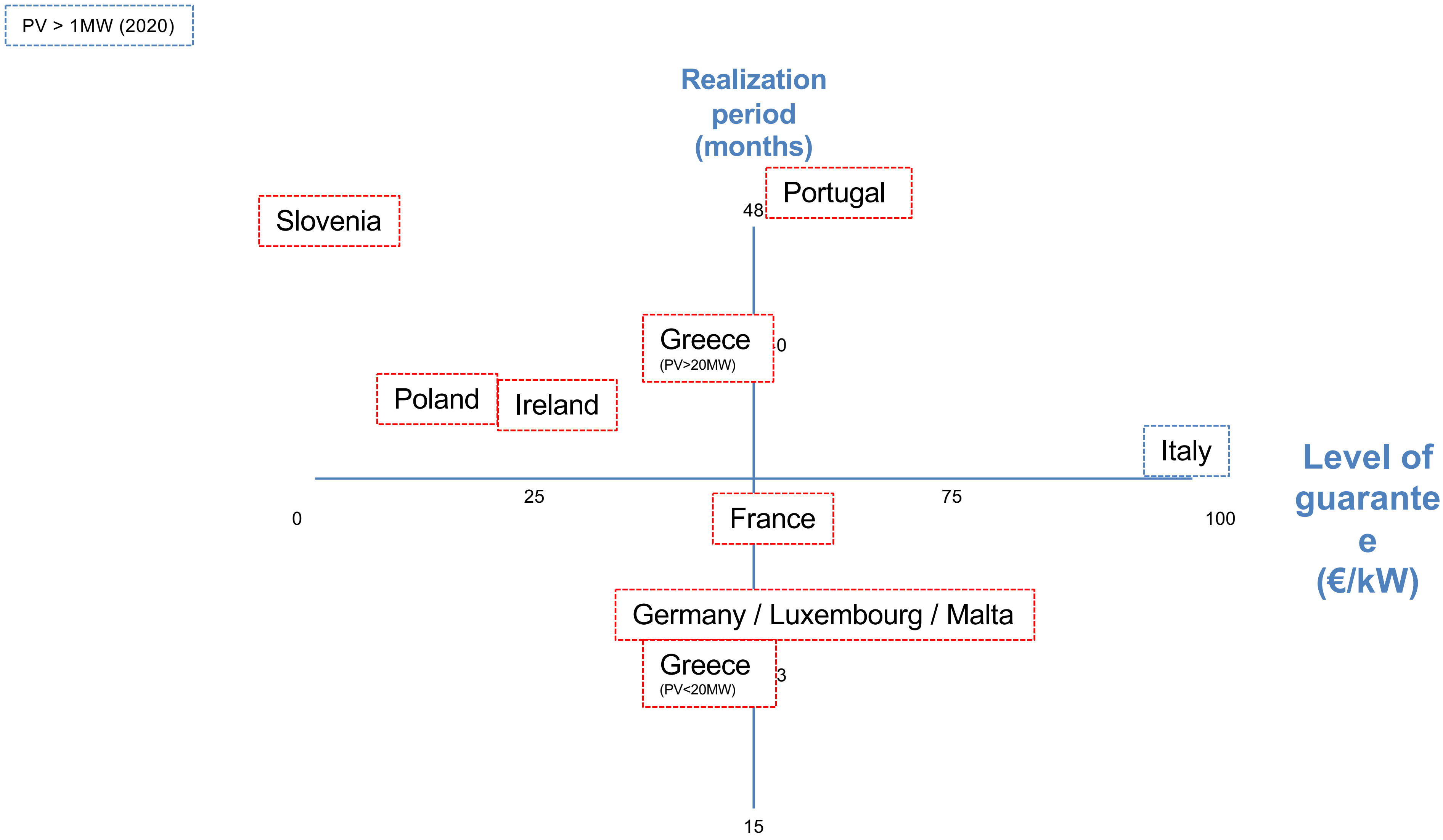
For instance, the level of guarantees required by the auctionners in 2020:

- About 100€/kW in Italy
- 13.4€/kW in Poland

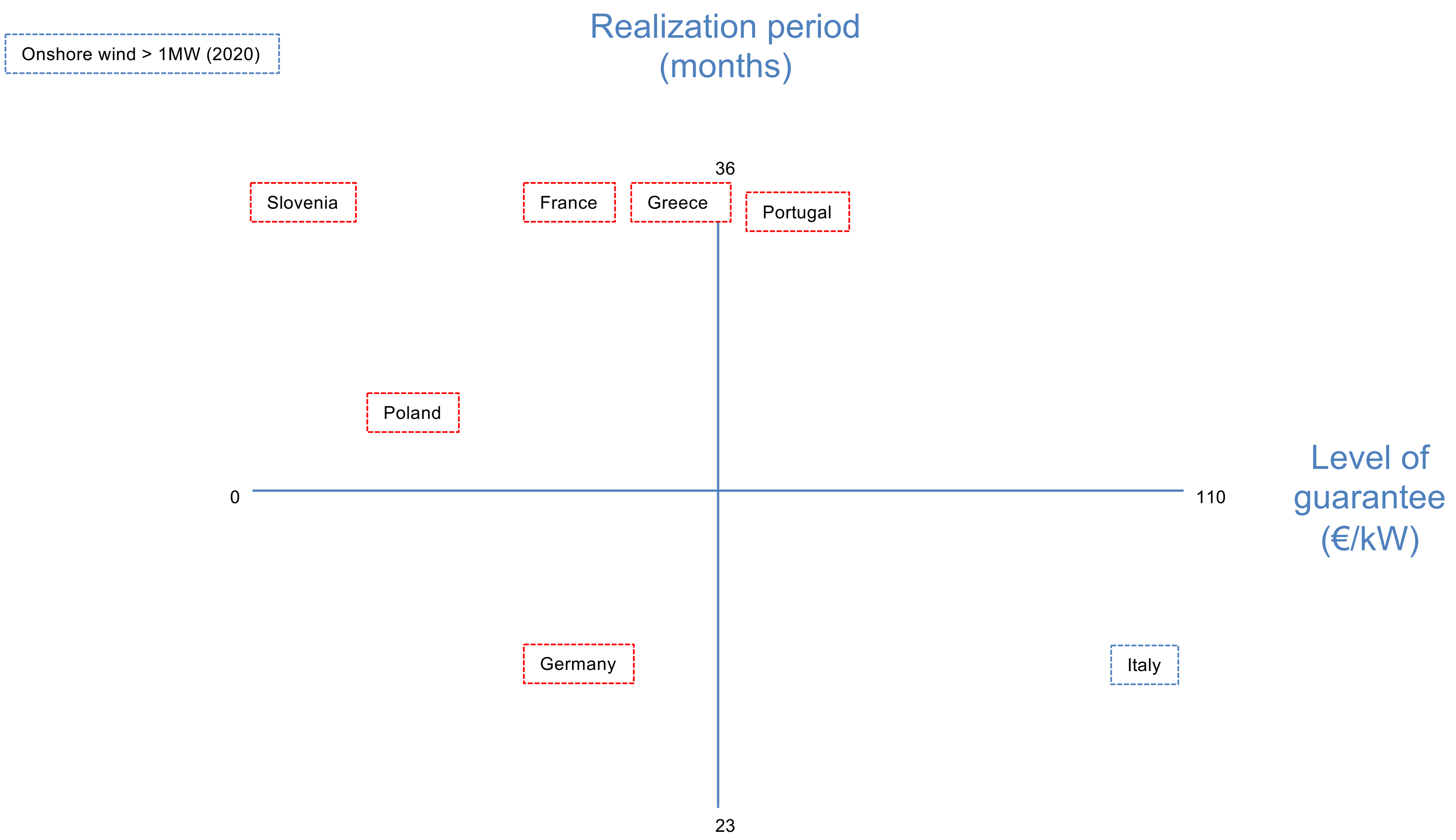


Which combination of design elements in practice?





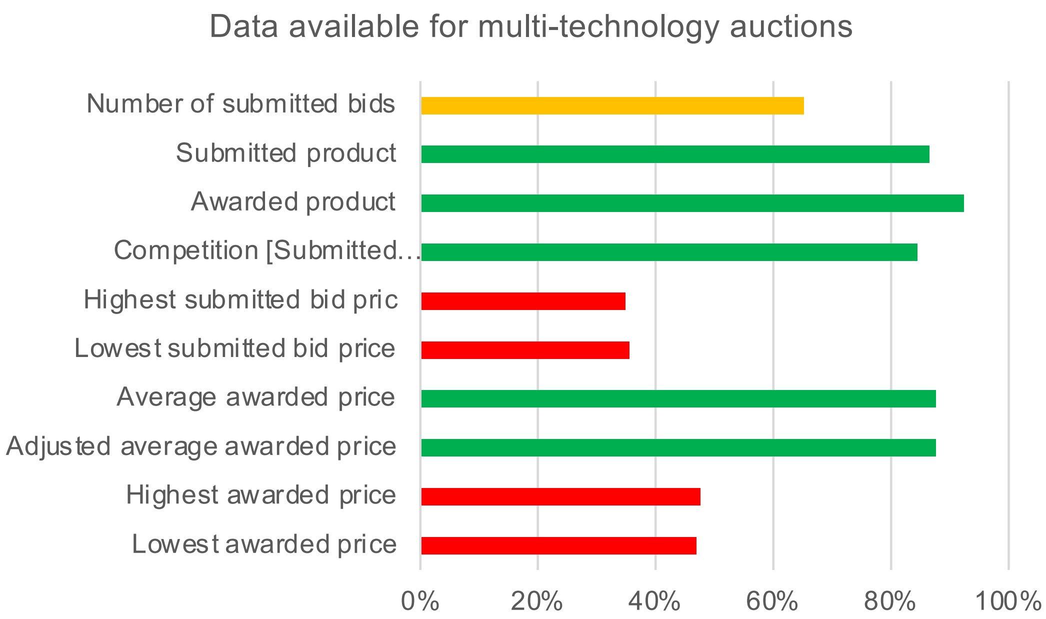
PV > 1MW (2020)
Realization period (months)
48
Portugal
Slovenia
Greece
(PV>20MW)
0
Poland
Ireland
Italy
Level of guarantee (€/kW)
0
25
75
100
France
Germany / Luxembourg / Malta
Greece
(PV<20MW)
3
15

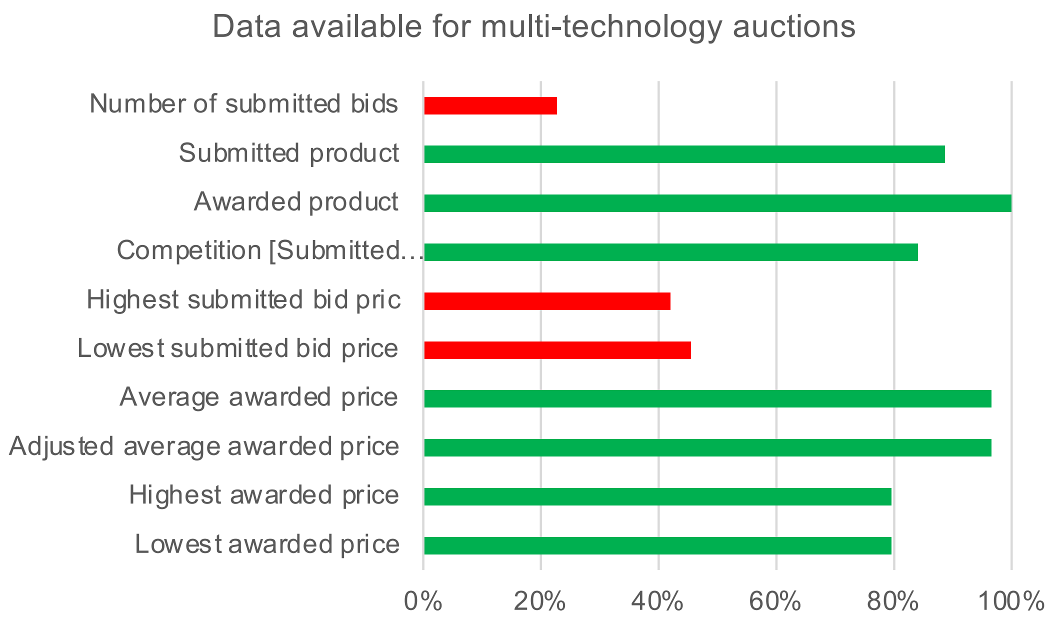


Onshore wind > 1MW (2020)
Realization period
(months)
36
Slovenia
France
Greece
Portugal
Poland
0
110
Level of
guarantee
(€/kW)
Germany
Italy
23

What about the impact of the design on auction outcome?

- Data available on design but incomplete for output:
  - Low submitted bids observations limit competitiveness assessment
  - Low data on bid distribution





Next steps

1. Improve the identification of the design elements that are interdependent. It will allow us to provide policy recommendations on auction design for auctioneers

2. Apply different clustering methods to derive auction typologies in Europe

3. Draw some conclusions on the impact of the auction typologies on the bidders

Any ideas for further researches?

- Case studies?

- Associate AURES database with others?

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