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Evaluating the German Onshore Wind Auction Programme: An Analysis Based on Individual Bids

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- Context of German wind onshore auction program
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  - Sources and variables
  - sample selection
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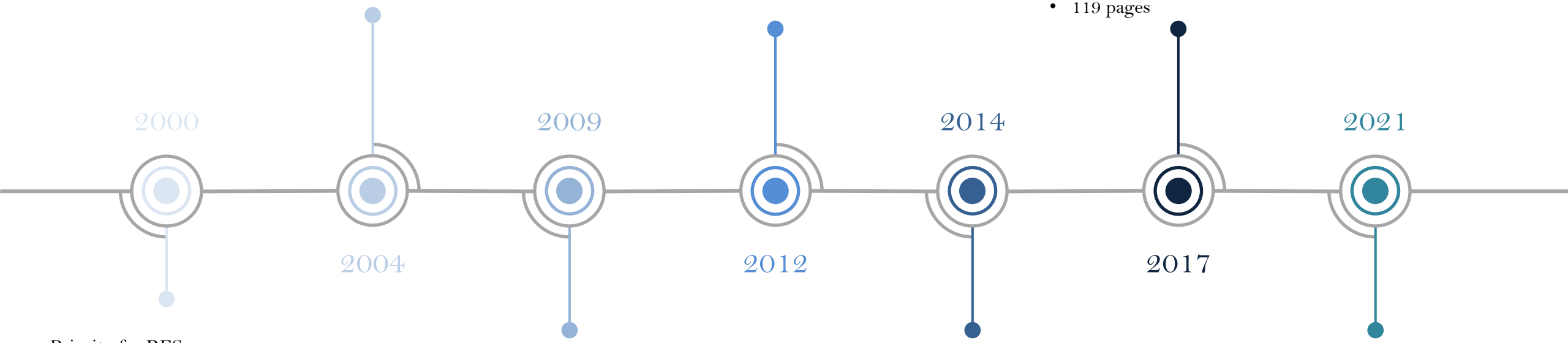
https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4130232

Research Context – Renewable Energy Policy in Germany



- Priority for RES
- Feed-in Tariffs for 20 years
- Double share of RES in energy consumption by 2010. 6,3%-12,5%
- Cost: 500 Mio. DM
- 0.1 cent/kWh
- <30 pages

- Tariff changes
- 2010:12,5%
- 2020:20%

- Tariff changes
- 2020:30%

- Tariff changes
- 35% 2020
- 50% 2030
- 65% 2040
- 80% 2050

- Tariff changes
- 40% 2025
- 55% 2035
- 80% 2050
- **Auction pilot** for Solar GM

- No changes on targets
- Full application of **auctions** for solar, wind (onshore and offshore) and Biomass.
- 119 pages

- 65% 2030
- 100% 2050
- 151 pages

Research Context – Renewable Energy Policy in Germany

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Market integration

Pure Feed-In Tariff (FIT)

- Fixed payment made by the TSO independent from the market price
- For Wind: $RY = FIT * Site\ quality$

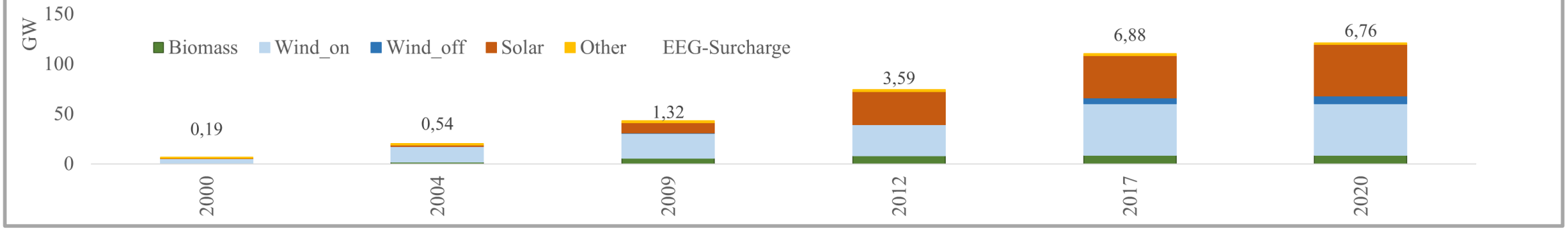
Feed-In tariff (FIT) for small units
Market Premium Model (MPM) for big units

$RY = market\ premium_m + market\ value_m$

TSO Trader

2000 2004 2009 2012 2014 2017 2021

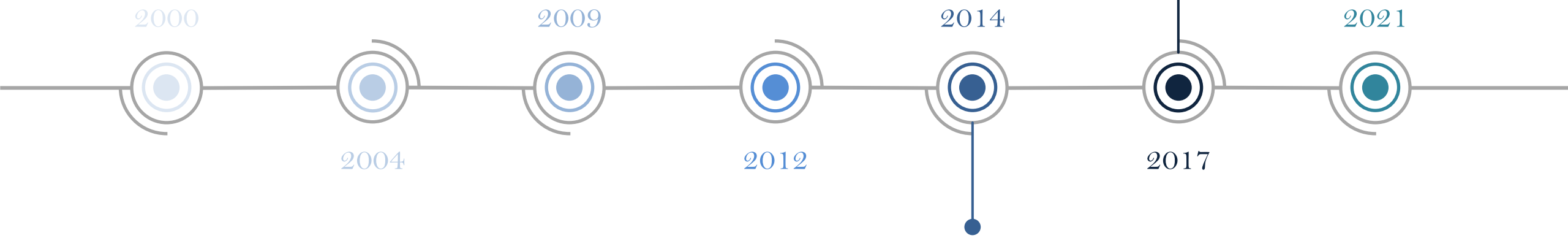
Capacity deployment



Research Context – Renewable Energy Policy in Germany

Auctions are market based instruments that introduce competition to reveal real costs and thus, should be more efficient than FITs.

- "Reduce" subsidy levels
- Manage deployment
  - Quantities
  - Locations
  - Actors



Introduction of wind onshore auctions

- EU Commission Guidelines (06.14)
- Germany RES Act (07.14)- Auction pilot for solar

Wind Auctions in Germany: Auction Design

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Usual design elements to foster primary objectives- deployment at competitive levels.

- Regular and consistent auctions
- Predefined volumes
- Ceiling price
- Pay-as-bid scheme
- Legal prequalification
- Financial prequalification
- Deadlines for construction
- Penalties

Design elements to foster secondary objectives

- Actor diversity (acceptance)
  - Special treatment for community energy companies CECs
    - No prequalification criteria
    - Flexible financial criteria
    - Extended deadlines
    - Uniform pricing scheme
- Geographical diversity (cost efficiency)
  - Capacity cap on the grid expansion area GEA.

Wind Auctions in Germany: Auction Results

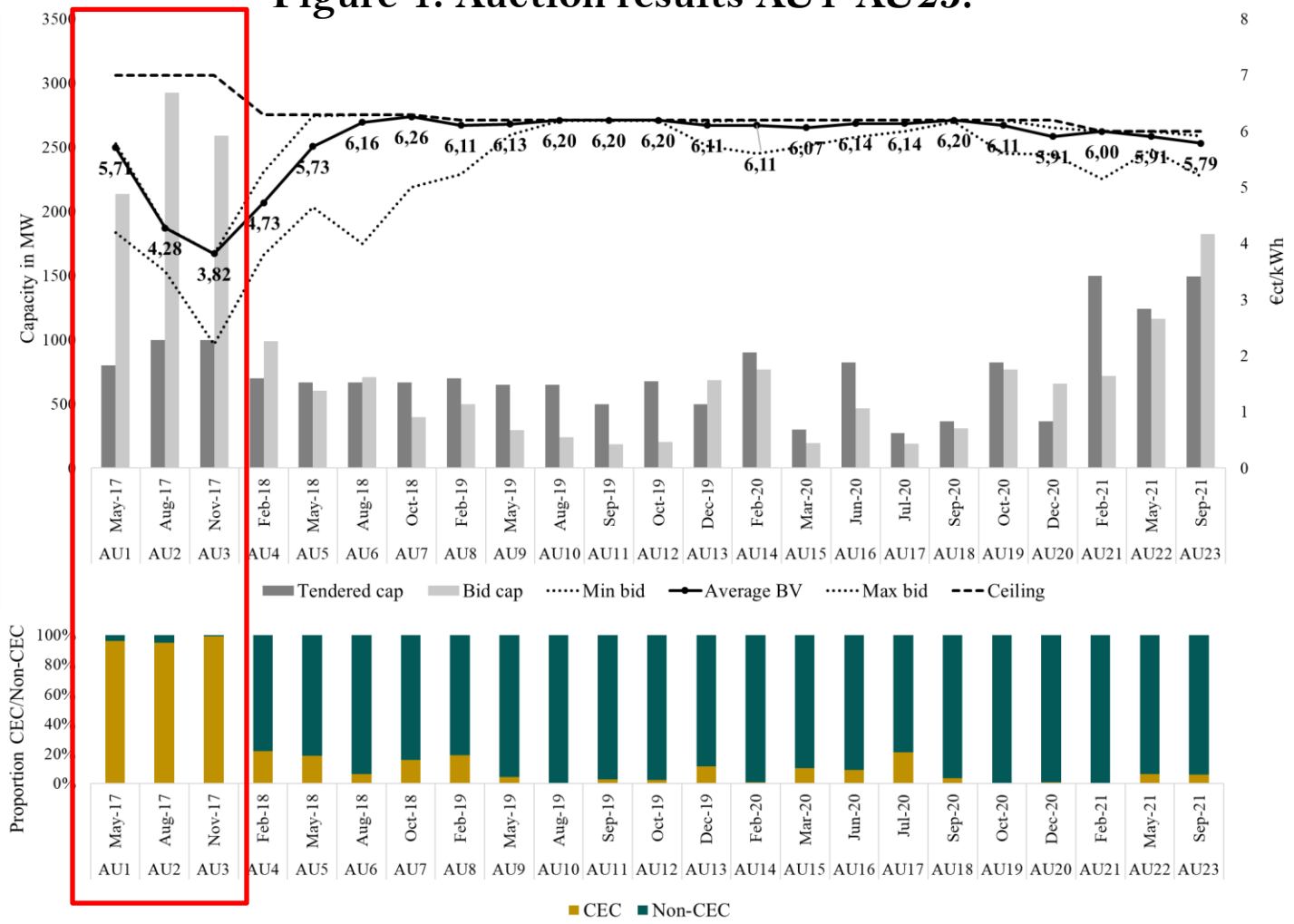
The evaluation of auction results has been limited to the analysis of resulting average prices and demand.

At first glance it seems the auctions have been successful.

Without knowing realization rates its not possible to make conclusions:

- Deployment (effectiveness)
- Cost reduction (efficiency)
- Achievement of secondary objectives

Figure 1: Auction results AU1-AU23.



Auction evaluation criteria

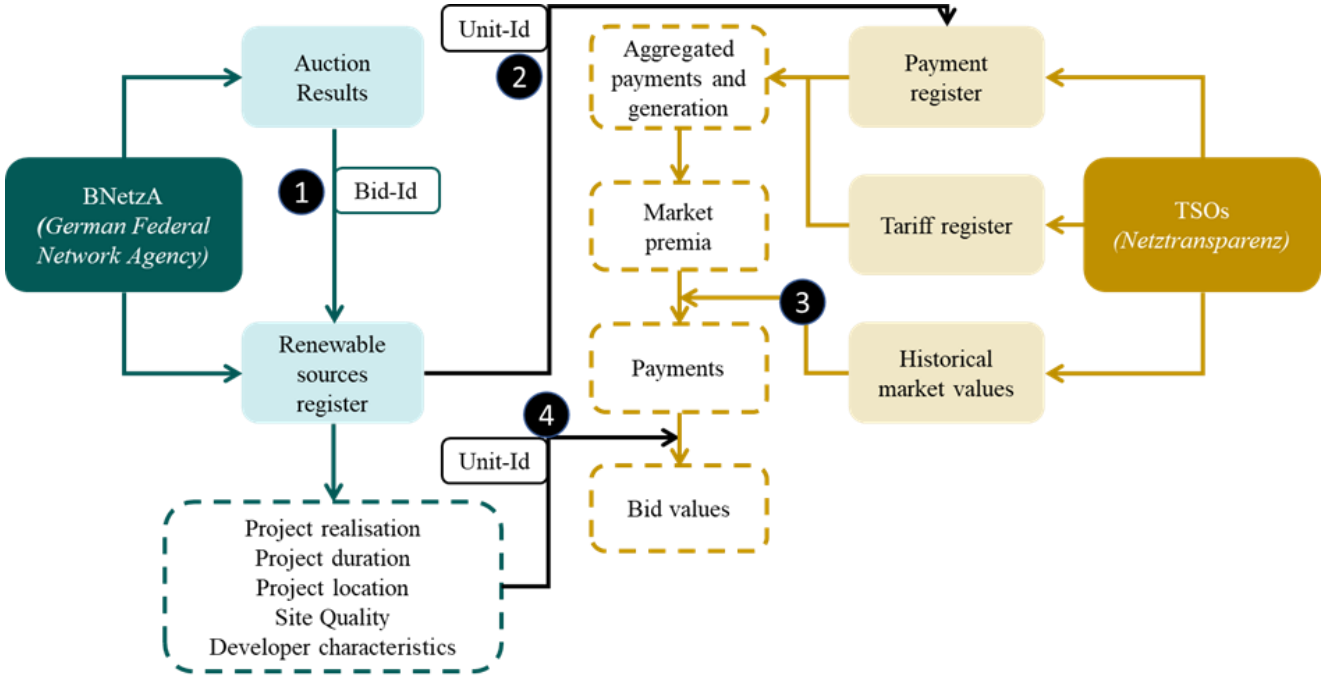
1. Wind deployment
   - What share of projects is realised? (differences for CEC y GEA)
2. Project duration
   - How long do German developers take to build onshore wind projects under auctions?
3. Do geographical aspects affect bids and construction periods?
4. Subsidy levels
   - What is the effective bid level?
   - What is the difference between the bid level and the actual payments?
5. Does the auction design favour experienced players?
6. What is the roll of competition?

Why aren't auctions evaluated in detail?

- Deadlines for construction are long
- Information at project level is not readily available

Data: Sources and variables

Figure 2: Data and unit-identification process



Note: Solid black lines and 1–4 show the four data-matching steps used in the identification of bid values. Coloured dotted lines represent data outputs from the matching steps.

2 $Pay_{i,m} = mp_{i,m} + mv_m$

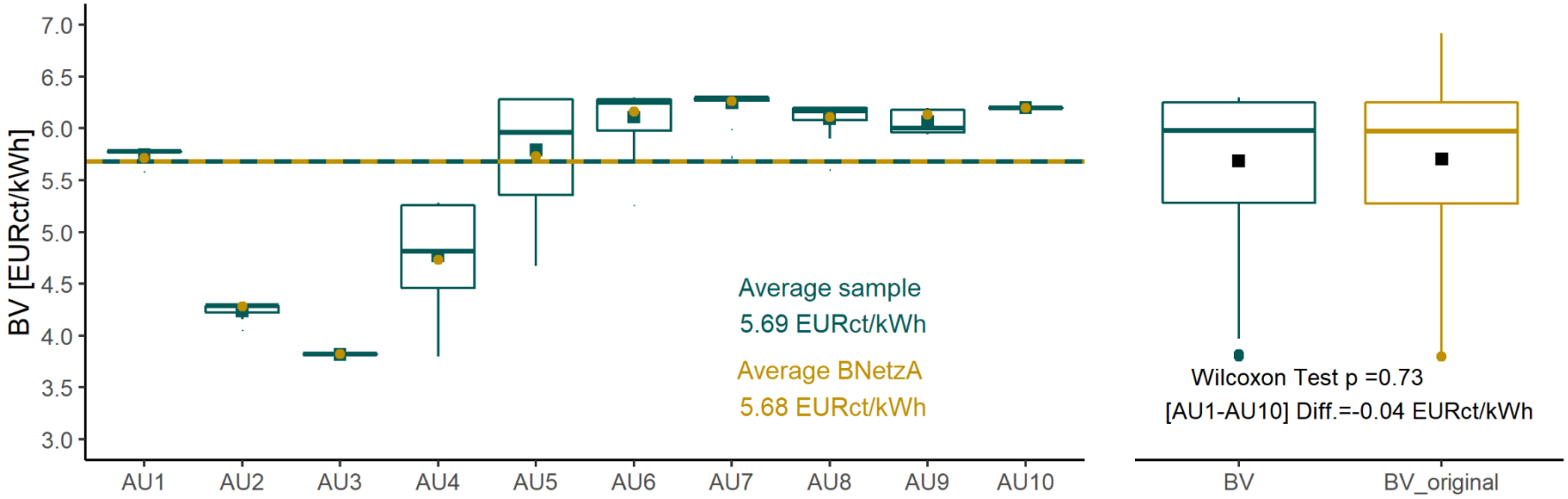
3 $BV_i = Pay_i / CF_i$

In addition:

Identification of CEC
Identification of GEA
Define Exp (experience)

Data: Sample and Quality

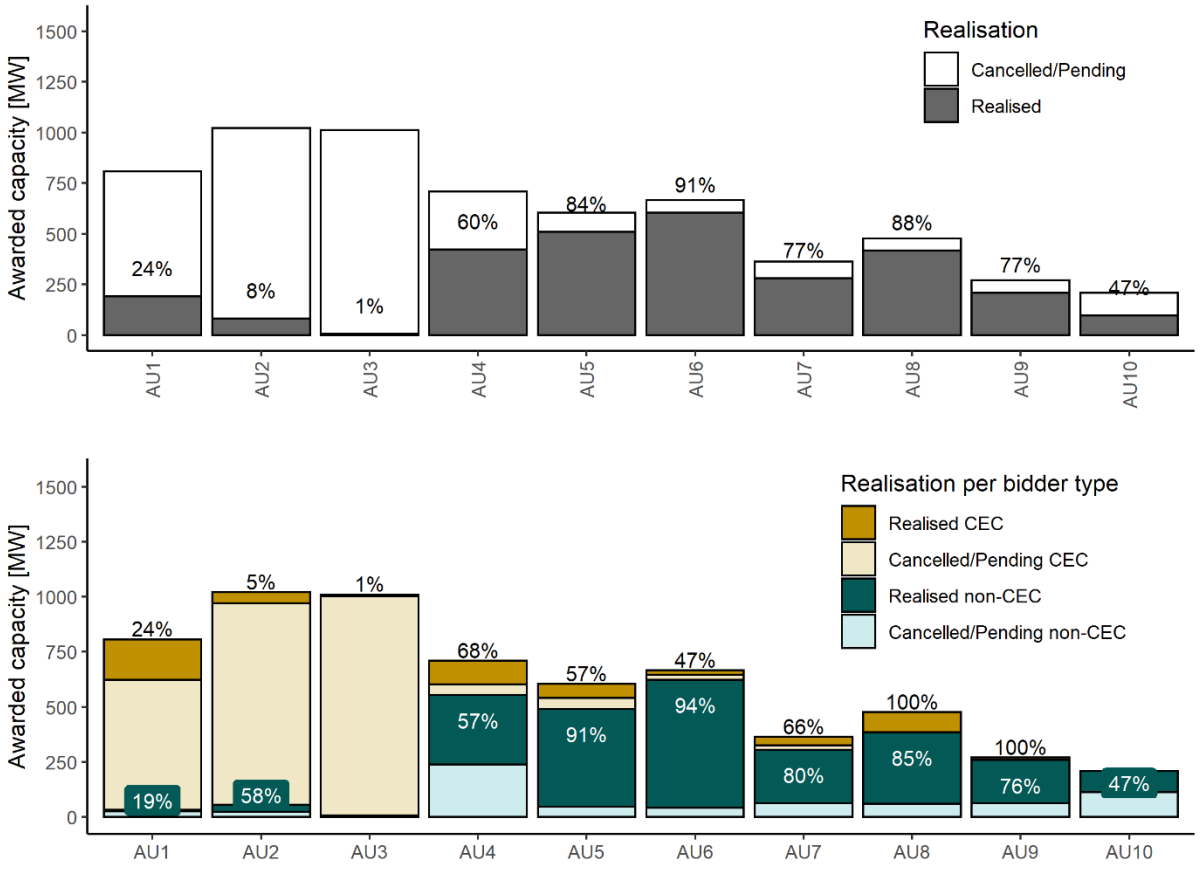
Figure 3: Published VS Estimated Bid Values.



- Auctions: AU1-AU10
- Identified BVs: 442 (50% of built projects)
- Non-CEC BVs: 347

Wind deployment: Realization rates

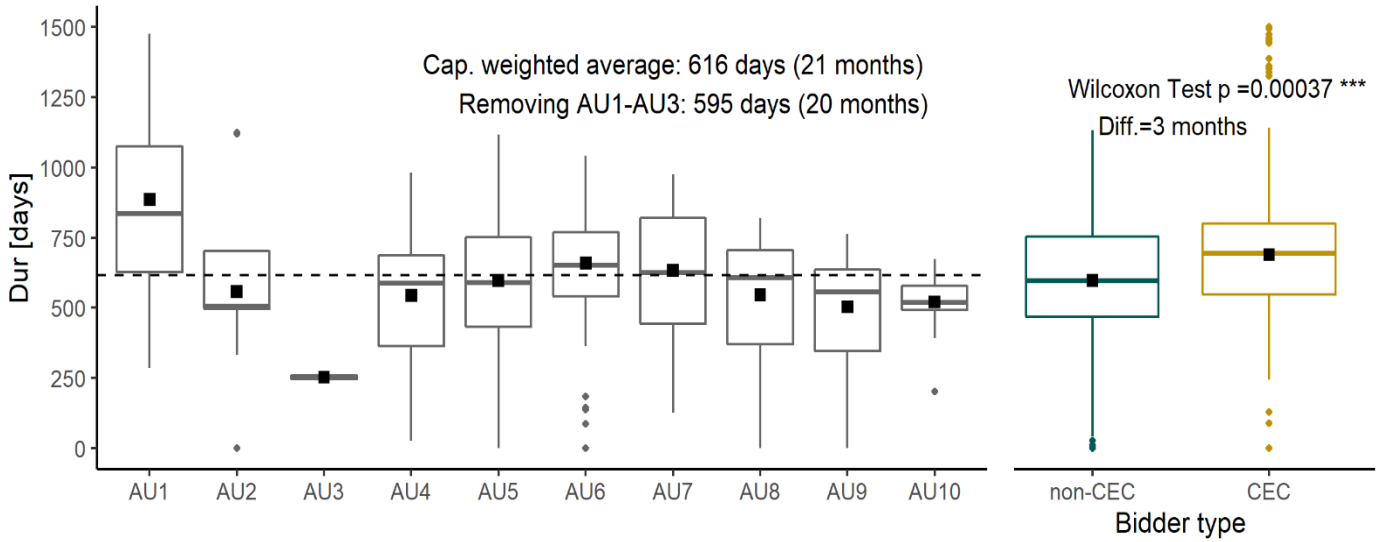
Figure 4: Realisation rates as the share of capacity realised over capacity awarded



- Realization rate of 46%.
- Low realization driven by non-compliance of CEC projects.
  - Difficulties to get permits
  - Bids below LCOEs
  - Incentives to re-entry.
- Amendments to the regulation seem to work.

Project construction duration

Figure 5: Average project duration (AU1–AU10) and duration per developer type

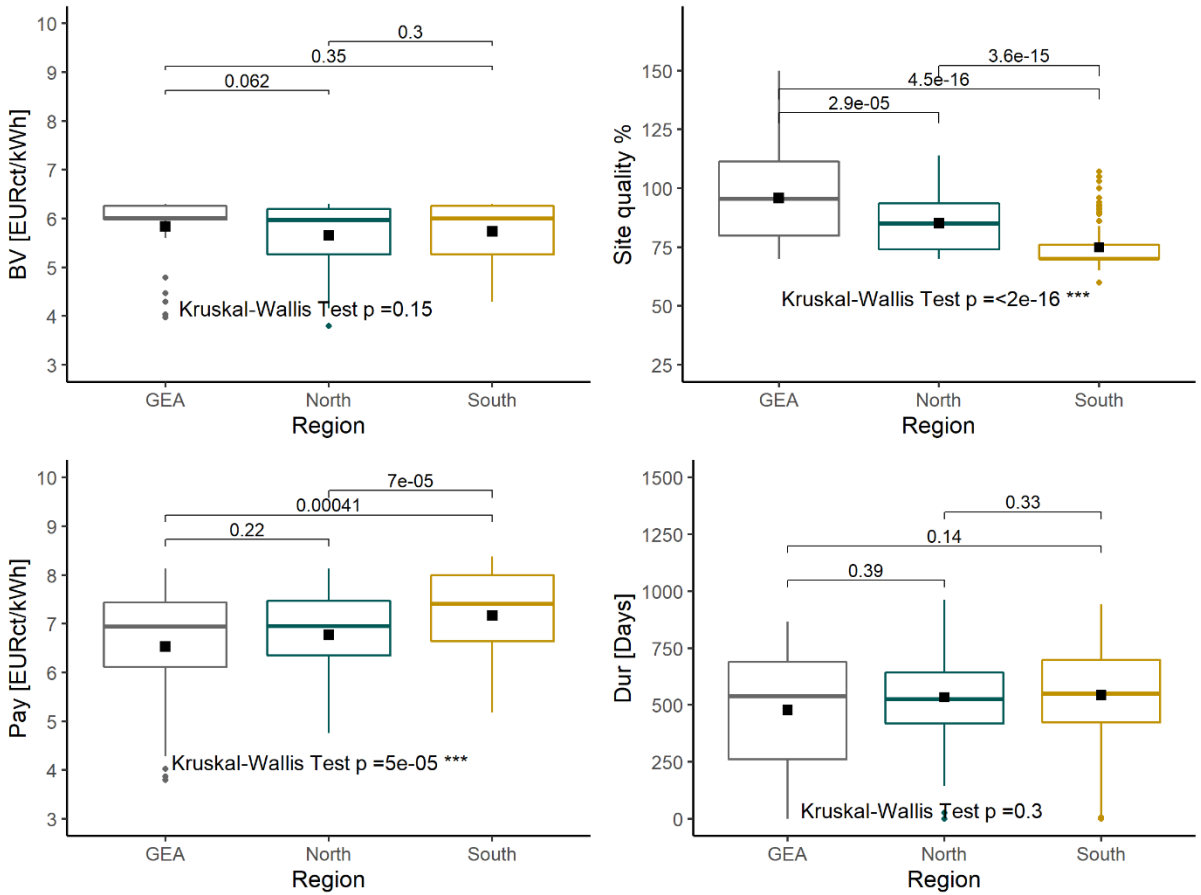


- Average project duration is 21 months.
- CEC projects take on average 3 more moths to be built.
- Projects built under auctions take on average 8 more months to be built than those under FIT.

Do geographical aspects affect bids and construction periods?

- No effect of bid values but on payments.
- This is consistent with higher site qualities in the north.
- No effect on project duration.

Figure 6: Effect of region and location change on duration and bid values (two-sided Mann–Whitney–Wilcoxon test).



Do geographical aspects affect bids and construction periods?

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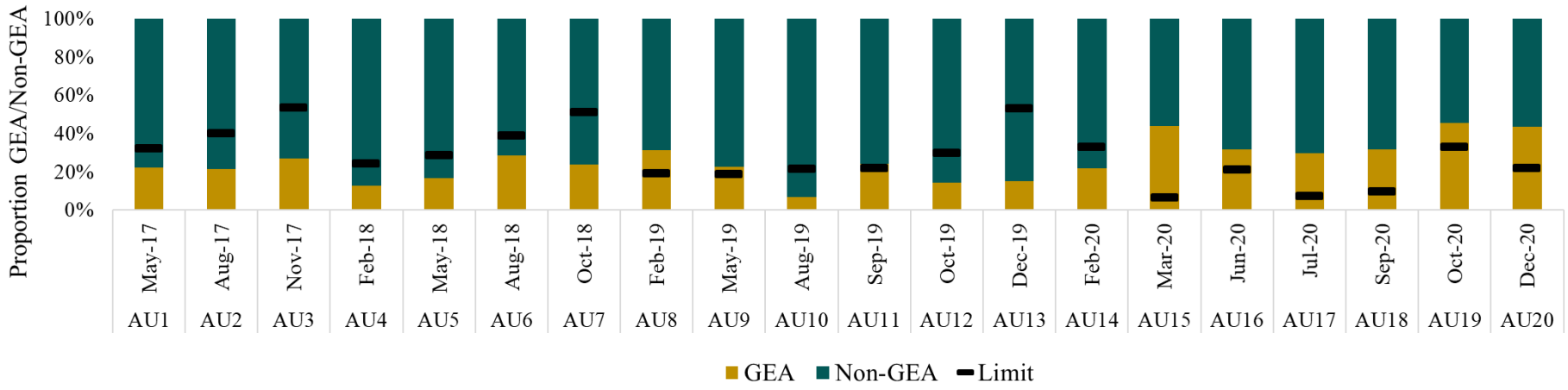
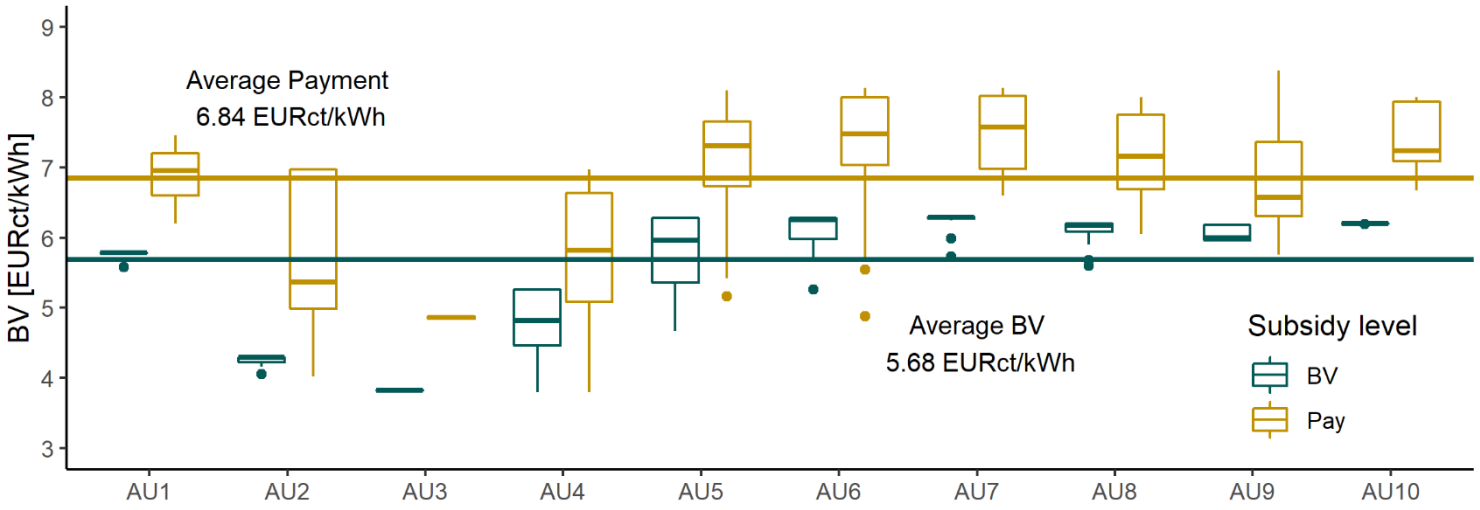
Figure 7: Demand for GEA measured as share of capacity bid



- The cap is not binding for most rounds.
- It seems there are additional hurdles outside the auction design limiting demand.
- The share of projects built in the south did not increase compared to pre-auction times.
- The regulation was removed for later auctions.

Subsidy Levels

Figure 8: Bid values vs net bid values per auction and on average.



- Payments are, on average, €1.27 ct/kWh higher than the bid values.
- This results from projects having site quality values of between 70% and 80%.
- Effective subsidy levels are thus higher than original reported values.

Does the Auction Design Favour Experienced Players?

Figure 9: Participation rate of inexperienced developers.

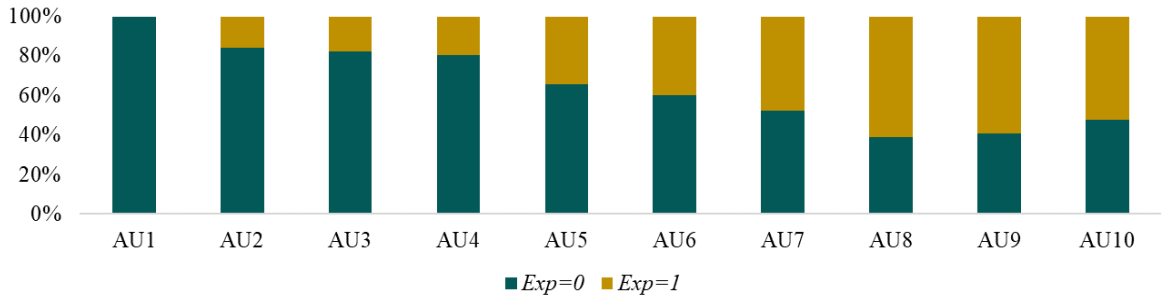
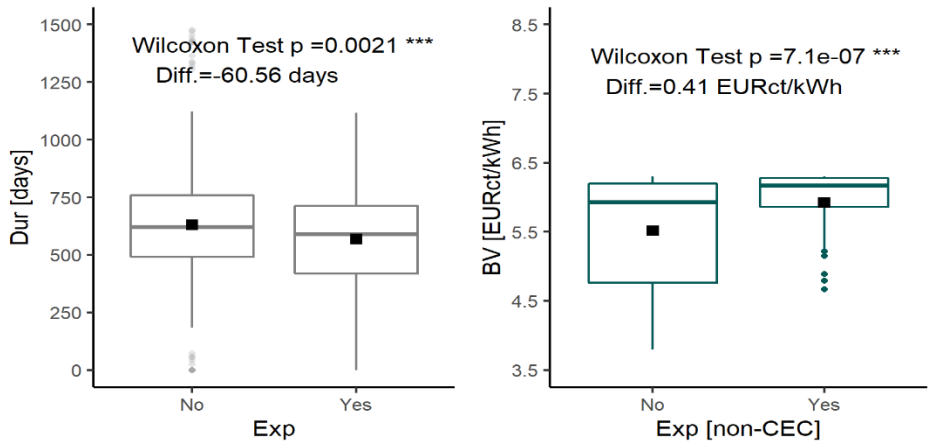


Figure 10: Effect of experience on bid values and project duration



- Share of inexperience developers stabilizes at around 40%.
- Experience developers access higher subsidy levels.
- Experience developers are also faster at building their projects.
- Experience developers have advantages when participating in auctions.

What is the role of competition?

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Econometric model: bid values explained by technology costs and competition

Estimate	Std.	Error	t-value	Pr(>|t|)	Sig.
Intercept	6.31	0.09	73.56	0.00	***
N_WTPI^{+6m}	0.86	0.11	8.00	0.00	***
N_Bcr	-0.67	0.04	-18.93	0.00	***
Residual standard error	0.476 on 344 Df				
n	347				
Multiple R-squared	0.530				
Adjusted R-squared	0.527				
F-statistic	193.7 ***				

Note: ***—1% significance level, **—5% significance level.

- Causal effects have been stablished theoretically.
- Direction of the effects is in line with theoretical findings.
- Competition plays a significant role in achieving cost efficiency.

Conclusions and Policy Recommendations

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Primary Objectives:

1. Low Effectiveness:

   Auctions failed at deploying the planned capacities and slowed down deployment for at least a year.

2. Low competition:

   Auctions were not demanded as expected

3. Low Efficiency:

   Resulting prices have been near ceiling levels.

4. Auctions were associated with longer construction periods than wind projects have historically needed.

Conclusions and Policy Recommendations

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Secondary Objectives:

1. Low actor diversity relative to efforts
    - Failed application of community energy company protection and objectives.
    - Incentives for professional developers to game the system.
    - Increased regulatory changes to correct the application.
    - Full policy reform RES Act 2023

2. Low geographical diversity
    - Redundant application of geographical constraints
    - Elimination of the policy RES Act 2021

Conclusions and Policy Recommendations

1. Auctions are a flexible policy instrument that can be easily adapted to specific needs and situations. However, both regulators and policymakers must first have a **deep understanding of the perused objectives and how to frame and translate those objectives into design elements** for a successful application.
2. At the same time, **more interest should be given to the external factors** surrounding the markets in which auctions are to be applied. While auctions are a valuable and versatile instrument, they alone cannot attract competition and guarantee efficiency if the market has high barriers for RES investment.
3. **Policy mistakes can be solved**. However, it requires great flexibility and comes at a price.

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Thank you!