AUCTION DESIGN ELEMENTS FOCUSING ON GRID INTEGRATION OF RENEWABLES - EXPERIENCES FROM ALL AROUND THE WORLD

Bettina Dézsi

Research Associate
REKK

Innovative solutions in renewable energy auction designs and their implementation possibilities in the ENC contracting parties

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Many cases known where integration of RES facilities can lead to problems, like

- High costs of ancillary services
- Need for RES production curtailment
- Reduction/Pause of RES capacity installation
- Reduced auction volumes creating a setback to overall RES expansion strategies

Most popular approaches and tools to combat these problems

- Requiring grid connection permits
- Conditions built in the pre-qualification criteria
- Location specific announcements
- Limited eligible project size
- Bid price adjustment/decision criteria considering low and high demand periods
- Negative bid auctions
- Project developers bear grid development costs

Colombia - qualification requirements and time slots

First tech-neutral, multi-criteria round in February 2019 (over 10 MW)

- For **qualification**, every bid had to have at least 50 points of the overall 100 points covering four aspects
- **Competition criteria were applied to help smaller players to participate** (participation index, concentration index and dominance index), the last two of them were unmet so the round **did not award any contracts**

Second RES exclusive round in October 2019 (over 5 MW)

- **Time slots** were introduced (0-7, 7-17, 17-0), producers could submit one or more bids and had to indicate whether their bids were mutually inclusive, exclusive or simultaneous
- Difference between produced electricity and the offered quantity is sold or need to be bought on the spot market
- **One competition criteria** remained: **one bidder could not be awarded more than 40%** of the round's volume
- The round **awarded almost 1.3 GW** of solar and wind installation at a weighted average price of EUR 25/MWh

RESILIENCE (25 POINTS)	Enhancement of the resilience and adaptability of the energy system through diversification of the energy mix
COMPLEMENTARITY (25 POINTS)	Complementarity of project's seasonal profiles with historical flows in the main hydropower basin
EMISSIONS REDUCTIONS (25 POINTS)	Contribution of the project to the reduction of CO_2 emissions
REGIONAL ENERGY SECURITY (25 POINTS)	Impact on the supply-demand balance and reduction of operational restrictions

Source: MINMINAS, 2018.

Takeaways

- The auctioneer's **openness to** take stakeholders' **feedback** into account was a key factor of the second round's success
- The 10 hours long timeslot creates a risky situation to PV developers as they have to provide the same offered quantities every hour of the time slot, while produced quantities differ a lot in the beginning and in the middle of the time slot
- Despite the country's excellent solar potential, design of the time slots can be one cause why only 3 PV projects won

Argentina – size limits and regional approach

RenovAr programme: 3 (and a half) auction rounds between 2017-19, the 4th round was announced but hadn't been launched

- After the second round auction design adjustment was necessary, mainly because of the insufficient transmission infrastructure
  - In **Round 3 region-specific caps of maximum capacity per interconnection points** were introduced to limit the to be conracted capacity: 20 MW per province with the exception of Buenos Aires, which has a 60 MW ceiling
  - New projects had to be connected to existing medium voltage grid capacities and their size was limited to 10 MW
  - It was expected that (private) investments into the grid infrastructure were to be tied to the 4th round's
  - The scheme was the victim of economic and political instability

Project size	Round 1-1.5	Round 2	Round 3
ANNOUNCED VOLUME	**1000 - 600 MW**	**1200 MW**	**400 MW**
Wind and PV	1-100 MW	same	generally reduced to 0.5-10 MW
Biomass	1-65 MW	reduced to 0.5-50 MW	
Biogas	1-15 MW	reduced to 0.5-10 MW	
Mini hydro	0.5-20 MW	same	

First round of **RenMDI** has already been successfully conducted in 2023 targeting two goals:

- 500 MW to replace thermal generation only in 6 pre-defined regions
  - Eligible technologies: biomass, solar PV with or without energy storage and wind power with storage between 3-20 MW
- 120 MW for general diversification of the power mix
  - Eligible technologies: biomass, biogas from organic sources, biogas from landfill sources and small hydro installations between 0.5-20 MW located anywhere in the country

Takeaways

- Location specific approach can be an effective way to utilize the already existing network on the short term, but
  - quickly leads to an upper limit to RES expansion by running out of sufficient connection points
  - It may forces investors to establish projects under less favorable conditions which leads to higher prices

German onshore wind and joint pv+wind auctions

Regional capacity addition limits in Northern states set at 902 MW/year until 2021

- Awarded projects are limited in areas where grids are overstressed (so-called grid expansion areas or Netzausbaugebiete)
- Once this cap is reached, bids for the grid expansion area are no longer considered, even if their bid prices are cheaper than bids outside this area.

Latest regulation states that **at least 15%** (from 2024: 20%) of supported projects **must be located** in Southern areas.

Technology specific **onshore wind auctions: adaptation of bid price by the reference yield model** (Refererenzertragsmodell) to partly offset site-specific differences in the availability of wind resources

- It works as a bonus for projects in sites with lower wind resources and as a malus for projects in sites with better wind resource,
- The correction is reviewed after 5-10-15 years

% of reference yield	60%	70%	80%	90%	100%	110%	120%	130%	140%	150%
Correction factor	1.35	1.29	1.16	1.07	1	0.94	0.89	0.85	0.81	0.79

Joint PV+wind auctions: adaptation of bid price by Distribution Network Component (VNK, Verteilernetzkomponente)

- The VNK acted as a malus for projects with sites in areas where installed RES capacities exceed peak load (maximum 0.88 EURcents/kWh for solar and 0.58 EUR cents/kWh for wind)

Takeaways

- According to the German regulatory agency (BNetzA) this factor **had little to no influence** on results, the applied malus only hindered one wind project to be awarded
- Several studies examined the theoretical effect of the reference yield model showing that the tool's **benefits outweights it potential risks** and lead to lower consumer prices

Mexico – bid price adjustment

- Three rounds organized in 2016 and 2017 with significant adjustment factors used to support grid integration

Regional adjusment:

- Auctioneer rewards or penalizes those zones where new capacity is needed or where production overcapacity exists, respectively, so a project in a node with higher generation costs would be rewarded
- The adjusted price is the base of award decision but support is calculated using the original bid price
- This factor was reduced from the second auction round

Hourly adjustment:

- More support will be paid for the electricity generated at times of higher demand and less for the electricity when demand is low
- Support is calculated by the adjusted price

Financial adjustment:

- Mexican inflation
- Peso/dollar exchange rate
- Support is calculated using the adjusted price

Takeaways

- Market players criticized the complexity of the scheme, regardless of this the **competition was very strong** at all the 3 rounds
- However, new administration closed the scheme because the new National Electricity Plan defined different directions

Negative bid auctions

- Negative bid means that **project developers do not receive financial support, but they have to offer a** lump-sum , or production related **payment** for the right to realize projects
- **Benefits:**
  - **Payments** resulted from negative bids **can be invested into grid development** allowing the integration of more and more new capacities that can be connected to the network
  - In a market situation where prices are very high, the payment can moderate RES producers extremely high revenue
- **Limits**
  - This approach can only be used if it is likely that the projects are able to be built without support, but grid connection points are scarce so some mechanism is needed to distribute them
  - Mainly used in case of offshore wind projects, which are project specific auctions usually with pre-defined locations and project sizes
  - If PPA contracts are popular, they can be better alternatives for project developers

Examples:

- In case of **Netherland**'s offshore wind auctions the first round where negative bids appeared was in 2017, in 2018 all the winning bids were negative
- In **Portugal** in case of ground mounted and floating PV auctions resulted negative prices because of the very good solar potential, the already very high PV volumes and the very scarce potential grid connection points

Summary of design elements in the entire auction process

- There are plenty of intervention points throughout the entire auction process and their effect is rarely self-evident
  - The extent to which **administrative rules** influence the outcome of auctions is always very country specific
  - Strong **qualification criteria** can deter potential bidders and have a negative impact on competition and prices
  - Targeted design tools can lead to actual grid development, while other tools only help to utilize the already existing network to the maximum
  - Many tools help to balance the difference between technologies or geographical features, the question is at what cost

Administrative rules and requirements

- Grid connection agreement
- Transfer or necessary network development to the project developers

Qualification criteria

- Establishing grid connection related preconditions for participation *(e.g.Colombia)*

Targeted design elements

- Limited eligible project size *(e.g. Argentina)*
- Different rules applied for different technologies
- Pre-defined project locatons *(e.g. Argentina)*
- Negative bid auctions *(e.g. Netherlands)*

Adjustment of bid prices//winner selection criteria

- Following supply/demand imbalances *(e.g. Colombia, Mexico)*
- Based on the yield potential of a certain RES technology *(e.g. Germany)*

Thank you for your attention!

Bettina Dézsi
Bettina.dezsi@rekk.hu
www.rekk.hu