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Renewable Auction Design in Theory and Practice: Lessons from the Experiences of Brazil and Mexico

Executive Summary

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Auctions for long term contracts represent an important complement to short-term markets, and have become increasingly popular as a means of coordinating and ensuring resource adequacy through a competitive, albeit interventionist mechanism. This is specifically helpful given the absence of decentralised forward markets in most liberalised electricity markets. Forwards contracts in liberalised markets rarely go beyond one year. In non-liberalised markets auction for long-term contracts is a step forward to introduce market mechanism and enhance efficiency. At least sixty countries have adopted competitive tendering as a procurement method for renewable energy generation. As such, these auctions for allocation of long-term contracts have become a mainstream mechanism for renewable support as they improve efficiency, isolate generators from short-term market volatilities and reduces their capital costs, which should translate into lower power costs for consumers. Nonetheless, the centralised long-term contracts can have adverse effects on the operation of short-term market, which can be minimised through appropriate design.

The experiences of Brazil and Mexico in long-term auctions represent an interesting point of comparison as both countries are global leaders in these auctions, attracting $12.4 billion USD of in clean energy investment commitments in 2017 alone, making up more than 70 percent of the annual total in Latin America and the Caribbean. Brazil was the first country to introduce long-term auctions for electricity procurement in 2004 and renewable specific auctions in 2007, and therefore has significant experience in the design and implementation of such mechanisms. Commencing its first auction process in 2015, Mexico is one of the newest countries to introduce auctions for renewable support. The two countries are also Latin America's largest power markets by installed capacity, and lead the region in hydrocarbon production and CO_2 emissions.

For auctions to be efficient and effective, they must be designed prudently. Auction design elements, however, interact with one another creating continual trade-offs between reducing the likelihood of unwanted outcomes and achieving optimal auction results. There are several examples of these trade-offs such as balancing noncompliance penalties with contestability, balancing lead times for development with speculative bidding, technology neutral to achieve efficiency versus technology specific to achieve government objectives, and the TSO grid connection model versus the generator model, among others.

Design elements also interact with the larger market and policy frameworks in which auctions exist. For example, if project developers are required to submit bids according to their short run marginal cost of generation, does the wholesale market have sufficient mechanisms for capacity or ancillary services to cover fixed costs for generators? Alternatively, if generators bid according to their long run marginal costs or levelised cost of energy (LCOE), does it lead to foreclosure of short-term markets? The above considerations are just some of the essential design features which must be considered when designing and evaluating auctions.

Brazil's auctions

Since 2004 Brazil has held at least 74 auctions resulting in more than 8.7 million GWh of electric generation and 488 billion USD in investment. Under the auctions, renewable electricity prices have decreased considerably when compared to the precursor program with feed in tariffs of $150/MWh for wind, $96/MWh for small hydro and $70/MWh for biomass. Average auction prices for these three technologies from 2004 to 2017 have decreased, to $53/MWh, $65/MWh and $69/MWh, respectively. Solar PV and large hydro renewable technologies have been deployed through auctions as well.

Accordingly, Brazil's auctions have been largely successful in increasing security of supply through attracting new generation capacity, encouraging a more diversified generation mix and promoting competition and efficiency in generation to achieve cost reduction. Moving forward, issues to consider include introducing a formal capacity product and market, and auction frequency issues.

Capacity product

While the forward contracts and firm energy certificates (FECs) Brazil currently utilizes may somewhat resemble capacity market features, energy is the only official product in Brazil's long-term auctions. The specific energy products are forward contracts which cover the distribution companies' load forecasts. These contracts help reduce risk for generators, and increase security of supply. The FECs serve to monitor and maintain the nation's supply-demand balance, and as each participant is in charge of its own load, FECs and contracts, the certificates are essentially a decentralized mechanism to secure supply.

The introduction of a proper capacity market may help encourage investment in capacity and mitigate the likelihood of supply shocks (however, careful examination is required to explore the impacts of such a market on the existing energy product market). In fact, there is discussion within the Brazil's market operator (CCEE) of creating a separate capacity market. To this end, a proposal was sent to the Brazilian Congress with the objective of creating a capacity market by 2021. The initiative could unbundle capacity and energy, and possibly introduce renewable certificates. The capacity market would potentially include centralized auctions five years ahead of project delivery, with costs shared by all customers, and the mechanism would operate under the management of the CCEE.

Auction frequency

Tenders should only be held when a market is able to absorb the auctioned generation, and is prepared to facilitate project development. Recession in Brazil has recently led to weaker demand growth and an excess of power supply. Accordingly, in 2017, Brazil held a de-contracting auction to cancel projects (mostly solar PV and wind) that it had awarded in reserve energy auctions in 2014 and 2015. Beyond the recession, it is likely that delays related to project finance, permitting and other administrative issues were responsible for significant project delays, which led to a backlog of projects. Combined with economic downturn, this provided the government with the pretext to cancel auctions, clear the pipeline and start afresh.

While this de-contracting mechanism was innovative and resolved the issue in the short-term, it may have simultaneously created a degree of moral hazard, as project developers were able to avoid full penalties. Project developers may assume the same mechanism will be available in the future, if a similar situation arises. Further, the mechanism required significant time and effort to develop on the part of the Brazilian government. The exact opportunity cost of this time and effort is unknowable. However, if Brazil had not contracted too much capacity, the time and effort could have been better spent. Lastly, cancelling projects across the board from multiple auctions can negatively impact investor confidence, which may raise the cost of capital and bid prices.

This issue is illustrative of the challenges of centralised coordination mechanisms in responding to market conditions. Due to macroeconomic conditions in Brazil, typical annual electricity demand growth of approximately 4 percent dropped to 0.9 percent in 2016 and is forecast at 2 percent for 2017. When determining auction dates and volumes, governments must consider worst case demand scenarios, and develop precautionary measures, or a means to cope with excess capacity if demand unexpectedly drops due to external factors. For example, policymakers can begin with minimum

demand auction and correct this estimation in subsequent re-configuration auctions. Governments should also ensure that a certain number of projects from the most recent auction are making tangible progress towards development before holding a follow up auction.

Mexico's auctions

Since beginning its power market liberalization program in 2014, Mexico has held three long-term auctions for clean energy, offering three products: energy, capacity and clean energy certificates, which were created as a means of supporting clean energy targets. Mexico has also held one mid-term auction which functions as a means for generators to reduce exposure to short-term markets by selling uncontracted energy and capacity one year in advance, with contract durations of up to three years.

While it may be premature to make conclusive assessments regarding the country's auctions, Mexico seems to enjoy a last-mover advantage, as many international cases provided insights and a framework on which to base Mexico's auctions. If all contracted projects from Mexico's first three long-term auctions are realized, the country would add at least an additional 7.5 GW of installed solar and wind capacity, compared to just 3.5 GW of the solar and wind capacity it currently enjoys. Issues to be considered in Mexico's auctions include the potential for low project realization rates due to low pricing, and increasing efficiency in its mid-term term auctions.

Low pricing

Record low prices down to $20.57/MWh (third auction average) have been celebrated by the national government, yet the resulting low prices are also a cause for concern. Underbidding can lead to underbuilding, as overly aggressive pricing may result in investors exposing themselves to excessively low or even negative returns, which can lead to higher non-completion rates for projects, or cause insolvency at some point in the project lifecycle. Investors may also be waiting to see how market conditions develop, without making a final investment decision at the time of the auction. Such consequences can negatively impact system planning, the overall investment climate and the market liberalisation process. The purpose of renewable auctions is to create investment incentives for the deployment of renewables. Auctions are not meant to create a market in which firms may purchase options to deploy renewables in the future if market conditions develop in their favour.

To increase the likelihood of project realization and reduce the possibility for speculative bidders to participate, Mexico's bid bond, which may be comparatively low, should be evaluated. In Mexico, the bond includes a fixed fee of about $99,000 (regardless of the number of bids submitted by the same generator), approximately $21,000/MW per capacity offered in the auction in a year, plus $10/MWh and $5/CEL (Clean Energy Certificates) offered in the auction in a year. Auction participants have opportunities to reduce this bid bond by up to an additional 50 percent if an interconnection agreement is achieved beforehand. Depending on technology and country-specific capital costs and specific offers, Mexico's bid bond may prove low when compared with a fixed percentage of estimated project costs (particularly if no capacity product is offered).

For example, Brazil requires investors to submit a bid bond worth 5 percent of total estimated investment costs to be able to win a project in an auction. For the 14 winning solar and wind projects in Mexico's third auction, the average bid bond submitted was 11 percent (nearly USD 900,000 USD) lower than it would have been under Brazil's 5 percent of investment costs methodology. Including the one winning gas project (which won only a capacity contract) increases this difference to 13 percent, more than USD 1.3 million lower than under the percent methodology. It should also be noted that the design of the bid bond in Mexico, which is not fixed and highly sensitive to capacity offers, could be attempting to encourage lower financial commitments from intermittent renewables which may be less likely to seek winning significant capacity in the auctions.

Beyond bid bonds, Mexico uses a pay-as-bid pricing rule, which encourages bidders to guess the market clearing price, and bid at or just below that price in order to clear in the auction. Employing a uniform pricing rule, in which all bidders receive the market clearing price, is likely to encourage

auction participants to bid closer to their marginal costs, thus reducing the propensity to “race to the bottom” in terms of extremely low pricing (we recognise that pay-as-bid vs. uniform pricing is a complex issue; while an exhaustive analysis of the issue is beyond the scope of this paper, a more complete discussion of the merits of each pricing system is included in the conclusions section).

Efficiency of mid-term auctions

The results for Mexico’s first mid-term auction were released in late February 2018, yet no electricity or capacity contracts were awarded. This was the consequence of significant mismatch between demand bid prices and supply bid prices. The mid-term auctions serve as a market hedge for load serving entities which seek to offload uncontracted energy and /or capacity in advance.

Generators thus face the trade-off between locking in contracts through this mid-term hedge market, or selling directly into the short-term markets. In the mid-term auction, demand submitted very low purchase bids, perhaps with the prices of the long-term auctions in mind. However, the two markets offer very different products; long-term auctions serve to allocate the right to build and secure financing, while mid-term auctions offer a hedge for existing generators. It seems that demand failed to recognize this distinction. The mid-term auctions represent a meaningful opportunity for load serving entities to secure contracts with end users. Auction participants on the demand side should fully recognize the purposes of each type of auction to avoid submitting unrealistically low bids based on expectations from a different type of auction.

Demand response auction eligibility in Brazil and Mexico

Both countries would benefit from incorporating demand response in their auctions. While implementing such a mechanism is not straightforward in long-term auctions, it is already happening in several jurisdictions such as the US and UK. Mexico is already planning to implement demand response services later in 2018 in its capacity market. Brazil can also consider allowing demand side resources in its long-term auctions given it is contemplating to implement a capacity market. Brazil and Mexico would also benefit from demand-side resource aggregators, which could participate in the capacity auctions on the behalf of consumers. The aggregation service could be provided by new companies, or by existing energy service companies who wish to enter a new business.

Auctions as an evolving tool

In summary, successful auctions that meet the goals of both policymakers and society are a constant balancing act, which includes weighing the trade-offs between specific design elements. Ultimately, auction design seeks to be consistent with the broader market context, and spread risk efficiently amongst primary auction participants so as to ensure that the auction trade-offs do not weigh too heavily in favour of, or against, one particular class of auction participants (i.e. investors, government, rate-payers). There are numerous trade-offs along every step of the auction design process that impact the per unit price of electricity resulting from auction, the generation technology deployed and resulting carbon emissions, as well as other critical outcomes such as local content, investor confidence and the likelihood of project completion.

As a tool to deal with an existing inefficient situation in the imperfect power markets, there is no optimal one-size-fits-all centralised auction design mechanism or policy. Each country implementing auctions must consider the broader market design, policies and context as well as the myriad of trade-offs that appear along each step of auction design, from determining what type of auction to hold, to deciding lead times and penalties. There is no single correct answer to these or other auction design decisions, as no two market contexts are identical, and auctions come about in different geographies in their own way and time.