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The Brazilian experience with auctions for wind power: An assessment of project delays and potential mitigation measures

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ABSTRACT

Renewable energy auctions are gaining popularity worldwide. However, practical experiences remain ambiguous. This holds especially true for on-time implementation rates. In Brazil, only 17% of the awarded capacity in the first ten auction rounds reached commercial operation within the set out deadline. In this article, we investigate the causes for these delays and discuss potential mitigation measures, based on expert interviews and extensive data analysis. The most severe delays were caused by expansion to the transmission grid. Delays in the supply of wind turbines also led to significant project setbacks. Other factors could be considered of minor relevance, but have led in individual cases to significant delays. These include factors related to project financing, project or environmental licenses, logistics, land-use conflicts and poor project management. Brazil effectively reduced delays caused by transmission grid expansion through amendments to the auction design. Our analysis also shows that options to further mitigate delays through an advanced auction design are limited, as they lead to conflicts with other energy policy objectives, e.g. local production of wind turbines, or because the delays are caused by factors beyond the control of the project developers.

1. Introduction

In the past decade, auctions have become more widespread as an instrument to support the expansion of renewable energy (REN21, 2014, 2017). There are two main theoretical advantages for using auctions as a support scheme for renewable energy over other support instruments. First, the remuneration level of renewables is determined by a competitive procurement process that may lead to falling remuneration levels (del Río and Linares, 2014). A second and related advantage is that auctions offer more control over the expansion of renewable energy by specifying the desired capacity to be contracted and its implementation deadline (del Río and Linares, 2014).

Practical experiences of auctions are however ambiguous. Various scientific evaluations highlight that some awarded projects do not reach commercial operation by the agreed deadline or are abandoned at some point after the auction (Bayer et al., 2016; del Río and Linares, 2014; Lucas et al., 2015; Lucas and Gómez, 2017). So auctions may successfully cap the expansion of renewable energies, but they do not guarantee that expansion targets are actually met. This represents a major risk, since renewable energy project delays and cancellations may lead to reduced energy security, higher wholesale market prices, higher CO_2 emissions of the respective electricity market and to a reduced public acceptance of renewable energy.

The importance of addressing policy challenges of designing auctions in order to achieve high on-time implementation rates is recognized across related literature (Ferroukhi et al., 2015; Held et al., 2014; Kreiss et al., 2017; Lucas and Gómez, 2017; Tietjen et al., 2015). The design elements that impact the implementation process relate principally to qualification requirements, penalties and the procedure to select the winning bids. Stricter requirements tend to improve implementation rates; they may, however, also lead to undesired side effects like higher remuneration levels or reduced competition levels.

Various countries that have expanded their wind power capacity through auctions have experienced delays in project implementation. In

Abbreviations: ANEEL, Brazilian Electricity Regulatory Agency; BNDES, Brazilian Development Bank; BRL, Brazilian Real; CCEE, Brazilian Power Trade Chamber; EPE, Brazilian Federal Energy Planning Company; ICG, Shared substation exclusive for power plants; LEN, Auction for new energy; LER, Auction for reserve energy; LFA, Auction for alternative energy; MME, Brazilian Ministry for Mining and Energy; ONS, Brazilian Independent Transmission System Operator; PPA, Power Purchase Agreement; USD, United States Dollar

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Brazil, only 17% of the awarded capacity in the first ten auction rounds reached commercial operation by the deadline. In Panama, only a small part of the awarded capacity of the first auction in 2011 was implemented on-time (Lucas and Gómez, 2017) and in Uruguay, all projects of the first six auction rounds were delayed (Lucas and Gómez, 2017). Though in Uruguay, the extent of the delays was only months and not years such as was the case in Brazil (Lucas and Gómez, 2017). The on-time implementation in South Africa was substantially better and reached a rate of 81% for its first two auction rounds (Bayer et al., 2016). The available data for Italy suggests that delays have also been experienced, however, the data is insufficient to determine the exact delays (Bayer et al., 2016). Yet other countries like France (EOLE program) and the United Kingdom (NFFO program) experienced a high share of project cancelations (del Río and Linares, 2014; Mitchell and Connor, 2004; Nadaï, 2007), so the relevant literature reviews the extend and the reasons for project cancelations, but not the delays of the implemented projects. These results show significant differences in magnitude of delays amongst the countries. Consequently the implementation rate is a major issue in some countries, while it is not a crucial issue for others.

Wind power auctions in Brazil provide an especially interesting case to further analyze and discuss the practical reasons for delays and mitigation measures through auction design. First, Brazil has a long history of using auctions as an instrument to extend its generation capacity. Second, earlier publications found that Brazil has severe problems with on-time implementation rates despite its vast experience with auction for wind power and auctions in general (Bayer, 2017).

Brazil has over one decade of experience in contracting new electricity generation capacity through auctions. These auctions were introduced in 2004, and by the end of 2016, 94 GW have been awarded, mainly from renewable sources like biomass, hydropower and wind power (Brazilian Power Trade Chamber, 2017a). Wind power projects were awarded for the first time in 2009. Since then until the end of 2017, 16 auctions have taken place with the participation of wind energy, and a total capacity of 14.6 GW has been contracted (Brazilian Power Trade Chamber, 2017a). As a result, Brazil now has a total installed wind capacity of 11 GW and was ranked ninth worldwide for its capacity at the end of 2016 (International Renewable Energy Agency, 2017). It was also ranked fifth worldwide in terms of the amount of capacity that was newly installed in 2016 (International Renewable Energy Agency, 2017).

The practical experience with wind power auction in Brazil has been the subject of several case studies (Bayer, 2017; Bradshaw, 2017; Dalbem et al., 2014; del Río, 2017; del Río and Linares, 2014; Elizondo Azuela et al., 2014; Erik Eduardo Rego and Virginia Parente, 2013; Lucas et al., 2015; Lucas and Gómez, 2017; Silva et al., 2013). Studies addressing project delays highlight that the rate of on-time implementation is low and that delays can stretch to several years (Bayer, 2017; Elizondo Azuela et al., 2014; Lucas and Gómez, 2017).

Even though a variety of studies were published on wind power in Brazil, a comprehensive assessment of the reasons for delays and their practical relevance is so far lacking. This would, however, be crucial to improving auction design and drawing lessons from past experience. We aim to close this research gap by combining two approaches. Firstly, we conducted an interview series with Brazilian experts in the field of wind energy. Secondly, we reviewed ANEEL's administrative decisions for each awarded projects to gain further information on the reasons for project delays.[1]

In Section 2 we describe the data sources used in this article. Section 3 focuses on the elements of the Brazilian auction design that effect on-time implementation rates. Section 4 will then provide an up-to-date overview of the extent of wind energy project delays in Brazil. In Section 5, the reasons for these delays will be explained and their relevance assessed. Section 6 points to lessons that can be drawn from the Brazilian experience with regard to auction design.

2. Data sources

The description of the auction design and legislative amendments is based on the 16 auctions in which wind energy was awarded. We assessed the ordinances of the auctions (Brazilian Electricity Regulatory Agency, 2009, 2010b, 2010c, 2011a, b, c, 2012, 2013b, c, d, e, 2014b, c, 2015a, b) as well as general electricity market laws and regulations of relevance for the auction framework (Presidency of the Republic of Brazil, 2004a, b).

The data used for analyzing the project status and delays originates in the databases and publications of the Brazilian Electricity Regulatory Agency (ANEEL) and the Brazilian Power Trade Chamber (CCEE). CCEE's monthly updated publication “Consolidated auction results” provides basic information on all awarded projects (Brazilian Power Trade Chamber, 2017a). Information on current project status was retrieved from ANEEL's database on Brazilian power plants (Brazilian Electricity Regulatory Agency, 2017a) and the monthly updated monitoring report on wind power projects that are not yet in commercial operation (Brazilian Electricity Regulatory Agency, 2017b). Furthermore, we checked all 397 awarded projects individually to see whether the deadline had been amended and what justification was given, or whether the project developer had requested the annulment of the contracts based on ANEEL's virtual library of laws and decrees (Brazilian Electricity Regulatory Agency, 2017d). To determine the owner of the projects we used the methodology proposed in Bayer (2017), which is based on ANEEL's database on the shareholder structure (Brazilian Electricity Regulatory Agency, 2016g). The data collection used for the evaluation in this paper is presented in Annexure A.

In order to collect further information on the practical reasons for the wind power project delays in Brazil, we conducted semi-structured expert interviews with Brazilian wind project developers, wind turbine manufacturers, as well as public authorities and consulting firms that are active in the wind energy sector. The key features of semi-structured expert interviews are: the topic centered approach, its flexible structure, and the interactional exchange to bring the relevant topics into focus (Crow and Edwards, 2013; Rapley, 2005). This approach was chosen because it is particularly suited for expert interviews aiming to collect specific information which is not yet available in (scientific) literature (Meuser and Nagel, 2009; Trinczek, 2009).[2]

The number of actors from the private sector is higher than from public authorities. However, this difference was not considered to affect the balance of the outcomes since the key public authorities were interviewed.

Table 1 summarizes the credentials of the interview partners. As they opted to remain anonymous for this research project, we do not state their names or the names of their companies. In order to reference the statements of the surveyed experts, we will use the letters “a” to “n” throughout the paper.

The insights of project developers and wind turbine manufacturers were obtained through interviews conducted with companies that rank in the top half, based on the installed capacity. The interviews (a-n) represent in total 58% of the installed wind power capacity of the first

[1] ANEEL maintains an official database containing the majority of its administrative decisions including the justification.

[2] At the beginning of the interviews, the interviewees were asked about their perspective on the reasons for project delays and were given the space to respond in their own words. Additional inquiries aimed to validate the statements or to learn about specific examples or underlying causes. In the next phase, the interviewees were asked about their assessment of known reasons that had not yet been mentioned in the initial interview phase. Finally, we inquired about the interviewee's point of view about the interrelation between auction design and delays.