Report D4.1-BRA, March 2016

Auctions for Renewable Energy Support in Brazil: Instruments and lessons learnt

AURES

European Commission

HORIZON 2020

Short about the project

Auctions for Renewable Energy Support: Effective use and efficient implementation options (AURES)

This project helps assessing the applicability of different auction types to renewable support under different market conditions. It also explores which auction types and design specifications suit particular requirements and policy goals in European countries. By establishing best practices and a knowledge sharing network, we contribute to informed policy decision-making and to the success of auction implementations across Europe.

Target-oriented analysis: Through analysis of empirical experiences, experiments and simulation, we will create a flexible policy support tool that supports policy makers in deciding on the applicability of auction types and certain design specifications for their specific situation.

Capacity building activities: We undertake specific implementation cases to derive best practices and trigger knowledge sharing amongst Member States. We strive to create a strong network with workshops, webinars, bilateral meetings, newsletters, a website that will serve as capacity building platform for both policy makers and market participants (including project developers, auctioneers, etc.). Wherever required, we can set up specific bilateral and multilateral meetings on specific auction issues and facilitate cooperation and knowledge sharing. Additionally, we offer sparring on specific implementation options, drawing from insights gained during the first phases of the project (empirical analysis of previous auctions in Europe and the world), conceptual and theoretical analysis on the applicability of specific designs in certain market conditions and for certain policy goals issues and facilitate cooperation and knowledge sharing. Additionally, we offer sparring on specific implementation options, drawing from insights gained during the first phases of the project (empirical analysis of previous auctions in Europe and the world), conceptual and theoretical analysis on the applicability of specific designs in certain market conditions and for certain policy goals.

Project consortium: eight renowned public institutions and private firms from five European countries and combines some of the leading energy policy experts in Europe, with an impressive track record of successful research and coordination projects.

This report deals with all past and ongoing auctions for renewable support in Brazil. Since 2004, five single-item, technology-specific offshore wind auctions were held, with one more currently ongoing. One multi-item, multi-site nearshore wind auction is currently ongoing.

The report contributes to the first and second of three tasks in work package 4 of the AURES project:

T4.1 Providing a characterisation of the different auctions

T4.2 Making an assessment of auctions and case-specific lessons learnt

T4.3 Interpreting and summarising the general lessons learnt and resulting and thereby outline specific recommendations

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Report D4.1-BRA, March 2016

Auctions for Renewable Support in Brazil: Instruments and lessons learnt

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Project deliverable:
WP4 - Empirical aspects of auctions for RES-E: Learning from real experiences.
Task 4.1 Characteristics of auctions
Task 4.2 Assessment of auctions and case-specific lessons learnt

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1. Characteristics of auctions in Brazil

Table 1. Characteristics of auctions in Brazil

Characteristics	Description
Country characteristics	Brazil is the fifth-largest country in the world in terms of surface area (8.5 million km^2)[1], and the seventh-largest economy with a GDP of €2,077 trillion. The country experienced a decade of economic and social progress from 2003-2013 in which over 26 million people were lifted out of poverty[2]. However, growth in Brazil has slowed in recent years, with GDP sinking 3.8% in 2015[3]. In 2001, the electric system underwent a serious supply crisis, which culminated in a power rationing plan. This event generated questions about the course the electric sector was taking. One of the proposals to correct the former model was the establishment of auctions in 2004 for distribution companies to acquire electricity to serve their captive customers[4]. Brazil had a total installed generating capacity of 134 GW in 2014, with roughly 66% (89.2 GW) of that coming from hydro[5]. The government has set a target to increase non-hydro renewables generation to 20% of total electricity by 2030, and is likely to reach it as early as 2017.
Market characteristics	Before 1995 the power sector was predominantly government-controlled with vertically integrated companies. The first reform model (implemented in 1995) aimed at opening up the market with emphasis on privatization. In the new model (implemented in 2004) the emphasis is on coexistence between state-controlled and private companies. Figure 1 shows the current structure of the country's power sector.

[1] CIA (2016)
[2] World Bank (2015)
[3] Biller (March 3, 2016)
[4] Captive or regulated consumers are supplied by the distribution company operating in their geographic concession area. They constitute 70% of the country's load and their rates are regulated by ANEEL. Free consumers are those with a load equal to or greater than 3 MW, e.g. independent power producers and large industrial consumers. These consumers can bilaterally negotiate their own supply contracts with generators.
[5] MME (2015)

Characteristics	Description

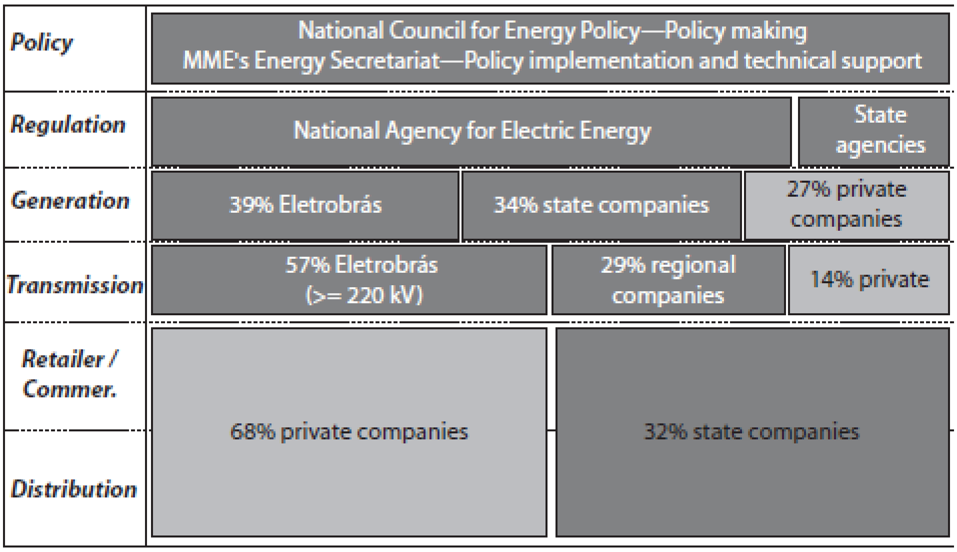

Figure 1 Power sector structure in Brazil[6]

The reforms also created a regulated market for electric companies providing a public service, alongside a market for free customers (defined as having a peak load ≥ 3 MW). In the former, power producers sell electricity in auctions to distribution system operators (DSO), which then sell it to captive consumers. The Government does not act as a central buyer.

Name of auction scheme	No specific name. Laws 10,847 and 10,848 adopted in 2004[7] provide the basis for the auction scheme.
Objectives	Main goals of the auctions are: - Attract new generation capacity to bridge the supply-demand gap: over the past decade, Brazil's demand has grown yearly by 4.3% - Ensure supply adequacy in the country: procurement based on load forecast - Optimal management of hydropower reserves by distribution companies - Price disclosure and efficiency in the procurement process by reducing the asymmetry of information between the industry and the government The first wind-specific auction in 2009 aimed to take advantage of the 2008-2009 world financial crisis that lowered equipment cost, as well as to foster competition among interested investors, to start the development of this technology in the country at a larger scale[8].

[6] Vagliasindi and Besant-Jones (2013)
[7] Lucas et al. (2013)
[8] Porrua et al. (2010)

Characteristics	Description
Contracting authority	The auction process is led by the National Electricity Regulatory Agency (ANEEL) under the guidelines of the Ministry of Mines and Energy (MME). An auction committee undertakes the main auction tasks, which are distributed among different institutions. Once an auction concludes, the winning generator companies sign contracts directly with distribution companies[9].
Main features	Under the Brazilian auction scheme project developers are through competitive bidding awarded contracts of feed-in tariffs valid for 20 years. The auction scheme is not exclusively designed for supporting renewable energy, as non-renewable power capacity is also auctioned. There are two types of auction: regular new energy auctions and reserve auctions. - New energy auctions: carried out twice per year for electricity to be delivered three and five years later (referred to as A-3 or A-5 auction, respectively). A-3 auctions are typically used for wind, solar and small-hydro, while A-5 ones for largescale hydro and conventional power sources. Main goal is to procure energy contracts (supported by firm energy certificates - FEC[10]) to back up the distribution companies' load growth. The counterparty of the contract is the distribution company, who passes all costs to regulated consumers. - Reserve auctions: carried out sporadically at the government's discretion. Main goal is to contract surplus energy to increase the system's reserve margin. These auctions have been used to promote RE in Brazil. Contracts do not need to be covered by FECs. The counterparty is the Electricity Trading Chamber (CCEE), who collects a fee from regulated and free consumers to cover contract costs
Year of introduction	The first technology-specific auction was held in 2007 for biomass and small hydro, and in 2009 for wind energy.
Technology focus and differentiation	Auctions can be[11]: - Technology-specific (e.g. biomass only auction in 2008 and wind only auction in 2009 and 2010)

[9] Rego and Parente (2013)
[10] FEC = Firm Electricity Certificate. FECs are awarded for each 100 MW, and the total FECs must add up to the total capacity contracted. The regulator issues FECs to each generator in the system.
[11] Lucas et al. (2013)

Characteristics	Description
	- Alternative energy auctions (wind, small hydro and biomass in 2007 and in 2010) - Technology-neutral auctions (carried out regularly since 2005; RETs have been participating since 2011). ANEEL determines which RETs are eligible in auctions and when they can compete with conventional power sources (as in the case of 2011 auction).
Lead time before auction	Approx. 4 to 5 months. For example: in April 2013, the MME confirmed the date for the next wind-only auction to be 23 August 2013. Participants had to register before 27 May to participate in the auction[12].
Min. / max. size of project	There are no project size requirements, and small actors are not exempt from the auction scheme. However, bid bond requirements virtually prevent small actors from participating. Since 2013, the maximum amount of energy that wind plants can offer in the auction (and their FECs, in regular auctions) is the P90 value of their wind certification. This way, wind farms' actual generation should be equal to or higher than their calculated certification in 90% of future years, resulting in a more conservative assessment of wind plants' contribution (all else being equal)[13].
What is auctioned?	Energy (MWh) is auctioned in this case.
Budgetary expenditures per auction and per year	No data on expenditures is available. Experts estimate annual expenditures less than 500,000.
Frequency of auctions	There is no fixed schedule but new energy auctions are usually carried out twice a year, whereas reserve auctions are scheduled at the discretion of the government. The 14th new energy auction in 2012 was cancelled due to low demand projections from the distributors[14]. The latest auction (scheduled for February 2016) has been postponed to March 2016. Participants said they needed more time to submit the necessary documents[15].
Volume of the tender	Volume is determined based on demand forecasts declared by distribution companies in new energy auctions or at the discretion of the auction committee in reserve auctions.

[12] BWEC (2013)
[13] Elizondo et al. (2014)
[14] Lucas et al. (2013)
[15] Morais (2015)

Characteristics	Description
Auction design elements	See Table 2.

Design elements for the assessment of auction schemes for RES-E

Table 2. Design elements of auction schemes in Brazil

Design elements	
Single- or multiple-item auctions	Multiple units of same product are allocated
Auction procedure	Brazil uses a hybrid scheme: phase 1 operates as a descending-clock auction, while phase 2 consists of a final pay-as-bid round for the winners of phase 1[16]. In phase zero, bidders first confirm the quantity of electricity (in GWh per year) they are willing to commit at the auction's ceiling price (disclosed in advance). This quantity cannot be revised in later rounds, even as the offered price decreases. Phase 1 starts with a high price expected to create excess supply so bidders indicate how much they are willing to supply at this price. The auctioneer then lowers the price until the desired supply level is met, plus a certain margin to keep competition among bidders who passed the first stage. In phase 2, remaining bidders offer a final sealed price, which cannot be higher than the price disclosed in the first stage. The clearing price is determined when supply equals demand, and the winners are those whose bids offered lower prices than the clearing one. Prior to the auction, two parameters are defined and kept undisclosed[17]: - "total demand": maximum amount of energy that will be contracted from all products (provided that there is sufficient supply) - "demand parameter": used to force a minimum level of competition. If the demand parameter is equal to 1.5, it means that the total volume of

[16] IRENA (2015)
[17] Ibid.

Design elements	
	the bids must be at least 50% higher than the auctioned volume. If the bid volume is insufficient, then the auctioned volume will be adjusted downwards automatically. The Brazilian auctions do not disclose the auction's volume to avoid collusive behaviour. Instead, bidders are told[18]: - the ceiling price offered for each technology group prior to the auction - the auction status ("open" when there is excess supply, or "closed" when there is excess demand) at the end of the first phase
Pricing rules	Pay-as-bid
Ceiling price	The MME sets the price ceiling of the first stage prior to the start of the auction[19]. First stage aims to discover the price ceiling of the second stage[20]. The maximum bidding prices for the April 2015 auction for wind and biomass were BRL 179 (€51.9) per MWh for wind power projects[21].
Qualification criteria	Project developers, who wish to participate in auctions in Brazil, have to fulfil a number technical and financial requirements but there are no past-experience requirements. The qualification requirement stage is highly standardised and fully automated (web-based), being tailored for each technology. Depending on the technology, the required documentation includes: environmental permits, access approval issued by the system operator and resource assessment measurements undertaken by an independent authority[22]. Bidders have to provide a bid bond equalling 1% of the estimated investment to enter into phase 1 of the auction. Subsequently, bidders are required to increase the bid bond to 5% of the estimated investment in order to participate in the second round. The bid bond is released after certain project milestones are completed. In wind and solar PV auctions, participants' net worth must be at least 10% of the project's estimated investment cost.

[18] Dutra and Menezes (2005)
[19] Ibid.
[20] Held et al. (2014)
[21] Dezem (2015)
[22] Cozzi (2012)

Design elements	
	Preparation for bidders to pass the qualification phase usually takes between three and six months. However, because qualification requirements almost never change from one auction to the next, a project that has been qualified once is likely to succeed in qualifying for subsequent auctions if it does not win[23]. Local content requirements (LCR) are not part of the prequalification or the bid evaluation criteria. However, to qualify for subsidised loans by the Brazilian Development Bank (BNDES) under its FINAME programme, wind manufacturers have to produce or assemble at least three of the four main wind farm elements (i.e. towers, blades, nacelles and hubs) in Brazil. This policy has led to the rapid growth of a domestic supply chain[24]. In Brazil the power plant owner has to pay network fees. Additionally wind-farm owners have to pay the grid connection fees from the wind park until the next transformation station.
Penalties	In terms of project realisation: if delayed by more than one year, the contract can be terminated without further justification (and without reimbursement of the bid bonds). In practice this has not been applied because project developers have credibly argued that public entities were responsible for delays occurred (e.g. in licensing procedures). Regarding electricity production: any deviations between 90% and 130% from the contracted electricity amount are bankable up to four years. - If electricity production falls below 90%: penalty of 115% of the feed-in-tariff is to be paid for the electricity shortage below 90%. Missing amount is transferred to the balance of the next year. - If electricity production exceeds 130%: 70% of the tariff is paid for the extra amount of electricity and the amount is again transferred to the following year. - After four years, producers are required to clear their balance and to compensate for deficient or over-production by buying or selling electricity from other producers.
Monitoring of realisation progress	An auction committee undertakes the main auction tasks which are distributed among different institutions[25]: the MME, ANNEL, the Chamber for

[23] IRENA (2015)
[24] Ibid.
[25] Lucas et al. (2013)

Design elements	
	Commercialisation of Electrical Energy (CCEE), which is responsible for spot price setting, contract settlement and conducting energy auctions, and the Energy Research Company (EPE) that sits within the MME and provides support in the planning of the energy sector. This committee defines the auction, suggests price caps, prepares the auction documents and coordinates with transmission planning
Exceptions from requirements for small plants/developers?	Incentivizing small actor participation is not one of the policy goals set by the Brazilian government to be met through its RE auctions and there are no exceptions in place to foster the participation of small developers. Moreover, given that the market structure is primarily dominated by large companies, the share of small plant / developers is insignificant,
Different options regarding what is effectively tendered and what is asked for as bids	No. Both the auction volume and the amount bid by projects developers is expressed in energy (MWh).
Transferability of support right	Auction awards are tradable and result in a “secondary market”. Some experts estimate that around 30% of earlier auctions are dealt with in a secondary market. This secondary market is made up entirely of “over-the counter” deals[26].

2. Evaluation criteria for the assessment of auction schemes for RES-E

Actor diversity and social acceptability

Smaller players seem to have been excluded from auctions in Brazil. This can partly be attributed to the fact that the required bid bonds have posed significant barriers for smaller (and for local) potential bidders (Held et al., 2014). Moreover, local bidders participating in the auctions have largely not been able to compete with the bids made by international investors. Brazil’s leading renewable energy developer Desenvix Energias Renovaveis SA, for example, forwent bidding in the 2012 auction because “the returns were far too low” (BNEF, 2012).

[26] Held et al. (2014)

Figure 2 shows that 40% of all wind energy projects auctioned in 2014 belonged to electric utilities, 38% to independent power producers and 14% to institutional investors. It also shows that small actors did not play an important role. Altogether nine actors own more than 50% of the total installed capacity. Due to the high transaction costs small players are excluded automatically, although the total number of participants has increased over the time and with a growing number of projects.

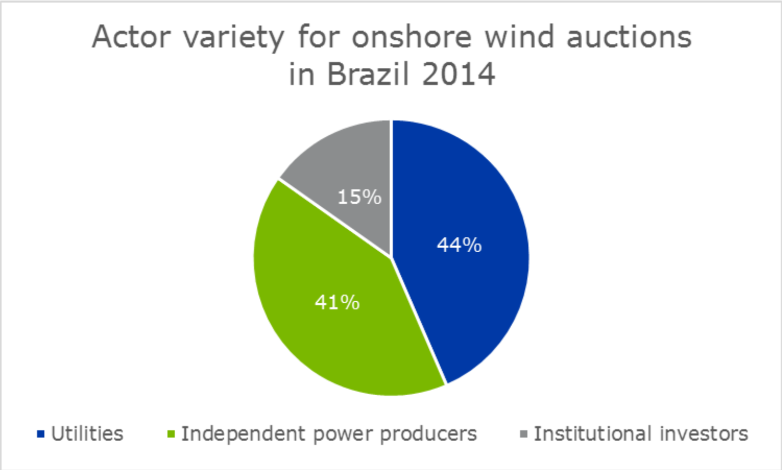

Figure 2 - Actor diversity for onshore wind auctions in Brazil 2014[27]

Policy effectiveness

Figure 3 provides a summary of the status by 2014 of the projects auctioned in the first three Brazilian wind auctions. One of aspect that stands out is the magnitude of the transmission problem: roughly 70% of the contracted capacity (that should have started operations in 2013) was delayed for more than a year, with almost 70% of that been attributed to problems in the construction of transmission lines and substations (Elizondo et al., 2014). The drought in 2014 strained hydropower production, while 48 wind farms that could have powered 3 million homes stood idle due to lack of access to the grid (Sciaudone, 2014). This issue was one of the major reasons why the Brazilian government discontinued its proposed scheme of generation-transmission co-planning in 2013.

[27] Bayer 2015.

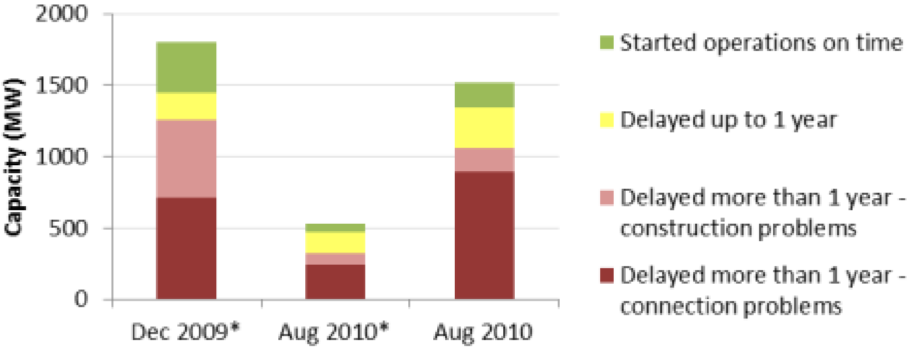

Figure 3 - Current status of the projects auctioned in the first three Brazilian wind auctions[28]

Transmission issues aside, only 30% of contracted capacity started operations on time. Difficulties regarding project finance were also a factor. As the local economy entered a weak patch, the disbursement cycle for development bank BNDES to finance wind projects that have won capacity was long (Frankfurt School-UNEP Centre, 2014). Large number of funding requests to the BNDES and their limited resources also created a bottleneck.

There are reasonable concerns about the financial feasibility of some projects. Of the 78 projects contracted in the August 2011 auction, for instance, 32 (representing 40% of total auctioned capacity) will deliver an annual return to equity of less than 10% (Lucas et al., 2013). According to BNEF, this happened despite the relatively harsh penalties stipulated in the PPA.

Static efficiency or cost effectiveness (including transaction and administrative costs)

The significant price reductions in comparison to the former Proinfa support scheme indicate a high level of competition in the auction, and a high static economic efficiency of auctions in Brazil (Held et al., 2014). Figure 4 shows that between 2009 and 2013 auctions resulted in approximately 11.7 GW of contracted wind capacity, as opposed to the 1.4 GW that was contracted with Proinfa subsidies. Similarly, the auction average final price during this period was $61 / MWh (€54 / MWh), or about 40% lower than that wind power under Proinfa before the auctions.

[28] Elizondo et al., 2014

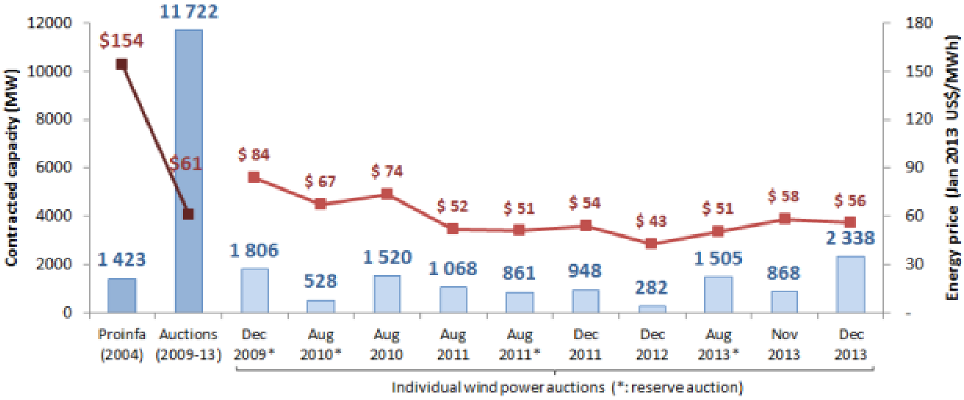

Figure 4 - Comparison of contracted capacity and prices during wind power auctions and Proinfa[29]

There are several factors behind Brazil's low RE support levels. First, wind farms in Brazil are able to generate much more power per unity of installed capacity than if installed in other places, which renders the Brazilian wind farms more cost-effective. Some wind farms have CFs higher than 50%, whereas in the UK and much of Europe 30–35% is at the high end of expectations (Moore, 2013). Second, auction prices disguise subsidies "built into the transmission and distribution system, where wind operators are given a 50% discount on grid costs, which are instead loaded onto other sources" (Moore, 2013).

Third, the chosen auction award has played a crucial role. Brazilian authorities decided to offer an attractive contract in terms of risk protection for investors, which appears to have increased the number of potential participants and decreased price bids. Auction winners receive a long-term (20-year) feed-in tariff and the energy contracts are indexed to the local consumer price index, making the seller's contracted amount constant throughout the contract (Maurer & Barroso, 2011; Porrua et al., 2010).

In addition, the Brazilian development bank, BNDES, offers favourable financing conditions to project developers. They are offered loans of up to 80% of the total investment, to be paid in (up to) 16 years at a basic spread of 0.85% per year (Gornsztejn, 2012). These favourable conditions are partly due to the fact that the PPA acts as a state guarantee, independent of delivery. Starting from the delivery date, the government first pays BNDES to cover the agreed loan quota, after which payment is made to project developers.

However, it is unclear at present whether the achieved prices are sustainable or whether project developers have made overoptimistic (winner's curse) or strategically low bids (underbidding), potentially leading to low realisation rates (Elizondo et al., 2014; Held et al., 2014).

Dynamic efficiency

The technology choices in auctions in Brazil have focused on onshore wind, biomass and hydro, thereby not encouraging a broad technology mix and decreasing dynamic efficiency (Held et al., 2014). However, the

[29] Elizondo et al., 2014

country has made efforts in recent years to deploy solar PV. In fact, three solar power auctions have been held to date: two solar-only in October 2014 and August 2015, and one in November 2015 where wind was included in the competitive bidding. The auctions secured approximately R$ 12 billion (€2.9 billion) in investments for the next three years with the following results[30]:

- October 2014 auction (solar-only): over 1 GW awarded — 31 projects to start supplying energy on Oct. 1, 2017 — at an average price of R$ 220 / MWh (€53.5 / MWh)
- August 2015 auction (solar-only): over 830 MW awarded — 30 projects to start supplying energy on Aug. 1, 2017 — at an average price of R$ 301 / MWh (€73.2 / MWh)
- November 2015 auction (solar and wind): over 920 GW awarded — 33 solar power projects to start supplying energy on Nov. 1, 2018 — at an average price of R$ 297 / MWh (€72.2 / MWh)

Compatibility with market principles and integration

Local content is only a precondition for financing, not an evaluation criterion within the auction itself. In 2013 the BNDES began to tighten LCRs, moving away from the minimum 60% LCR, to a series of targets to be accomplished by manufacturers by January 1 2016. Currently, wind project developers must meet at least three of the following four criteria (IRENA, 2015):

- Wind towers manufactured in Brazil, with at least 70% of the steel (by weight) or concrete produced in Brazil
- Wind blades produced in Brazil
- Nacelle assembled in a local facility in Brazil
- Hub assembled in Brazil, using national cast iron

For solar PV there is a sliding scale of loan rates and maximum support levels according to how much local content is included in a project, as well as the efficiency of modules (Spatuzza, 2015). The system classifies project components in “minimum”, “optional” and “premium”. Projects meeting the minimum LCRs can receive loans up to 65% of total equipment costs. Those including “optional” and “premium” items can receive up to 80% of total costs. From 2020 onwards a blanket 60% LCR will be in place for modules.

For wind and solar PV project developers to access BNDES financing, they have to build projects using equipment that has Finame accreditation to prove that it has been produced / assembled locally. In the case of wind, companies like Acciona, Fuhrlander, Siemens, Suzlon and Vestas were found not complying with this requirement (Nielsen, 2012), but some have regained accreditation in recent years.

Administratively determined feed-in tariffs and feed-in premiums are, under certain conditions, sanctioned by the WTO when combined with LCRs. The feed-in tariff programme of the Canadian province Ontario was found to be inconsistent with WTO law due to the local content requirements attached. However, RES auctions are unlikely to be subject to WTO law even if they include LCRs. The two preconditions for the application of the General Agreement on Tariffs and Trade (GATT) Article III 8(a) would likely not be fulfilled,

[30] Figueiredo and Pascal (2016)

since government agencies do not purchase electricity "for [their] own use or benefit" and they "commercially resell" it to the end-customers (Kuntze and Moerenhout, 2013). Still, there is a large grey area surrounding what types of LCRs are "acceptable" or not.

Distributional effects & minimisation of support costs

For regular auctions, energy costs are passed through to regulated consumers in tariffs. For reserve auctions, contract costs are passed to regulated and free consumers via a reserve energy charge. As mentioned before, during the 2014 drought in Brazil, 48 wind farms that could have powered 3 million homes stood idle. Yet consumers still had to pay for the unused power because energy contracted in auctions entitles developers to a fixed payment based on a reference annual production. Hence, although auctions managed to lower RES substantially, this did not necessarily translate into lower support contributions coming out of consumers' pocket. According to wind power association, Abbeolica, consumers are paying about R$ 560 million[31] (€137 million) for energy they have not used, and about R$ 3 billion (€734 million) to turn on thermo-electric plants that are replacing the missing wind power.

3. Lessons learnt: key best practices and pitfalls identified

Long-term fixed feed-in tariffs render lower risk premiums and thus lead to the lower bids. Auction award provides project developers with revenue stability and eases financing (del Río & Linares, 2014). Besides lower risk premiums and thus lower financing costs, this design feature might attract more potential bidders and thus applies pressure on auction prices due to competition

Auctions in Brazil have been capable of significantly reducing support levels in comparison with former FIT (static efficiency). However, reductions have been partially due to an effective auction design, but equally due to external factors (e.g. excellent sites, international competition, and economic crisis in other parts of the world)

Highly favourable financing conditions to project developers also help explain Brazil's lower RES. These favourable conditions are partly due to the fact that the PPA acts as a state guarantee, independent of delivery.

Although high competition and generous financing conditions in Brazil have contributed to low support costs, it might come at the expense of low realisation rates. Penalties and demanding eligibility requirements have not been enough to raise rates of project implementation. Concerns about the financial feasibility of some projects, difficulties to secure financing, and issues with access to transmission infrastructure help explain the country's relatively low / uncertain realization rates.

[31] Sciaudone (2014)

4. Bibliography

Bayer, Benjamin (2015): Erfahrungen mit Ausschreibungen für erneuerbare Energien in Brasilien. IASS

Biller, D. (2016, March 3): Recovery eludes Brazil economy after biggest dive in 25 years. *Bloomberg*. Available from: http://www.bloomberg.com/news/articles/2016-03-03/brazil-s-economy-shrinks-less-than-forecast-in-fourth-quarter

BNEF (2012, February 15): Brazil Desenvix shifts from wind to hydro as power prices fall. *Bloomberg New Energy Finance*. Available from: http://www.bnef.com/News/53016

BWEC (2013, April 27): Brazilian wind energy auction date announced - tougher criteria imposed. *Cleantech Magazine*. Available from: http://www.cleantechinvestor.com/portal/wind-energy/11508-brazilian-wind-energy-auction-date-announced-tougher-criteria-imposed.html

Central Intelligence Agency (CIA) (2016): The World Factbook: Brazil. Available from: https://www.cia.gov/library/publications/the-world-factbook/rankorder/2147rank.html

Chatterton, R. and Du Rietz, A (2015): Renewable targets that bite? Comparing renewable energy targets with BNEF's New Energy Outlook. Presentation. Available from: http://about.bnef.com/content/uploads/sites/4/2015/11/BNEF_RN_Renewables-targets-vs-NEO_2015-07-20_v3.pdf

Cozzi, P. (2012): Assessing reverse auctions as a policy tool for renewable energy deployment. Energy, Climate, and Innovation Program, Center for International Environment and Resource Policy. Medford, USA: Tufts University.

Dezem, V. (2015, April 27): Brazil wind-power deals fall short of expectations in auction. *Bloomberg*. Available from: http://www.bloomberg.com/news/articles/2015-04-27/brazil-wind-power-deals-fall-short-of-expectations-in-auction

Dutra, J., and Menezes, F. (2005): Lessons from the electricity auctions in Brazil. The Electricity Journal, 18 (10), 11-21.

Elizondo Azuela, G., Barroso, L., Khanna, A., Wang, X., Wu, Y., and Cunha, G. (2014): Performance of renewable energy auctions: experience in Brazil, China and India. Policy Research Working Paper 7062. Washington, USA: World Bank Group

Figueiredo, R., and Pascal, L. (2016, February 18). New Developments in Brazil's Solar Power Sector. *Renewable Energy World*. Available from: http://www.renewableenergyworld.com/articles/2016/02/new-developments-in-brazil-s-solar-power-sector.html

Frankfurt School-UNEP Centre / BNEF (2014): Global trends in renewable energy investment 2014. Frankfurt am Main, Germany: Frankfurt School of Finance and Management.

GIZ (2015): Renewable energy auctions. Goal-oriented policy design. Bonn and Eschborn, Germany: Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

Gornsztejn, J. (2012): Financing wind power development in Brazil. Presentation for IRENA. Copenhagen, Denmark. Available from: http://www.irena.org/DocumentDownloads/events/CopenhagenApril2012/12_Jaime%20Gornsztejn.pdf

Held, A., Ragwitz, M., Gephart, M., de Visser, E., and Klessmann, C. (2014): Design features of support schemes for renewable electricity. Report for the European Commission. Utrecht, The Netherlands: Ecofys

IRENA and CEM (2015), Renewable Energy Auctions – A Guide to Design.

Kuntze, J., and Moerenhout, T. (2013): Local content requirements and the renewable energy industry - a good match? Geneva, Switzerland: ICTSD

Larrea, S. (n.d.). Brazilian electric power sector: Changes in regulatory framework. Inter-american Development Bank (IDB). Available from: http://www.eba-net.org/sites/default/files/meeting_materials/Energy_Bar_Ass_Brazilian_Power_Sector_Chang.pdf

Lucas, H., Ferroukhi, R., and Hawila, D. (2013): Renewable energy auctions in developing countries. Abu Dhabi, United Arab Emirates: IRENA

Maurer, L., and Barroso, L. A. (2011): Electricity auctions: an overview of efficient practices. Washington D.C., USA: World Bank Group.

Ministério de Minas e Energia (MME) (2015): Resenha energética brasileira: exercício de 2014. Brasilia, Brazil.

Moore, S. (2013): Going, Going, Gone: The role of auctions and competition in renewable electricity support. London, UK: Policy Exchange.

Morais, L. (2015, December 21): Brazil postpones energy tender from February to March 2016. *SeeNews Renewables*. Available from http://renewables.seenews.com/news/brazil-postpones-energy-tender-from-february-to-march-2016-506357

Nielsen, S. (2012, December 13): BNDES raises local-content requirement for Brazil wind turbines. Bloomberg. Available from: http://www.bloomberg.com/news/articles/2012-12-13/bndes-raises-local-content-requirement-for-brazil-wind-turbines

Porrua, F., Bezerra, B., Barroso, L.A., Lino, P., Ralston, F., and Pereira, M. (2010): Wind power insertion through energy auctions in Brazil. Power and Energy Society General Meeting 25th-29th July 2010. Minneapolis, USA: IEEE.

Rego, E., and Parente, V. (2013): Brazilian experience in electricity auctions: comparing outcomes from new and old energy auctions as well as the application of the hybrid Anglo-Dutch design. *Energy Policy*, 55, 511-520.

Sciaudone, C. (2014, February 6): Unplugged wind farms sit unused as drought strains grid. *Bloomberg*. Available from http://www.bloomberg.com/news/articles/2014-02-06/unplugged-wind-farms-sit-unused-as-drought-strains-grid

Spatuzza, A. (2015, October 12): IN DEPTH: Brazilian solar and the trouble with local content. Recharge News. Available from: http://www.rechargenews.com/solar/1406989/in-depth-brazilian-solar-and-the-trouble-with-local-content

Vagliasindi, M. and Besant-Jones, J. (2013): Power Market Structure: revisiting policy options. Directions in Development. Washington DC, USA: World Bank

World Bank (2015): Country Overview: Brazil. Available from: http://www.worldbank.org/en/country/brazil/overview