DOI: 10.5902/ 19834659 32720

EVIDENCE OF EXISTENCE WINNER'S CURSE BETWEEN ENTERPRISES WIND AND PHOTOVOLTAIC POWER GENERATORS WINNERS OF THE 8TH RESERVE ENERGY AUCTION

Winner's Curse: evidências da maldição do vencedor entre empreendimentos eólicos e fotovoltaicos vencedores do 8º leilão de energia reserva

Submission: 23/05/2018
Accept: 27/05/2019

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ABSTRACT

Purpose – This article sought evidence of the existence of the as Winner's Curse, among the participants of the 8th Reserve Energy Auction promoted by Brazilian government.
Design/methodology/approach – In order to perform the study, we opted for the use of Multidimensional Scaling to identify groups that have similarities to search for evidence related to the Winner's Curse, characterizing it as descriptive quantitative research of an exploratory nature.
Findings – The results showed that among the 53 projects studied, thirteen are with their schedules delayed, pointing for possible asymmetries among the bidders related to the logistics of their enterprises. The results also calling into question the energy security strategy carried out by the Brazilian government, by allowing several ventures terminating their contracts, coulding also be evidence of the winner´s curse among the future winners of this new model of auction.
Research limitations/implications – The principal limitation is in the choice of only one Brazilian auction for explorer the auctions specially the auctions Brazilians energy.
Practical implications – In the practical implications that research demonstrated than bidders don't planned yours power plants, causing delays or suspension in constructions, evidence of possible existing winner's course in between bidders.
Originality/value – Too was demonstred than in a competition where the products are homogeneity, the example of the energy, the information, experience and relationship between competitors, can to do one enterprise win a auction; but if the anxiety for win is bigger, and doesn't consider basic aspects such as costs the company will have great difficulties in fulfilling its contracts and future sanctions may occur.
Keywords: Winner's Curse, Auctions Energy, Asymmetry of Information

RESUMO

Objetivo – Este artigo buscou evidências da existência da Maldição do Vencedor, entre os participantes do 8º Leilão de Energia de Reserva promovido pelo governo brasileiro.
Metodologia – Para a realização do estudo, optou-se pela utilização do Escalonamento Multidimensional para identificar grupos que possuam semelhanças para busca de evidências relacionadas à Maldição do Vencedor, caracterizando-a como pesquisa quantitativa descritiva de natureza exploratória.
Achados – Os resultados mostraram que entre os 53 empreendimentos estudados, treze estão com seus cronogramas atrasados, apontando para possíveis assimetrias entre os licitantes relacionadas à logística de seus empreendimentos. Os resultados também questionam a estratégia de segurança energética levada a cabo pelo governo brasileiro, ao permitir que diversos empreendimentos rescindam seus contratos, podendo também ser uma prova da maldição do vencedor entre os futuros vencedores deste novo modelo de leilão.
Limitações de pesquisa – A principal limitação está na escolha de apenas um leilão brasileiro, para explorar a teoria dos leilões, especialmente os leilões de energia brasileira.
Implicações práticas – Em relação as implicações práticas, esta pesquisa demonstrou que os licitantes não planejaram suas usinas adequadamente, causando atrasos ou suspensão em suas obras, evidência de possível existência da Maldição do Vencedor entre licitantes.
Originalidade – Também foi demonstrado que em uma competição onde os produtos são homogêneos, a exemplo da energia, a informação, a experiência e o relacionamento entre concorrentes, pode fazer com que uma empresa vença o leilão; contudo, se a ânsia de vencer for maior e não se considerar aspectos básicos como custos, a empresa terá grandes dificuldades em cumprir seus contratos acarretando em possíveis futuras sanções.

Palavras-chave: - Maldição do Vencedor, Leilões de Energia, Assimetria da Informação

1 INTRODUCTION

Since 2004, the Brazilian government has been promoting several auctions to purchase electric power from private enterprises covering several sources, especially the Wind and Photovoltaic sources described by Schleicher-Tappeser (2012) as successors of the current energy sources, although they still present risks (Yu & Foggo, 2017) and high implementation costs (Aflaki & Netessine, 2017).

The wind and photovoltaic sources, which are the object of study of this article, are also constant objects of auctions in the reserve modality, one of the four auction modalities organized by the Chamber of Commercialization of Electric Energy (CCEE), whose purpose is to provide energy security to the distribution system. The last auctions of these modalities occurred in April and August of 2018 electing 24 winners (7 Photovoltaic and 17 Winds) that will be in operation between 2022 and 2024.

Although the implementation of wind and photovoltaic projects is still expensive, compared to the gains they will make during the 20 years of the contract, they are advantageous and profitable with investment percentages varying between 10% and 20% in relation to the value of contract. However, even with long-term contracts, at fixed prices, giving enterprises some legal certainty as recommended by (Borenstein, 2002), some projects present problems in their schedules during the implementation phase, characterizing them as strong candidates not to be operationally and financially.

In addition to the scheduling problems, the Brazilian government announced a new auction modality called the Discontractation Mechanism (CCEE, 2017b) directed to the projects of the 8th Reserve Energy Auction (LER) and previous auctions with the objective to terminate the contracts through the payment of a prize if the bid is one of the winners. This auction model, the first in the world, questions the strategic planning carried out for the sector, betting on the improvement of the economic scenario, currently low, setting the precedent for the proof of the phenomenon of the winner among the vendors of the 8th LER and of other auctions.

In the light of this evidence, the research objective here was to explore among the winning projects of the 8th Renewable Energy Auction (8th LER) evidences that point the existence of the winner's curse, a phenomenon that is manifested among bidders occurring under two forms (Thaler, 1988). On the first the bid of the winner exceeds the value of the object, resulting in financial loss. On the second, the reward obtained is lower than the expectation generated, caused by the excess of optimism at the moment of the event (Karl, 2016; Steiner & Stewart, 2016).

In order to meet the proposed objective, it was decided to delimit the study and analyzes only the 8th LER winning projects that will still be in operation. As an instrument, we opted for the use of multidimensional scaling in order to identify small groups and similarities among the participants that would allow the discovery of characteristics inherent to the winner´s curse, applying in parallel the inferential analysis for the data discussion.

As a result, it was observed that the 8th LER winners, who are delayed, have indications of asymmetry of information related to technological and logistical issues, possible explanations for the difficulties experienced by these projects. For future studies, it is suggested that quantitative and in-depth studies be applied to the companies that rescinded their contracts through the Auction of Discontractation that happened in August of 2018.

2 THEORETICAL REFERENCE

The energy market, in particular electric, has undergone major changes in its format. The prerogative related to the verticalization of the entire power sector (generation and distribution) monopolized by public companies ceased to exist (Aflaki & Netessine, 2017), a fact that occurred in Brazil in 1995 through laws 8,987 and 9,074, which regulated the sector, allowed the private initiative explore this market in regulated environments mediated by the Electric Energy Chamber of Commerce (CCEE) and opened free negotiation (Abbud & Tancredi, 2010).

In parallel, there are the sustainable sources that visualize wind and photovoltaic (solar) sources, as the successors of current energy sources (Schleicher-Tappeser, 2012), based on innovative technologies that can allow exploration of these sources in a simpler and cheaper way (Borenstein, Bushnell, & Wolak, 2000). This kind of energy are necessary in face of the fast depletion of natural resources together with several short- and long-term uncertainties that affects the sector (Markard, Raven, & Truffer, 2012).

Although it is tempting to exploit the electricity generation market, and it is believed that the global energy landscape will be composed of new sustainable matrices (Dale & Benson, 2013), the non-observance of investment risks associated with energy storage (Yu & Foggo, 2017) and the high costs involved are the main barriers to these sources (Aflaki & Netessine, 2017). That is the case of photovoltaic sources whose value of generated energy is four times higher than the costs of the technologies (Bagnall & Boreland, 2008).

(Borenstein, 2002) warned about the barriers mentioned (technology and cost) and proposed as a solution, public policies oriented to encourage projects that generate energy from renewable sources through long-term contracts with fixed prices, as a form of risk protection and price volatility. Countries in Europe and the United States already adopt such measures (Aflaki & Netessine, 2017). In Brazil this practice is also adopted for enterprises that seek in the regulated market the guarantee of revenue through contracts with terms over ten years (CCEE, 2017a); made through auctions that seek the price equilibrium in relation to the generation of energy required by the national system (Ferreira & Patah, 2017). And since the auction is the mechanism adopted by the Brazilian government for the commercialization of energy, it is relevant to have a better understanding of what an auction is and how its dynamics work, which is better informed to readers in the following topic.

2.1 Power Auctions

The auction is a marketing practice that existed some centuries ago (Krishna, 2003), and of course, evolved over time (Justo, 2010; Klemperer, 1998). In a practical way, the auction is a mechanism that promotes competition in the acquisition of goods or services (objects, products, contracts), whose main characteristic is the transparency of the rules determined by the auctioneer and accessible to the potential participants, allowing them to get previous knowledge of the rules before the auction occurs (Maurer, Luiz; Barroso, 2011).

The traditional theory of the auctions has four models: the English or open auction of upward price where the winner is the highest value bid; a Dutch or open-top auction where the auctioneer establishes a high value, which is presumed to be out of reach of the interested parties, and with each new round, a new value, less than base price is established until the winner finishes the good or service; the closed first-price auction (sealed-bid) characterized by sealed bids where the best price is identified after opening all simultaneously; and finally the sealed-bid second-price auction, also known as Vickrey's auction where the winner is the one that presents the best offer, but the amount that he will pay refers to the second best bid (Justo, 2010).

In addition to the formats mentioned by Justo (2010), the auctions can still be classified in terms of their 'Unique' format that allows the participant only a role, bidder or 'Double' where the participant is allowed to take both roles. They can be classified according to their offer as 'Single unit' or 'Multiple units' and can also be determined according to the attributes that make it as 'Unique Attribute' (e.g. price) or 'Multiple Attributes' (e.g. quality, price, etc.). The possible combinations related to the auction model are demonstrated in Figure 2.1.

Figure 2.1 – Classification of Auctions

Source: (Parsons & Klein, 2011; PLA et al., 2014)

Although auctions have advanced over the years (Bulow & Klemperer, 1996; Li, Shi, & Qu, 2011; Milgrom & Weber, 1982), the use of auctions as a mean of marketing and fostering competition is increasing along the years in different economic sectors (Maurer, Luiz; Barroso, 2011), as was the success of the UK in 2000 in the telecommunications auction for the provision of 3G mobile services.

Regarding the electric sector, Maurer and Barroso (2011) mention that auctions are being adopted in several countries: in generation, transmission, and auxiliary services to this sector. In Brazil, the world trend of adopting the auctions in the electric sector began in 2004 with the creation of the Electric Energy Trading Chamber (CCEE), whose model adopted, according to (Rego & Parente, 2013), a variation of the Anglo-Dutch hybrid model proposed by (Klemperer, 1998).

It is important to note that in Brazil there are two markets focused on electricity: one related to the open market, where the agreed values between generators and buyers are subjected to the rules of the market (supply/demand) and the one related to the regulated market in the form of auctions under the responsibility of the CCEE (Decreto Lei 5163, 2004), which in partnership with the Energy Research Company (EPE), organizes the auctions, collects the manifestations of demands from the distribution concessionaires and accredits the agents of energy (water, thermal, wind and photovoltaic).

Since 2004, 70 auctions organized by CCEE have been conducted, mostly directed to the main water source of the Brazilian energy source. At the end of 2005 other sources of renewable energy were contemplated by the auctions being the last event organized by the CCEE in December 2016. Considering only the auctions that covered the wind and photovoltaic sources, the focus of this study was concentrated on 8,396 projects capable of generating 8,888 MWh per year, of which 184 (135 wind farms and 49 photovoltaic plants) will still be operational between 2019 and 2024 (CCEE, 2019).

As it is a rapidly expanding market and a prerequisite for the development of any country, electricity generation enterprises become quite attractive, especially considering the public policies suggested by Borenstein (2002), applied by the Brazilian model, and that may trigger the appearance of a phenomena related to the behavior of companies, especially the winner´s curse for companies that seek through these auctions a position in this market.

The next section clarifies to the reader the concepts surrounding the winner's curse and how this behavior interferes with the dynamics of auctions.

2.2 Winner's Curse and Irrationality

According to Thaler (1988) whenever an object is brought to auction two behaviors are expected. The first is the characteristic risk aversion among bidders who are unsure of the actual value of the object, resulting in bids that undervalue the object in question. The second is the winner's euphoric behavior at the auction that can later turn into repentance, termed in the market as the winner's curse - Winner's Curse.

The winner´s curse takes place in two forms: in the first the bid of the winner exceeds the value of the object, resulting in financial loss. In the second, the reward obtained is lower than the expectation generated by the excess of optimism at the moment of the event (Karl, 2016; Steiner & Stewart, 2016). In both cases, the winner evaluates the result negatively.

The expectation created by the bidder (Thaler, 1988) is explained by Roider and Schmitz (2012) as the anticipation of emotion in auctions, that is, bidders create positive and/or negative expectations about their possibilities of gain or defeat. When they believe in the win, they tend to be higher than the standard in both first price auctions and second price auctions. However, when they feel the possibility of defeat, its implications are directly related to the format of the auction adopted. If it is a second price auction, they increase their offers in response to the possibility of defeat. Whereas if the auction is of the first price the bidder tends not to participate, or if it does so, it will offer bids below the standard, noting the risk aversion.

Risk aversion in the view of Cox, Smith and Walker (1988) is related to the utility function of gain together with the function of the gain threshold and its positive/negative impressions in auction environments. Ockenfels and Selten (2005) relate these impressions to the weighted impulse equilibrium that follows the principle of ex-post rationality by asserting that "for a given value, supply will tend to increase if they observe the loss of opportunity or to decrease if they judge the occurrence of overpayment ".

The ex-post rationale mentioned by Ockenfels and Selten (2005) refers to the existence of informational asymmetry between bidders. Under this theme, Filiz-Ozbay and Ozbay (2007) mention that in auctions where the bidders are faced with incomplete information, ex-ante, there will always be the possibility of not becoming the best ex-post option (revealed information), meaning that repentance does not occur only when the bidder wins, but also when the bidder at the end of the auction finds that he has lost to a bid slightly higher than his bid; in this case, it evaluates that it could have won if it had offered a slightly higher bid, thus earning good gains.

This sense of regret among bidders, in Cooper and Fang (2008) is evidence of the existence of limited rationality. According to the authors, bidders, in addition to being annoyed by the prices applied to their bids, even in cases of victory, are also annoyed by the prices charged by the bidders when they are winners of the auction in question, limited rationality among bidders.

Finally, Battigalli & Siniscalchi (2003) mention that even if there is an asymmetry of information between bidders, it is possible to identify a provisional rational behavior. For the authors, "different types of the same player (bidder) may maintain different beliefs about the bidding behavior of their opponents," thus, even if there is a limitation to access to information, rationality can be achieved by observing the behavior of its competitors, thus responding to some gaps created by barriers to access to information.

3 METODOLOGY

This article aims to explore the evidence that points to the existence of the winner's curse, among the projects that participated on the 8th Renewable Energy Auction (8th LER) in November 2015. In this way, the present work has a quantitative nature with a descriptive approach, and will have as subsidy the official reports published by the Chamber of Commerce of Electric Energy - CCEE and Empresa de Pesquisa Energética - EPE in relation to the participation of these enterprises in the 8th LER, this kind of information is characterized as secondary sources.

For the analysis of secondary data collected, we first sought the use of inferential statistics by evaluating the values offered by each enterprise in relation to the ceiling value mentioned in the 8th LER edict. At the same time, Multidimensional Scaling (MDS) was used as a support, a multivariate technique that points out possible similarities (Euclidean distance) between the observed cases, to determine groups of projects that may contain the characteristics that indicate the existence of the winner´s curse, obeying, however, the premises for its application recommended by Hair et al. (2009) related to data standardization, coefficient of determination - R2 and the value of Stress. The confirmation of the existence of significant differences between the groups identified by the MDS occurred through the non-parametric statistical test called Kruskall-Wallis Test, recommended by Bruni (2012) for not requiring "considerations on population distributions and variances" for the test of equality of averages among populations K (K> 2). Regarding the premise related to sample size, required in other multivariate methods, it does not apply to EMD (Hair et al., 2009). As a support tool in the analysis, SPSS software (Statistical Package for the Social Sciences) version 20 was used.

4 DATA ANALYSIS

The first stage of the analysis refers only to the validation of data for the use of Multidimensional Scaling. Since it is a multivariate methodology, there are assumptions to be observed. The first one refers to the degree of adjustment of the model, followed by the value of Stress that indicates the quality of the model.

As for the parameters used for the generation of results, we chose to measure the data by means of an interval scale and to create the distances between the variables by Euclidean distance. Table 4.1 presents the assumptions pointed out by Hair et al. (2009) for the validation of the study together with the data demonstrating the fit to the premises:

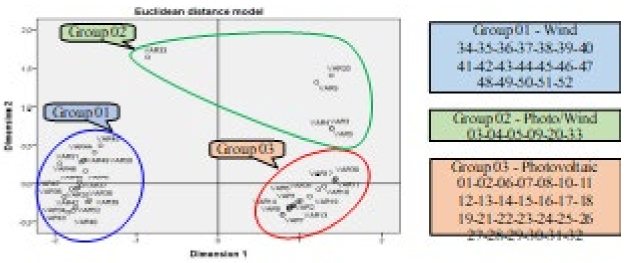
Table 4.1 – Assumptions of Study

Description Assumptions	Desirable results	Search Data
Sample size	Not required	Nº of cases = 8.7 / variable
R^2 (RSQ)	Significance > 0,60	R^2 = 0.99652 – 99.6%
Stress Level	20% - Poor; 10% - Reasonable; 5% - Good; 2.5% - Excellent; 0% - Perfect	Stress = 0.04900 – 4.9%

Source: Adapted from Hair et al. (2009)

Taking into account the indicators described by Hair et al. (2009) as minimum criteria to apply the scaling multidimensional, we concluded that the coefficient of determination (R2 - RSQ) and stress levels are within a range that ensures the reliability of the data and the use of this method. Through Figure 4.1 (circulated areas) one can see which cases have greater proximity to each other.

Figure 4.1 – Dimensional Model



Source: Authors (2016).

Observing Figure 4.2, we highlight the cases in which there is similarity, obtained through the Euclidean distance, demonstrated through the MDS, thus forming groups 01, 02 and 03. It was chosen to isolate the cases (03, 04, 05, 09, 20 and 33) in a distinct group because they did not have a similarity between the cases formed by groups 01 and 03.

Considering the separation of cases obtained through similarity between cases, already presented in Figure 4.1, we used the results obtained to prove the lack of statistical equality between the means of the groups, shown in Table 4.2, through the non-parametric Kruskal-Wallis test.

Table 4.2 – Test Kruskal-Wallis

Test Statistics[a,b]

	Zscore (POT_USINA)	Zscore (GAR_FISICA)	Zscore (LANCE)	Zscore (VALOR_TETO)	Zscore (TX_DESAGIO)	Zscore (Qtd_Energia_Contrato)
Chi-Square	17,440	31,808	30,689	43,551	35,005	31,079
df	2	2	2	2	2	2
Asymp. Sig.	,000	,000	,000	,000	,000	,000

a. Kruskal Wallis Test

b. Grouping Variable: Grupos

Source: Search Data (2017)

The Kruskal-Wallis test uses the null hypotheses, H_0, affirming the equality of the means and the alternative hypothesis, H_1, in this case affirming the difference between the groups. Therefore, the hypotheses are:

• H_0: The means of K groups are equal (K> 2), thus representing that there is no statistical difference between groups.

• H_1: The means of K groups are different (K> 2), thus representing that there is a statistical difference between groups;

According to Larson and Faber (2010), Bruni (2012) and Hair et al. (2009), the finding of the equality between the means for K groups> 2 is given only by the analysis of significance (Asymp. Sig 2-tailed) where, Sig $\leq$ 0,05 rejects H_0 and it is verified the existence of differences of the between groups (H1). If the Sig $\geq$ 0,05 we accept the null hypothesis H_0 and it is verified the existence of relevant equality between the groups.

Observing Figure 4.3, it is verified that the chi-square test (comparison of means) points respectively (17,440; 31,808; 30,689; 43,551; 35,005; 31,079). All significance is below 0.05, leading to the conclusion that the hypothesis of difference between the means (H_0) among the K groups (three in all) should be rejected, confirming the existence of a statistical difference between the groups identified by MDS (H_1).

After completing the methodological tests related to the premises and diagnosis of difference between the groups, the projects that will participate in the 8th Renewable Energy Auction (LER) were analyzed.

5 DISCUSSION DATA

Since 2005, the Brazilian government has sought to include renewable sources of energy in its National System (SIN). Although the Brazilian initiative aimed at including other renewable sources (2005 - 2019, fourteen years) seems recent, this was already foreseen in the Constitution of 1988 in Articles 175 and 176; it was regulated in 1995 through laws 8,987 and 9,074, leaving the paper only in 2004, with Decree Law No. 5163, which culminated in the creation of the Electric Energy Trading Chamber (CCEE).

After the approval and regulation phases, which lasted for 17 years, today Brazil has 4,696 projects in operation, totaling 153,518,211 KW (ANEEL, 2017a), distributed according to Table 5.1.

Table 5.1 - Enterprises in Operation in Brazil

Matrix	Quantum	Power (kW)	% Participation SIN
Wind	451	10,943,243	7.13
Photovoltaic	51	172,234	0.11
Thermal	2.926	41,044,006	26.74
Nuclear	2	1,990,000	1.3
Hydroelectric Power Plants	614	553,292	0.36
Small Hydropower Plants	433	4,957,984	3.23
Hydroelectric Power Plants	218	93,857,452	61.14
SUM	4696	153,518,211	100

Fonte: ANEEL (2017a)

Table 5.1 shows that wind and photovoltaic projects represent only 7.24% of the total energy matrix in operation in Brazil. It is expected that 135 additional wind farms and 49 photovoltaic plants will be included, including the 53 winners (33 photovoltaic and 20 wind farms) of the 8th LER in 2015. This information is very relevant considering the growing need for energy security in the country and to future investors.

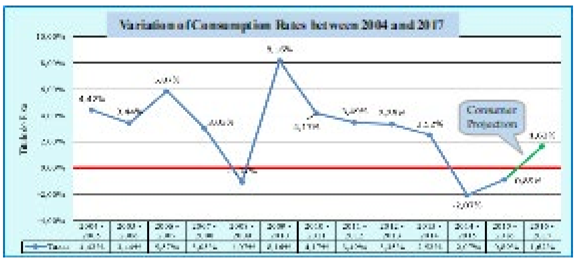
However, in April 2017, the Ministry of Mines and Energy (MME) published the guidelines for the realization of a Relaxation Auction through the 151 directive named "Competitive Mechanism of Relaxation of Reserve Energy" with exclusive focus on wind, photovoltaic and wind farms and hydroelectric generating plants that have existing power reserve contracts (1) and have not yet begun the operation tests (2) required by the full contracted generation. Enterprises that fall under these two prerequisites may bid competitive bidding to terminate their contracts.

The adoption of this type of auction, the first in the world, is seen as necessary by the Electric Sector Monitoring Committee (CMSE), whose purpose is to improve the cash flow that remunerates the current ventures characterized as reserves and which in the future will compensate the winners of the 8th LER. In addition to this justification, the CMSE is also based on consumption projections issued by the National Electric System Operator (ONS), which minimize the future risks related to the lack of energy for the years 2017 and 2018.

Although it is not the focus of this auction of discontractation, several ventures from previous auctions are not financially viable, probably reflecting the winner's curse - stemming from risk aversion or over-optimism that turns into regret when you realize it (Steiner & Stewart, 2016).

In parallel with this probable phenomenon, it is important to note that the Brazilian energy market slowed down, between 2009 and 2013 the average consumption growth was quite positive, with an average of 4.3% per year, but in the last three years (2014, 2015; 2016) fell sharply with a recovery trend of 1.62% in 2017. Graph 5.1 shows the growth rates since 2004 and the projection of consumption for the year 2017.

Graph 5.1 – Evolution rates Consumption and projection of closing for 2017.



Source: Authors (2017)

Among the 53 winning projects of the 8th LER, 40 were eligible to break their contracts (31 photovoltaic and 9 wind farms), out of a total of 192 projects that fall within the prerequisites that had been awarded in previous auctions. The probable participation of these ventures is in contradiction with the Schleicher-Tappeser (2012) statement, which predicts a growth in the exploitation of renewable energies in detriment of the current matrices that exploit the energy of fossil origin, through technologies that will make them financially viable (Borenstein et al., 2000).

Focusing only on the winners of the 8th RSI, grouped through the similarity between cases, whose strategic role is to provide energy security to the national distribution system, and which will still be operational between 2018 and 2019 (CCEE, 2017a), the exception of the Brisas Suaves Plant, excluded because its data are not available in the collected sources, present delays in its schedules, characterizing itself as a probable indication that these ventures are unfeasible. A summary of the schedule for the construction and assembly of these new sources (wind and photovoltaic) is presented through Table 5.2. and demonstrates the number of companies and the status of them in relation to the schedules agreed with CCEE.

Table 5.2 - Quantitative companies and Status Schedule

Status Schedule	Group 3 Photovoltaic		Group 2 Photovoltaic/Wind		Group 1 Wind	
In advance	3	11.5%	2	33.33%	0	0.00%
Normal	18	69.2%	4	66.67%	10	55.56%
Late	5	19.2%	0	0.00%	8	44.44%
Sum	26	--	6	--	18	--

Source:(ANEEL, 2017a, 2017b)

Delays in groups 3 and 1 may be indicative of the winner's curse. According to Ockenfels and Selten (2005), both risk aversion and positive impressions that arise among bidders are related to the existence of rationality originating from incomplete information (Filiz-Ozbay & Ozbay, 2007) that can be translated in bids below the expectation of gain prospected and fed by the possibility of victory and / or the lack of knowledge of the characteristics that involve the enterprise, such as costs, location and maintenance.

Table 5.3 – Value of Bid in relation to the Maximum Value

Status	Group 3 (Photovoltaic)				Group 2 (Photovoltaic/Wind)				Group 1 (Wind)			
	Zone (%)	Nº Bid	Max Value	Bid Value	Zone (%)	Nº Bid	Max Value	Bid Value	Zone (%)	Nº Bid	Max Value	Bid Value
In Advance	76.85	2	381.00	292.80	76.85	1	381.00	292.81				
	79.52	1	381.00	302.99	78.78	1	381.00	300.15				
Normal	76.12	2	381.00	290.00	76.57	3	381.00	291.75	93.60	5	213.00	199.37
	76.80	1	381.00	292.60	83.57	1	213.00	178.00	95.76	4	213.00	203.93
	78.22	4	381.00	298.00					99.71	1	213.00	212.39
	78.61	2	381.00	299.50								
	78.97	4	381.00	300.88								
	79.00	1	381.00	301.00								
	79.01	4	381.00	301.02								
Late	77.69	1	381.00	295.99					96.94	8	213.00	206.48
	77.95	1	381.00	296.99								
	78.73	1	381.00	299.95								
	79.13	1	381.00	301.49								
	79.48	1	381.00	302.80								
Sum		26	---	---	Sum	6	---	---	Sum	18	---	---

Source: (ANEEL, 2017a, 2017b)

In relation to the values of the bids and observing Table 5.3 it is noticed the existence of a balance between the values offered by the winners of the 8th LER, already discounting the value of the discount in relation to the ceiling value, where the average corresponds to 78, 27% in group 1, a group formed only by wind farms, 78.15% in group 2 formed by four photovoltaic projects and one wind power and 96.07% in group 3, formed only by photovoltaic projects. As the auction is a tool designed to promote competition among bidders (Maurer, Luiz; Barroso, 2011), and being the Brazilian model characterized by incomplete ex-ante information (Filiz-Ozbay & Ozbay, 2007) it is natural that the behavior be repeated because of the observations made by between competitors, offering equal or very close values in their bids (Battigalli & Siniscalchi, 2003).

Table 5.4 - Construction costs Wind towers x Projection of Billing of Delayed Enterprises

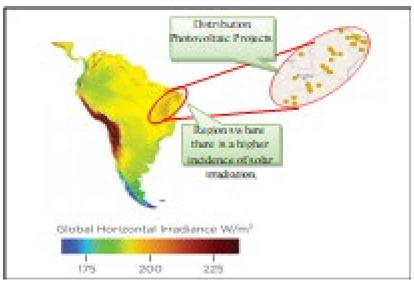
Description	Qtt Energy (MWh)[a]	Qtt Energy Annual (MWh)	Nº of Towers[b]	Total Cost of Construction Towers (USD)[c]	Revenue Projection (USD)[d]	PayBack Investment (years)[e]
Project 1	2,366,820	118,341	11.4	20,257,234.93	128,267,977.32	3.15
Project 2	2,068,776	103,439	10.0	17,706,323.86	112,115,713.51	3.15
Project 3	1,893,456	94,673	9.1	16,205,787.94	102,614,381.86	3.15
Project 4	2,244,096	112,205	10.8	19,206,859.78	121,617,045.17	3.15
Project 5	2,209,032	110,452	10.6	18,906,752.60	119,716,778.83	3.15
Project 6	2,226,564	111,328	10.7	19,056,806.19	120,666,912.00	3.15
Project 7	2,103,840	105,192	10.1	18,006,431.05	114,015,979.84	3.15
Project 8	2,296,692	114,835	11.1	19,657,020.56	124,467,444.66	3.15

Source: ANEEL (2017b, 2017c), Nielsen et al.

a) Quantity of Energy agreed for 20 years 8th LER; b)Agreed Annual Energy ÷ 10,384 MW/year (equivalent to a tower 94 h x 122 Ø x 3 MW); c) Nº of Towers x 1.185 x USD 1,500.00/KW; d) Amount of Energy for 20 years x 54.19 (206.48 ÷ 3.81 USD price 11/13/2015); e) Total Cost of Construction Towers ÷ (revenue projection ÷ contract term 20 years)

Another essential criterion for the success of the enterprise is its location. In the case of photovoltaics, the incidence of sunlight is fundamental to the viability of these projects and in Brazil, this incidence is balanced in all regions. According to the technical study of Nascimento (2017), Brazil has more than 1.5 to 2.5 KWh/m^2 of irradiance, varying from 125 to 210 W/m^2. Figure 5.2 shows the map of solar irradiation in the South American continent together with the cut of the region where the photovoltaic projects winners of the 8th LER will be installed.

Figure 5.2 – Map Solar Irradiation and Photovoltaic developments



Based on the information provided by Nascimento (2017), together with the average W/m^2, it is possible to estimate the square footage for the generation of all the energy agreed with CCEE and what will be the implementation costs incurred by these projects. As an example, the data of the units that are in arrears in their schedules belonging to group 3, five in all, were also used to estimate these values whose results may also be indications of the existence of the winner's curse. Table 5.5 presents this comparison.

Table 5.5 - Costs of Photovoltaic Structures x Billing Projection Undertakings in Delay

Description	Qtt Energy (MWh)[a]	Qtt Energy Annual (MWh)	Area in M^2 [b]	Total Cost Structures (USD)[c]	Revenue Projection (USD)[d]	PayBack Investment (years)[e]
Project 1	1,244,772	62,239	28,814,352	10,477,736.49	98,934,478.56	2.11
Project 2	1,367,496	68,375	31,655,093	11,510,712.45	108,688,582.08	2.11
Project 3	946,728	47,336	21,914,815	7,968,864.12	75,245,941.44	2.11
Project 4	946,728	47,336	21,914,815	7,968,864.12	75,245,941.44	2.11
Project 5	946,728	47,336	21,914,815	7,968,864.12	75,245,941.44	2.11

Source: ANEEL (2017b, 2017c), EPE (2012)

a) Quantity of Energy agreed for 20 years 8th LER; b) Agreed Annual Energy ÷ 0.00216 conversion (MWh for MWh/m^2); c) Agreed Annual Energy x 83.34 (conversion of MWh for KWp) x USD 2.02/KWp; d) Amount of Energy for 20 years x 79.48 (206.48 ÷ 3.81 USD price 11/13/2015); e) Total Cost of Construction Structures ÷ (Projection Revenue ÷ contract term 20 years)

In order to close the discussions, in analyzing Table 5,5, it is noted that the implementation costs of the photovoltaic systems required for these projects correspond to approximately 11% of the projected revenue, and that they can be recovered within 3 years after full operation. Regarding the costs of the photovoltaic system, studies by EPE (2012) project that the values of implantation will be reduced as the technological development of the materials used advances, making these sources of energy even more competitive. Another factor that the analysis of the costs of implantation brings the reflection, refers to the discount rate that varied between 21% and 23% in relation to the ceiling values and that, nevertheless, show to be positive when compared to other sources of generation.

6 CONCLUSIONS

The proposed discussion explores the results of the 8th LER winning projects planned to start operating between 2018 and 2019, Some of these projects that were already in the implementation phase presented problems regarding their execution schedules and are strong candidates for not becoming operational and financially viable, being subject to sanctions arising from breach of contract.

One of the possible explanations for these delays is described by auction theory through extensive studies that report the existence of the so-called winner's curse, a phenomenon that may induce auctions winners to repent after finding that the results obtained in their transactions did not match those expected, probably caused by the existence of asymmetry of information among bidders.

The Brazilian auction models adopted by the CCEE are characterized as asymmetrical in relation to the amount that will be commercialized of energy, but it can be observed that the asymmetry can also be due to the complete or partial ignorance of the characteristics that involve the enterprise, especially those that seek to explore wind and photovoltaic sources.

The information provided by CCEE, EPE and ANEEL shows that among the 53 winning projects of the 8th LER, thirteen were behind schedule. It is not clear what actually caused these delays, but the figures show that all companies had 20-year contracts with investment amounts ranging from 10% to 20% of the amounts they would receive during the course of these contracts. These consolidated amounts refer to the amounts already discounted from the discount in relation to the ceiling value. The figures also show that the ventures are feasible, but technological and logistical issues arising from probable asymmetry information are possible explanations for the difficulties experienced by these projects,

Another very relevant information, refers to the Auction of Discontractation, intentionally called “mechanism of discontractation” that framed 40 enterprises of the 53 winners of the 8th LER. This type of auction is against the world-wide efforts in the search of renewable and sustainable sources of generation, Reserve Energy Auctions (LERs) play a strategic role; are those that will guarantee the energy supply in cases of a lower volume water of the reservoirs and that will generate energy at prices much lower than those practiced by the thermoelectric plants that come into operation at the slightest sign of shortages.

To conclude, this auction of discontractation, in addition to allowing them to stop acting as a strategic source and rescind their contracts, opens the precedent to prove the existence of the winner´s curse among these ventures and may impact future events of this modality. Allied to this, the strong economic downturn shows signs of recovery, and with the heated market there will be an increase in energy demand, leaving in doubt the strategy adopted by the Brazilian government that opts for the maintenance of onerous emergency sources to the public coffers.

The main difficulties encountered for this research are the search for information. Although the data are public, data collection requires the researcher to be patient to perform searches in several locations and the ability to concatenate information. Another difficulty was related to cost-related divergences for the implementation of wind and photovoltaic projects, which was addressed through official studies dealing with these issues.

For future research, it is suggested that companies that opt for termination of contracts should be used as the object of analysis, and that quantitative studies should be carried out, seeking variables that explain the cause / effect relationship that explains and measures the winner´s curse. We also suggest in-depth studies applied to the agents in search of information and theorization about the phenomenon of the winner’s curse.

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3. Development of theoretical propositions (theoretical work)	x		x
4. Theoretical foundation / Literature review	x	x	x
5. Definition of methodological procedures	x	x	
6. Data collection	x		
7. Statistical analysis	x		x
8. Analysis and interpretation of data	x	x	x
9. Critical revision of the manuscript	x	x	x
10. Manuscript writing	x	x	x
11. Other (translation english)		x	x