
Wind power energy in Brazil: public financing and future perspectives

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Abstract: This paper focuses on the financial challenges faced by the wind power energy players in Latin America – Brazil. Governmental efforts are already underway to attract and support this industry with enormous growth potential, in order to diversify the energy matrix and reduce greenhouse emissions. However, public financing may not be able to face this challenge alone and solutions among the private sector may be found. This study, based on the debt structure of three key companies of this sector, concludes that the analysed wind energy projects were financed mainly through subsidies from the Brazilian Development Bank (BNDES). Furthermore, the Brazilian market starts considering green bonds as a strategy to fund wind energy projects. So, there is room for strategies to include the private sector in the financing of the wind power energy industry in Latin America – Brazil.

Keywords: climate finance; clean; renewable; wind power energy; Latin America; Brazil; green bonds; public financing; future perspectives.

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1 Introduction

Brazil is the largest wind power energy market in Latin America, followed by Mexico, Chile, Argentina and Uruguay (World Energy Council, 2018). Despite this leadership, the country still has an enormous potential in the wind energy industry, considering its vast natural resources, as wind power and territory. Additionally, the Brazilian case is an example for Latin America of “how adequate incentives can add wind energy technologies to a power system that relies mostly on hydro sources”, as stated by the Colombian authors Dyner et al. (2011, p.1).

Some of the mechanisms adopted in Brazil to foment the wind power energy industry are the subsidised financing from the BNDES and the auctions promoted by the regulatory agency (Aneel). These mechanisms guarantee an established price and energy quantity to be purchased in the next 20 years, thus reducing the business risk. Therefore, the country has developed local initiatives for wind energy, which became competitive in the Aneel auctions, reaching price parity with conventional energy sources (IFC, 2016).

In this context, it is worth mentioning that the wind power energy industry in Brazil is still very much dependent on the public sector, as demonstrated in this paper. However,

according to the International Finance Corporation (IFC), a financial member of the World Bank, governments should ‘strategically use limited public finance’, because “governmental budgets will not be enough to address climate change” [IFC, (2016), p.vii]. Hence, “governments should use public funds strategically to mobilise private capital by, for example, reducing risk and providing project support” [IFC, (2016), p.vii]. Thus, it may be necessary to find other financial alternatives to foster the wind energy segment.

Notwithstanding, solutions among the private sector to financially support the wind energy industry may be found. There are other incentive mechanisms and other funding opportunities beyond the public one. This paper will highlight the green bond, a fixed asset financial instrument “where the proceeds will be used to finance projects and activities that promote progress on environmentally sustainable activities” [Galaz et al., (2015), p.572].

Given this scenario, this research focused on answering the following question: what is the current relevance of the public and private financing to support high-technology wind farm projects in Brazil and what are the future financial perspectives for this sector? In order to answer this question, this study analyses the strategies adopted by three key companies of this sector (CPFL Renováveis, Renova and Casa dos Ventos) to finance wind farm projects. It explores how these companies benefit from government policies and seek opportunities in the financial markets and, furthermore, identifies challenges faced by the Brazilian market to finance this new industry. The paper thus hopes to contribute to the growing literature on green finance with analysis of companies investing in the wind power energy industry in Brazil.

The remainder of the paper is structured as follows. Section 2 focuses on the wind power energy worldwide and in Brazil. Section 3 discusses green finance and the alternatives for private financing wind power energy. Section 4 presents the methodology of the study. Section 5 focuses on the financing structure and challenges faced by the three analysed companies. Section 6 concludes with the result of the analysis, as well as suggestions on future research.

2 Wind power energy

Wind power is one important source of clean energy, with a lower environmental impact in comparison with other forms of energy generation as hydropower, solar, geothermal, gas and coal. The wind power energy has the lowest average greenhouse gas emissions expressed as CO₂ equivalent for individual energy generation technologies and the lowest water consumption in kg/kWh of electricity generation. Its footprint (land usage in km²/TWh) is significantly lower than the hydro one and a little bit higher than the solar and geothermal ones (Li et al., 2015) (Table 3). The wind power energy is also a renewable resource and does not produce waste or toxic gases. Additionally, wind farms can coexist with the traditional land occupation and without evicting landowners. Also, it is a complementary economic activity where owners can receive payments that help to stimulate the local economy. Thus, wind can be an ‘effective power generation source’, with a “vast potential to fulfil the world's energy needs” [Kumar et al., (2016), p.210].

On the technological side, the wind-driven electric generator technology has improved efficiency and reduced costs in recent years. For example, “at the end of 1982,

a 55 kW wind turbine with a 15m rotor diameter was state-of-the-art. Today, 7,500 kW turbines with a rotor diameter of around 127m are available from many manufacturers” [Bilgili et al., (2015), p.327]. In order to reduce costs, one remaining technological challenge is to improve the capacity factor, increasing the ratio between the effective electrical energy output and the maximum one for the same period. A few years ago, the focus was on improving the nominal capacity. There are challenges in increasing factor capacity for onshore and offshore wind turbines. The technology may also evolve in terms of reliability and therefore there are technological challenges for the design and manufacturing of electronic and mechanical components. As known, high technological industries require high financial investments for research and development and the wind energy one is not different. Thus, analysing financial funding opportunities is primordial for this industry.

Specifically speaking of Latin America, countries are working to achieve its own renewable energy target: Brazil with 56 TWh by 2021, Chile with 21 TWh by 2025 and Mexico with 138 TWh by 2025, from which 34.5 TWh will be sourced from wind generating. In fact, Brazil generates approximately 1.06 TWh from wind generating stations, “which is fairly far to its 2021 target of 56 TWh” [Garcia-Heller et al., (2016), p.174].

Focusing on Brazil, the main wind power energy market in the region, there are few Brazilian companies with proprietary technology for producing wind turbines. Therefore, the big players in the Brazilian market are multinational companies. China is a player in the wind turbine global market and the country has adopted a strategy for developing this technology domestically. The country opened the market for multinational companies in a first step and then China developed the skills to have its own Chinese manufacturers. Brazil may follow China’s path, since the country has a huge potential for wind farms. In this sense, it makes sense to discuss local financing and future perspectives for this sector.

In 2015, investments in new assets for wind power energy in Brazil totalled US\$5.7 billion. This number was expected to increase and indeed it did. In the wind energy segment, Brazil was the 10th largest producer in terms of installed capacity, with 8.7 GW (Climate Bonds Initiative, 2016b; ABEEólica, 2017). In 2016, Brazil reached 10.74 GW and became the 9th country in the worldwide ranking of wind power energy installed capacity. Up to mid-2017, this number had already increased to 11.49 GW and it is expected to reach out 17.99 GW up to 2020. The Brazilian wind power energy generation totalled 21.6 TWh in 2015, positioning the country in the 8th place of this global ranking. Also, Brazil has the highest wind power energy capacity factor, totalling 38%, which is 60% higher than the worldwide average of 23.8%. The wind power energy represents 7.5% of the Brazilian energy matrix, with 460 wind farms (ABEEólica, 2017). The investment needed in wind, solar, biomass and small hydro plants (SHPs) power generation from 2015 to 2024 is estimated in US\$48.9 billion (R\$155.8 billion) (Brasil, 2015b), corresponding to 58% of the total investment in electric power generation (Brasil, 2015a). According to studies, Brazil has a potential of 300 GW of wind generation (Melo, 2013, IRENA, 2012), which corresponds to 2.2 times the current Brazilian total electricity matrix production. Thus, there is a very positive perspective for the wind energy growth in Brazil.

Governmental efforts are already under way in order to attract and support the wind power energy industry in Brazil, as the BNDES financing and the Aneel auctions. The

Brazilian government also implemented a feed-in-tariff policy, by means of the Program for Incentive of Alternative Energy Sources (Proinfa), created in 2002 (law n° 10.438, from April 26) and detailed in the decree no. 5,025 of 2004. Proinfa was crucial to begin the development of the local wind energy industry. The program was established with the objective of increasing the share of electricity produced by projects designed based on wind, biomass and SHP, in the National Interconnected Electric System (SIN). The Proinfa covered a mandatory contracting of 3,300 MW of renewable energy, with 1,100 MW for wind sources with a 20-year contract. The cost of these contracts was collected from/passed on the consumers, in proportion to the actual consumption. Each technology received a fixed price. The payments were centralised by Eletrobras, the federal power utility company. Additionally, the Brazilian government, by means of regular annual auctions between 2005 and 2011, offered mid and long-term contracts, totalling 62,000 MW of new capacity for future energy delivery (60% renewable and 40% conventional hydro), among 443 projects. This process included 25 auctions of different energy sources (e.g., gas, conventional, large hydro's, renewables, etc.), including eight renewable energy ones. The total amount involved was US\$300 billion in contracts, with an average price around US\$70/MWh (Barroso, 2012).

Also, from 2007 on, the Brazilian Government operated annual technology-specific auctions. Prices were established for each technology and contracts were indexed to inflation. In the case of wind energy, the accumulated wind capacity was 1,299 MW after Proinfa (with a price of US\$150/MWh) and up to 2011 it reached 8,029 MW (with a price of US\$53/MWh) after the energy auctions mentioned above (CCEE – Electric Energy Trading Chamber). Brazil has thus become a competitive wind energy producer in the Aneel auctions. According to the IFC, the energy auctions in Latin America and the Caribbean regions resulted in some of the world's lowest bid prices, mainly due to the vast renewable energy resources and high targeted shares for renewable energy deployment (IFC, 2016). This is specifically true for the Brazilian case. Since 2007 incentives have been offered on electrical wire costs for contract sales from renewable energy sources to free consumers, those able to choose their energy supplier. Also, the government granted tax benefits and BNDES offered subsidised financing (Barroso, 2012). This was the main source of financing to the wind power energy industry in Brazil, totalling 60% (US\$11.17 billion) of the total financed amount between Proinfa and the 2015 auctions (ABEEólica, 2017).

The clean energy industry in Brazil is very dependent on the public sector. However, the public sector may not be able to face the challenge to foster and develop the clean energy industry alone. Solutions among the private sector may be found. As a matter of fact, in 2017 BNDES published its New Operating Policy signalling “the intention to stimulate new players to finance infrastructure and the development of the capital market” (ABEEólica, 2017). In this context, it is applicable the discussion of green finance instruments connected to the wind energy industry.

3 Green finance

Green finance is capital (equity or debt) directed at segments with potential to provide environmental benefits and an environmentally sustainable development (G20 GFSG,

2016). Thus, these financial instruments have the potential to become the main instruments to financially support the wind power energy industry, mobilising private and public resources. Green finance includes both of them. However, according to Mathews et al (2010), the energy revolution will not occur without involving private investments. The growth potential of the energy industry in the upcoming decades, estimated by the International Energy Industry, significantly increase the required financing alternatives and provide opportunities for developing new financial instruments (Mathews and Kidney, 2012). Some of these instruments are already known, such as green bonds, green financing, green investment funds, green investment trusts, green indices and green exchange traded funds (ETFs).

Green bonds are “fixed income securities used to raise funds in order to finance or refinance projects or assets that have positive environmental or climate-related attributes,” with potential to “attract institutional investors, such as pension funds, social security trust funds, insurance companies and asset managers” (Febraban and CEBDS, 2016). According to the climate bonds initiative, the worldwide green bonds issuance totalled US\$155.4 billion in 2017 (US\$81 billion in 2016), with an estimated amount of US\$250–300 bn for 2018. Since its first issuance by the European Investment Bank (EIB) back in 2007, the volume of green bonds is achieving record levels year after year. Regarding the potential of the green bonds market, it is also important to consider that in a universe of US\$118 billion of labelled green bonds issued between 1 January 2005 and 31 May 2016, there were other US\$576 billion of unlabeled climate aligned bonds (Climate Bonds Initiative, 2016a), that have potential to be green but have not been declared as such.

The green bonds were stated as priority in the suggested policy packages for governments, according to the United Nations Environmental Program, in its financial initiative report (UNEP, 2015). The green bonds can finance immediate investments in climate mitigation and can mobilise institutional investments for green infrastructure, more specifically for clean and renewable energy (OECD, 2016). Also, according to Flaherty et al. (2017), “the issuance of green bonds could fund immediate investment in climate mitigation such that the debt might be repaid by the future generations, those who benefit most from reduced environmental damages.”

As a clear demonstration of the connection between green bonds and the energy sector, it is interesting to point out that the largest corporate green bond issuer in 2016 was Iberdrola, a Spanish company that operates in the distribution of natural gas and in the generation and distribution of electric energy. Also, the energy sector represented 38% of the total amount of green bonds issuance in the same year (Climate Bonds Initiative, 2017). Specifically, in the clean energy sector of emerging economies, the highlights were the green bond issuance made by the AP renewable, from Philippines and by the ReNew Power, from India. According to the Brazilian Business Council for Sustainable Development, among the Green Finance Instruments, green bonds can become the natural instruments of (re)financing the clean and renewable energy industry worldwide, including in Brazil (Febraban and CEBDS, 2016).

4 Methodology

In order to identify what is the current relevance of the public and private financing to support high-technology wind farm projects in Brazil and to discuss the future financial perspectives for this sector, this study focused on three key Brazilian wind power energy companies: CPFL Renováveis, Renova and Casa dos Ventos. They occupy the second, third and fourth position in market share of the Brazilian wind power energy generation, totalling around 21% of the market (Almeida, 2015). The companies selected are those where wind power is a relevant share of investments, different from companies like Eletrobras (the leader in market share, with 16% of share) and ENEL (sixth position, with 4%). In these cases, despite the fact they also operate in the wind power industry, this energy source is not as relevant to their balance sheet as it is to the companies analysed in this paper. Anyway, the conclusions of this study may be extended to other companies in the sector, according to the findings obtained from the reviewed bibliography, as detailed above.

Financial statements from 31 December 2016 and other relevant data were gathered from the web-pages of the three selected companies and comparatively analysed. Bibliography and public information about green finance and the wind energy sector were also reviewed, to support this discussion. The objective was to evaluate the financing structure of the selected Brazilian wind power energy companies and the challenges to finance this segment in Brazil. Hence, the study discussed how market forces and governmental policies are been used to finance high technology wind power energy projects in Brazil and how it may change in the nearby future.

5 Financing wind projects in Brazil

Renova Energia is a Brazilian renewable energy company with operations in wind power plants, SHPs and solar. Founded in 2001, since 2009 it has been heavily concentrated in wind power projects. Renova is the owner of the largest wind farm in Latin America, located in the interior of Bahia. CPFL Renováveis, a company of CPFL Energia, is dedicated to the generation of energy through renewable sources, mainly through wind power, SHPs, thermoelectric plants powered by sugarcane biomass and solar. Casa dos Ventos Energias Renováveis is the owner of the largest portfolio of wind power projects under development in Brazil.

Table 1 shows the data from the financial statements at 31 December 2016 of the three analysed companies, according to the reports of the independent external auditors. In all three cases, the total amount of loans, financing (money with a pre-specified allocation) and debentures represented a significant portion of capital from each analysed company. The total amount of loans, financing and debentures totalled between 71% and 90% of total liabilities, between 144% and 350% of total equity and between 59% and 86% of total fixed assets, as detailed.

Table 1 Loans, financing and debentures data from CPFL, Renova and Casa dos Ventos

Data-base: 31 December 2016					
	CPFL <i>Renováveis</i>	Renova	Casa dos Ventos		
			Estevão	Sao Jorge	Sao Clemente
<i>Current liabilities</i>					
Loans and financing	551,201	2,045,371	846,788	-	21,497
Debentures	338,780	670,173	-	601,683	-
<i>Long-term liabilities</i>					
Loans and financing	3,759,356	93,338	-	-	673,560
Debentures	1,758,534	-	-	-	-
Total amount of loans, financing and debentures on current and long term	6,407,534	2,808,882	846,788	601,683	695,057
Percentage of total loans, financing and debentures on total:					
Liabilities	80%	71%	90%	90%	75%
Equity	144%	144%	204%	350%	284%
Fixed assets	86%	59%	63%	76%	62%

Source: The authors using financial statements data from the three analysed companies

According to the information disclosed in the analysed financial statements, the companies financing was mainly subsidised with resources obtained through the BNDES. Additionally, debentures were also relevant to complement the required financial resources for the projects. The BNDES financing and the debentures were contracted according to the data presented in Table 2.

In 2016, a significant part of Casa dos Ventos' financial resources were bank credit notes, totalling R\$847 million at 31 December 2016, specifically in the pre-operational Company Ventos de Santo Estevão Holding. This represents a change in the financial profile of Casa dos Ventos in comparison with December 31, 2015 financial figures, when resources from BNDES totaled R\$1.7 billion, mainly due to Ventos de Santo Tito Holding and Ventos de São Tomé Holding, companies sold by Casa dos Ventos to Cubico in 2016. The comparison between 2016 and 2015 financial data of Casa dos Ventos is detailed in Tables 3 and 4.

The data presented in this section shows that companies have liabilities structured with a high participation of BNDES financing, confirming what was theoretically stated in the 'wind power energy' section of this paper. The subsidised credit lines from BNDES, associated with others governmental incentives to the wind farms projects, as feed-in-tariffs and tax benefits, guarantee an 'extra' return to compensate risks and to foster wind farm investments.

Additionally, the analysed data shows that debentures were another relevant financial resource to the wind energy segment. Debentures are bearer credits that represent a debt guaranteed by the equity of the issuer. In this study, the issuers were the three analysed companies.

Table 2 Financing data from the CPFL, Renova and Casa dos Ventos

	CPFL Renováveis			Renova	Casa dos Ventos			
					Subtotal	Estevão	Sao Jorge	Sao Clemente
BNDES								
Finem	3,296,587	TJLP +0% up to 3.5% pr pre-fixed 2.5% up to 5.5%	-	-	-	-	-	-
Finame	2,857	Pre-fixed 2.5%	-	-	-	-	-	-
Long-term contract + bridge loans	-	None	1,776,035	TJLP +0% up to 8% p.a.	695,057	-	-	TJLP +2.55% p.a.
Debentures	2,097,314	TJLP + 1% + 0.60% or CDI + 1.34% up to 2.85% or 115.43% up to 134.22% of CDI	670,173	143% CDI or IPCA + 7.60% p.a.	601,683	-	-	3% p.a. + DI rate
CCB bank credit	88,388	CDI + 3.4 up to 3.8% p.a.	-	-	846,788	1.75% p.a + DI rate	-	-
BNB	287,707	Pre-fixed 9.5% up 10% p.a. + bonus 1.5% up to 25%	-	-	-	-	-	-
Bradesco	250,363	CDI + 0.5% p.a.	-	-	-	-	-	-
Safra	208,547	105% of CDI	-	-	-	-	-	-
NP (ABC) – promissory note	105,883	CDI + 3.80% p.a.	-	-	-	-	-	-
FNE Baco de Nordeste	-	-	84,464	9.5% p.a.	-	-	-	-
NIB	67,872	IGPM + 8.63% p.a. TJLP -1%, TJLP+	-	-	-	-	-	-
Finep	17,074	2% or pre fixed 3.5%	14,172	3.5% p.a.	-	-	-	-
Other loans	-	-	270,278	100% CDI + 4.3% up to 8.7% p.a.	-	-	-	-
Funding costs	14,721	-	6,240	-	-	-	-	-
Total	6,407,871	-	2,808,882	-	-	-	-	-

Source: The authors using financial statements data from the three analysed companies

Since governmental funds have a social opportunity cost and Brazil is a country with budget constraints, the reduction of governmental incentives to the wind energy industry must be discussed. On top of that, wind farm projects are already competitive with other sources of energy and private financial instruments are already becoming representative in supporting this industry.

Some benchmark experiences, such as the Spanish one with wind energy, “proved that the need for financial support is not permanent, since it can be reduced gradually as far as the implementation of these projects is successfully done” [Abdmouleh et al., (2015), p.253]. According to these authors, when legislative supports as feed-in-tariffs or energy auctions are implemented, “there is progressively less requirement for developers to receive financial support (grants) towards their installations”. In a context of guaranteed prices, investors will have sufficient confidence to develop renewable energy projects “without the need for further financial support” [Abdmouleh et al., (2015), pp.253–254].

As occurred in Spain, Brazil successfully fostered the local wind energy industry with feed-in-tariffs, energy auctions, tax benefits and public financing. Now that local wind energy initiatives already became competitive in the regulatory agency (Aneel) auctions, reaching price parity with conventional energy sources, it is time to reinforce the focus on the private financial alternatives to this industry.

Table 3 Financial statements data from Casa dos Ventos in 2015 and 2016

Consolidated data in R\$ (000)							
	<i>Casa dos Ventos 31 December 2016</i>			<i>Casa dos Ventos 31 December 2015</i>			
	<i>Estevão</i>	<i>Sao Jorge</i>	<i>Sao Clemente</i>	<i>São Tito</i>	<i>São Tomé</i>	<i>Sao Jorge</i>	<i>Sao Clemente</i>
<i>Current liabilities</i>							
Loans and financing	846,788	-	21,497	23,263	25,605	-	-
Debentures	-	601,683	-	18,844	95,533	487,126	-
<i>Long-term liabilities</i>							
Loans and financing	-	-	673,560	535,045	594,965	-	520,397
Debentures	-	-	-	93,240	-	-	-
Total loans, financing and debentures	846,788	601,683	695,057	670,392	716,103	487,126	520,397
Percentage of total loans, financing and debentures on total:							
Liabilities	90%	90%	75%	90%	89%	97%	99%
Equity	204%	350%	284%	413%	412%	319%	192%
Fixed assets	63%	76%	62%	78%	83%	80%	72%

Source: The authors using financial statements data from Casa dos Ventos

Table 4 Financing data from Casa dos Ventos

	Casa dos Ventos 31 December 2016				Casa dos Ventos 31 December 2015				
	Subtotal	Estevão	Sao Jorge	Sao Clemente	Subtotal	São Tito	São Tomé	Sao Jorge	Sao Clemente
BNDES Long-term contract + bridge loans	695,057	-	-	TJLP + 2.55% p.a.	1,699,275	2.02% p.a. + TJLP	2.4% p.a. + TJLP	-	2.55% p.a. + TJLP
Debentures	601,683	-	3% p.a. + DI rate	-	694,743	9.24% p.a. + TJLP	8.86% p.a. + IPCA	3% p.a. + DI rate	-
CCB bank credit	846,788	1.75% p.a. + DI rate	-	-	-	-	-	-	-

Source: The authors using financial statements data from Casa dos Ventos

The Brazilian financial market may evolve in financing wind farms projects and the demand for private financial products may increase in the nearby future. In fact, financing infrastructure projects in Brazil is still a challenge and it requires the development of financial products, as well as improvements in the financial regulatory framework. However, efforts are already been taken in this sense, as the creation of the Brazil Climate Finance Lab (The Brasil Lab) and of the Financial Innovation Lab (LAB). The Brasil Lab, with representatives of the Brazil Ministry of Foreign Affairs and of the US Department of State in the Brasil Lab Steering Group, intend to identify, develop and support implementation of “transformative climate finance instruments that can drive funds for Brazil’s national climate priorities” (The Brasil Lab, 2018). In its turn, the LAB is a joint project of the Brazilian Development Association (ABDE), the Inter-American Development Bank (IDB) and the Brazilian Securities and Exchange Commission (CVM), focused on green finance (LAB, 2018). In both initiatives, green bonds may be the next step forward in the Brazilian financial market.

The market of green bond in Brazil reached US\$3 billion in 2016 and energy was 23% of this amount. CPFL Renováveis was the first company in the wind power industry in Brazil to issue a green bond with an international certification. BNDES itself issued an amount of US\$1 billion in green bonds in 2017. It was the first time a Brazilian bank issued a green bond in the international market. BNDES will use money to invest in the wind and solar industry. The green bond initiatives are beginning in Brazil. The local wind power energy opportunities are many and it is expected that the green finance will evolve quickly in the country in order to match supply and demand for funding cleaner energy projects.

6 Conclusions

This study analyses the financial structure of the wind power energy players CPFL Renováveis, Renova and Casa dos Ventos. It is possible to conclude, based on the information disclosed in the financial statements and on the information publicly disclosed in the internet, that those wind energy projects were financed mainly through subsidised financing obtained with the BNDES. Additionally, debentures were also relevant to complement the required financial resources for the projects. It is important to notice that there were also others incentive mechanisms in the Brazilian market, such as feed-in-tariff and tax benefits for wind farm projects. Additionally, this study concludes that there is much room for searching strategies involving the private sector in the financing of the wind power energy industry in Brazil. The data analysed in this paper shows a high share of public financing in the debt structure of CPFL Renováveis, Renova and Casa dos Ventos. The BNDES credit lines were important to support the implementation of wind farms projects in Brazil. However, the Brazilian government has a constrained budget.

Since the wind industry has achieved a certain degree of maturity in the country, the next steps for the strategy of wind farm development probably will involve identifying and developing new sources and instruments of financing. Based on what is happening worldwide in the green finance industry, it is expected that the Latin America and the Brazilian market may become a good prospect for green bond initiatives in the next future. Future research should look at the relations between green bonds and the wind

power energy industry worldwide or other green finance mechanisms applicable to finance this industry.

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