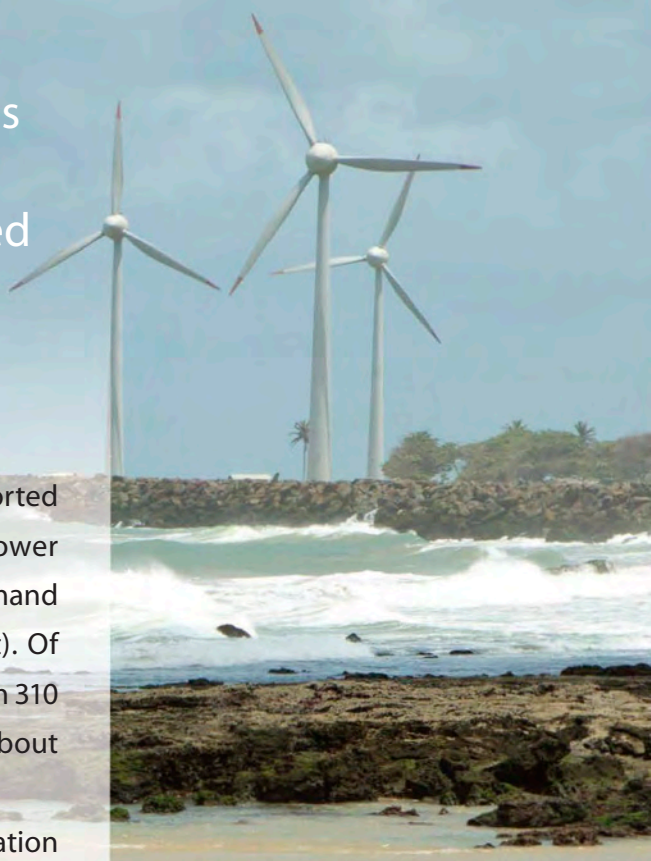
Renewable energy makes progress

In the Northeast the wind now accounts for almost half of the power that is generated. Three years ago, it accounted for no more than 4.5%.

Chico Santos



ON JULY 20, the National Power System Operator (ONS) reported that at end-June 2016 in the Northeast region electric power generation reached 8.6 gigawatts (GW) and the total load demand was 10 GW (the difference being supplied by the Southeast). Of power generated in the Northeast, 4 GW—46.9%—came from 310 wind farms that have the capacity ultimately to generate about 8 GW.

Three years ago, total demand was 8.9 GW and local generation was 6.1 GW, of which wind power contributed just 0.3 GW, representing 4.4% of the power generated in the region. Although one reason current wind power is contributing so much is that lower water reservoirs have depressed hydropower generation below historical averages, the ONS believes the astonishing growth of wind power in the region will continue, because multiple demands on the water from the São Francisco River make expansion of renewable power sources crucial; the energy source that will grow fastest in the Northeast in the near future is likely to be wind. For Brazil as a whole, however, hydropower is likely to dominate for some time, accounting for 67% of total electric power by 2030, according to the Energy Research Company (EPE).

The importance of winds to electric power in the Northeast has drawn attention to how much renewable sources could contribute to meeting Brazil's energy demand. According to the

"Our main problem today is the low demand for electricity. Wind power is very competitively priced, and wind farms can be deployed rapidly, making it possible to meet energy demand very quickly if necessary. "

José Quina Diogo

National Electric Energy Agency (Aneel), in June wind and biomass had an installed capacity of 23 GW, equivalent to more than 150% of the capacity of Itaipu (14 GW), the second largest hydroelectric plant in the world; or more than double the nominal capacity of Belo Monte (11 GW), the second largest hydroelectric plant in Brazil.

Solar power is relatively new to Brazil, in mid-2016 contributing only 0.03 GW installed capacity, but another 1.9 GW solar capacity is planned or already being constructed. EPE estimates that by 2030 solar power will account for 3% of the electricity generated centrally in Brazil.

Meanwhile wind power is expected to surge. Based on projects contracted, some of which are already under construction, Elbia Melo, president of the Brazilian Wind Energy Association (ABEEólica), projects that by 2019, 18.5 GW of wind power capacity can contribute 10% of Brazil's electric supply.

This geometric expansion was unleashed in 2009 when Aneel held the first wind power auction, contracting for 1.8 GW in capacity, but not all the news today is good. Since the second half of 2014, the economic crisis has been reducing electric power consumption, which was down 2.1% in 2015. That is a concern not only for new wind and solar projects but also for the young equipment industry, which was born of a program designed by the National Development Bank (BNDES), which provided abundant low-cost funding.

Economist Joisa Dutra, director of the Getulio Vargas Foundation Center for Regulation and Infrastructure (CERI) and former director of Aneel, points out that "national regulation has favored these renewable energy alternatives." She recognizes the incentive represented by BNDES-subsidized loans but is concerned that the subsidies may be masking the cost of renewable energy. "BNDES resources are finite," Dutra says, pointing out the need to find market sources of funding.

Dutra also emphasizes that because of the intermittent nature of wind and solar, a permanent power base is necessary so as not to compromise power grid reliability and supply security. Dutra argues for the importance of natural gas to provide a permanent power base, either domestically produced or imported as liquefied natural gas (LNG).

Noting that today in Brazil some natural gas power plants generate energy more cheaply than hydropower plants, Dutra sees a need for expansion of renewable energy while also keeping in mind the need for secure

energy supplies and the competitiveness of the economy—two major objectives of the national energy policy. The nascent wind and solar equipment and components industry, she argues, must become internationally competitive and not rely solely on domestic demand.

Search for storage

Dutra also calls for more investment in energy storage technology, which is being studied around the world to find solutions to the intermittency of wind and solar power. In response to this concern, André Pepitone, director of Aneel, points out that since 2015, to ensure that the power grid is reliable even as the share of wind and solar power in the national energy supply grows, the regulatory agency has introduced technical requirements related to voltage control, power factor, and frequency. As for energy storage, Pepitone says Aneel is planning to launch a call for research and development on technical and commercial technologies for such systems. It is already working with the British Embassy on the project "Energy Storage in Brazil: Technology, Regulation, and Public Policies," in partnership with the University of Birmingham (UK), EA Technology (USA), and the Institute of the Brazilian Association of Electricity Distributors.

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In March the project partners held an international workshop to discuss storage technologies currently available in England and the United States, associated regulation, and related R & D projects underway by companies in Brazil and abroad. "One of the most promising solutions to minimize intermittence is storing energy by means of high-performance batteries," Pepitone says.

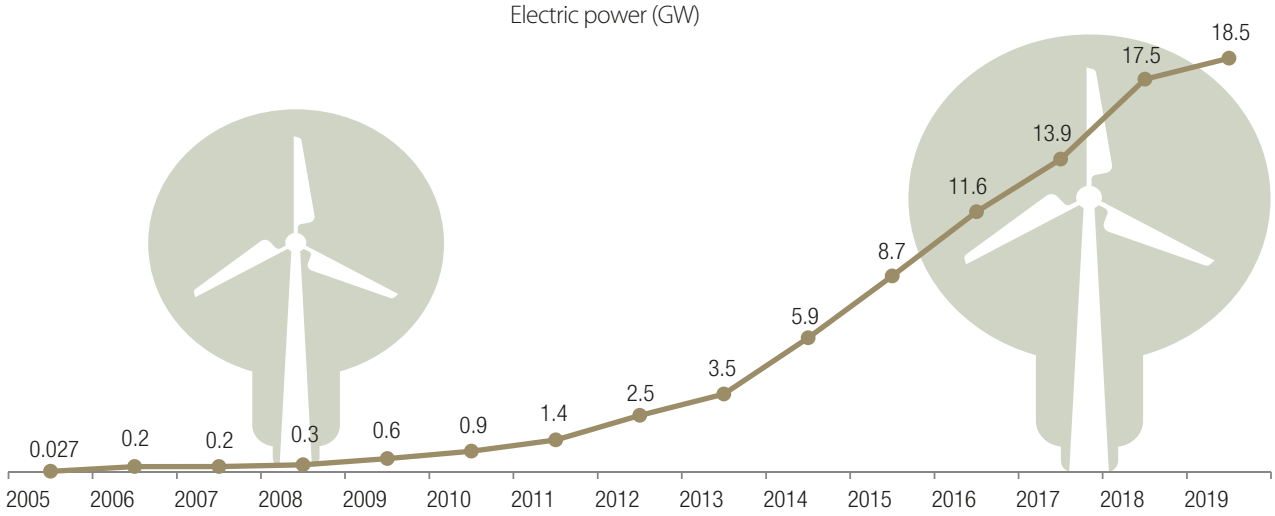
Wind power and biomass already account for 15.7% of the total Brazil electric power supply

Electric power by source, June 30, 2016

Source	Installed capacity (GW)	Share of total supply (%)
Hidropower plant	88.8	61.1
Biomass	13.4	9.2
Gas-fired thermal plant	13.0	8.9
Oil-fired thermal plant	10.0	6.9
Wind	9.8	6.7
PCH	4.8	3.3
Coal-fired thermal plant	3.6	2.5
Nuclear	2.0	1.4
Total	**145.4**	**100**

Sources: ABEEólica and Aneel. It does not include solar power.

Brazil's wind power generation is projected to reach 18.5% in 2019



Source: ABEEólica.

One company that have been investing in energy storage is the American AES Corporation and its subsidiary, AES Tiete in Brazil. According to Rodrigo D'Elia, who heads up the Brazilian subsidiary, "Eight years ago AES began studying energy storage as a product," the product is in its fourth generation, and AES has already installed 0.394 GW of storage units around the world.

D'Elia says that recently the group won a tender to install a 0.100 GW storage unit in California, USA, which is designed to meet demand at peak times at lower costs than a reserve thermoelectric plant. In Brazil, the group has submitted a proposal to install a battery system in Santarém, Pará state, to store 0.210 GW of power, which would cost less than expanding the 0.187 GW thermal plant installed by Brazilian electric utilities company, Eletrobrás. D'Elia points out that Chile already has saved US$37 million in 2015 by integrating storage technologies in the power grid.

Such storage, D'Elia notes, could delay the need to invest in power transmission lines. As an example, D'Elia points out that the region receiving power from Tucuruí plant in Pará needs a second transmission line to increase capacity. Instead of building a new line that will be idle most of the time, at night a storage system could accumulate the energy received through the old line when demand is low and distribute it at peak times during the day.

D'Elia challenges the perception that energy storage technology is expensive. The AES, he says, has been entering into contracts of up to 20 years without the need for subsidies; meanwhile in recent years lithium batteries have become 80% cheaper, largely due to improvements in electronics industry, such as mobile phones.

D'Elia considers it quite feasible to manufacture large-scale storage batteries in Brazil, noting that many overseas manufacturers for AES, like

Panasonic and LG, already have operations in Brazil. "It's a matter of creating the market and properly encouraging these manufacturers," he says. He estimates that Brazil has potential to produce 0.6 GW in storage within 10 years.

Carlo Zorzoli, president of Italian company Enel in Brazil, makes another point: "In the short term, we see the possibility of using batteries more for isolated power systems than for interconnected ones," he says. In interconnected power systems like Brazil's, he recognizes that use of energy storage will be a matter of cost. Zorzoli believes electric vehicles will be primarily responsible for the spread of high-performance battery technology. "The transport sector is more relevant [for energy storage technologies]; but that does not mean we are not interested [in the electricity sector]," he says, noting that Enel has been researching high-performance batteries in the US and Italy to integrate wind and thermal power operations.

Renewables and economic activity

What is questionable at this point is the future of wind and solar power considering that the recent fall in electricity demand has reduced the market for new projects and the depreciation of the exchange rate has raised costs, especially for solar power, where the auction price of a megawatt-hour (MWh) rose from R$215.12 in October 2014 to R$297.75 in November 2015. Some investors are asking for extension of contractual deadlines of solar power projects. Zorzoli says Enel's five-year plan will be maintained. Enel currently operates the largest solar plant in Brazil, a 0.011 GW plant in Pernambuco state, and has four other solar projects. In mid-year it started to build two solar plants of 0.292 GW and 0.254 GW in Piauí and Bahia states, the largest solar plants under construction in Latin America. Of course, as the country grows less, it will need less energy, and fewer investors will be interested in solar power projects. "But our five-year plan will not be impacted," Zorzoli says.

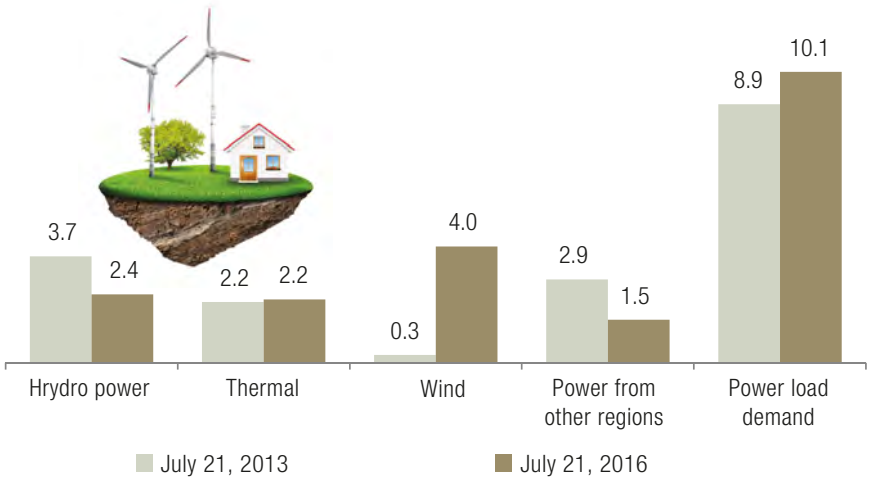
"Because of the intermittent nature of wind and solar, a permanent power base is necessary so as not to compromise power grid reliability and supply security."

Joisa Dutra

Melo of ABEEólica see no signs of a wind power crisis. "So far we cannot say the sector's expansion has stopped," she says. She expects that by 2020 wind power will account for 12% of the Brazilian energy supply, even if the government does not auction any new wind power projects this year. She also does not expect a significant decline in BNDES financing of the sector, although its new management, led by CEO Maria Silvia Bastos Marques, has been reducing financing for new energy projects and recommending that investors seek private financing. Melo points out that the BNDES CEO is on record as stating that the renewable energy sector is a bank priority. She believes that despite management changes,

The share of wind power in the total power supply in the Northeast region has increased significantly

Power production and power load demand in GW



Source: ONS.

the BNDES statements are reaffirming, because there is no viable alternative to BNDES financing.

Another aspect in favor of expansion of wind power, Melo says, is that since 2013 joint wind farms and transmission line projects are mandatory, which according to Aneel's Pepitone has substantially reduced the risk of concluding a wind farm without a transmission line.

As for solar power, Rafael Kelman of the PSR consultancy, believes that despite the drop in energy demand and concerns about energy prices and the continuity of power generation, it is important to continue the auctions for new solar power projects to signal the priority of renewable energy and keep the solar supplies and equipment industry operating. But he also recognizes that putting the brakes on contracting new energy projects is not unreasonable. "I think a compromise solution for the sector will be to wait for the resumption of growth to contract more [solar power projects]," he said.

BNDES and industry

Unquestionable proof of the importance of wind power in Brazil in recent years is BNDES lending: Of R$107.3 billion in financing for 322 electricity projects between 2003 and 2015, R$24.8 billion went to 76 wind power projects—23.1% of total approved projects, second only to the hydroelectric sector (R$66.3 billion, 61.8% of total financing).

The BNDES loans accounted for 60.5% of total planned wind power investments of R$41 billion in the period. Lígia Chagas, head of the BNDES Department of Alternative Energy, said there will be no change in funding rules for the auctions already made, both wind and solar, but admitted that the bank's participation in financing, which reached 70%, will drop somewhat as it executes its policy of encouraging investors to seek new sources of financing.

Chagas also highlighted the policy of encouraging development of the industry supplying the wind sector, recognizing that this is decisive to protect the sector from exchange rate depreciation (the solar energy supplies and equipment industry is less developed and more dependent on imports). After finding, in 2011, that several accredited companies were not in fact meeting BNDES requirements, a new accreditation methodology was developed in partnership with ABEEólica and banks on-lending BNDES resources to consolidate the industry

over three years. The result, she said, was the installation of 47 wind power equipment plants.

There are now operating in Brazil seven manufacturers of aerogenerators—the most sophisticated part of the wind power generator set—including WEG, a national manufacturer that has been internationalizing its operations in recent decades. According to João Paulo Gualberto da Silva, WEG wind power director, the company, which started in the wind power sector in 2012, has already delivered 80 aerogenerators, and expects to deliver about 100 this year. WEG's aerogenerator was developed with technology from US Northern Power Systems adapted to Brazilian conditions.

Although currently there is much uncertainty in the market, da Silva says this year WEG expects to have positive returns on investment and expectations for 2017 are even better. The uncertainty is due to the economic downturn, which was reflected in the wind power project auctions. But despite anxiety at the moment, da Silva is confident in the future of the wind power sector. He points out that wind farms in the Northeast are reaching up to 58% capacity, compared with 38% in Germany, one of the world leaders in wind power. He points out that despite competing with international giants such as Denmark's Vestas Denmark and the US's GE, WEG has managed to gain about 10% of the Brazilian market.

Encouraging the development of domestic manufacturers has also created several companies that manufacture steel wind towers. In 2014 in Jacobina city, Bahia state, the Andrade Gutierrez group (51%) and GE (49%) established Northeast Wind Towers (TEN). According to Anderson Pinho, TEN managing director, the location was chosen because Bahia state is expected to lead the wind farm market in coming years. The company's 210 workers produce eight towers a month; until December 2015 the company operated two shifts, but the crisis led to a reduction in production to one shift and 35% fewer workers. "We think 2017 will be a year of low production, but we are planning for 2018 and 2019," he said.

Chile already reports that in 2015 it saved US$37 million by integrating storage technologies in the power grid.

Another company already consolidated in the wind tower segment is Engebasa, located in Cubatão, São Paulo state, near the port of Santos. The steel fabricator was founded 46 years ago by Portuguese entrepreneur José Quina Diogo, who still heads it; the tower factory was established in 2008, he says, without any external financing. In 2011 the facilities were expanded to add 40% more production capacity. Engebasa has produced more than 1,100 towers that are operating in more than 30 wind farms in the Northeast and South.

Despite the current difficulties, Diogo has a positive outlook on the sector: "Our main problem today is the low demand for electricity. Wind power is very competitively priced, and wind farms can be deployed rapidly, making it possible to meet energy demand very quickly if necessary."