



2018 ANNUAL WIND ENERGY REPORT

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MESSAGE FROM THE CEO



Elbia Gannoum
CEO ABEEólica

This is the seventh Annual Wind Energy Report, and includes data that demonstrates that wind energy is growing its share of the Brazilian energy matrix. Over 1.94 GW of wind energy were added in 2018, with 75 new wind farms. By late 2018, this country had 14.71 GW of installed wind capacity in 583 farms, or 9% of the country's total energy matrix. There are over 7 thousand wind generators in 12 states providing enough clean energy to supply an average of around 76 million people a month. A total of 48.42 TWh of wind energy were generated in 2018. Compared to 2017, wind energy supplied almost 14% of the nation and 70% of the northeast, as demonstrated in the data that follows.

It is also important to point out new contracts closed during

the year. There were two auctions in 2018 - one A-4 and one A-6 -, enabling a total of 1.25 GW of installed capacity in 48 wind farms. Wind energy accounted for 11.17% of the energy contracted in the A-4 auction, and 57.22% of the energy in the A-6 auction.

We estimate much more wind energy will be contracted this year due to growth of the free market. 2018 was the first year in which the free market contracted more energy than auctions focused on the regulated market. There were at least three large free market auctions, all offering energy from renewable sources. Although the numbers for these transactions have not been disclosed, we believe that wind energy companies sold some

2 GW of installed capacity to the free market in 2018. This reinforces that the energy market is increasingly open to wind energy. By the end of last year at least 3GW in new installed capacity had been contracted.

The news is also good when we compare Brazil to the world. According to data published by the Global Wind Energy Council (GWEC), Brazil came in # 5 in terms of new installed capacity in 2018. The first four countries are China, the US, Germany and India, in that order, with 23 GW 7.59 GW, 3.71 GW and 2.19 GW of new wind energy installed respectively. Brazil is up there with the wind energy giants and is growing strongly.

Furthermore, one must consider that we are well below what could be installed, given our workforce, number of companies and ability to mobilize. Additional contracting could easily lead to a further 2 GW per year,

thus keeping Brazil among the world powers in this area and increasing wind energy's share of the matrix.

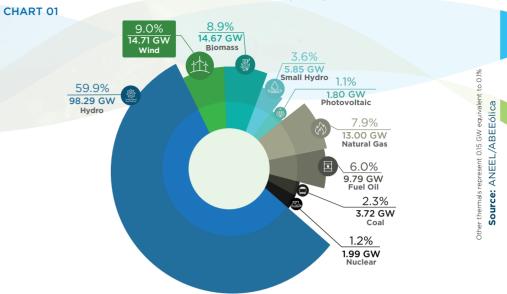
In general, 2018 was a good year for wind energy in Brazil, not only because of increased production and new facilities, but especially because of the outcome of the auctions and a stronger free market, which should grow in the coming years.

I invite all of you to read our Annual Wind Energy Report, which has the most important data and numbers for 2018.

I would like to end this session by reminding you that we publish monthly updates with industry numbers and news on the ABEEólica website and social network pages. Go online to keep track of what we are doing and what is going on in the industry.

Enjoy your reading!

BRAZILIAN ELECTRICAL MATRIX (GW)



INSTALLED CAPACITY IN **BRAZIL - ALL SOURCES**

Seventy-five new wind farms were built in 2018, totaling 1.94 MW.

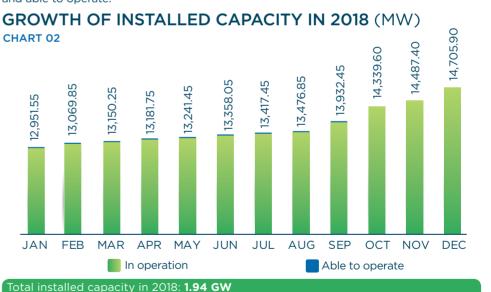
The new projects were installed in the states of Bahia, Rio Grande do Norte, Piauí, Ceará and Maranhão.

NEW INTALLED CAPACITY ADDED IN 2018 (MW)

State	Power (MW)	Number of Wind Farms	ólica	
ВА	1,157.55	42	BEE	
RN	364.20	15	ĕ,	
PI	195.00	8		
CE	114.10	5	Ā	
MA	108.00	4	ırce	
Total Geral	1,938.85	75	Sot	

By the end of 2018 there were a total of 583 plants and 14.71 GW of installed capacity, a 15.19% growth compared to December 2017, when the installed capacity was 12.77 GW. Considering all sources of electricity, a total of 6.37 GW of new capacity were installed, primarily in hydro and wind power, which accounted for 47.55% and 30.42% respectively. With an additional 1.94 GW, wind power now makes up 9% of the nation's power matrix, as shown in Chart 1 below, which also shows the percent contribution from all sources of energy to the electric power grid at the end of 2018. It is important to remember that at the end of 2017, wind power accounted for 8.1% of the energy generated.

The 14.71 GW installed capacity is comprised of 14.44 GW in commercial farms in operation (98.17%) and 0.27 GW in the test phase (1.83%). It is worth mentioning that there are no farms waiting to come onstream, as the last 98.7 MW in this situation¹ now have flow margin available for transmission and have been operating normally since October. Chart 2 shows how installed capacity grew over the course of 2018, given the operating conditions and able to operate.²⁻³



¹On October 22 2013, ANEEL (The Brazilian Electric Energy Agency) published Normative Resolution 583, which defines the terms and procedures for obtaining and maintaining the operating status of power generation concern. Chapter I, Art. 2, paragraph I, defines the new operating condition suitable to come on-stream for commercial operation, defined as an operating situation where the generating unit is able to produce energy to meet its trade commitments or for its own exclusive use, however, it is unable to provide power to the system due to delays or limitations of the transmission or distribution systems

Accumulated installed capacity in 2018: 14.71 GW

2 Considers the installed capacity of generating units in commercial operations and in test as defined in regulation, at the plant busbar Considers the date of recognition as the date of operation, and the first date of test operations of the first generating unit of the wind park defined in regulation.

³ Considers the date of recognition as the date of operation, and the first date of test operations of the first generating unit of the wind park defined in regulation park defined in regulation

GENERATION

In 2018, 48.42 TWh of wind energy were generated, in a monthly average 4.035,3 GWh were generated, with a record in September of 5.540.1 GWh, Compared to 2017, energy produced by wind increased 14.6%. Chart 3 shows average generation in 2018.4

WIND POWER GENERATION 2018 (GWH)



Total generated in 2018: 48.42 TWh

In terms of percentage and supply, wind power accounted for 8.60% of all the electricity generated and added to the National Interconnected System (SIN). Wind energy generation peaked in September (12.15% of SIN generation), as winds are normally better in the second half of the year.

⁴ This chart shows wind energy generated by wind farms in test and commercial operations at the connection point

In 2018, wind energy generation broke a number of monthly records. Below are the records for the year for the entire integrated national system (SIN) and its subsystems.⁵

NORTHEAST

On September 13th, 2018, 74.12% of all energy consumed in the northeast was generated from wind, with a capacity factor of 76.58%.

NORTH

On September 13th, 2018, 3.95% of all energy consumed in the north was generated from wind, with a capacity factor of 97.65%.

SOUTH

On September 1st, 2018, 13.72% of all energy consumed in the south was generated from wind, with a capacity factor of 77.22%.

NATIONAL INTEGRATED SYSTEM

On September 12th, 2018, 13.98% of all energy consumed in the national **integrated system** was generated from wind, with a capacity factor of 72.30%.

The chart below shows that the northeast subsystem's wind power capacity is close to the total, accounting for 85.4% in 2018, compared to only 12.4% in the south sub-system. This is because most of the wind farms in this country are located in the northeast.

WIND GENERATIONS AND ITS SHARE OF THE POWER SUPPLY

CHART 04

	20	17	20	2018		
Region	Generation ⁶ (TWh)	Share	Generation ⁶ (TWh)	Share	% growth	
Southeast	0.08	0.2%	0.05	0.1%	-33%	
South	5.84	14.4%	5.75	12.4%	-2%	
Northeast	33.99	84.0%	39.69	85.4%	17%	
North	0.55	1.4%	0.99	2.1%	78%	
Total	40.46	100%	46.47	100%	14.8%	

The five states with the greatest amount of energy from wind in 2018 were Rio Grande do Norte (13.64 TWh), Bahia (11 TWh), Piauí (5.59 TWh), Rio Grande do Sul (5.56 TWh) and Ceará (5.53 TWh).

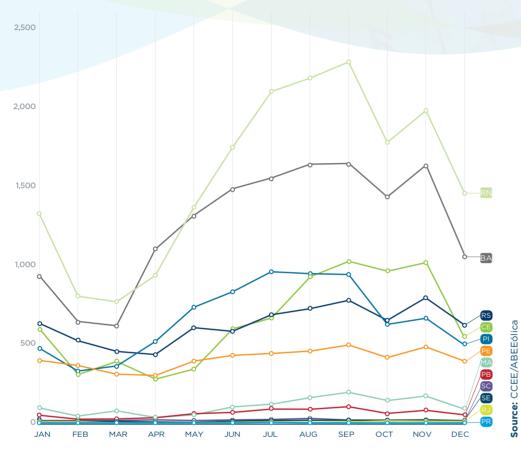
⁵ The SIN is made up of four subsystems; Northeast, North. Southeast/Middle-West and South. The boundaries for these subsystems differs from the geographic boundaries. For wind energy the north subsystem is comprised of the state of Maranhão

⁶ This chart shows wind energy generated by commercial wind farms in operation at the connection point.

The chart below shows the amount of wind power generated in each Brazilian state.⁷

GENERATION BY STATE 2018 (GWH)





	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	ОСТ	NOV	DEC
RN	973.3	559.6	592.1	644.2	986.2	1,233.4	1,559.5	1,599.1	1,640.8	1,330.3	1,428.6	1,098.3
ВА	669.1	460.1	461.6	799.9	960.4	1,050.9	1,168,9	1,210.9	1,173.6	1,066.2	1,166.4	814.6
PI	337.9	190.0	226.4	368.9	530.5	592.1	689.8	675.3	647.5	472.8	488.2	370.0
RS	490.5	359.0	349.6	312.9	443.5	417.0	527.3	544.4	556.0	504.5	578.1	472.5
CE	440.0	171.9	266.3	161.7	226.6	421.0	511.2	662.0	761.0	719.7	738.0	442.9
PE	278.0	213.2	190.9	178.8	226.2	286.6	305.1	315.8	344.7	303.0	329.8	263.3
MA	84.8	36.0	64.0	28.5	38.3	74.2	90.1	119.9	135.8	118.1	129.3	66.8
РВ	40.2	24.2	24.2	30.1	47.9	55.7	63.2	62.5	65.9	51.0	60.0	43.7
SC	15.2	11.9	10.5	106	16.9	12.4	15.5	19.0	16.5	15.3	16.6	11.2
SE	7.4	5.9	5.9	4.2	5.3	5.7	5.8	6.3	7.7	9.1	9.6	6.9
RJ	7.4	4.4	2.7	1.3	1.7	3.1	3.5	3.7	5.3	7.2	6.7	4.8
PR	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.2

⁷ This chart shows wind energy generated by wind farms in commercial operation at the connection point.

ANNUAL WIND ENERGY REPORT 2018

CAPACITY FACTOR

The capacity factor of a wind power source is calculated as the ratio of the plant's actual generation to its total capacity over a given period. The average in 2018 was 42.2%, peaking in September at 58.6%. This is an extremely good outcome, as it shows the source is consolidating. Including all wind farms in Brazil, even those acquired as part of PROINFA (with an average capacity factor of 28.2%), average performance is above the world average of 25%.⁸⁻⁹

CAPACITY FACTOR 2018

CHART 06



Average capacity factor in 2018: 42.2%

During instantaneous peaks, capacity factors exceeded 70%, as in the record generation measured in the northeast and SIN and discussed in the previous chapter.

The five states with the highest average capacity factor in 2018 were Maranhão (50.7%). Pernambuco (47.8%), Bahia (46.2%), Piauí (44.3%) and Rio Grande do Norte (42.0%).

This chart shows wind energy generated by wind farms in commercial operation at the connection point.

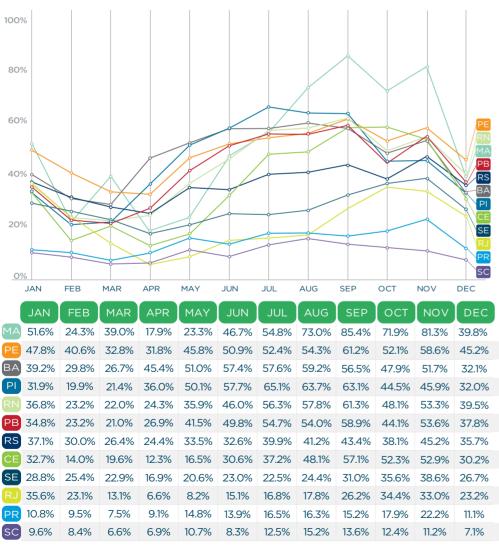
⁹ Incentive Program for Alternative Sources [Programa de Incentivo às Fontes Alternativas] was created by law 10,762 dated November 11,2003, and regulated by

Executive Order 5025 of March 30, 2004, regarded internationally as the pilot program of renewable sources of electric energy generation in Brazil, PROINFA plants follow different a contracting model from that adopted by current plants (auctions), and use autidated technology.

It is important to highlight that Maranhão did not open its first wind farms until 2017, but capacity factors listed in the previous Annual Wind Energy Report were already high, even though plants operated for only part of the year. This is the first report that includes a full year of data for the state of Maranhão. The calculated capacity factor for each Brazilian state are shown in Chart 7 below.

CAPACITY FACTORS BY STATE 2018

CHART 07



WIND ENERGY CONTRIBUTION TO RESIDENTIAL SUPPLY

Wind energy can also be represented as generation compared to average home use of electric energy in Brazil. According to the monthly review published by EPE (Empresa de Pesquisa Energética, or Energy Research Company), average residential consumption in Brazil in 2018 was 158 kWh per month.

Thus, actual average wind energy generation in 2018 was the equivalent to the average energy used by 25.5 million homes, or some 76 million people. This is a 13.9% increase compared to the previous year, when wind energy supplied 67 million people. In 2018, wind powered households for more people than the population of the entire northeast (over 57 million people). 10-11

The following chart shows the number of homes powered by wind energy in 2018.

HOUSEHOLDS SUPPLIED BY WIND POWER, MONTH BY MONTH

CHART 08

ANEEL/CCEE/ABEEólica



Average monthly supply in 2018 - Homes: **25.5 million**Average monthly supply in 2018 - Inhabitants: **76.6 million**

¹⁰ IBGE Data - Estimates of the population residing in Brazil and its states on July 1st 2018

¹¹ Considering an average of three people in each household.

WIND ENERGY CONTRIBUTION TO REDUCE CO₂ EMISSIONS

Besides the lowest impact over the implementation, wind power does not emit any ${\rm CO_2}$, and can replace other, ${\rm CO_2}$ emitting sources. The following chart shows ${\rm CO_2}$ emissions avoided due to wind power month by month.¹²

Total avoided ${\rm CO_2}$ emissions in 2018 were up to 20.58 million tons, equivalent to the annual emissions of 15.5 million automobiles. For comparison purposes, the city of São Paulo has a fleet of over 6.2 million automobiles, and the state has over 18.9 million automobiles. ¹³⁻¹⁴

AVOIDED CO, EMISSIONS IN 2018 (MILLIONS OF TONS)

CHART 09



Tons CO2 avoided in 2018: 20.58 million

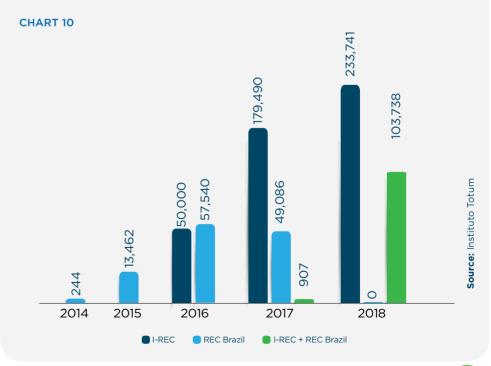
RENEWABLE ENERGY CERTIFICATE PROGRAM

Launched in Brazil six years ago, the Renewable Energy Certification Program has grown consistently ever since. REC Brazil, the Renewable Energy Certification Program, is a joint initiative of ABEEólica (Brazilian Wind Energy Association) and Abragel (Brazilian Clean Energy Association). It has the support of CCEE (Electric Energy Trading Chamber), ABRACEEL (Brazilian Energy Traders Association), and ABIOGÁS (Brazilian Biogas and Biomethane Association). The goal is to foster energy generated from renewable sources, and those that have a major impact in terms of sustainability.

The program was created in 2011 by a technical group appointed by Abragel and ABEEólica and comprised of experts with experience in energy, sustainability, market and certification, who jointly defined the concepts involved in sustainable ventures.

Within this program, the Totum Institute certifies renewable energy generators using the I-REC criteria, and renewable energy generators based on additional sustainability criteria with the additional stamp of approval of RECBrazil. The Totum Institute also issues RECs (Renewable Energy Certificates). The first 200 certificate transactions were completed in 2014. To date, over 1,300,000 RECs have been issued in Brazil.

GROWTH OF RENEWABLE ENERGY CERTIFICATE TRANSACTIONS



¹² Based on the MCTIC (Brazilian Ministry of Science, Technology, Innovation and Communication) methodology and data used to calculate emissions avoided due to wind power (75% in power plant operation and 25% in power plant construction).

¹³ Considers the indices in the 2017 Statte of São Paulo Vehicular Emissions Report issued by CETESB, the state of São Paulo Environmental Company.

¹⁴ Detran-SP fleet data updated in December 2018. The data is for automobiles only, and excludes motorcycles, buses, mini-buses, pickup trucks, utility and other vehicles.

SOCIOENVIRONMENTAL CONTRIBUTIONS OF WIND ENERGY

In addition to the benefits shown in the picture alongside, wind energy has a positive impact on the community due to social, cultural, healthcare and environmental projects undertaken for the development of the local population. We must point out that due to BNDES funding, a percentage of the investment must go to social projects. However,

more often than not this goes beyond the required amount and develops extremely important project for the community. Below are a few examples of community projects undertaken by wind energy players:



Wind power is renewable, nonpolluting, has low environmental impact and helps Brazil fulfill its Climate Agreement Goals.



Wind farms do not emit CO_a. In a single vear wind energy avoided CO₂ emissions equivalent to those of about 15.5 million automobiles, over twice the fleet of passenger vehicles in the city of São Paulo.



Among the best costbenefits in terms of energy prices. Wind energy offered the best prices in the prices in 2018 auctions



Generates income and improves the life's quality of landowners who lease their land for wind tower placement. Furthermore, leases are taxable, thus providing significant revenue for the government.



Measures that promote water security and enable access to water for production and human consumption, reaching isolated communities



Digital inclusion activities, training youth and adults, fostering employability and enterprise.



Stronger and expanded local production chains such as coconut. manioc, corn, beans, honey, milk and others to improve the population's income and promote sustainable development.



Health promotion projects including oral health and nutrition. for instance.



Enables landowners to continue planting their crops or growing their animals.



Job creation, payment of leases to landowners, the possibility of farming and wind energy activities coexisting are just some of the means that help keep people in rural areas



Training local labor



Activities to encourage sports, alongside monitoring schoolwork



Activities to encourage tourism, art, gastronomy and regional culture with festivals, courses. training and contests.



Educational projects such as day-care centers and schools, with initiatives to increase the quality of life of students in public schools, with citizenship activities, educator training and better school environments, promoting discussions on sustainable development and renewable energy.



Encouraging local artisans.

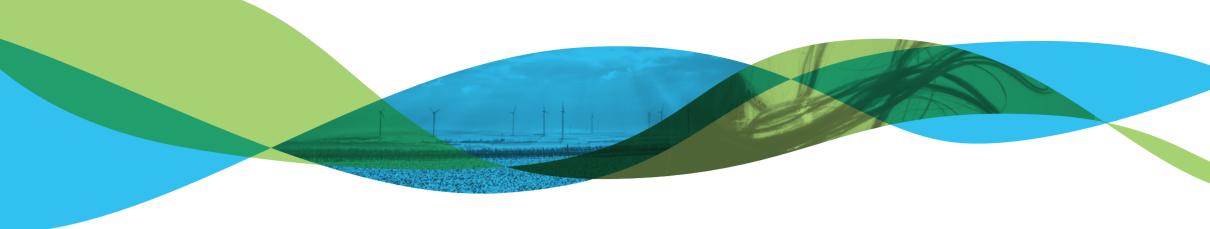
EXPANSION OF THE INSTALLED CAPACITY FOR WIND POWER

The following chart shows the increase in installed capacity and the growth in wind power as a function of previous contracts in regulated auctions and free market agreements.

GROWTH OF THE INSTALLED CAPACITY (MW)

CHART 11





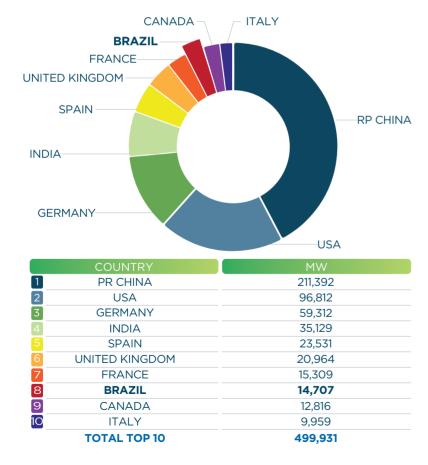
Source: GWEC

GLOBAL FIGURES

In 2018, Brazil held onto its eighth place in the GWEC (Global Wind Energy Council) accumulated Wind energy Capacity Ranking.

TOP 10 CUMULATIVE CAPACITY 2018

CHART 12

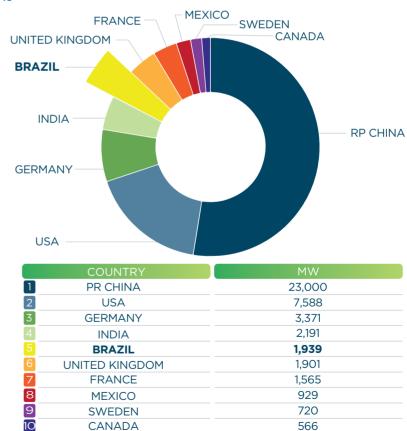


In the list of the year's new installed capacity, Brazil ranks fifth, having installed 1.94 GW of new capacity in 2018. Here Brazil went up one position compared to 2017. Below is the GWEC ranking.

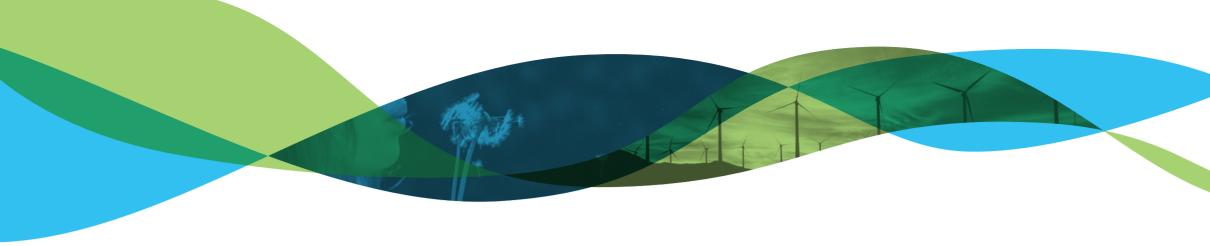
TOP 10 NEW INSTALLED CAPACITY 2018

TOTAL TOP 10

CHART 13



43,770



INVESTMENTS IN WIND POWER

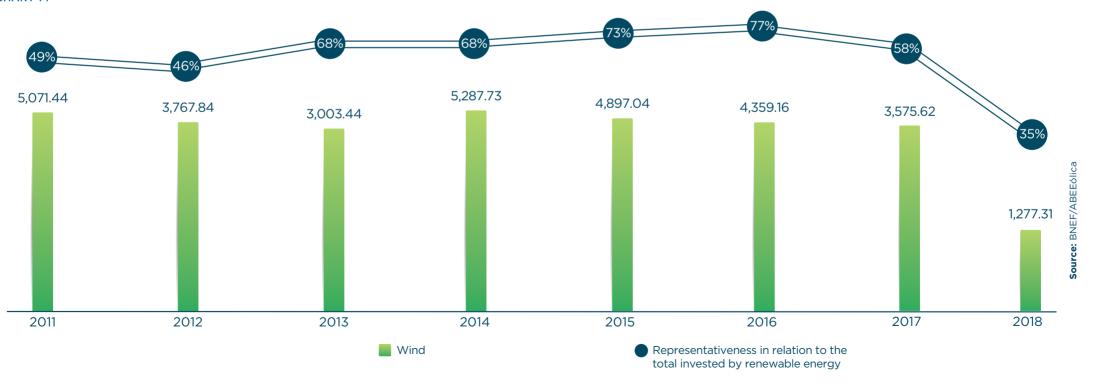
US\$ 1.27 billion (R\$ 4.67 billion) were invested in wind power in 2018, or 35% of the total investment in renewables (sun, wind, biofuels, biomass, waste, PCHs (small hydro) and other sources) in Brazil. If we look at 2011 through 2018, the total was US\$ 31.2 billion. The following chart shows investments in renewable energy and the amount invested in wind energy since 2011, as calculated by Bloomberg New Energy Finance - BNEF, which also publishes an analysis of this data. This year the

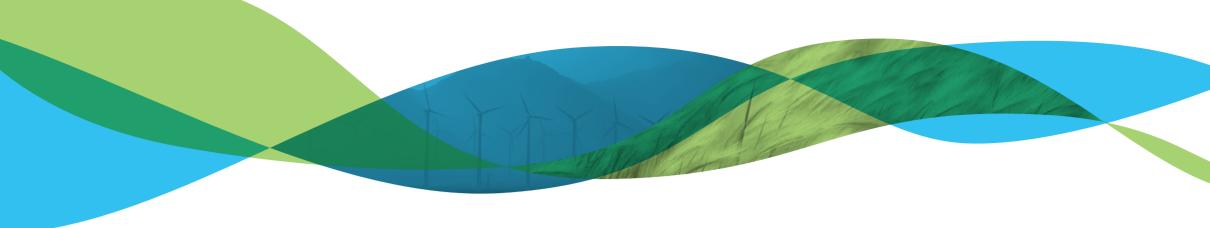
INVESTMENTS IN US\$ MILLION

CHART 14

BNEF made an additional comment due to the 2018 numbers, which we reproduce below in its entirety:

"The decline is primarily the result of there being no auctions between November 2015 and December 2017, and with the first-ever decontracting auction held in August 2017, allowing projects to be released from their commitment by paying reduced penalties. In spite of this, the Brazilian wind energy industry remains one of the largest in the world, having attracted over US\$ 33 billion for new projects since 2010. We expect investments to increase over the short and medium term, given the outcome of the 2017 and 2018 auctions, where a total of 2.8 GW of energy were contracted, and anticipation regarding the six announced auctions (2019, 2020 and 2021)."



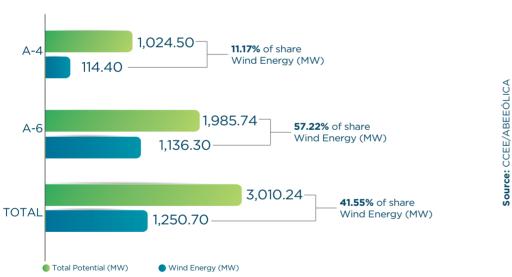


AUCTIONS

In 2018, 1.25 GW in installed capacity (48 wind farms) at two auctions - one A-4 and one A-6. The table below shows the total contracted in each auction and how much was in wind energy.

AUCTIONS IN 2018¹⁵

GRÁFICO 15



It is worth mentioning that this was a good year for the free energy market, with at least three large free market auctions focused on trading renewable energy. Although sources have not disclosed the numbers, we estimate that wind energy companies sold some 2 GW in installed capacity to the free market in 2018, showing this market is growing in importance for wind energy.

CLOSING REMARKS

As we have shown in this document, 2018 was a good year for wind energy, both in terms of installed capacity and new contracts, showing an increasingly strong industry. The current year, 2019 will have some challenges is one of challenges as the country undergoes profound political change. ABEEólica is ready and actively working to create candid and transparent dialog that are technically based with the new government team. We work with those who defend a source of energy that has numerous proven benefits.

Whenever we talk about future wind energy contracts in Brazil, we like to remind people of a very important concept: our energy matrix is very diversified and must remain so. Each source has its advantages and we need them all, especially if we consider that any expansion of the energy matrix should primarily come from renewable sources. In terms of wind energy, it makes technical, social, environmental and economic sense as it has been the most competitive type of energy in recent auctions.

Regarding specific themes we will focus on in 2019 we have funding and expanding private sector capital offers, modernizing the electric power industry overall, expansion of the free market and stronger socioenvironmental activity by industry players.

By the end of this year we should have almost 16 GW of installed wind capacity, becoming the second largest energy source in the nation's matrix. We believe these will be the highlights of the year, but also expect to have other good news to share with you in our next Annual Wind Energy Report. We we all know, the winds are good! Good

CORPORATE

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ABOUT ABEEÓLICA

Established in 2002, ABEEólica, the Brazilian Wind Power Association is a non-profit organization that brings together and represents the wind power sector in Brazil. Since it was created, ABEEólica has e ectively contributed to the development and recognition of wind energy as a competitive, clean, renewable, low-impact source of energy, and a strategic element of Brazilian electrical matrix.

JOIN US

Learn of the advantages of being a member and read the association statues on the ABEEólica website at "Join Us", or send an e-mail to comunicacao@abeeolica.org.br

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