



ABEEólica

Associação Brasileira
de Energia Eólica



ANNUAL WIND ENERGY
REPORT 2020

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Elbia Gannoum
CEO

MESSAGE FROM THE CEO

By the end of 2020 there were a total of 686 wind farms and 17.75 GW of installed wind power capacity, a 14.89% growth compared to December 2019, when the installed capacity was 15.45 GW. A total of 66 new wind farms were built in 2020, totalling 2.30 GW in new capacity.

Because of the pandemic, 2020 was clearly full of challenges for all of us, including the energy industry. The most immediate impact was the absence of auctions because of a falling demand, meaning no sales to the regulated market in 2020. The good news is that the free market is now very important for the wind power industry. In fact, by 2018 and 2019 we were already selling more to free market clients than the regulated market.

Our performance in the free market last year was excellent, a good sign for our production chain where new transactions continue to take place. The outlook for the future remains optimistic. Although there is no specific database for the free market, we believe some 3 GW in new contracts were signed in 2020, enough to keep investments going and to generate new jobs.

We also saw new types of contracts emerging in the free market in 2020. These are mostly large, long-term deals customized to the client and its needs. The current scenario shows a free market that is complex and experienced, with an array of fascinating custom-designed new solutions and highly differentiated products and services.

The pandemic also fostered discussions on the importance of a green economic recovery, with businesses that protect the planet and use ESG criteria - Environment, Social, and Governance -, the three pillars of corporate sustainability and social impact. Wind energy provides the perfect solution, not only for its low environmental impact but also its multiplying effects.

In 2020 we published a study by GO Associates entitled "Socioeconomic and Environmental Impact of Wind Energy

Generation in Brazil", which quantified the known positive impact of wind energy. This effort analyzed, for instance, the multiplier effects of investments made by wind generators and the impact of the amounts paid to lease land for placing wind generators.

The study also compared a number of cities and towns with wind farms to others where no such installations exist, looking at their Human Development Index (HDI) and GDP. Regarding city GDP and HDI, those with wind farms performed 20.19% and 21.15% better respectively. This clearly demonstrates that wind energy has positive multiplying effects that impact municipal indicators. This is an important indicator that shows us we are on the right path, dedicating our efforts to grow an industry that will help us fight for the good of the planet.

Elbia Gannoum
CEO

ABEEólica – Brazilian Wind Energy Association

Enjoy your **Reading!**

INSTALLED CAPACITY IN BRAZIL - ALL SOURCES

A total of 66 new wind farms were built in 2020, and another 14 were repowered, totalling 2.30 GW in new capacity - 31 MW of this repowered.

By the end of 2020, there were a total of 686 wind farms and 17.75 GW of installed wind power capacity, a 14.89% growth

compared to December 2019, when the installed capacity was 15.45 GW.

The states that received new wind farms in 2020 were Bahia, Rio Grande do Norte, Piauí and Ceará, with 23, 18, 15 and 10 farms respectively.

New installed capacity added in 2020 (MW) by state

STATE	Power (MW)	Nº of Wind Farms
BA	784.3	23
RN	723.2	18
PI	518.0	15
MA	251.5	10

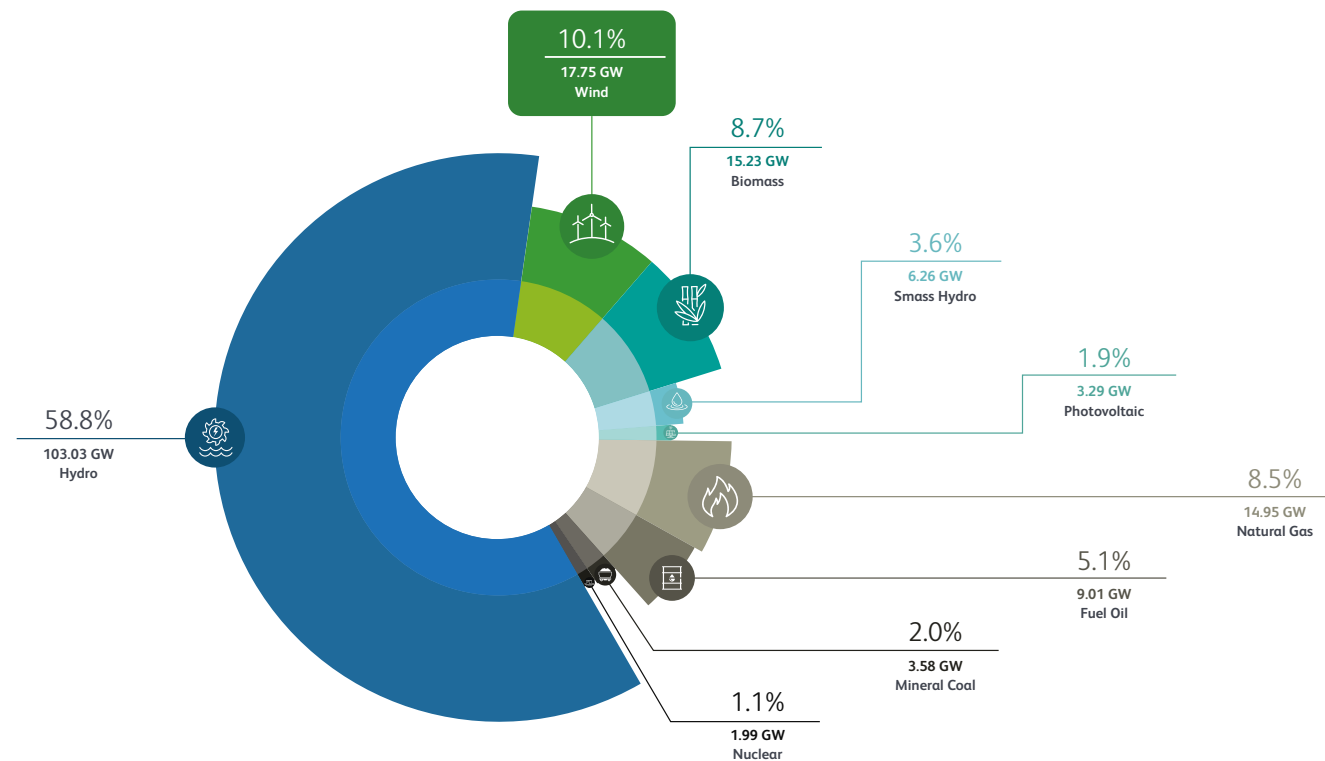
Source: ANEEL/ABEEólica

A total of 5.32 GW in new power were added to the country's power grid in 2020, with wind power growing faster than other sources, accounting for 43.17% of the new capacity installed. The second fastest growing source was natural gas, responsible for 29.18% of new capacity. With the additional

capacity, wind power now makes up 10.13% of the nation's power matrix, as shown in Chart 1 below, which shows the percent contribution from all sources of energy to the electric power grid in late 2020.

Brazilian electric energy matrix (GW)

CHART 1



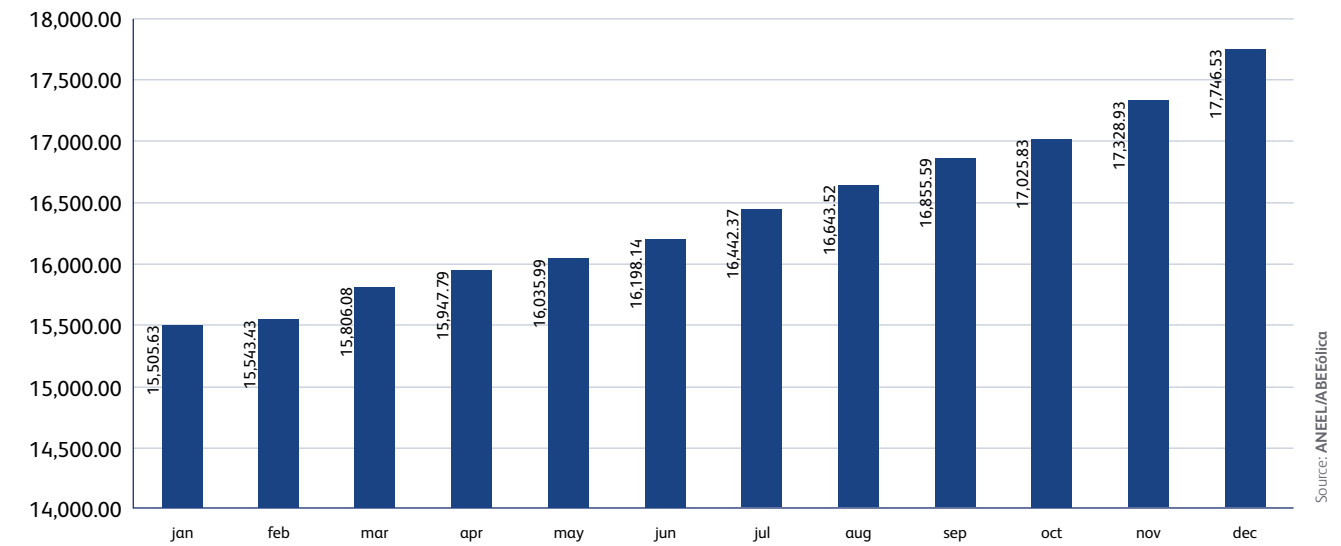
Source: ANEEL/ABEEólica

The 17.75 GW installed capacity includes 17.16 GW (96.72%) in commercial wind farms and 0.58 GW (3.28%) in plants in

the testing phase. Chart 2 shows how installed capacity grew in commercial wind farms and 0.58 GW (3.28%) in plants in 2020.

Growth of installed capacity in 2020 (GW)

CHART 2



Source: ANEEL/ABEEólica

Total installed capacity in 2020: 2.3 GW
Accumulated installed capacity in 2020: 17.75 GW

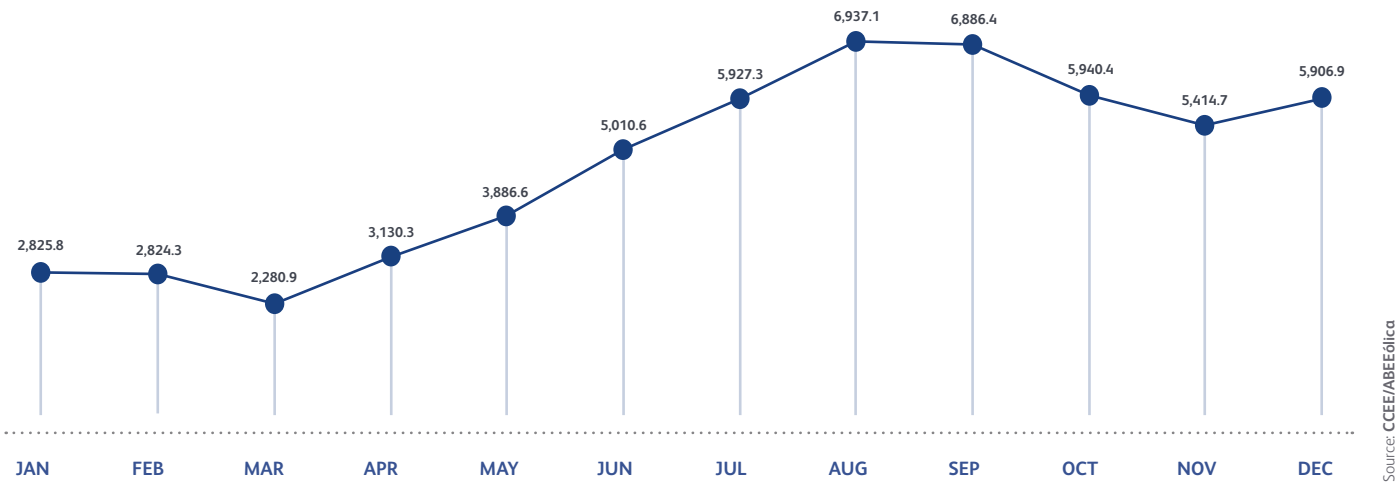
GENERATION

In all, 57.0 TWh of wind energy were generated in 2020. Compared to 2019, energy produced by wind increased 1.9%. In a monthly average of 2020, 4,658.8 GWh were generated

4,747.6 GWh, with a record in August of 6,937.1 GWh. Chart 3 shows mean generation in 2020¹.

Wind power generation - 2020 (GWh)

CHART 3



Total generated in 2020: 57,0 TWh

In terms of percentage and supply, wind power accounted for 9.97% of all electricity generated and added to the National Interconnected System (SIN) in 2020². Wind energy generation peaked in the month of August (14.77% of SIN generation), as winds are normally better in the second half

of the year. In 2020, wind energy generation broke a number of monthly records. Below are the records for the year in each SIN subsystem.

NE 94,40%

of all energy consumed in the northeast was generated from wind, with a capacity factor of **71.14%** and **9,255.73 MWavg generated**. (06-Sep-2020)

N 6,80%

of all energy consumed in the north was generated from wind, with a capacity factor of **93.30%** and **397.45 MWavg generated**. (14-Nov-2020)

S 16,90%

of all energy consumed in the south was generated from wind, with a capacity factor of **85.41%** and **1,705.09 MWavg generated**. (25-May-2020)

SIN 15,64%

of all energy consumed in the national integrated system was generated from wind, with a capacity factor of **66.97%** and **10,647.95 MWavg generated**. (28-Nov-2020)

The next chart shows that the northeast subsystem's wind power capacity is close to the total, accounting for 85.6% in 2020, compared to only 11.5% in the south subsystem.

This is because most of the wind farms in this country are located in the Northeast.

Generation and its share of the power supply

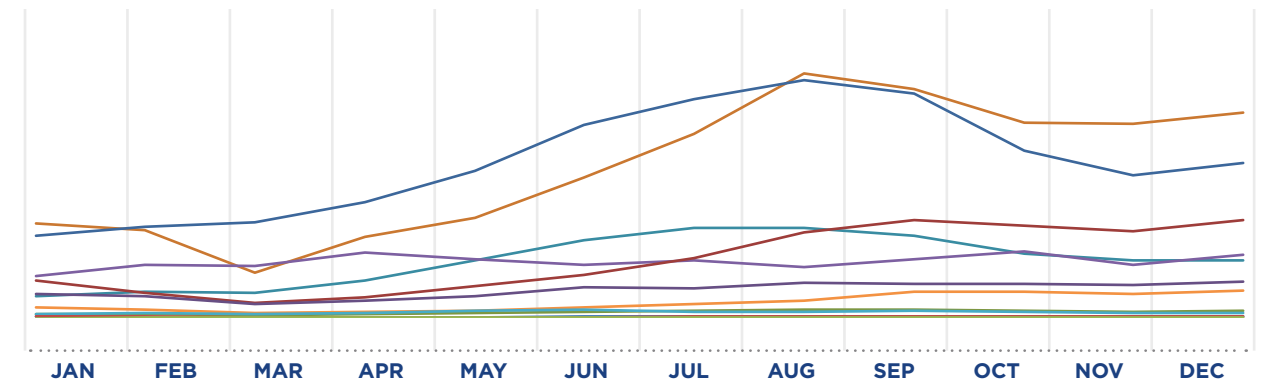
REGION	2019		2020		Growth %
	Generation (TWh)	Share	Generation (TWh)	Share	
Southeast	0.06	0.1%	0.05	0.1%	-11%
South	5.62	10.3%	6.34	11.5%	13%
Northeast	47.13	86.7%	47.08	85.6%	0%
North	1.55	2.9%	1.51	2.7%	-3%
Total	54.37	100%	54.98	100%	1.1%

The five states with the greatest amount of energy from wind in 2020 were Bahia (16.22 TWh), Rio Grande do Norte (15.59 TWh), Ceará (5.95 TWh), Piauí (5.91 TWh), and Rio

Grande do Sul (5.81 TWh). The Chart 4 below shows the amount of wind power generated³ in each Brazilian state.

Generation by State - 2020 (MWmed.)

CHART 4



REGION	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
RN	818.3	753.9	384.3	697.9	862.3	1,219.3	1,596.4	2,118.3	1,984.4	1,691.7	1,680.2	1,781.3
BA	711.4	786.8	824.3	1,004.1	1,271.0	1,678.8	1,900.2	2,066.6	1,950.0	1,450.8	1,237.0	1,338.4
PI	184.4	221.8	217.4	316.5	498.0	673.6	778.3	773.2	714.8	551.7	492.5	491.6
RS	356.5	456.5	447.6	564.5	503.5	459.0	496.1	438.2	506.8	573.4	459.8	546.9
CE	315.6	208.7	129.4	176.5	267.3	373.2	512.1	737.1	844.5	799.7	744.2	845.1
PE	205.8	184.1	119.5	148.8	181.7	262.2	250.6	300.6	291.2	295.0	276.5	309.4
MA	89.5	65.1	36.3	45.0	59.6	82.6	113.6	142.5	218.6	223.1	202.8	227.9
PB	28.6	23.5	15.2	24.9	35.0	50.5	57.7	66.5	63.2	52.9	50.1	56.2
SC	30.7	33.9	30.5	38.8	55.1	66.1	49.1	49.4	54.9	50.5	33.4	38.5
SE	5.7	2.8	2.8	1.6	2.4	4.4	6.4	5.6	4.8	6.0	6.4	7.4
RJ	4.4	3.9	1.7	1.6	2.4	2.9	3.8	6.5	8.0	6.1	4.4	8.3
PR	0.2	0.2	0.2	0.2	0.3	0.4	0.3	0.2	0.3	0.3	0.2	0.2

³This chart shows wind energy generated by wind farms in commercial operation at the center of gravity.

¹This chart shows wind energy generated by wind farms in test and commercial operations at the connection point.
²The SIN is made up of four subsystems: Northeast, North, Southeast/Middle-West and South. The boundaries for these subsystems differ from the geographic boundaries. For wind energy, the north subsystem is comprised of the state of Maranhão.

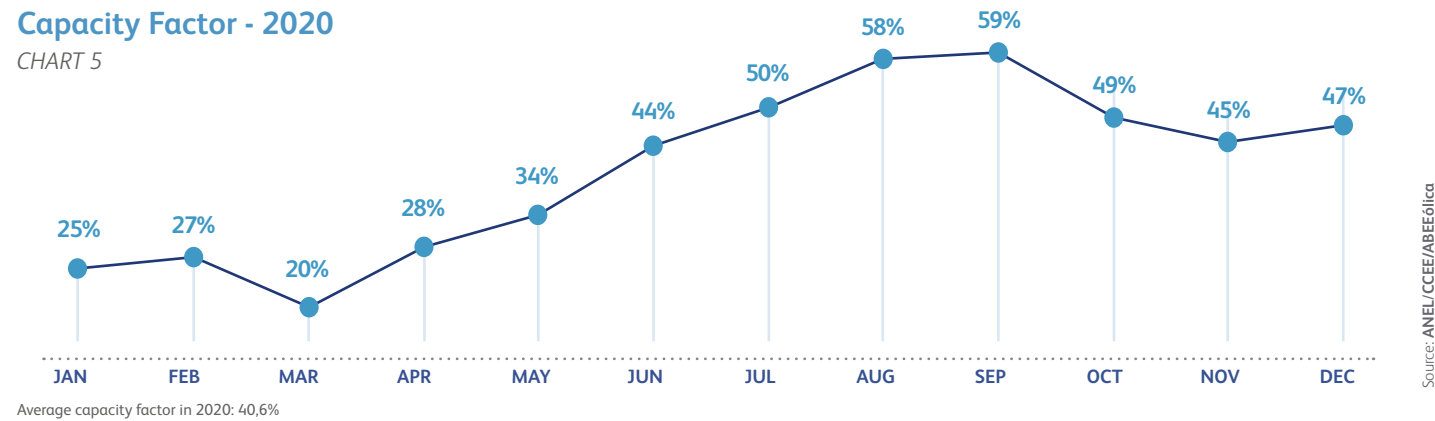
CAPACITY FACTOR

The capacity factor of a wind power source is calculated as the ratio of the plant's actual generation to its total capacity over the same period. The average in 2020 was 40.6%, peaking in September at 59%.

During daily peaks, wind farm capacity factors exceeded 80%, as in the record generation measured in the Northeast and SIN, discussed in the previous chapter⁴.

Capacity Factor - 2020

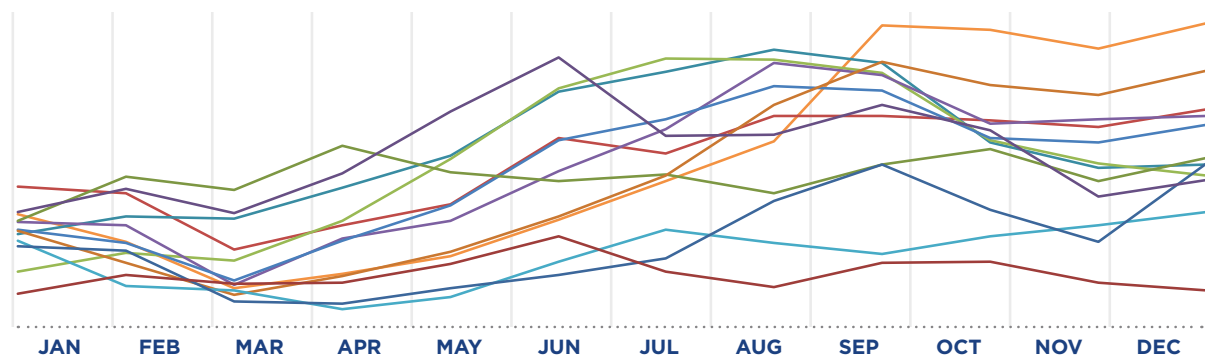
CHART 5



The five states with the largest average capacity factor in 2020 were Bahia (43.6%), Pernambuco (40.3%), Maranhão (40.2%), Piauí (40.1%) and Rio Grande do Norte (39.4%).

The calculated capacity factors for each Brazilian state are shown in Chart 6 below.

CHART 6



REGION	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
MA	28.2%	22.0%	11.5%	14.7%	18.8%	26.9%	35.8%	45.0%	71.3%	70.4%	66.1%	71.9%
PE	34.6%	33.1%	20.1%	25.9%	30.6%	45.6%	42.2%	50.6%	50.7%	49.8%	48.2%	52.2%
BA	23.7%	27.8%	27.2%	34.2%	41.5%	56.2%	60.7%	65.9%	62.9%	44.7%	38.8%	39.6%
PI	15.1%	19.5%	17.8%	26.8%	40.9%	57.1%	63.9%	63.4%	60.5%	45.3%	38.8%	32.1%
RN	26.5%	25.8%	12.2%	22.7%	26.8%	38.1%	47.7%	62.8%	60.1%	48.9%	50.0%	50.6%
PB	24.7%	21.7%	13.2%	22.2%	30.2%	45.1%	49.9%	57.5%	56.5%	45.8%	44.8%	48.6%
RS	26.9%	36.8%	33.8%	44.0%	38.0%	35.8%	37.4%	33.1%	39.5%	43.3%	35.8%	41.3%
CE	22.8%	16.1%	9.4%	13.2%	19.3%	27.9%	37.0%	53.3%	63.1%	57.8%	55.6%	61.1%
SE	22.3%	11.8%	10.9%	6.6%	9.5%	17.5%	24.8%	21.6%	19.3%	23.3%	25.8%	28.7%
RJ	20.9%	19.9%	8.3%	7.9%	11.5%	14.5%	18.2%	31.3%	39.7%	29.2%	22.0%	39.9%
PR	10.0%	14.3%	12.3%	12.8%	17.0%	23.3%	15.3%	11.6%	17.3%	17.4%	12.7%	10.9%
SC	28.8%	34.1%	28.6%	37.7%	51.7%	64.2%	46.1%	46.4%	53.3%	47.5%	32.4%	36.2%

Source: ANEL/CCEE/ABEEólica

⁴-This chart shows wind energy generated and installed capacity of wind farms in commercial operation at the connection point.

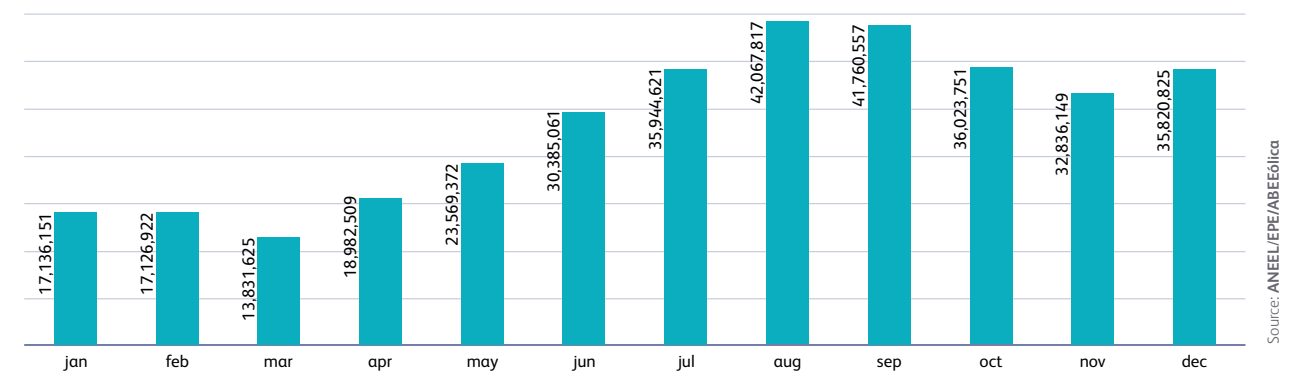
WIND POWER CONTRIBUTION TO RESIDENTIAL SUPPLY

Wind energy can also be presented as generation equivalents compared to average household electricity use in Brazil. According to the monthly review published by EPE (Empresa de Pesquisa Energética, or Energy Research Company), average residential consumption in Brazil in 2020 was 165 kWh per month.

Thus, actual average wind energy generation in 2020 was equivalent to the average power consumed in 28.8 million homes or some 86.4 million inhabitants. In 2020, wind powered households for more people than the population of the entire northeast (over 57 million people)⁶. Chart 7 below shows the number of households powered by wind energy in 2020.

Households powered by wind in 2020, month by month

CHART 7



Source: ANEL/EPE/ABEEólica

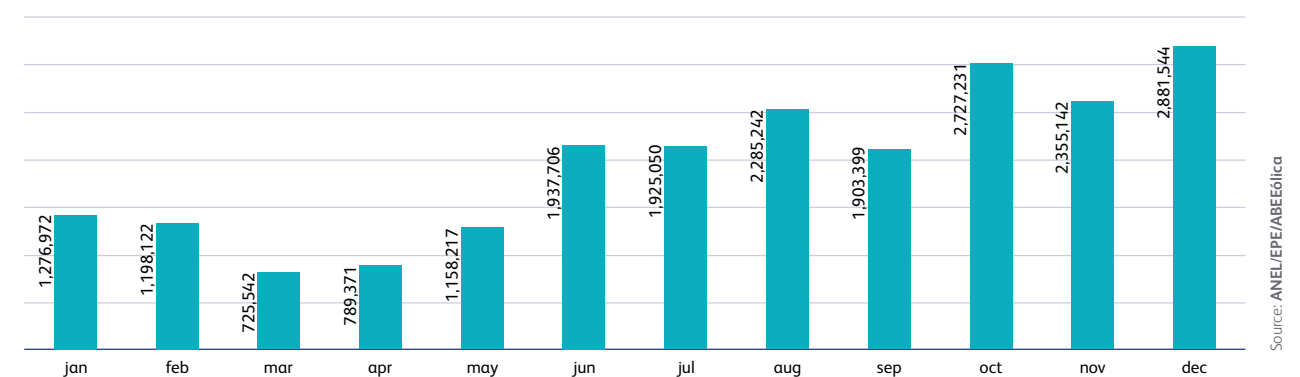
WIND POWER CONTRIBUTION FOR REDUCING CO₂ EMISSIONS

In addition to very low implementation impact, wind power does not emit any CO₂, and can replace other CO₂ emitting sources of electricity. Chart 8 below shows CO₂ emissions avoided due to wind power month by month⁷.

A total of 21.2 million tons of CO₂ were avoided by using wind energy in 2020; this is equivalent to some 21 passenger cars. For comparison purposes, the city in São Paulo has a fleet⁸ of over 10 million passenger cars⁹.

Avoided CO₂ emissions in 2020 (million tons)

CHART 8



Tons CO₂ avoided in 2020: 21.2 million

Source: ANEL/EPE/ABEEólica

⁵-Considering an average of three people in each household. ⁶-IBGE Data - Estimates of the population residing in Brazil and its states on July 1, 2017. ⁷-Based on the MCTI's (Brazilian Ministry of Science, Technology and Innovation) methodology and data used to calculate emissions avoided due to wind power (75% in power plant operation and 25% in power plant construction). ⁸-Considers the indices in the 2019 State of São Paulo Vehicular Emissions Report issued by CETESB, the state of São Paulo Environmental Company. ⁹-Detran-SP fleet data, updated in December 2019. The data is for automobiles only, and excludes motorcycles, buses, mini-buses, pickup trucks, utility and other vehicles.

SOCIOENVIRONMENTAL CONTRIBUTIONS OF WIND POWER

Benefits of Wind Power for the World



Generates income and improves the quality of life of landowners who lease their land for wind tower placement.



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



Is renewable and does not pollute, helping Brazil fulfill its Climate Agreement goals.



Offers one of the best cost-benefits in terms of energy prices.



Wind farms do not emit CO₂.



Trains and qualifies local labor.

Installing wind farms contributes to higher municipal GDP and HDI, as per a study by GO Associates. A group of cities and towns with wind farms was compared to a group without, showing that those with wind farms experienced.



A 21.15% increase in GDP (1999 - 2017).



A 20% increase in HDI (2000 - 2010).



Wind energy occupies only a small amount of land so farmers are able to continue to plant crops or farm livestock. Turbines occupy some 8% of the land area set aside for wind farms, and this could decrease to around 6%. 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. Below are a few examples of community projects implemented by wind energy players:

- 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, and fostering employability and entrepreneurship.
- Strengthening and expanding local production chains such as coconut, manioc, corn, beans, honey and milk, among others that improve the population's income and promote sustainable development.
- Health promotion projects including oral health and nutrition, for instance.
- Activities to encourage sports, alongside monitoring schoolwork.
- Encouraging local artisans.
- 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.

RENEWABLE ENERGY CERTIFICATION PROGRAM

Launched in Brazil six years ago, the Renewable Energy Certification Program has grown consistently ever since. REC Brazil, or 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 with additional sustainability criteria and the additional stamp of approval of RECBrazil. The Totum Institute also issues RECs (Renewable Energy Certificates).

2020 brought good news in terms of Renewable Energy Certificates. This market is growing and Brazil stands out in the global market. The outlook for the future is bright.

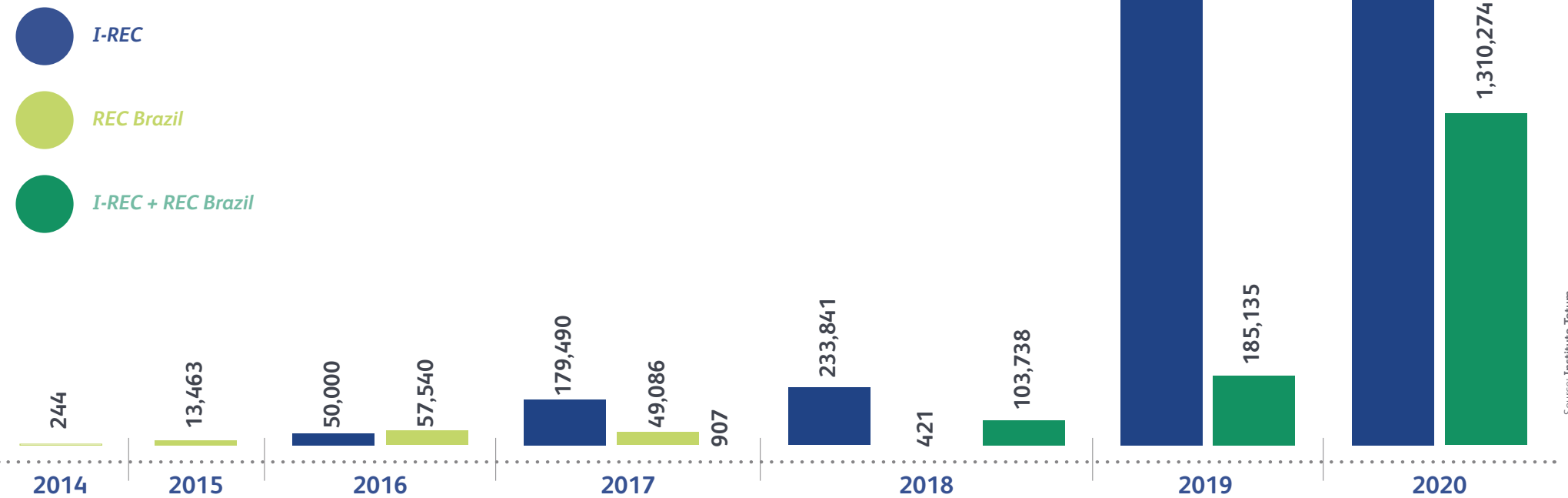
The number of Brazilian power plants with Renewable Energy Certificates is growing. By late 2019 there were 104 registered power plants, and by 2020 this number had increased to 148. This puts Brazil at the leadership of the I-REC Platform. The International REC Standard (I-REC) is a global system that enables trading certificates of renewable energy.

Another way to look at 2020 is based on the number of renewable certificates issued. Just over 300 certificates were issued in 2018. In 2019 this number increased to 2.5 million - 3/4 for wind power plants. In 2020 over 4 million of such certificates were issued.



Growth of renewable energy certificate transactions

CHART 9



Source: Instituto Totum

EXPANSION OF THE INSTALLED CAPACITY FOR WIND POWER

Chart 10 below shows the increase in installed capacity and the growth in wind power as a function of previous contracts signed following regulated auctions and free market agreements.

Growth of installed capacity (MW)

CHART 10



GLOBAL FIGURES

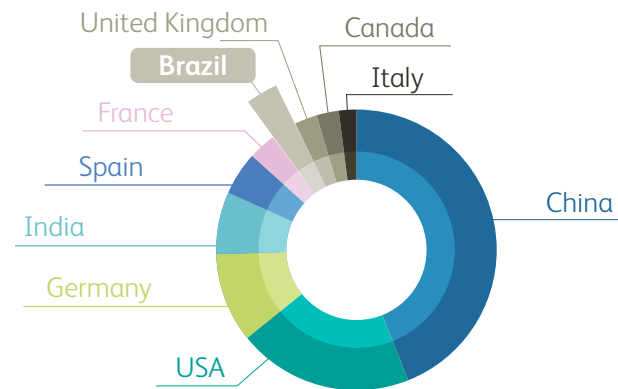
In 2020, Brazil held onto its #7 rank in the GWEC (Global Wind Energy Council) list of accumulated wind capacity. However, looking only at new capacity installed in 2020, Brazil ranks

third, having installed 2.3 GW of new capacity in 2020. Below is the GWEC ranking.

TOP 10 cumulative capacity 2020

CHART 11

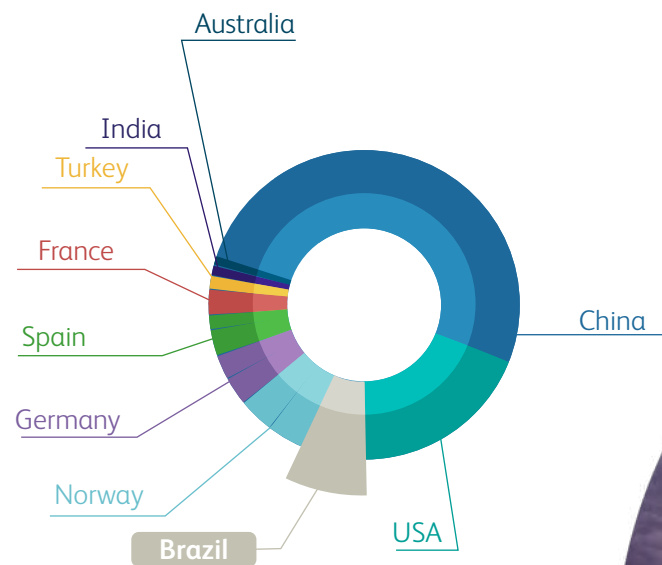
COUNTRY	Power (MW)
China	278,324 MW
USA	122,275 MW
Germany	55,122 MW
India	38,625 MW
Spain	27,238 MW
France	17,946 MW
Brazil	17,750 MW
United Kingdom	13,731 MW
Canada	13,578 MW
Italy	10,543 MW



TOP new installed capacity 2020

CHART 12

COUNTRY	Power (MW)
China	48,940 MW
USA	16,913 MW
Brazil	2,297 MW
Norway	1,532 MW
Germany	1,431 MW
Spain	1,400 MW
France	1,317 MW
Turkey	1,224 MW
India	1,119 MW
Australia	1,097 MW



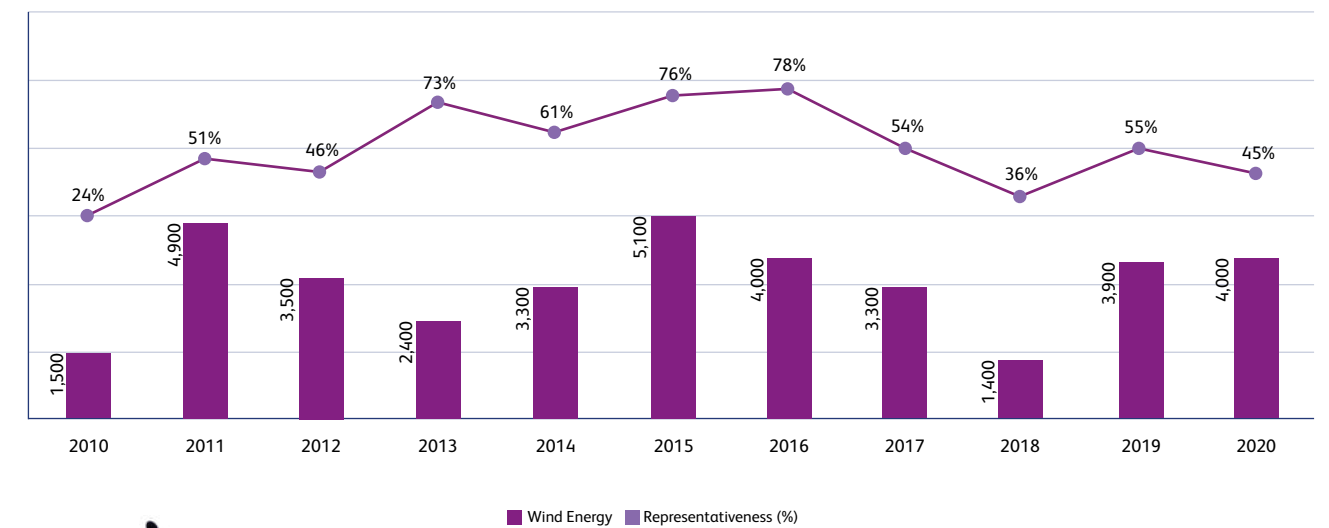
INVESTMENTS IN WIND POWER

US\$ 4.0 billion (R\$ 20.6 billion) were invested in wind power in 2020, or 45% of the total investment in renewables (solar, wind, biofuels, biomass, waste, PCHs (small hydro) and other sources) in Brazil. If we look at 2010 through 2020, the total was around US\$ 37.3 billion. Chart 13 below shows investments in renewable energy and the amount invested in wind energy since 2010, as calculated by Bloomberg New Energy Finance - BNEF, which also publishes an analysis of this data.

“Brazilian investments in clean energy remained healthy in 2020, increasing 23% compared to the previous year, reaching an almost record high of US\$ 9 billion (in 2011, US\$ 9.7 billion were invested). According to the BNEF, long-term wind power developments and a strong pipeline of auction-supported projects that may come on-stream ahead of schedule support this.

Investments in new projects in the wind energy sector (US\$ million)

CHART 13



AUCTION

As the Covid-19 pandemic led to a drop in demand, there were no new auctions for the regulated power market in 2020. On the other hand, the free market showed a good appetite for new contracts. Although there is no specific database, we estimate that some 3 GW in new contracts were closed in 2020 in the free market.

The free market for wind energy underwent a profound transformation in 2020, both in terms of supply and the relationship between power supplies and consumers. These are long-term deals customized to the client and its needs. The current scenario shows a free market that is complex and experienced, with an array of fascinating custom-designed new solutions and highly differentiated products and services.

What we are now seeing is generators/traders who are going directly to free or potentially free consumers, not with ready-made or off-the-shelf solutions requiring only minor adjustments but rather they are developing tailor-made agreements that bear in mind innovative client features. These may include partnerships to build wind farms, the



possibility of becoming a partner in a wind farm in the project development, management or operation stage.

The fact is that at this point we don't have details on these new models, as there is a certain "secret" to stitching together these deals. We like the "stitching" metaphor, as the free market has long been like a ready-made fashion store with different sizes of the same style, while new contracts are all made-to-order and meticulously tailored to a single consumer.



CLOSING REMARKS

As submitted in this document, 2020 was a good year for wind energy, despite the difficulties of such an atypical year. I am completing this text for this report in early 2021 when the vaccine has arrived for a good percentage of our population, and recent statements coming out of Europe, China and the US bring hope. The challenges for 2021 are not less than those in 2020, but now we see a light at the end of the tunnel.

ABEEólica is ready and actively working to engage in technology-based, candid and transparent dialogs with the new government team. We work with those who defend a source of energy that has numerous proven benefits. We work with joy as we are discussing very promising and interesting themes going forward, such as offshore wind energy and hydrogen as a source of power.

Speaking of the future, I always like to stress that it will be promising for our good winds and society. This growth in wind energy is far more than the increase in a renewable source, it represents the possibility of transformation with a

source that offers real benefits for communities. I can see the true potential and opportunity for transformation. Responsible investment in natural resources will generate economic and social development by distributing income and fostering inclusion and a reduction in social and economic inequality. We must make this leap in our thought process and actions. It is not enough to generate non-CO₂ emitting renewable energy, this energy must positively impact people's lives. Then we can start talking about a true energy transformation as I see it.

Elbia Gannoum
CEO
ABEEólica – Brazilian Wind Energy Association

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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 effectively 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 statutes on the ABEEólica website at "Join Us", or send an e-mail to: comunicacao@abeeolica.org.br

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