



THE WIND ENERGY INDUSTRY IN BRAZIL

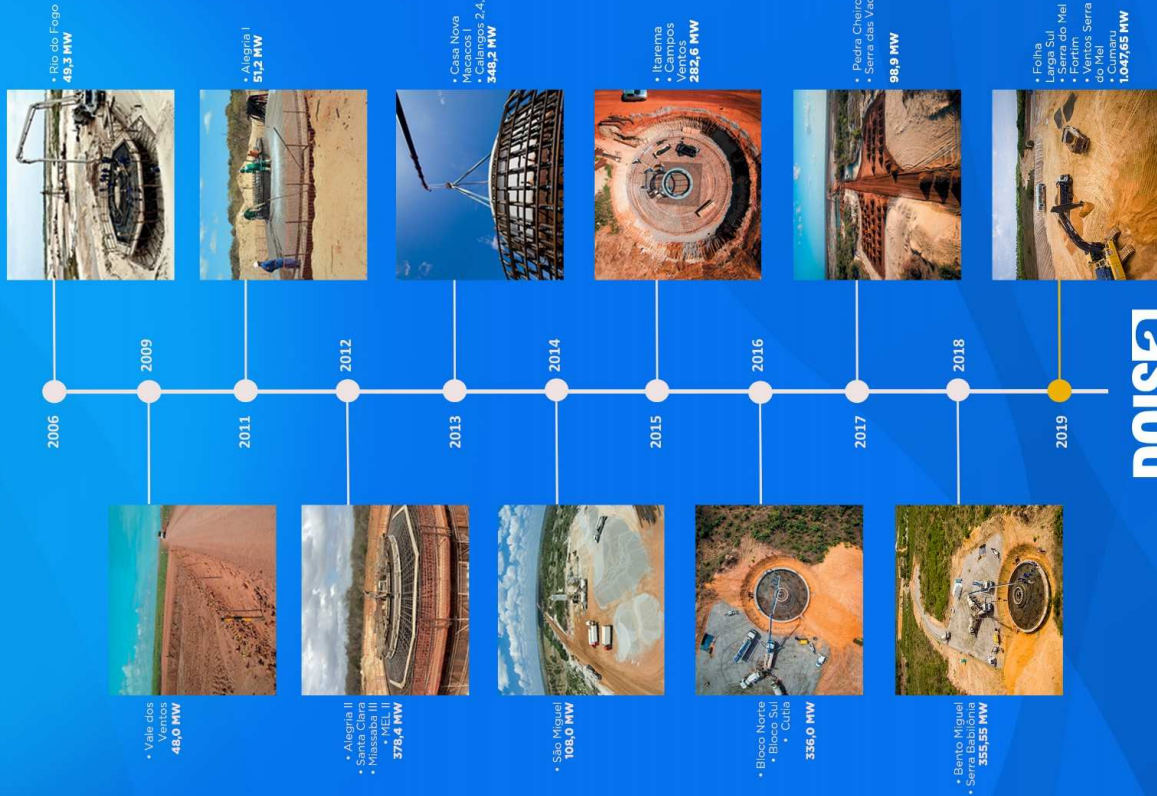
May 2018

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The background features a series of overlapping, wavy lines in shades of green and yellow, creating a sense of movement and depth. A central teal rectangle serves as a focal point for the text.





BRAZILIAN CONTEXT



11 de abril de 2019

Eólica já é a segunda fonte da matriz elétrica brasileira com 15 GW de capacidade instalada

Wind Energy Timeline

- 2002 Creation of ABEEólica and PROINFA
- 2004 Regulation of the New Model of the Electric Sector
- 2009 1st Auction with participation of wind energy (LER 2009)
Clause 5.12 – exemption of the transmission risk of Incentive to Alternative Sources
- 2010 1st participation in Alternative Sources Auction (LFA 2010)
- 2011  1 GW
- 2012 New Local Content Rule of BNDES – 2013 to 2016
 Creation of the Seal and Certificate of Renewable Energy
- 2013 2nd most competitive source
 Extinction of the Clause 5.12
 P50 to P90
- 2014  5 GW
 CONAMA Resolution # 462 Environmental Licensing for Wind Energy
- 2015 Ordinance # 416 of Review of the Physical Guarantee for Wind Energy
- 2016  10 GW
- 2017 End of the Quadrennium of the availability PPA
 Provisional Measure # 735 of 2017 – End of the discount TUST/TUSD
- 2018 Quantity PPA for Wind Energy
- 2019  15 GW

WORLD TOP 10 – Accumulated Capacity

Brazilian Timeline

2013
13th
place
3.4 GW

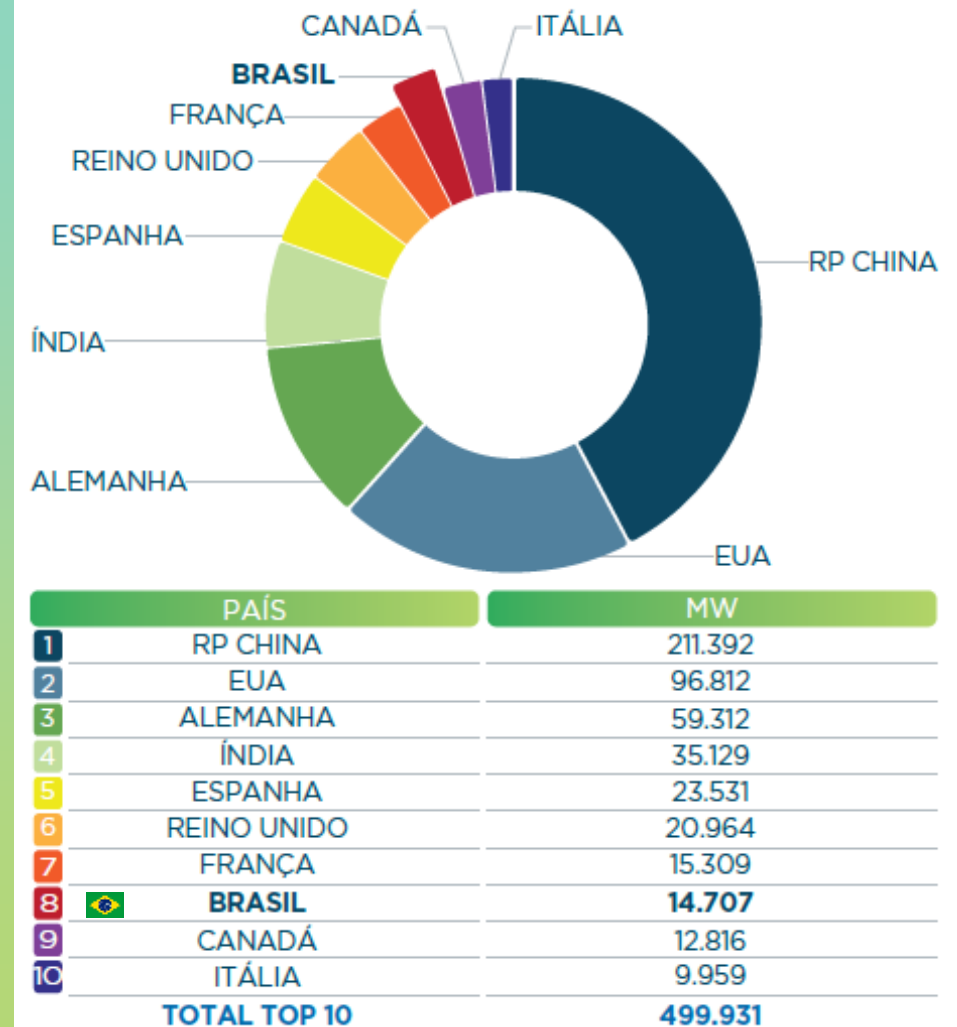
2014
10th
place
5.9 GW

2015
10th
place
8.7 GW

2016
9th
place
10.7
GW

2017
8th
place
12.77
GW

2018
8th
place
14,71
GW



Source: GWEC | ABEEólica

WORLD TOP 10 – New Installed Capacity

Brazilian Timeline

2013
7th
place
0.95
GW

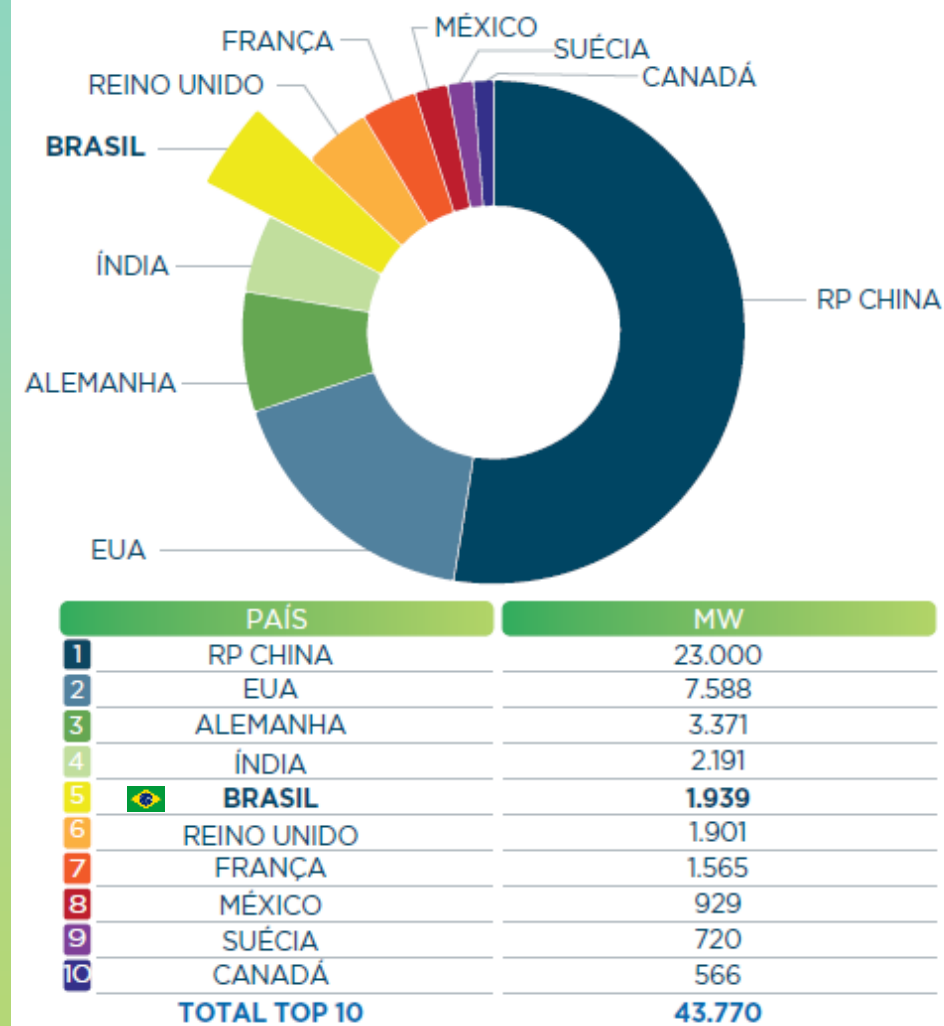
2014
4th
place
2.5 GW

2015
4th
place
2.75
GW

2016
5th
place
2.01
GW

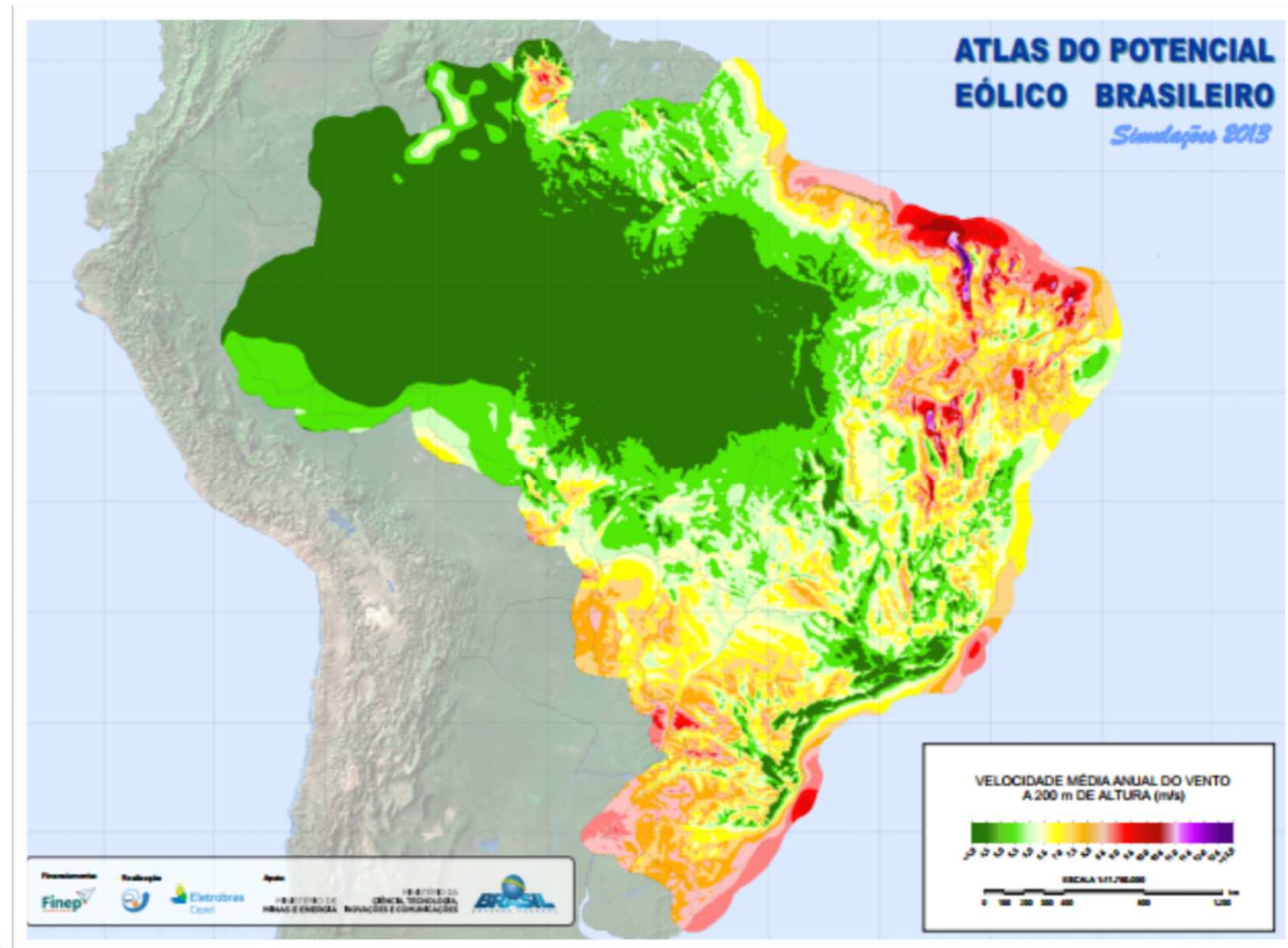
2017
6th
place
2.02
GW

2018
5th
place
1.94
GW



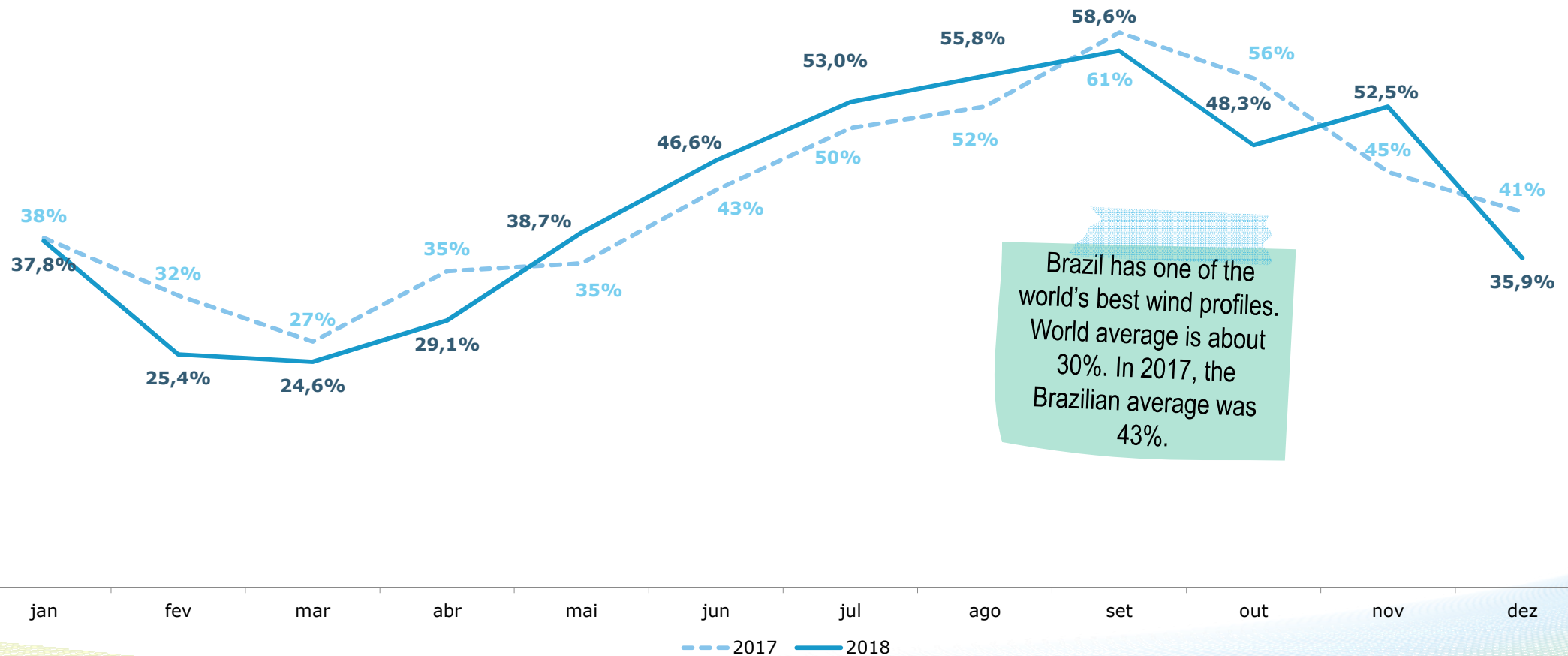
Source: GWEC | ABEEólica

Brazilian Wind Potential



Source: Atlas Eólico Brasileiro - 2013

Capacity Factor



Brazil has one of the world's best wind profiles. World average is about 30%. In 2017, the Brazilian average was 43%.

Source: CCEE | ABEEólica

Generation (MWmed)

In 2017, generation grew 26,5% in relation to 2016, according to CCEE.

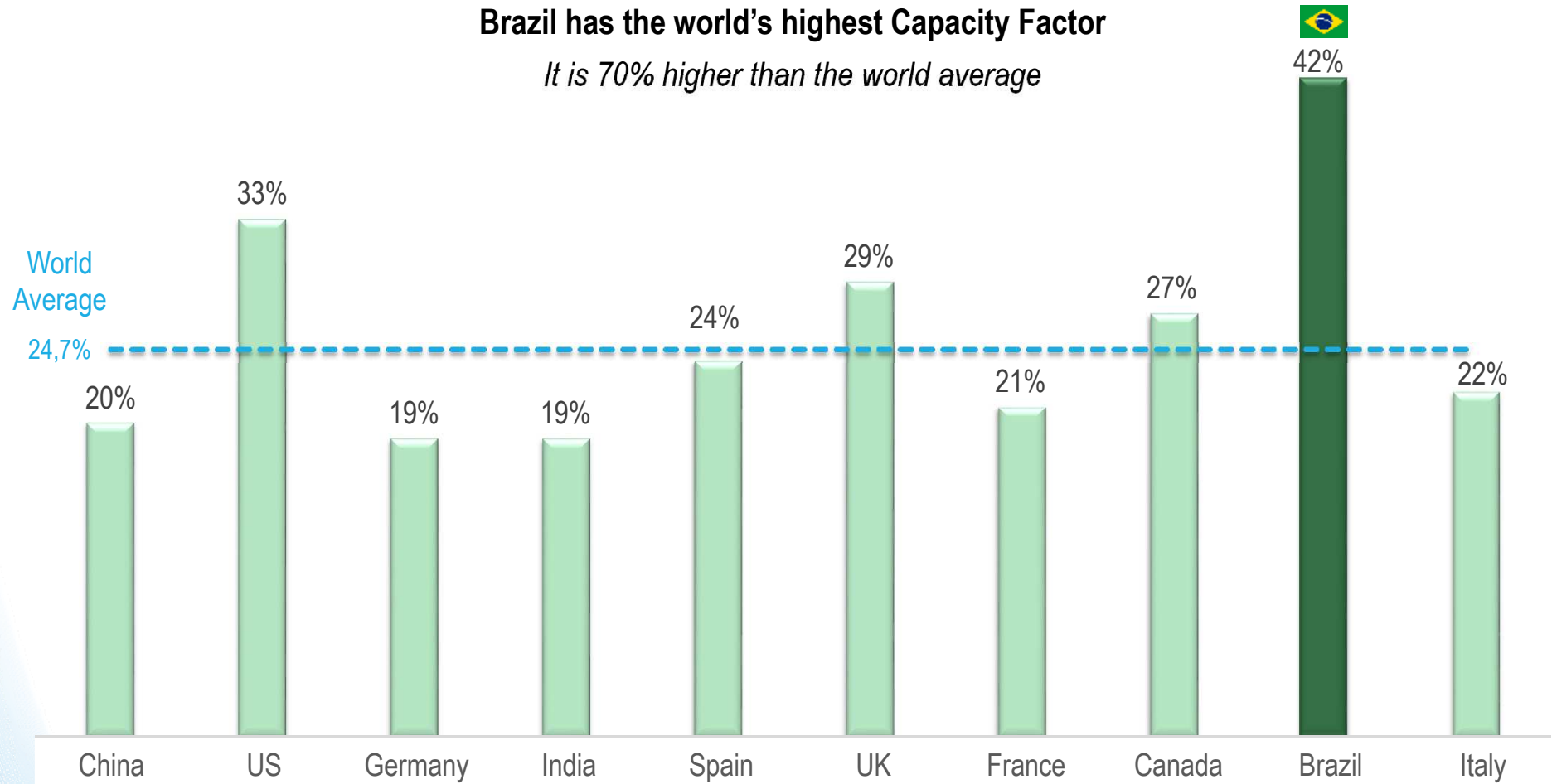


Source: CCEE | ABEEólica

World Capacity Factor 2016

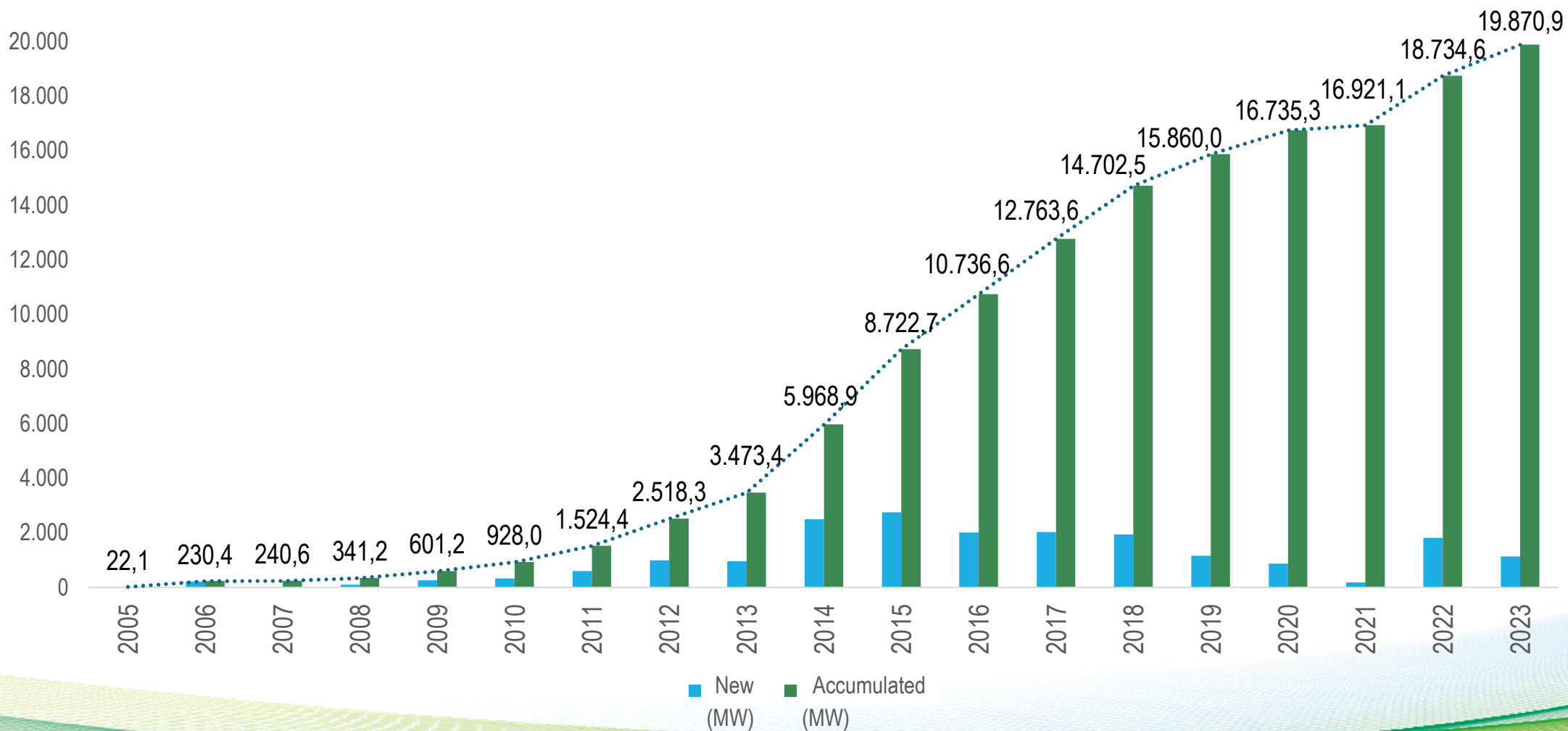
Brazil has the world's highest Capacity Factor

It is 70% higher than the world average



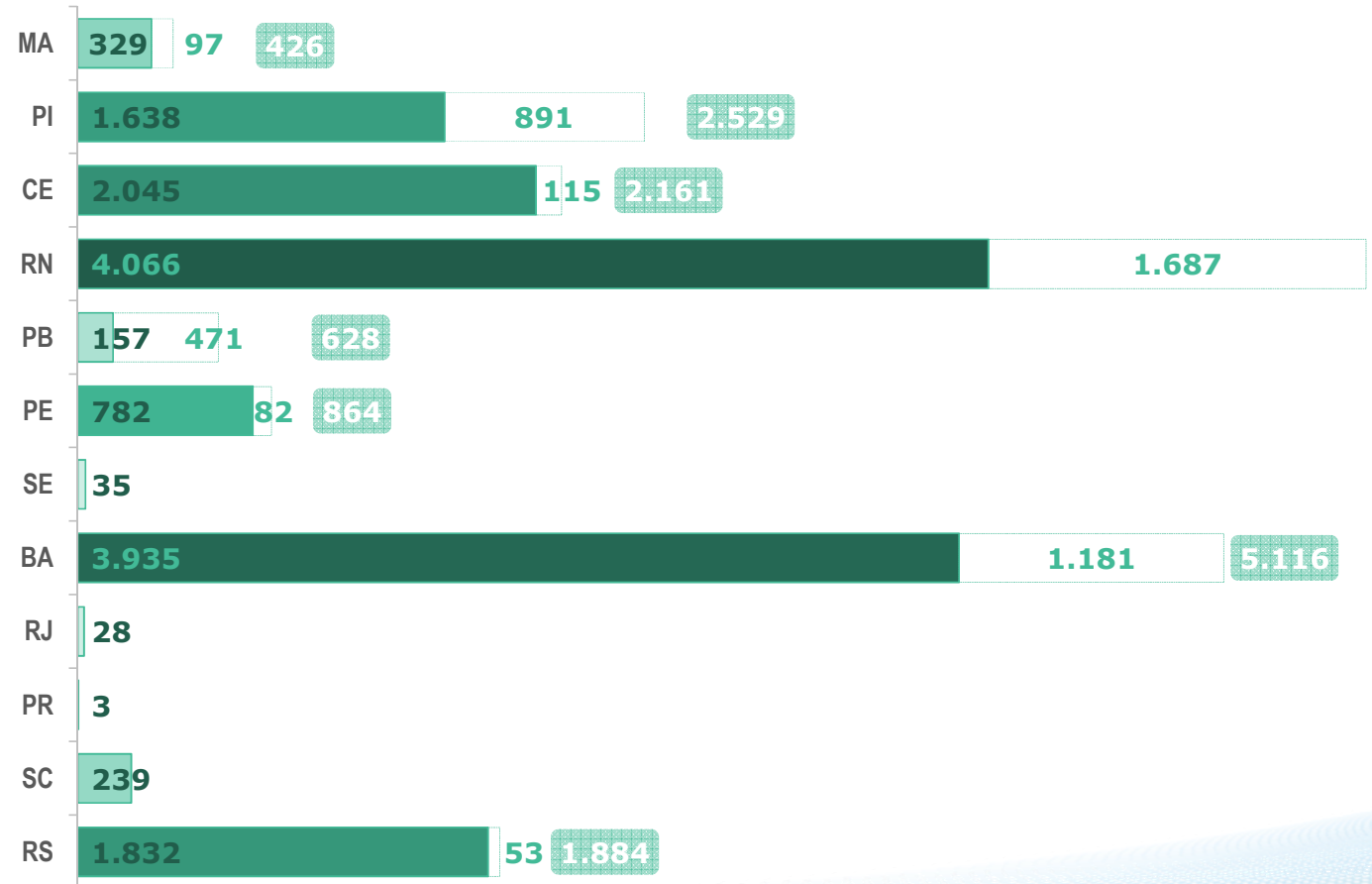
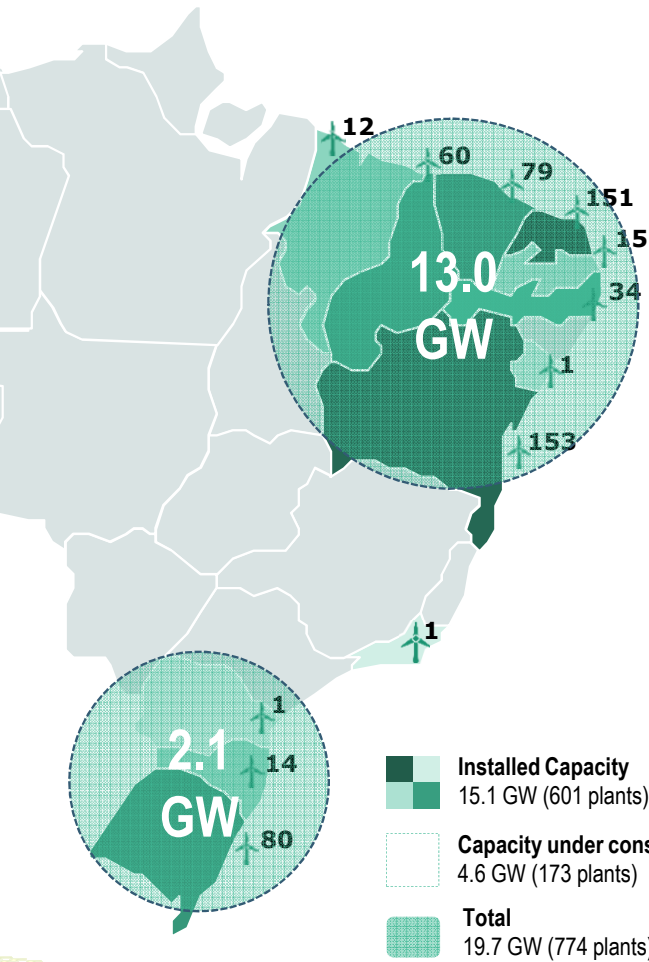
Source: MME | ABEEólica

Evolution of the Installed Capacity



Source: ANEEL | ABEEólica

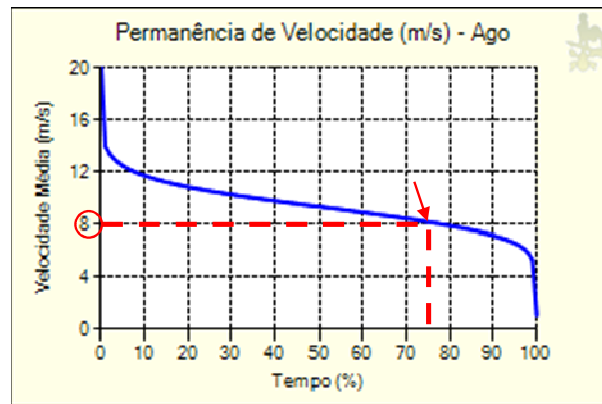
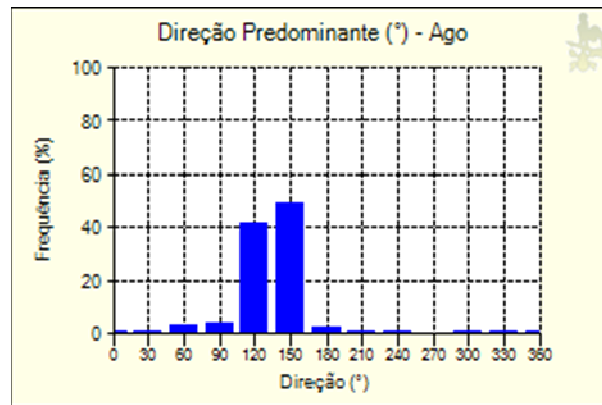
Wind Capacity by State



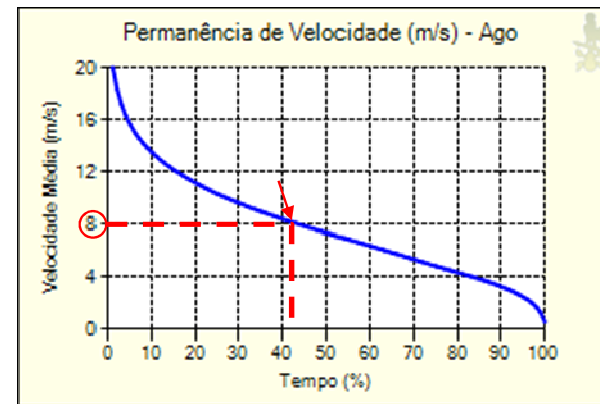
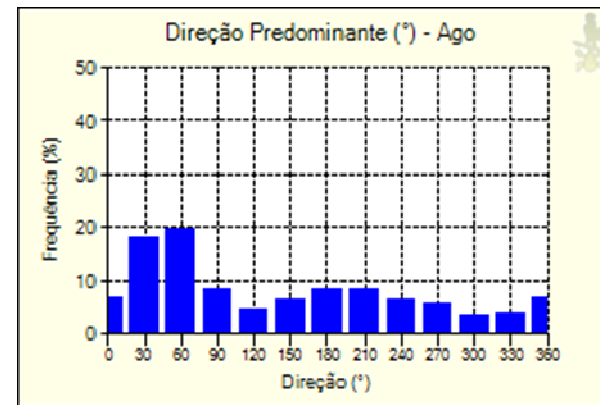
Fonte: ANEEL | ABEEólica

Brazilian Wind Features

Northeast – RN



South – RS



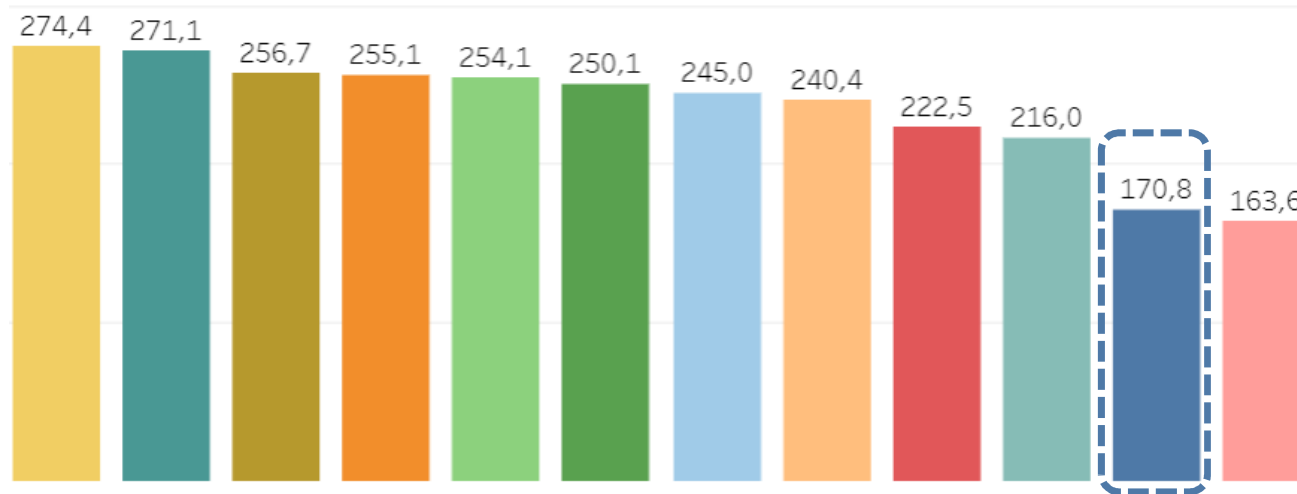
Fonte: AMA EPE (Dados 2017)

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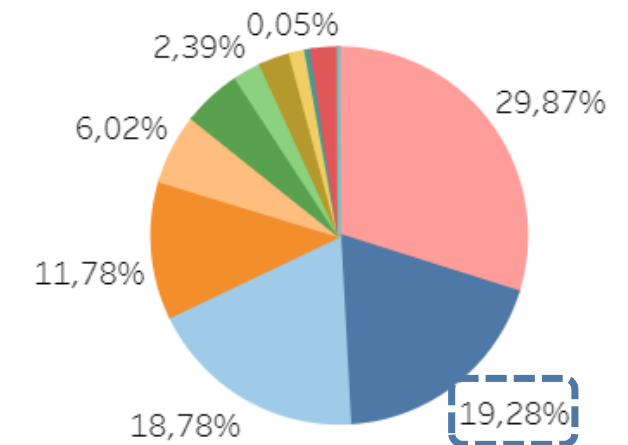
ENERGY AUCTIONS

History of Energy Auctions

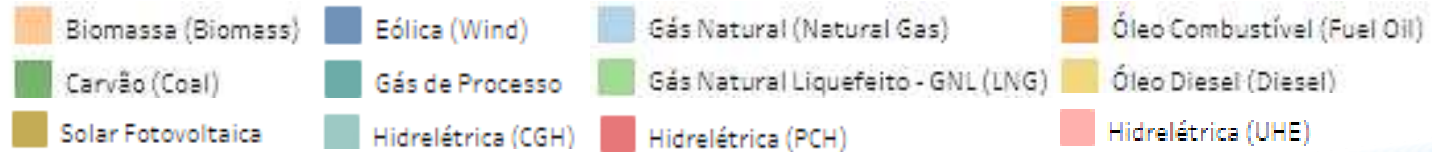
Average Price per source in Supply Adequacy Auctions



Source Share in Supply Adequacy Auctions



Source Energy

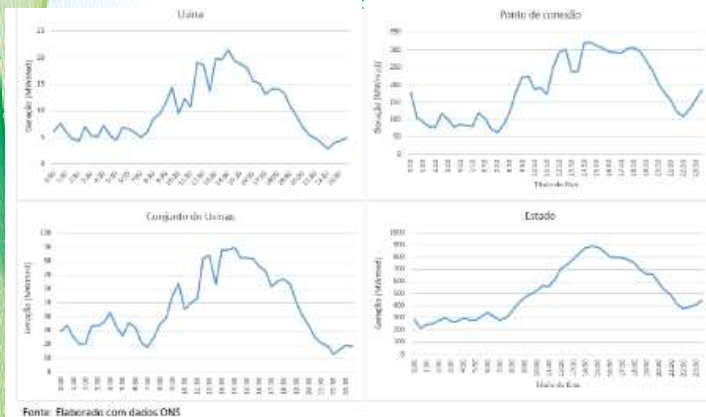
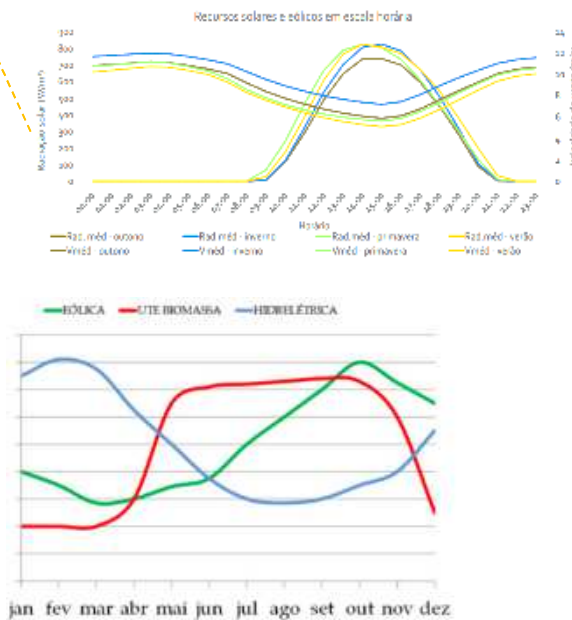
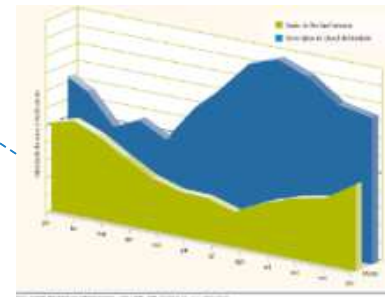


Source: CCEE

Operating the variability

Complementarity

- Hydro (reversed seasonality)
- Solar PV
- Biomass
- Wind (aggregation)



Fonte: Elaborado com dados ONS

Storage



National System

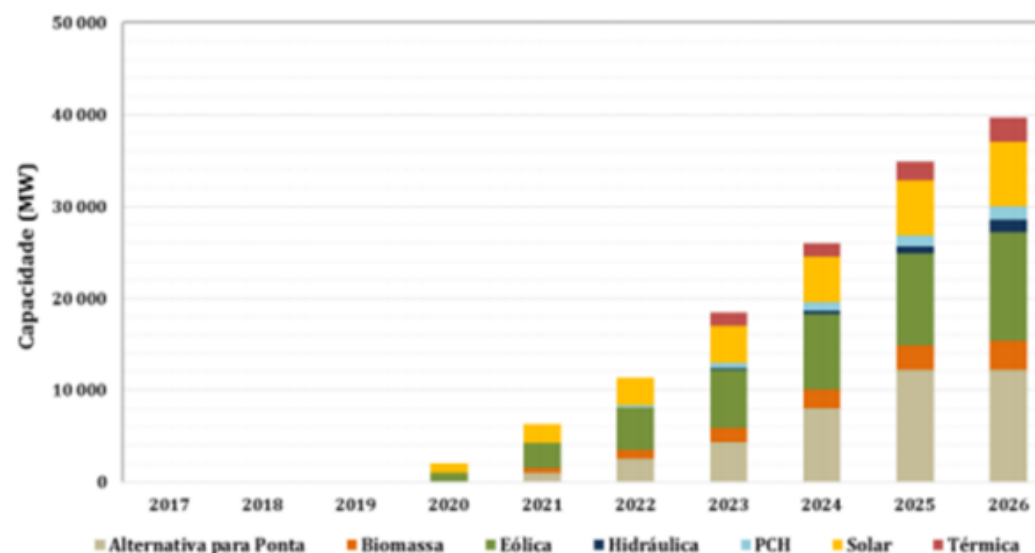


Technological Systems



Source: ONS | MRTS | ABEEólica

EXPECTANCY OF EXPANSION – Government Projections 2026



New Indicative Expansion

Fontes	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
Alternativa Ponta	0	0	0	0	994	2.532	4.334	8.002	12.198	12.198
Hidráulica	0	0	0	0	0	0	118	351	787	1.317
PCH+EOL+BIO+SOL	0	0	0	2.000	5.271	8.843	12.514	16.187	19.857	23.529
Térmica	0	0	0	0	0	0	1.500	1.500	2.084	2.667

Accumulated installed capacity considering the indicative expansion 2017-2026

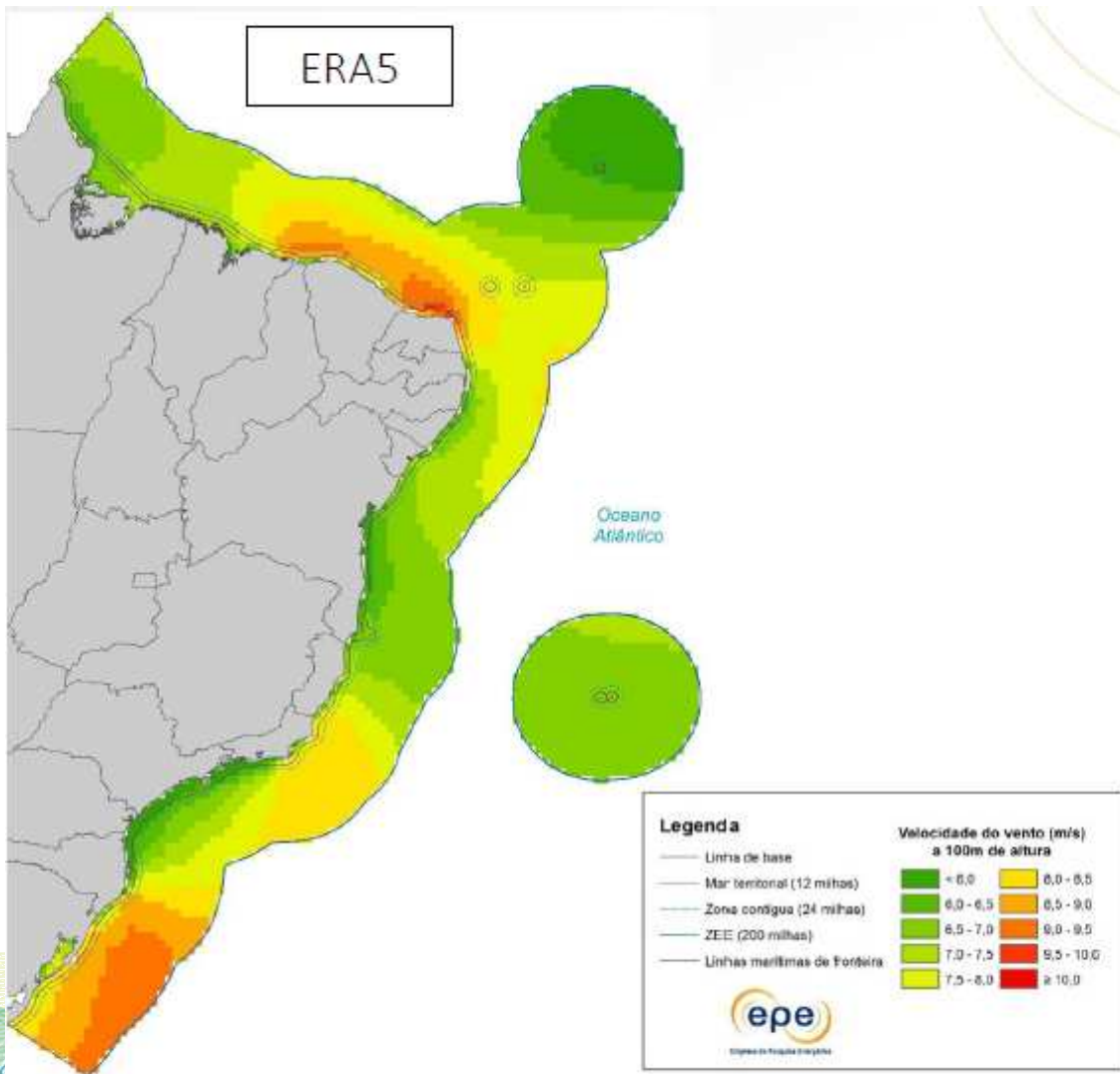
PCH	6 052	6 270	6 393	6 658	6 658	6 958	7 258	7 558	7 858	8 158
EÓLICA	12 843	15 598	16 645	17 645	19 450	21 254	23 058	24 862	26 666	28 470
BIOMASSA ^(d)	13 010	13 182	13 506	13 577	14 199	14 666	15 234	15 802	16 368	16 936
SOLAR	960	1 990	2 660	3 660	4 660	5 660	6 660	7 660	8 660	9 660

Source: MME | EPE | ABEEólica

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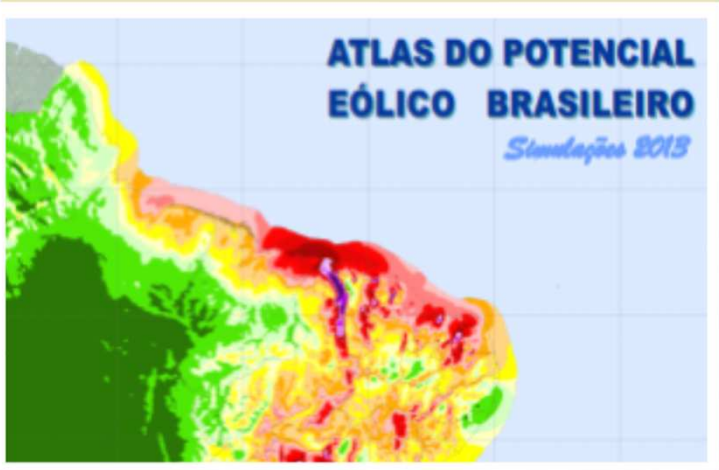
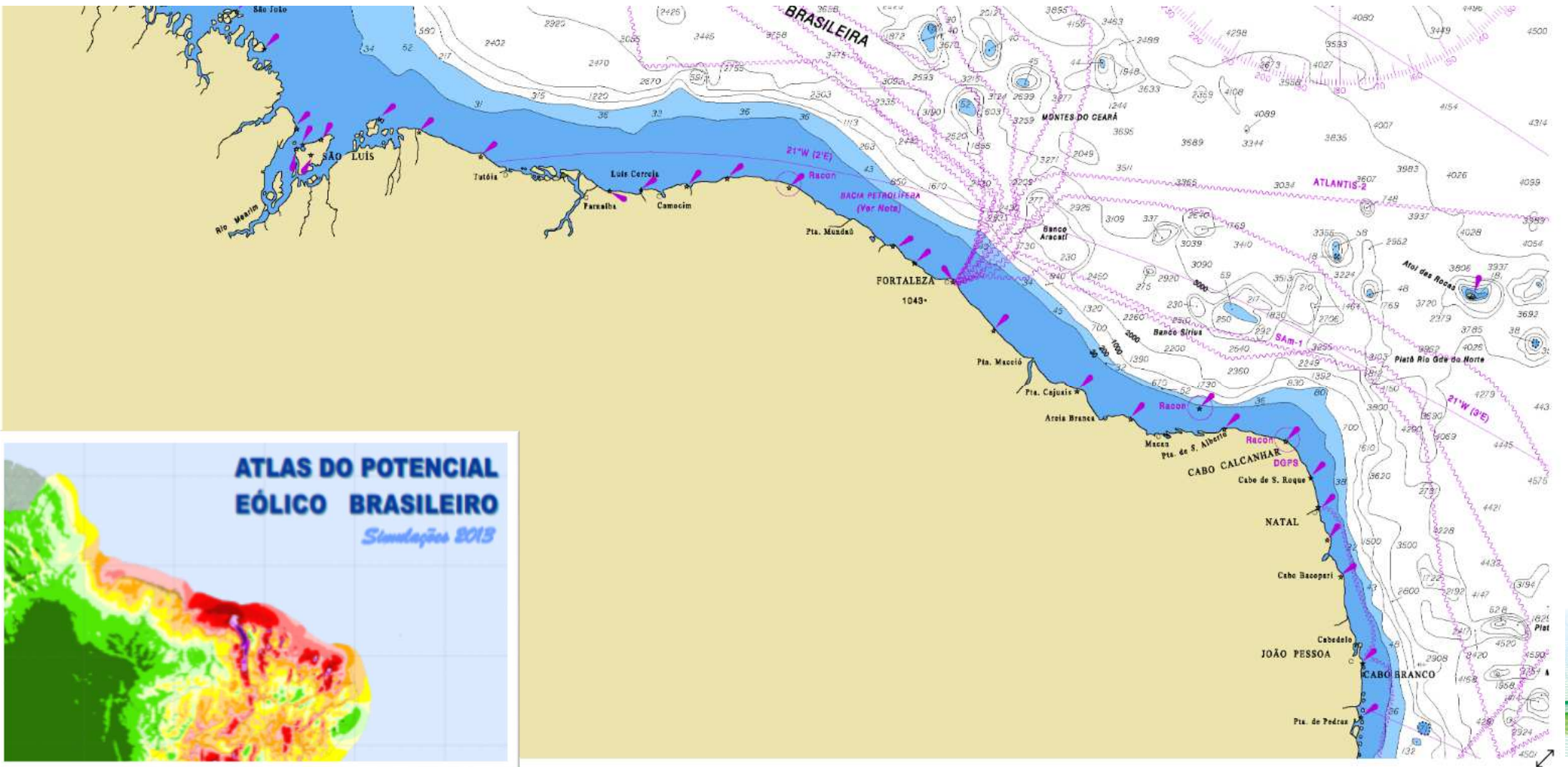
Offshore

Wind Velocity Vs. Water Depth



Source: EPE | Marinha do Brasil

Water Depth – North East



Source: Marinha do Brasil

Offshore Wind Potential – V>7.0m/s

ERA5:

Região	Áreas aproveitáveis (km²)				Potencial (GW)				Potencial (TWh)			
	0 -20 m	20-50	50-100	>100	0 -20 m	20-50	50-100	>100	0 -20 m	20-50	50-100	>100
Norte	20.927	31.633	12.174	89.391	78	119	46	335	221	333	128	942
Nordeste	38.846	56.074	13.489	990.336	146	210	51	3.714	595	841	200	13.804
Sudeste	3.990	14.371	13.999	397.911	10	37	36	1.035	39	137	142	3.885
Sul	16.105	21.001	40.245	288.343	42	55	105	750	154	217	431	3.240
Total	79.869	123.078	79.907	1.765.981	276	421	237	5.833	1.008	1.528	902	21.872
	2.048.835				6.768				25.310			

PDE 2027: Expansão Indicativa entre 2023 e 2027: **40 GW**
Consumo Total: **750 TWh**

Source: EPE /MME

Energy planning officials to look at regulatory issues as interest grows in big potential off nation's coasts

by Alexandre Spatuzza in Sao Paulo

08 April 2019
Updated 08 April 2019

Share:  E-mail

Brazil plans to publish a 'roadmap' for offshore wind this year and will look at regulatory changes needed to allow the start of exploratory work ahead of turbine deployment along its 8,000km of shallow shores.

"We have started to work on a roadmap for offshore wind in order to give the issue more visibility [in Brazil]," Thiago Barral, president of Brazil's energy planning authority EPE said during an online industry seminar.

This is not the first time that the Brazilian government has raised the prospect of advancing offshore wind, which remains a controversial issue as far as some sections of the country's 15GW onshore wind sector is concerned.

In 2015, energy minister Eduardo Braga [commissioned preliminary studies](#) into offshore wind deployment, and last year congress started debating a bill that would set the legal grounds for tendering offshore blocks for the construction of wind farms.

Brazil's long coastline, with water depths of 30 metres stretching several kilometres from shore, has raised expectations of hundreds of gigawatts of potential in its waters. The fact that many of its large cities and industrial centres are close to the shore could help its viability, offshore advocates believe.



Brazil's Senate paves

However, others in the industry say it's not yet necessary to explore offshore wind since the country's onshore potential – estimated at up to 500GW compared to a current 15GW installed wind base – has barely been scratched.



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Solar

Brazil's Senate approves wind, solar offshore auctions

December 19 (Renewables Now) - The Brazilian Senate approved on Tuesday a bill that authorises the implementation of wind and solar auctions for offshore power plants.

The 484/2017 bill also allows future projects to be developed in inland waters such as closed lakes and rivers. Specifically, wind farms with power above 5 MW can be developed in inland waters, the territorial sea (up to 22 km from the coast) and the exclusive economic zone (up to 370 km from the coast).



Offshore wind farm. Image Source: Equinor

Solar power plants with a power output of more than 1 MW can still be installed on land or water bodies under the federal government control. These rules are not valid for developments on private land.

Offshore wind and solar projects of less than 5 MW and 1 MW, respectively, can be executed if regulator Aneel allows it.

The text prohibits granting concessions in areas tendered in oil and natural gas deposit auctions but it does allow for wind or solar power plants to be installed to meet the consumption of oil rigs.

Now the bill project needs to go through the lower house of the Congress.

Petrobras – Gearing the Offshore in Brazil



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Conference

Petrobras and Equinor Sign Offshore Wind MoU in Brazil

Brazilian oil & gas major Petrobras has signed a Memorandum of Understanding (MoU) with the Norwegian energy company Equinor to jointly develop the offshore wind energy segment in Brazil.

Under the strategic partnership already entered into between the two companies, Petrobras and Equinor have been investigating other potential areas of cooperation, including the development of renewable energy initiatives.

"This step we have taken today is a source of pride for all of us and further strengthens our strategic partnership with Equinor," said the director of Strategy, Organization and Management System of Petrobras, **Nelson Silva**, during the signing of the memorandum of understanding, at the Rio Oil & Gas Conference in Rio de Janeiro.

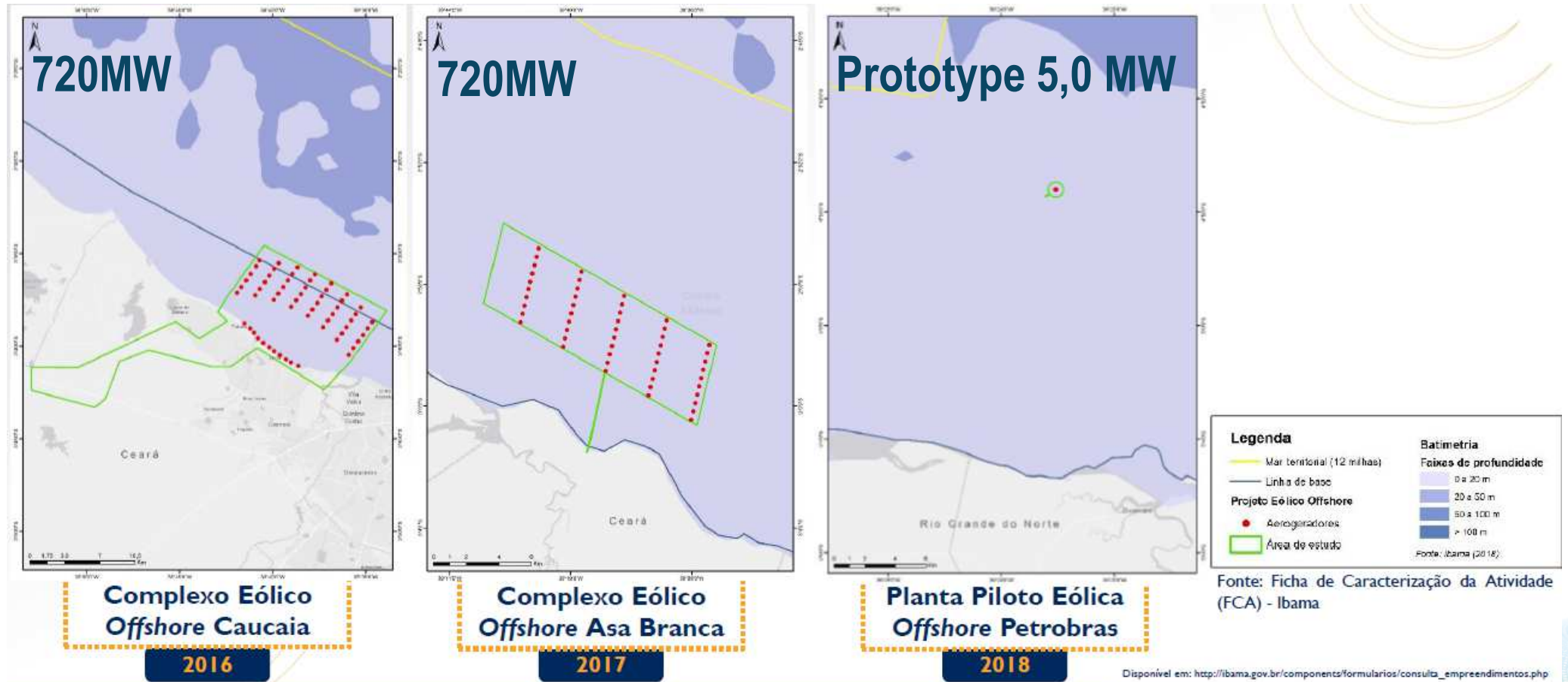
"Brazil has huge potential for offshore wind power generation and we want to take advantage of this potential together with Equinor, which is the oil company that has the most experience in the matter, always observing the discipline of capital and the economic logic."

Joint studies with Equinor are part of Petrobras' strategy to develop high-value renewable energy businesses in partnership with large global players, aiming at the transition to a low carbon matrix.

This memorandum of understanding does not establish obligations for the parties to undertake any concrete steps, but indicates the intention of the companies to work together to develop projects in the offshore wind energy segment.

Source: CCEE | ABEEólica

Environmental Permit Process



Empresa de Pesquisa Energética
Ministério de Minas e Energia



Source: CCEE | ABEEólica



THANK YOU!

ABEEólica



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