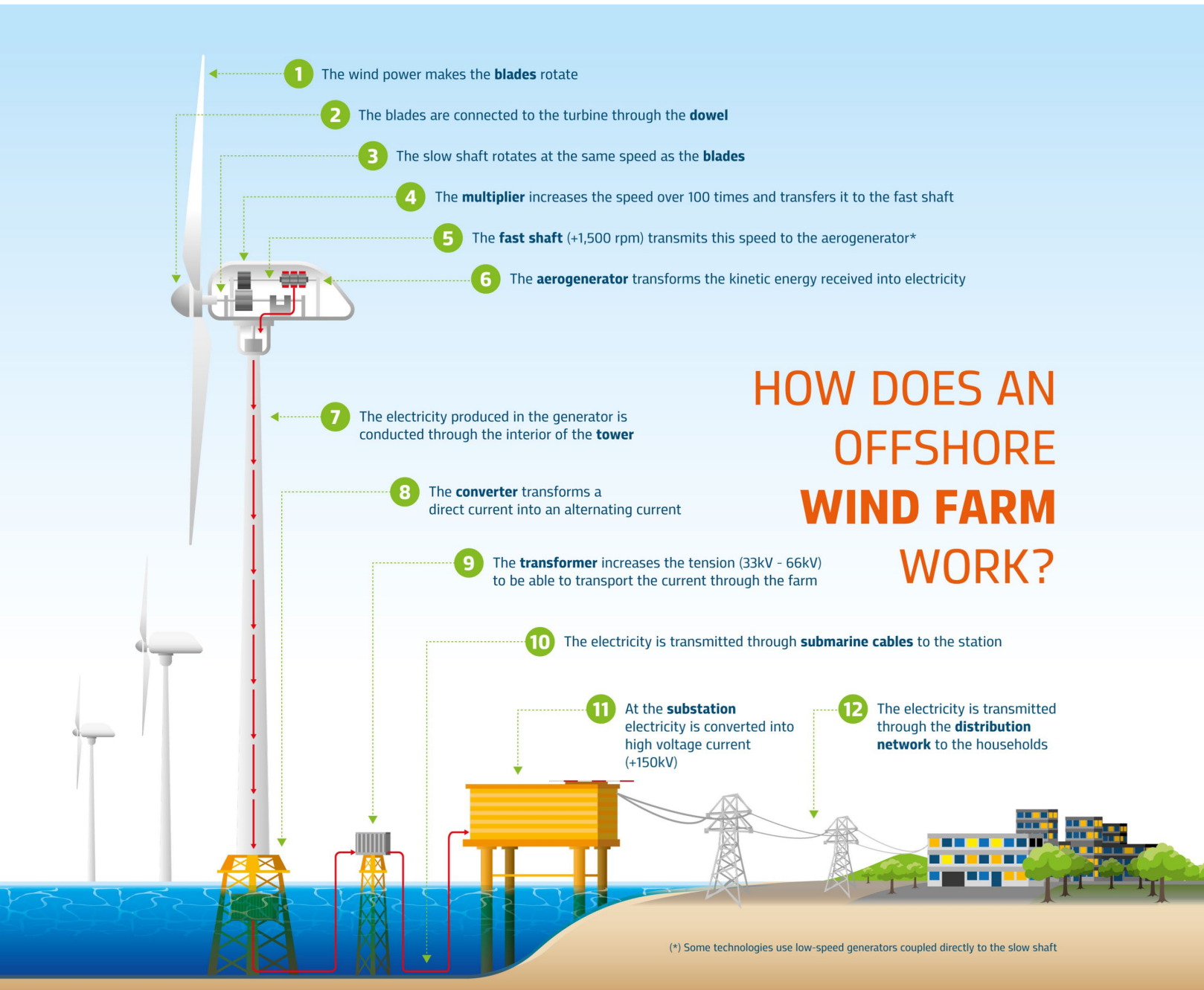
OFFSHORE WIND ENERGY AND THE OIL AND GAS SECTOR

INSTITUTO BRASILEIRO DE PETRÓLEO E GÁS

HOW DOES IT WORK?

Wind energy is well known for being a renewable energy source obtained from the power of the wind. Wind turbines are structures with blades like those of a windmill propelled by the wind, turning a rotor connected to a generator that produces electricity. In the case of offshore wind farms, the principle is the same, but with the difference that the wind turbines are located on the sea, where the winds tend to reach greater steadiness and speed since there are no obstacles such as mountains or buildings.

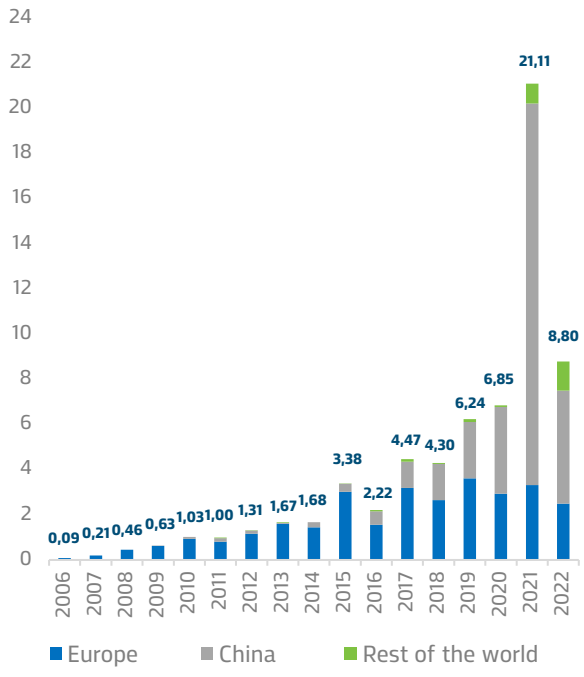
Electricity generated offshore is transmitted via submarine cables to substations and distribution centers located on land and is then sent to consumer units via distribution networks. Recent technological advances associated with the quest for decarbonization have been driving the development of this source, which has been growing rapidly worldwide and consolidating itself as an important alternative to boost the energy transition.



OFFSHORE WIND FARMS IN THE CONTEXT OF ENERGY TRANSITION

The year 2021 was particularly remarkable for offshore wind power. Data from the Global Wind Energy Council (GWEC) indicates that 8.8 GW of offshore wind power was connected to the grid worldwide in 2021. As a result, global capacity increased to 64.3 GW. China was the country that stood out the most during the year, concentrating around 57% of new installations last year (5 GW)1. Exhibit 2 shows the evolution of new offshore wind installations in recent years, with China's participation standing out.

Exhibit 2: **New offshore wind farms installed** 2012-2021, Gigawatts (GW)

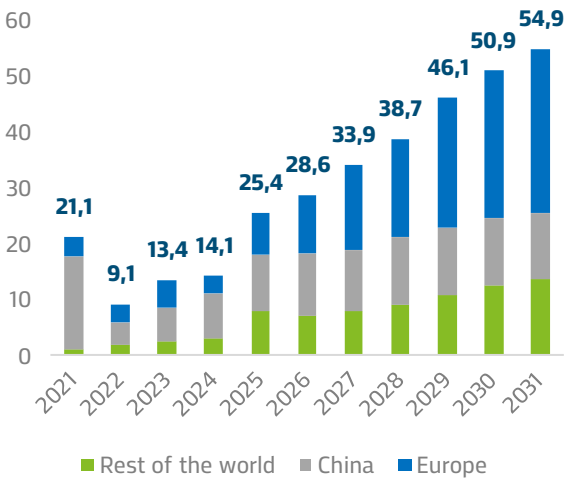


Source: Global Wind Energy Council, 2022

In addition to the sustainability goals that are being defined by an increasing number of countries, the conflict between Russia and Ukraine has given a new impetus to renewable sources due to the volatility of fossil fuel prices, as well as fears about energy security and Europe's dependence on Russia's fuels.

In Europe, the continent most affected by the conflict between Russia and Ukraine, the IEA estimates that wind power will gain prominence over the coming decades, accounting for more than 50% of total generation by 2050, considering its most optimistic scenarios for the diffusion of renewable sources[2]. This trend can also be observed specifically in the case of offshore wind. GWEC's projection for this source over the next few years indicates significant growth, with a strong emphasis on the European continent, as shown in Exhibit 3.

Exhibit 3: **Projection for new offshore wind farms** 2021-2031, Megawatt (MW)



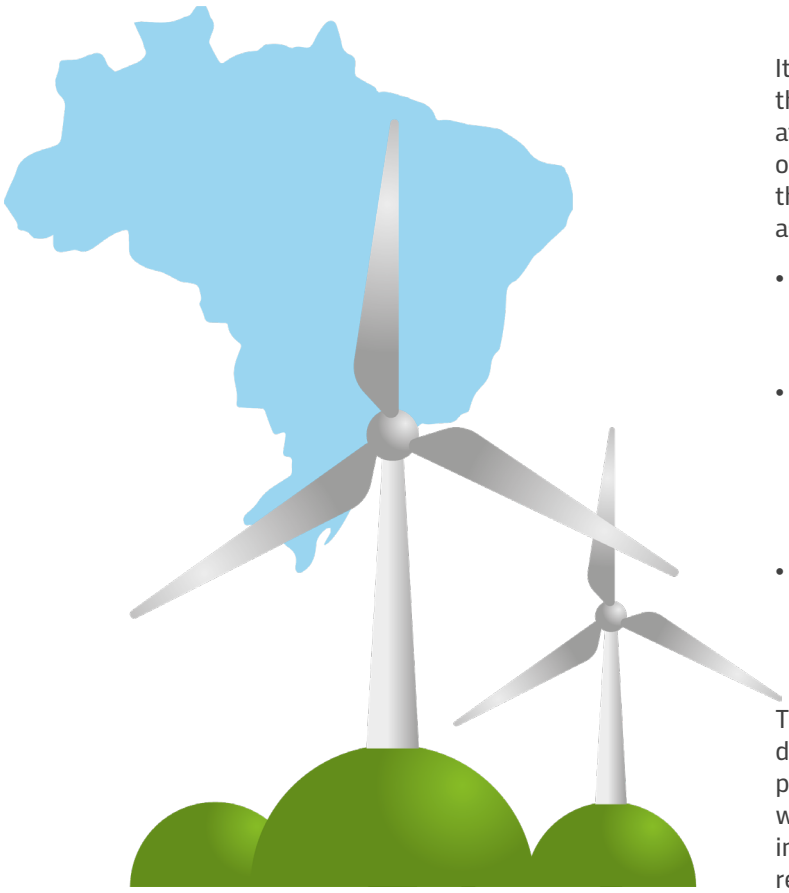
Source: Global Wind Energy Council, 2022

Projections indicate that offshore wind power will play a key role in the energy transition in the coming years. In this scenario, countries like Brazil, which have great potential for developing this source, are able to take on a strategic position in this market, especially if they take advantage of the synergies that exist between sectors such as oil and natural gas.

OFFSHORE WIND POWER IN BRAZIL

Brazil has more than 20 GW of installed capacity[3] of wind energy, which is equivalent to around 13% of its electricity mix. With 7,367 km of coastline and 3.5 million km² of maritime space, the country can be a promising player in offshore wind generation, helping consolidate its position as one of the leaders in the energy transition[4]. Brazil's potential is already attracting the attention of investors. Data from the Brazilian Institute for the Environment and Renewable Natural Resources (IBAMA) indicates that there are around 189 GW of offshore wind projects with environmental licensing processes underway at the agency[5].

[1] 2022, GWEC. Global Offshore Wind Report 2022.
[2] 2022, International Energy Agency. World Energy Outlook 2022.
[3] Installed capacity represents the maximum amount of power that a generating unit or a set of them can supply to the system when operating at full capacity.
[4] 2022, BRASIL. https://www.gov.br/pt-br/noticias/meio-ambiente-e-clima/2022/11/eolica-offshore-e-a-aposta-do-brasil-para-consolidar-a-transicao-energetica
[5] 2022, IBAMA. http://www.ibama.gov.br/phocadownload/licenciamento/2022-12-07_Usinas_eolicas_offshore_Ibama.pdf



Still regarding Brazil's particularities, another important aspect is the country's potential for producing and exporting green hydrogen, i.e., hydrogen produced from renewable sources. This is due to the privileged logistic position of its ports in relation to European countries. This increases the need for Brazil to expand its production of electricity from renewable sources. Thus, the demand for green hydrogen that is likely to gain momentum in the coming decades, could be another important vector for the development of offshore wind power in Brazil.

From a regulatory point of view, the country has made important progress. At the beginning of 2022, the Federal Government issued a decree containing the main guidelines for the operation of offshore wind projects in Brazil. Senate Bill 576/2021, which regulates the use of offshore energy potential, was also approved last year. On the environmental front, IBAMA has launched a Term of Reference for offshore wind projects, which is also an important signal.

However, there are still discussions involving the consolidation of a regulatory framework for offshore wind power. The National Electric Energy Agency (ANEEL) will be responsible for contracting offshore areas for energy generation and the agency has postponed regulation of this source until 2024. There is therefore no clear forecast for the first auctions to be held for this source, which brings uncertainties that are still damaging the business environment for investors.

It is also worth highlighting the need to increase the competitiveness of offshore wind in Brazil in attracting international investment compared to other countries that are already more advanced in their regulatory frameworks, with the following as priorities:

- The bidding process as the only model that offers legal certainty to developers for the transfer of use of the maritime area;
- The qualification of stakeholders to participate in the bidding process, ensuring that the bidder has the technical, economic and financial capacity to develop the suggested area;
- The criterion for judging the auction to award the areas, which is limited to the highest amount offered to pay for the occupation/retention of the area.

There are also other issues, such as the development of a local supply chain capable of providing the necessary goods and services, as well as logistical bottlenecks that require investment in port infrastructure and reinforcement of transmission lines, which is associated with adequate financing alternatives.

O&G SECTOR CONTRIBUTIONS

The O&G sector is proving to be an important partner for the development of offshore wind power, especially in technological and regulatory terms. The Energy Research Company's (EPE) Ten-Year Expansion Plan 2031 (PDE), for example, states that "the oil sector's expertise in the installation of structures, logistics and operations in the marine environment could benefit the development of offshore wind". This can be explained by the existence of important similarities between the challenges faced by the O&G sector and the offshore wind industry.

Knowledge of the type of environment, installations on floating bases and the suitability of materials and techniques are some examples of the synergies that exist between these two sectors. The O&G sector's extensive expertise in the maritime environment can be an important way of reducing costs and leveraging knowledge, especially when it comes to the construction and operation of assets in this environment. In addition, it is worth noting that improving technologies and reducing their costs depends on engineering resources, the management of large projects and the ability to mobilize large volumes of capital, aspects that can be associated with the O&G industry.

From the point of view of regulatory and environmental discussions, important contributions can also be identified from the O&G sector. The environmental licensing process for the oil sector is already quite mature, so the data and knowledge used can be widely reused by the offshore wind sector, including the relationship with affected communities and species. There are also important opportunities for interaction between the two sectors by improving the regulations for decommissioning oil fields, which could also include an assessment of the possible reuse of the field for offshore wind activity[6].

Cooperation between the two sectors can also bring gains for logistics, operations, and maintenance activities. It is possible, for example, to share maintenance assets, vessels and even port structures and their management[7]. Seeking to benefit from this type of synergy, large companies in the O&G sector have already been mapping and adapting existing solutions for the renewable energy segment, with a strong emphasis on offshore technologies. The existing synergies explain why several O&G companies are considering investing in offshore wind production as part of their decarbonization and portfolio diversification strategy.

Brazil has also seen initiatives involving these sectors together. This is the case, for example, with the Technical Cooperation Agreement signed in 2022 between the Brazilian Oil and Gas Institute (IBP) and the Brazilian Wind Energy Association (ABEEólica), which created a specific Working Group on offshore wind to deal with issues such as regulation, the value chain, Research & Development (R&D), funding, safety, and the environment. Thus, the diffusion of offshore wind involves a path that can be paved with an important contribution from the O&G industry.

[6] 2019. Carvalho, Lívia. A POTENCIAL SINERGIA ENTRE A EXPLORAÇÃO E PRODUÇÃO DE PETRÓLEO E GÁS NATURAL E A GERAÇÃO DE ENERGIA EÓLICA OFFSHORE: O CASO DO BRASIL. http://www.ppe.ufrj.br/images/publica%C3%A7%C3%B5es/mestrado/Livia_Paiva_de_Carvalho._MESTRADO_2019.pdf

[7] 2019. Carvalho, Lívia. A POTENCIAL SINERGIA ENTRE A EXPLORAÇÃO E PRODUÇÃO DE PETRÓLEO E GÁS NATURAL E A GERAÇÃO DE ENERGIA EÓLICA OFFSHORE: O CASO DO BRASI. http://www.ppe.ufrj.br/images/publica%C3%A7%C3%B5es/mestrado/Livia_Paiva_de_Carvalho._MESTRADO_2019.pdf

Expedient:

President/CEO of IBP:
Roberto Furian Ardenghy

Corporate Executive Director
Claudia Rabello

E&P Executive Director
Julio Moreira

Natural Gas Executive Director
Sylvie D´Apote

Downstream Executive Director
Valéria Amoroso Lima

O&G Technical Analysis Management

Isabella Costa
William Vitto
Vinicius Daudt

Communications and Associates Relationship Management

Flavia da Justa
Tatiana Campos
Vanessa Rangel
Demy Gonçalves
Alexandre Romão
Carolina Souza
Caroline Lyrio

@ibpbr /ibpbr @IBPbr

IBP - Brazilian Petroleum and Gas Institute
52 Almirante Barroso Ave - Floors 21 and 26 - RJ - Phone +55 21 2112-9000
ibp.org.br | relacionamento@ibp.org.br