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LEGAL CHALLENGES FOR THE IMPLEMENTATION OF A WIND FARM IN THE CITY OF MACAÉ, RIO DE JANEIRO, BRAZIL

DESAFIOS LEGAIS PARA A IMPLANTAÇÃO DE UM PARQUE EÓLICO NA CIDADE DE MACAÉ, RIO DE JANEIRO, BRASIL

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ABSTRACT

This paper aims to analyze the feasibility of implementing a wind farm in the coastal region of the northern region of Rio de Janeiro state, more specifically in the city of Macaé. For this sake, a systematic review was carried out on the basis of "Periódicos Capes" and Google Scholar. It was observed a group of challenges for this type of enterprise, such as, the environmental licensing of these enterprises, the lack of government incentives, competition with sources already consolidated in the region, the need to install a park far from the population, and at the same time, the environmental impact of the installation in protected preservation areas.

Keywords: wind energy, wind farm, environmental challenges, Macaé, legal challenges.

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RESUMO

O presente trabalho tem por objetivo analisar a viabilidade da implementação de um parque eólico na Região Litorânea da mesorregião Norte Fluminense, mais especificamente na cidade de Macaé. Para isso, foi feita um revisão sistemática na base Periódicos Capes e no Google Scholar. Observou-se um grupo de desafios para esse tipo de empreendimento, tais como, o licenciamento ambiental desses empreendimentos, a falta de incentivos governamentais, a concorrência com as fontes já consolidadas na região, a necessidade de instalar um parque longe da população, e ao mesmo tempo, o impacto ambiental da instalação em áreas de preservação protegidas.

Palavras-chave: energia eólica, parque eólico, desafios ambientais, Macaé, desafios legais.

1 INTRODUCTION

1.1 Wind energy overview

The energy matrices of several countries in the world, for many years, were designed only for the accentuated use of fuels of fossil or mineral origin, such as: oil, coal, uranium and others (BARBIERI, 2017). The use of these sources to generate energy and consequent consumption has caused numerous and notable damages to the environment, such as: global warming, melting of the polar ice caps, reduction of fauna and flora, fires, and others. Thus, the use of these energy sources “irrationally” puts at risk the survival of all beings that living in planet Earth(GOLDEMBERG; LUCON, 2007).

Knowing the effects, caused by the consumption and use of energy from these energy matrices, to the word, the society, private and governmental institutions are inclined to use an energy source without the generation of compounds harmful to the environment. That is, they begin to use a sustainable energy source in order to avoid severe damage to the environment, guaranteeing sustainable development, a concept that is widespread in the contemporaneity (ELKINGTON, 2001; BLACKBURN, 2012; BARBIERI, 2017).

From a geomorphological point of view, Brazil is a privileged country because its topography, hydrography and tropical climate allow the use of the various existing renewable energy sources. Given these characteristics that place Brazil as a prominent country in the production of electric energy from renewable sources and aiming at a reduction in the emission of greenhouse gases to the environment, there was an increasing investment in diversified forms of sustainable generation of electric energy(PINTO; MARTINS; PEREIRA, 2017).

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According Loureiro, Gorayeb, and Brannstrom (2017), the diversification of energy matrices, especially those from renewable sources, has become a necessary practice for nations that seek their self-sufficiency in this sector, considering the relevance of carbon policies and the consequent concerns with air quality, in addition to limitations to other forms of energy generation, imposed by natural or political-economic conditions.

Aiming this diversification of energy as a way of preserving the Environment and guaranteeing a higher quality of life for living beings, public policies are beginning to be build with focus in the production and consumption of electrical energy from renewable sources with the aim of mitigating environmental impacts aforementioned. Thus, consequently, are drivers of job and income generation for the population, because the implementation of a wind farm will depend on labor for services such as production, installation, maintenance, and others(KOENGKAN; FUINHAS; MARQUES, 2017).

Among the various sustainable energy sources, wind energy guarantees a prominent role due the fact that it is renewable and does not release polluting greenhouse gases into the atmosphere during the operation for the production of electricity. This fact makes it one of the sources that contribute to mitigating environmental impacts at both national and global levels. However, one cannot ignore the fact that there is the emission of greenhouse gases during its productive, industrial scale, resulting in environmental impacts that must be analyzed and mitigated(PINTO; MARTINS; PEREIRA, 2017).

The state of Rio de Janeiro has a coastline of approximately 636 km of length, alternating between coastal plains with varied forms of beaches, lagoons and bays, some of which are well-know worldwide for their remarkable beauty. Its geological structure associated with environmental conditions favor the incidence of winds since they are formed from the continuous circulation of air layers in the atmosphere, under the predominant action of the radiant energy of the Sun and the rotation of the Earth (AMARANTE; SILVA; FILHO, 2003).

The winds are formed due to the uneven heating of the Earth by the Sun, which can occur both on a global scale (different latitudes, seasons and day-night cycle), as well as local (sea-land, mountain-valley) according to Amarante, Silva, Filho (2003) e Burattini (2008). It making the wind speeds and directions present well-defined seasonal trends, always driven from the regions of higher pressure (lower temperatures) to those of lower pressure (higher temperatures) according to Aguiar Fontanet (2012).

The breeze is an atmospheric circulation generated by temperature difference between the

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continent and the ocean. During the day, solar radiation causes the earth's surface to heat up quicker than the sea's surface. This heating of the air above this surface produces a low (pressure) thermal and shallow. The air over the water remains colder than the air over the earth, thus forming a high (pressure) thermal. This creates a pressure difference between both surfaces, causing a displacement of air from water to land, called sea breeze (AHRENS, 2011).

During the night, the surface of the land cools down more than the surface of the sea. As the air over the earth becomes colder than the air over the water, it forms a high (pressure) thermal. As the pressures are now higher on land, the wind be reversed, causing a displacement of air from land to water, called the land breeze. Therefore, wind energy is derived from the kinetic energy of air masses (winds) caused by uneven heating on the Earth's surface. The energy contained in the movement of the air can be harnessed through the kinetic energy generated by the movement that the wind generates in the blades of the wind turbines or mills (AHRENS, 2011).

It is the wind turbines that transform the kinetic energy into electrical energy and these have three main elements, which are the rotor, the shaft and the generator, and several other secondary elements that vary according to the type and design of the wind turbine. In short, the rotor is the set of blades and hub responsible for capturing energy in the wind, the axis is the link that transfers the energy captured in the rotor to the generator, and the generator is responsible for converting mechanical energy into electrical energy.

According to Lima, Oliveira (2015), the energy crisis is an indisputable fact in today's world. The exhaustibility of fossil sources, the basis of energy production, is alarming and arises when there is a need to reduce the emission of greenhouse gases, elements produced mainly by this type of non-renewable primary source. Therefore, the issue of changing the energy matrix of countries is in vogue, in order to reduce environmental degradation, while guaranteeing the necessary supply.

According to Melo (2013), the rapid expansion of wind energy in Brazil is related to the geological conditions associated with climatic factors, mainly the incidence of winds in coastal regions, of the country, the technological growth that is emerging in Brazil and the attractive conditions for financing and contracting at auctions. The need for a revolutionary industrial change been reinforcing in order to incorporate the concept of “sustainability” throughout the productive scale, that is, the adoption of a model that prioritizes renewable and clean energy sources.

The benefits from the use of wind energy to the Brazilian environment are noteworthy since it is an energy matrix that does not use fossil fuels for its operation at any time and makes use of a totally sustainable raw material which contributes to reducing dependence on fossil fuels and

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reducing the emission of polluting gases into the atmosphere. It is worth mentioning the importance of wind energy associated with hydraulic energy in periods of drought and/or reduction in the rainfall level, which contributes to a reduction in light tariffs, in view of the increase the potential of wind energy production in periods of drought (NASCIMENTO; MENDONÇA; CUNHA, 2012).

1.2 Wind energy overview in brazil

Brazil has a great potential and it has been growing in the generation of wind energy. In 2015, it were installed 111 new wind farms, setting a new record of high relevance. For the first time, more than one hundred wind farms were ready in one year, adding to the Brazilian Electric Matrix a total of 2,753.79 MW of power. The percentage of electrical potential gained from the total for each state be illustrated in **Figure 1**. The states contemplated with the new developments were Rio Grande do Norte (687.56 MW), Bahia (687.50 MW), Piauí (617.10 MW), Rio Grande do Sul (438.89 MW), Pernambuco (272.65 MW), Ceará (48.00 MW) and Santa Catarina (2.10 MW). Noteworthy, as in 2014, are the states of Pernambuco and Piauí, which maintained the increase in new wind capacity, increasing this addition by about ten times for Piauí and four for Pernambuco. However, due to the fact that the greatest potential is found in permanents preservation areas (APPs in Portuguese), which are considered as national heritage and subject to special protection regimes, the licensing process becomes more difficult (SANTOS, 2016).

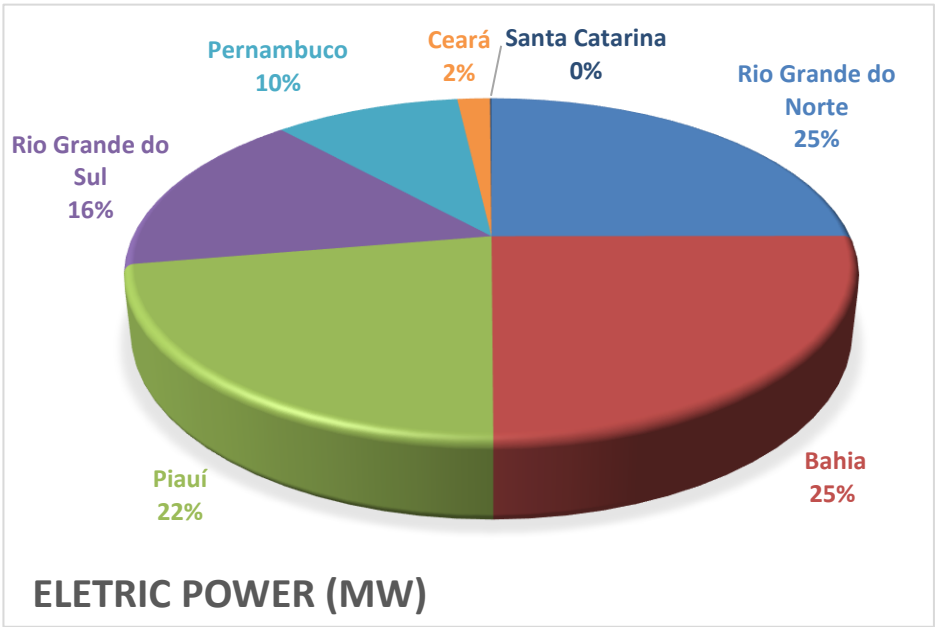

Figure 1: Percentage of contribution by state of Eletric Power generated by new enterprises during 2015. Drafted by the Authors. **Source**: (SANTOS, 2016).

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The transformations that have taken place in the Brazilian energy sector have encouraged the growth of renewable sources. In 2015, renewable sources in Brazil totaled a 41.2% share in the energy matrix, an indicator almost three times higher than the world indicator, of only 13.8%. The country also stands out in the electricity generation matrix with 74% of renewables, while the world holds 23.8%(MME, 2016).

In 2015, the global demand for energy reached 13,777 Mton (equivalent ton of oil), of which 81.4% of fossil fuels, 46 times higher than the Brazilian demand for energy, with only 57.5% of fossil sources. Among the sources consumed in the world, oil represented 31.4%; mineral coal (28.1%); natural gas (21.6%); nuclear energy (4.9%); hydraulic energy (2.6%) and other unspecified sources (11.4%) as shown in **Figure 2**(MME, 2016)**.**

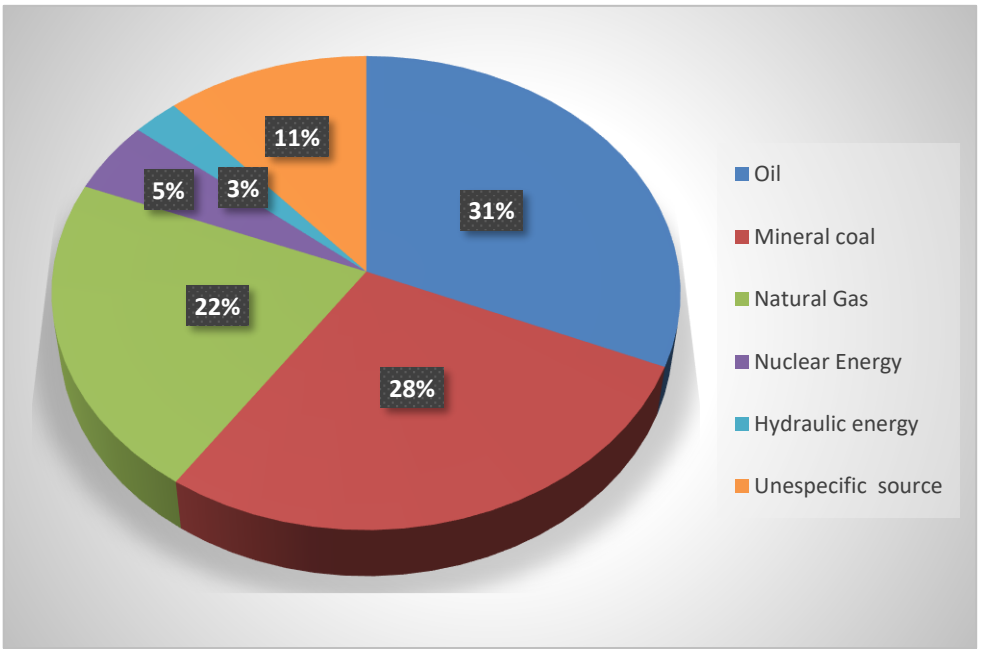

Figure 2: Percentage of contribution of world energy sources during 2015. Drafted by the Authors. **Source**: (MME, 2016).

Of the total world energy demand in 2015, 36%, or 5,000 million ton, were used to generate electricity, as inputs, resulting in 24,364 TWh offered and 2,880 Mton of thermal losses. Of the sources used to generate electricity, 39.1% were mineral coal, 22.3% gas, 3.9% oil, 10.6% uranium, 17.1% hydraulics and 7% others not specified as shown in **Figure 3**. Renewable sources totaled 23.8%, of which, 3.5 percentage points of wind and 1 percentage point of solar (MME,

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2016).

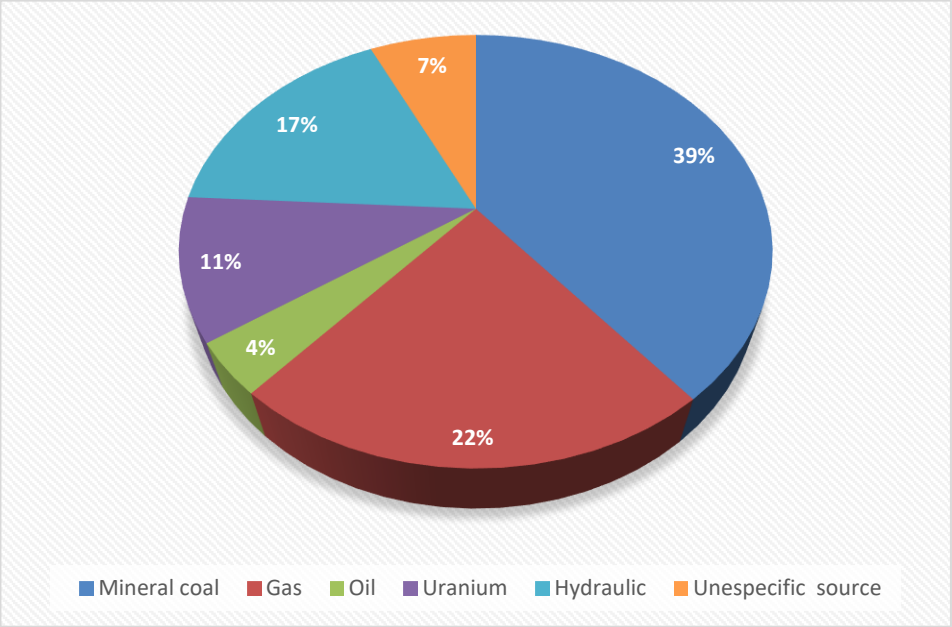

Figure 3: Percentage of contribution of Eletric Power by the global energy matrix during 2015. Drafted by the Authors. **Source**: (MME, 2016).

In 2020, Brazil has 83% of its electrical matrix originated from renewable sources, according to the secretary of Energy Planning and Development at the Ministry of Mines and Energy. Participation is led by hydroelectric (63.8%), followed by wind (9.3%), biomass and biogas (8.9%) and solar centralized (1.4%) illustrated in **Figure 4** (PLANALTO, 2020).

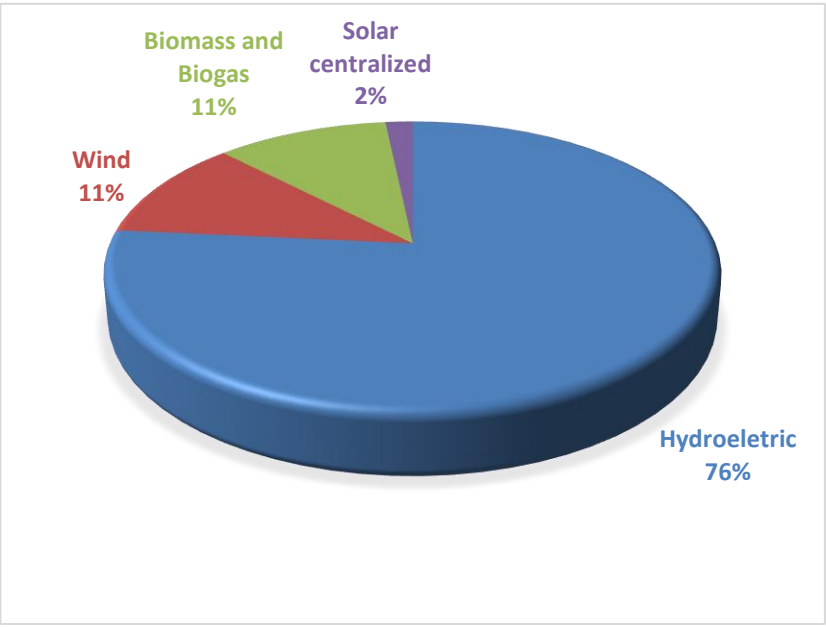

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Figure 4: Percentage of Eletric Power contribution from renewable sources by the Brazilian energy matrix during 2020. Drafted by the Authors. **Source**: (PLANALTO, 2020).

The expansion of wind generation stood out, with an increase of 971 MW, higher than the 776 MW added in thermoelectric plants. Large-scale photovoltaic solar plants added 551 MW to the Brazilian matrix in 2019. Considering the progress seen in 2019, the 3,870 solar energy projects in operation are already responsible for 1.46% of the inspected power in the country(PLANALTO, 2020).

1.3 Objective

This study aims to analyze the feasibility of implementing a wind farm in the Coastal Region of the North Fluminense mesoregion, more specifically in Macaé. It will be performed through the review of environmental legislation regarding wind energy, with focus on contribution of this energy source in mitigation the environmental impacts caused by the existing energy matrices; also aiming to offer support to electricity supply and guarantee low-cost energy to the population.

2. RESEARCH METHOD

This research consisted of answering the legal challenges for the implementation of a wind farm in the city of Macaé. The entire text was prepared through a systematic search on the basis of "Periódicos Capes" and Google Scholar.

The results were divided into three sections: The section 3.1 presents an overview of the laws of the city of Macaé applied to the theme of Wind Energy. The section 3.2 presents other legislation about the topic that may render the project unfeasible or create difficulties in its implementation, not only for the city of Macaé. The section 3.3 connects the two previous sections to define the difficulties in the city that is the subject of this work.

3 RESULTS

3.1 Legislation applied to wind energy in macaé

The Complementary Law No. 027/2001, which provides for the Municipal Environmental Code of Macaé, does not specifically deal with wind energy. However, in its Article 45, it is proposed that companies include in their Environmental Impact Study ("*EIA*" in Portuguese) and its Respective Environmental Impact Report ("*RIMA*" in Portuguese), possibilities for new technologies

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that will supply or mitigate impacts related to energy demand. It becomes a first step towards the construction of energy alternatives, as can be seen below:

> "Art. 45 - *RIMA* will reflect the conclusions of the *EIA* in an objective and appropriate way for their wide dissemination, without omitting any important element for the understanding of the activity and will contain, at least:
>
> I - the objectives and justifications of the project, their relationship and compatibility with sectoral policies, plans and government programs;
> II - the description of the feasibility project (or basic) and its technological and location alternatives. It should specifying for each one of them, in the construction and operation phases, the area of influence, the raw materials, the labor, the energy sources, water demand, operational processes and techniques, probable effluents, emissions, waste and energy losses, and direct and indirect jobs to be generated; " (MACAÉ, 2001, our translation).

In the Organic Law of the Municipality of Macaé, Article 156:

> "Art. 156. Everyone has the right to an ecologically balanced environment, for the common use of the people and essential to a healthy quality of life, imposing on the Public Power the duty to defend and preserve it for the present and future generations.
> § 1 st In order to ensure the effectiveness of this right, it is incumbent upon the Public Power to establish appropriate legislation as provided in art. 30, items I and II, of the Constitution of the Federative Republic of Brazil, defining the specific sectorial policy, ensuring adequate coordination of the bodies directly or indirectly responsible for its implementation, aiming at:
> [...]
> IX - encourage the use of alternative energy sources and, in particular, natural gas, biogas and biodiesel for automotive purposes, as well as groups and systems for harnessing solar and wind energy and others defined by law; "(MACAÉ, 2008, our translation).

On December 4, 2012, possibly with a view to ensuring the Organic Law of the Municipality of Macaé, the Clean Energy Program was instituted in Macaé, which promotes the use of renewable energy in residences in the Municipality:

> "Art. 1 st The "Clean Energy" Program became instituted in the Municipality of Macaé.
> Sole Paragraph - The objective of the Program is to encourage the use of electricity generated from solar, wind, hydraulic and other forms of electricity generation with low environmental impact in residential, commercial and industrial properties." (MACAÉ, 2012, our translation).

However, the incentives that were stablished in the "Clen Energy" program were not enough to encourage investors to install a wind farm in the city of Macaé. The reason for this will

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be discuss in the following sections.

3.2 Challenges to implement an incentive policy for renewable energy

In this section, some difficulties in the wind energy sector will be present.

The first challenge is in the instability of incentive laws for the sector. The discontinuity of tax incentives creates uncertainty for companies in the sector that work with long-term return investments. The "ICMS 101/97" Agreement, which exempted from the Tax on the Circulation of Goods and the Provision of Interstate and Intercity Transport and Communication Services ("*ICMS*" in Portuguese) the equipment used in the generation of wind energy, had its effect extended until 2018 only. These uncertainties scare away investors who need to pay a high amount to start the operation of producing energy from wind sources.

On July 25, 2014, CONAMA Resolution 462 of 07/24/2014 was published in the Official Gazette of the Federal Government ("*DOU*" in Portuguese), which establishes procedures for the environmental licensing of electric power generation projects on land, changes art. 1 st of CONAMA Resolution No. 279, of July 27, 2001, also changes item IV, and adds paragraph § 2 nd to art. 1 st of CONAMA Resolution No. 279/2001, and makes other provisions. It aims to unify the laws around the theme and define the role of states, the federal government and municipalities in licensing procedures. This new resolution is an incentive to the sector, as wind energy investors now have legal certainty and a more transparent decision-making regarding licensing. However, there are many challenges that need to be overcome.

A second challenge is the delay in licensing and construction of transmission lines for the wind farm. This stems from the fact that the risk of the transmission lines has being transferred to the entrepreneur of the sector, as it is part of the system associated with the wind project in accordance with CONAMA Resolution No. 462/2014:

> "Art. 2 - For the purposes provided for in this Resolution, it is considered:
> I - wind project: any electricity generation project that converts the kinetic energy of the winds into electrical energy, in a terrestrial environment, formed by one or more wind turbine units, their associated systems and measurement, control and supervision equipment, classified as:
> a) Singular wind power plant: wind turbine unit, formed by a wind turbine, generating electricity;
> b) wind farm: set of wind turbine units;
> c) wind complex: set of wind farms.
> II - wind micro-generator: electric power generating unit with installed power

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> less than or equal to 100 kW (one hundred kilowatts);
> III - associated systems: electrical systems, substations, connection lines for exclusive or shared use, at the level of distribution or transmission voltage, service accesses and other infrastructure works that make up the wind farm, and which are necessary for its implementation , operation and monitoring.
> [...]
> Art. 3 - The licensing agency will be responsible for framing the environmental impact of wind power generation projects, considering the size, location and low polluting potential of the activity " (CONAMA, 2014, our translation).

A third challenge is the noise that is produced inside or around a wind farm, which varies considerably depending on a number of factors, such as the model of the installed turbines, the terrain topography, the speed and wind direction, and others. The increase in sound emissions from wind turbines is related to an increase in wind speed. When there are people living near a wind farm, care must be taken to ensure that the sound of the wind turbines will be below a reasonable level in relation to the level of ambient sound in the area. Several studies have recorded a common set of adverse health effects for people living close to the wind turbines. These symptoms started after the operation of the wind farms, including sleep disorders, headache, ringing in the ears, pressure in the ear, nausea, dizziness, tachycardia, irritability, problems with concentration and memory, panic episodes with a feeling of internal pulse or trembling that arise when awake or asleep (SANTOS, 2016; FILHO, 2013). Noise can also affect the reproduction of sea turtles, among other species (SANTOS, 2016; HOFSTAETTER, PESSOA, 2015). These disorders have their main cause in the effect of the low frequency of the noise of wind turbines in the organs of the inner ear (SANTOS, 2016; FILHO, 2013).

Despite the absence of conclusive studies, the precautionary principle justifies the cessation of the operation of any wind farm in inhabited areas, even if the local community has accepted it (SANTOS, 2016; FILHO, 2013).

According to Mota (2012), the civil liability of the State under the guilt of administrative fault always occurs when there is an accident attributable to the State.

Because of this, Permanent Preservation Areas have been envisioned by wind entrepreneurs for the development of wind farms due to the possibility of public use and their distance from the areas occupied by the human population. In order to build and operate a wind farm in APPs, it is necessary to consider the CONAMA Resolution No. 369, March 28 th, 2006, and the Law No. 12,651, May 25 th, 2012, which provides for exceptional cases, of public utility, social interest or low environmental impact, which allow the intervention or suppression of vegetation in

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Permanent Preservation Area.

Permanent Preservation Areas are defined in Article 3 th, II, of Law No. 12,651, May 25 th, 2012, as a protected area, covered or not by native vegetation. In addition, It has the environmental functions of preservation of water resources, landscape, geological stability and biodiversity, as well as facilitating the gene flow of fauna and flora, protecting the soil and, finally, ensuring the well-being of human populations, in view of their "public utility " as shown in Article 8 th below:

> "Art. 8 th The intervention or suppression of native vegetation in a Permanent Preservation Area will only occur in the cases of public utility, social interest or low environmental impact provided for in this Law.
> § 1 st The suppression of native protective vegetation of springs, dunes and sandbanks can only be authorized in the case of public utility " (BRASIL, 2012, our translation).

According to Fiorillo e Ferrei (2018), natural resources are identified within the scope of the 1988 Federal Constitution of Brazil by article 20, V and article 91, § 1 st, III. In addition to Law No. 6934, August 31 st, 1981, which institutes the National Environment Policy in its article 6, II, as elements of nature that are useful to the human being, revealing themselves as inputs used to benefit the needs of the human person, as is the case of their destiny to energy.

According to Machado (2013) the health of human beings does not only refer to the absence of diseases diagnosed at present, it takes into account the state of the elements of nature, water, soil, air, flora, fauna and landscape. Then they are in a state of health and health or disease and discomfort for human beings, as can be understood in the principle of the right to a healthy quality of life, and set out in the National Environment Policy in its article 6 th, II:

> "Article 6 th (…)
> II - consultative and deliberative body: the National Environment Council (CONAMA), with the purpose of advising, studying and proposing to the Government Council, government policy guidelines for the environment and natural resources and deliberating, within the scope of its competence, on norms and standards compatible with an ecologically balanced environment and essential to a healthy quality of life;" (BRASIL, 1981, our translation).

According to Hofstaetter and Pessoa (2015) it can be taken as an example to say that the wind energy farms are implanted, in the great majority, in the coastal strip, in landscapes practically untouched by human intervention, with the presence only of traditional communities of

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fishermen and subsistence agriculture. With the arrival of the wind farms, there is a lack of characterization of the landscape, affecting the traditions and the identity of the local communities, as well as shaking activities linked to sun and beach tourism that is strong on the coast of Rio Grande do Norte. It is pertinent to highlight that the native forest of the biomes in question is removed in some parts of the area, to make way for wide roads through which immense trucks, cars, heavy machinery with parts of the towers pass and, thus, can be compromised.

In general, a sedimentary material is introduced for waterproofing and compacting the soil, in the implantation stage, aiming at providing vehicle traffic over the network of access roads to the wind turbines, the construction site, the material deposit, the office and the warehouse. All this dynamics of transport and people indirectly causes an imbalance in the local environment, in the natural habitat where the animals characteristic of this region live, which have their routine altered, their silence broken, and their habitat invaded by anthropic action, for give way to progress. The installation of wind farms increases the pressure on the region's biological diversity, with direct impacts on fauna (especially birds, bats and sea turtles), flora, and not forgetting the avian migration routes of native species(HOFSTAETTER; PESSOA, 2015; SANTOS, 2016).

In addition, there are studies in other countries, which analyze the influence of the light caused by the movement of the propellers, during the day and at night, on the mental health of the surrounding population, which includes as many animals from the biota as humans living close. In this effect, the degree of intermittent shading depends on the distance of the tower, the latitude of the place, the period of the day and the year. It becomes more relevant the shorter the distance between the blades and the energy receiver, as well as the fact of being at the same altitude. According to research, intermittent shading can cause discomfort and harm people suffering from epilepsy, as well as nausea and headaches in affected residents (HOFSTAETTER; PESSOA, 2015; SANTOS, 2016). It is felt at a distance of up to ten times the diameter of the blades and depends on the direction of the home wind turbines, being well documented in several countries around the world, but it is poorly regulated (FILHO, 2013; SANTOS, 2016).

3.3 Challenges to implement a policy to encourage renewable energy in the city of macaé

As well approached by Foulquier (2015), there is some difficulty for some municipalities to develop public wind projects for electricity supply. It is due to the lack of technically trained personnel, and in the case of a mixed company, some disadvantages must be considered, such as the possibility of the public power having to bear the costs of an unsuccessful project, and the cost

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of the installation site. In the case of installation in a private place, it would be necessary to grant the area by renting the space. In the case of a public place, unless the public-private joint venture is the only competitor of the space, there should be a fair dispute for the concession to all companies that desire it.

In the same way that a private company tends to analyze the profits that such an enterprise will succeed with time, in order to evaluate if the initial investment will be compensated, the public entity needs to analyze if the benefit to the population in the long term will be worth the cost taken from the taxpayer for the formation of this energy supply company. This is very difficult to predict, especially where there are already competing electric power companies established in the market, which discourages both private and mixed companies. Bearing in mind that a large portion of the market will possibly not have any apparent gains (due to the availability of electricity) or possibly will not have the environmental notion of changing its energy supplier, unless this second gives it much more comfortable conditions and This availability of consolidated energy could make the project unfeasible. These projects end up having a greater beneficial effect in rural areas or others that had no electricity available.

The gain from this investment in a renewable source may, in the short term, not be felt by those who paid extra taxes for it. Especially if the population can choose to use the electricity supplied by another competing company. In addition, in the case of private companies, expecting to lose part of the market share, the forecast of the return on the cost of the initial investment becomes uncertain.

Regarding environmental license, in addition to the common barriers faced by any infrastructure project, investments in sustainable projects have yet to mitigate environmental regulatory risks, risks from environmental disasters (floods, droughts) and technological risks. In this case, to make the project viable, it would be ideal if there were certain incentives given the long-term environmental benefit, and it is up to the regulator to establish what are the minimum environmental concerns that infrastructure projects must respect in order to be implemented (MOTTA; OUVERNEY, 2015).

Although challenges are applicable to many Brazilian cities, it can also be extended to the city of Macaé.

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4. Final considerations

In general, the disadvantages of the legislation concerning wind farm installation that was covered in the text are:

1) The need to incorporate the transmission lines as an environmental impact caused by the company within the environmental licensing and the costs for the undertaking.

2) The adverse effects that a wind farm can have on the population that need to be considered when choosing the region for its implementation.

3) The environmental licensing procedures offers no advantages or differentiation from other large enterprises and;

4) the incentives, when provided by law for the sector, are temporary, which discourages the entrepreneur.

In contrast, there are already some advantages that are affered by the legislation addressed:

1) The provision of inclusion of clean energy technologies among the mitigation options for any enterprise that seeks environmental licensing. In this case, it would be considered as an isolated source of energy for the enterprise, but that they could sell energy to the concessionaire or surrounding regions.

2) There is some that are applied to the energy sector, which recognizes its peculiarities.

3) The understanding foreseen in the laws of the municipality of Macaé to the need to stimulate and encourage the clean generation of electric energy, which can be considered as an advance already.

Thus, the problems for the implementation of the wind farm are:

1) The difficulty of locating regions in urban spaces away from human residences and at the same time not occupying regions of protected forest.

2) The observance that if the population already has consolidated electricity, the consumer market becomes unfeasible for the financial maintenance of the enterprise.

3) Although legislation provides for the possibility of innovative technologies as a source of electricity, this is not enough.

Unfortunately, legislation has been decisive for programs with a social and environmental bias to be developed as a form of compensation and in the search for environmental licenses by

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companies. For this reason, Rather than being a suggestion, there could be some requirement for part of a large construction to have a percentage of its energy demand be met by some renewable source.

It is suggested, such as prioritizing regions that do not have consolidated acess to electricity, this allows a greater gain, both for the company that has an exclusive market to explore, and for the population itself, which will have a representative gain.

In Brazil there are totally public institutions, in the areas of: health, through the single health system (*"SUS"* in Portuguese); basic and higher education; security, such as the Navy, Army and Aeronautics, and; infrastructure, such as the National Department of Transport Infrastructure *("DNIT"* in Portuguese). These companies, even competing with solely private companies, have gained space and notoriety in their services provided to the population. However, there is a great deal of discussion about public-private partnerships applied to prisons, basic sanitation companies, and energy due to the lack of really attractive field for investments, the perception that governments cannot manage all activities well, and the understanding by some that the government should focus on priority areas, namely health, education, security and infrastructure. Therefore, only public, public-private or only private management is highly dependent on resource limitations and the management capacity of each local analysis.

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