

OFFSHORE WIND FARMS IN THE ENVIRONMENTAL LAW OF THE SEAS

Lucas Noura de Moraes Rêgo Guimarães

Doctor in Law from Universidade Livre de Berlim, as research fellow at CNPq (2017). Master in Law and Public Politics from Centro Universitário de Brasília – UniCEUB (2011), where he received institutional scholarship. Graduated in Law from UniCEUB (2007). Advisor to the Brazilian Institute of Energy Law (IBDE). Member of the Brazilian Society of Energy Planning (SBPE) and Cigré-Brasil.
E-mail: lucasnoura@hotmail.com

ABSTRACT

This article aims to inaugurate the discussion surrounding the Brazilian environmental regulation of the offshore wind farms. Although it is a renewable source of energy with a growing prominence in the international scenario, from the environmental point of view it is still uncertain which are the dimensions of the impacts on marine wildlife caused by the installation and operation of an offshore wind farm. While UNCLOS dedicated one whole chapter to the protection and preservation of the marine environment, international experiences show that certain instruments are paramount to sustainable resource exploitation, such as EIA, exclusion zones and environmental planning. The Brazilian legislation contains some legal mechanisms with immediate use to offshore wind farms, as well as envisages the exploitation of maritime wind in planning instruments.

Keywords: Offshore wind farms; Brazilian Environmental Law of the Seas; Regulation; International experiences; Environmental impacts.

USINAS EÓLICAS OFFSHORE NO DIREITO AMBIENTAL MARINHO

RESUMO

Este artigo visa inaugurar discussão a respeito da regulamentação ambiental brasileira das usinas eólicas offshore. Embora diante de fonte renovável de energia com crescente destaque no cenário mundial, sob o ponto de vista ambiental ainda é incerta qual a dimensão dos impactos causados à vida marinha pela instalação e operação de eólicas offshore. Enquanto a CNDUM dedicou um capítulo exclusivamente à proteção e preservação do meio marinho, experiências internacionais mostram que certos instrumentos são fundamentais à exploração sustentável do recurso, tais como EIA/RIMA, zonas de exclusão e planejamento ambiental. A legislação brasileira possui dispositivos com aplicação imediata às eólicas offshore, bem como contempla o aproveitamento dos ventos marítimos em instrumentos de planejamento.

Palavras-chave: *Usinas eólicas offshore; Direito Ambiental marinho brasileiro; Regulamentação; Experiências internacionais; Impacto ambiental.*

INTRODUCTION

Offshore wind farms, still non-existent in Brazil¹, are reality in some countries, demanding a legal regulation for their deployment and use to capture the sea winds for electricity generation purposes. Although wind is considered a renewable and clean source of energy, as well as being a more sustainable alternative to fossil fuels, its energy use is not completely free of environmental impacts.

Although the environmental impacts caused by *onshore* wind farms are clear, due to the wide diffusion of the technique, for *offshore* wind turbines there are still doubts as to the type and magnitude of the environmental impacts caused by their deployment and use. The lack of consensus on the subject motivated and continues to motivate the adoption of various measures to mitigate environmental impacts. In this sense, the legal instruments present in international and foreign law that aim at the protection and management of the marine environment merit problematized analysis.

This article is divided into five parts: initially the environmental advantages and disadvantages of setting up a wind farm at sea (topic II); then an analytical comparison of the Brazilian environmental legislation applicable to *offshore* wind farms (topic III) is made; the same is done for environmental law under the United Nations Convention on the Law of the Sea – UNCLOS (topic IV); Finally, it focuses on the study of instruments used by foreign law in the conciliation between protection of the marine environment and economic exploitation of *offshore* winds (topic V); conclusions are presented at the end (topic VI).

1 ENVIRONMENTAL ASPECTS RELATED TO *OFFSHORE* WIND FARMS

Offshore wind farms have a number of advantages when compared to *onshore* wind farms. This series of advantages, coupled with the increasingly common obstacles to the installation of *onshore* wind farms, including noise emission, *shadow flicker*², visual pollution, real

1 For a discussion about the regulation of the exploitation of Brazilian *offshore* wind potential, cf. GUI-MARÃES, Lucas Noura de Moraes Rêgo. Geração de eletricidade a partir de usinas eólicas *offshore*: premissas a serem consideradas. In: BORGES, Thiago Carvalho et al. (orgs.). *Direito do Mar Vol. 1 – Reflexões, tendências e perspectivas*. Belo Horizonte: D'Plácido, 2017, p. 295ss.

2 *Shadow flicker* describes the alternation between moments of shadow and light caused by the rotation of wind turbines. For its occurrence it is necessary the concomitance of three factors: incidence of

estate speculation, *NYMBY* policies³ and socio-environmental issues⁴, has made the *offshore* wind industry feasible economically and socially in some countries.

The main advantage is the presence of stronger and more constant winds, which, at once, increases the capacity factor⁵ of the wind farms located in the world and attenuates the intermittent generation of electricity from the winds. Other advantages are: absence of limitations in terms of land use and the various visual impacts; absence of sound impacts (at least for humans), due to the distance from the coast⁶; absence of geographical obstacles, such as mountains, contributing to constant winds; low roughness of the sea surface, making the turbines do not need great heights, when compared to the *onshore* plants; in global terms, the turbulence of the wind is much lower at sea due to the absence of barriers, avoiding exorbitant wear of the turbines and consequently increasing their useful life; and, finally, greater ease of transport of the constituent elements of aerogenerators by sea than by land.

On the other hand, this is technology still in the development phase, which is why it presents some economic, technological and environmental disadvantages. Regarding the environment, it is worth mentioning the ignorance about the scale of the environmental impacts caused by the installation and operation of wind turbines, especially beyond the territorial sea, highlight deserving the noise and vibration caused in the foundation works (*pile-driving noise*) and in the operation of the aerogenerator, alteration of the geomorphology, impacts on the seabed by the placement of electricity transmission cables, as well as harmful effects arising from the electromagnetic field formed inside the underground cables, when these are carrying electricity⁷. Birds, fish, aquatic mammals and corals may

sunlight at low angulation (sunrise and sunset), location of the turbine between the Sun and the affected property and enough winds to make the blades move. An Environmental Impact Study can anticipate the occurrence of *shadow flicker*, preventing turbines from being installed in certain locations, cf. <http://www.iwea.com/index.cfm/page/environmentalimpacts#q72>. Accessed on 04.11.2016.

3 Acronym for *Not In My Backyard* referring to the resistance movement of citizens opposed to the installation of wind power plants near their homes.

4 The installation of wind power plants in the route of migratory birds or in environmentally protected coastal areas should be highlighted.

5 Capacity factor is the index that indicates the relation, in a given period, between the effective production of electricity by a power plant and the maximum total capacity of generation of electricity.

6 On average, European *offshore* wind farms are 42km offshore.

7 See ZEUSCHNER, Ruven Fleming. *Pipelines and Cables – The Offshore Transportation of Oil, Gas and Renewable Energy*. In: International Energy Law Review, vol. 8, 2011, p. 314; 317; GILL, A.B.; BARLETT, M. (2010). *Literature review on the potential effects of electromagnetic fields and subsea noise from marine renewable energy developments on Atlantic salmon, sea trout and European EEL*. Scotland: Scottish Natural Heritage, Commissioned Report n. 401, 2010.

be affected, to some extent still uncertain, by the installation and operation of *offshore* wind turbines. It is known from the experience with *onshore* wind turbines that turbines are often installed on migratory bird routes⁸, which requires the use of instruments and mitigating alternatives, aiming at maintaining the exploitation of the wind potential in a non-detrimental way to the local fauna and flora. For *offshore* wind farms, not only birds are affected by the spinning of wind turbines, but also coral and straddling and migratory fish, especially aquatic mammals, because of the *pile-driving noise*⁹.

More specifically, the environmental impacts are also related to: sedimentary modification and contamination caused by discharges from perforations; removal of dredged material; behavioral and physiological effects in marine mammals, birds and fish caused by noise from seismic and geophysical studies and human presence; introduction of non-native species; risks of collision against wind turbines; barriers to the movement of birds, fish and aquatic mammals; changes in seawater related to salinity, turbidity and temperature; risk of accidents such as spills of chemicals, among others¹⁰.

In this sense, it is fundamental to have rules that make compatible the economic exploitation of the *offshore* wind potential with the preservation of the marine environment, especially the most sensitive habitats.

8 CAINE, Catherine. *The dogger bank offshore wind farm proposal: a study of the legal mechanisms employed in the construction of an offshore wind farm*. In: North East Law Review, vol. 2, 2014, p.93; PETERSEN, Ib Krag et al. *Final results of bird studies at the offshore wind farms at Nysted and Horns Rev, Denmark*. Denmark: National Environmental Research Institute, 2006; ZAMPIERI, Natália; [Links] *The biases of biodiversity presented by the case of the Bald Hills wind farm*. In: Journal of International Law, vol. 13, n. 2, 2016, pp.263-275.

9 THOMPSON, Paul M. et al. *Framework for assessing impacts of pile-driving noise from offshore wind farm construction on a harbor seal population*. In: Environmental Impact Assessment Review, vol. 43, 2013, pp.73-85; BAILEY, Helen; BROOKES, Kate L.; THOMPSON, Paul M. *Assessing environmental impacts of offshore wind farms: lessons learned and recommendations for the future*. In: Aquatic Biosystems, vol. 10, 2014; CAINE, Catherine. *The dogger bank offshore wind farm proposal: a study of the legal mechanisms employed in the construction of an offshore wind farm*. In: North East Law Review, vol. 2, 2014, p.94.

10 Available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/504874/OESEA3_Non-technical_summary.pdf. Accessed on: 30.01.2017.

2 BRAZILIAN ENVIRONMENTAL LAW APPLICABLE TO OFFSHORE WIND FARMS

Comparing the current installed capacity of *onshore* wind power plants (10GW) with the wind potential mapped in Brazilian lands (146GW¹¹), it is understood why *offshore* wind farms have not yet gained momentum in the country, *neither legal-regulatory nor economic-financial*. Generally, the adventure of building offshore wind power plants is associated with the depletion of the terrestrial wind potential, along with the imposition of socio-environmental restrictions, which contribute to the economic attractiveness of the *offshore* option¹². Less urgent, but also important, is the acquisition of technological *know-how* (take, for example, the construction of the Angra I, II and III nuclear power plants).

From the environmental point of view, wind farms can be analyzed for their environmental impact (III.1) and for the licensing process (III.2). In addition to these two aspects, *offshore* wind farms should also be considered because of their place in environmental planning (III.3).

2.1 Regarding the environmental impact

In Brazil, the *onshore* wind potential is far from exhausted, even considering only the areas with the best potential. In addition, and unlike what has been happening with the installation of hydroelectric plants in the Amazon, whose rivers are considered the “last frontier to be explored” and where the preservation of the environment presents itself as insurmountable and irreconcilable with the use of water resources for electricity generation¹³, the socio-environmental impacts caused by the installation of *onshore* wind farms are still considerably low.

The matter is governed by CONAMA Resolution n. 462, dated July 24, 2014, which establishes procedures for the environmental

11 AMARANTE, Odilon Camargo; BROWER, Michael; ZACK, John; SÁ, Antonio Leite de. *Atlas do Potencial Eólico Brasileiro*. Brasília: Ministério de Minas e Energia, 2001. Available at: http://www.cresesb.cepel.br/index.php?link=/atlas_colico_brasil/atlas.htm. Accessed on 03.11.2016.

12 As for the low population density as a factor that delays the deployment of *offshore* wind turbines, cf. SNYDER, Brian; Mark J. Kaiser. *A comparison of offshore wind power development in Europe and the US: Patterns and drivers of development*. In: Applied Energy, Vol. 86, 2009, p.1852.

13 See, for example, São Luiz do Tapajós hydroelectric power plant, whose environmental licensing process was filed by the Brazilian Institute of the Environment – IBAMA in August 2016, which in practice means the environmental unfeasibility of the project, as designed and presented to the Environmental Agency. In the scope of the process, not only IBAMA, but also the Federal Public Ministry and the National Foundation of the Indian – FUNAI opined for not building the plant.

licensing of projects to generate electricity *from a wind farm on a land surface*. The edition of the Resolution took into account the fact that wind energy ventures have *low polluting potential* and indispensable role in the construction of a cleaner national energy matrix, as well as the need to consolidate a low carbon economy in the generation of electricity from in accordance with Article 11, sole paragraph, of Law n. 12,187, of December 29, 2009¹⁴, which instituted the National Policy on Climate Change – PNMC. In addition, the regulation of the environmental licensing procedures for the installation of wind farms takes into account “the voluntary national commitment assumed by Brazil to reduce projected emissions to 2020, pursuant to Article 12 of Law 12,187 /09¹⁵” and the need to “expand the supply of alternative renewable sources, notably wind power plants, in order to comply with stipulated targets for the energy sector in Article 6, Paragraph 1, III of Decree n. 7,390, of December 9 of 2010”¹⁶.

Its Article 3 assigns to the licensing body the framework of the wind energy generation enterprise with regard to environmental impact¹⁷, considering the size, location and low polluting potential of the activity. When the wind farm is considered of low environmental impact¹⁸,

14 The sole paragraph of art. 11 states that “Executive Decree will establish, in accordance with the PNMC, the Sectoral Plans for mitigation and adaptation to climate change aiming at the consolidation of a low carbon economy **in the generation and distribution of electric energy**, (...) with a view to meeting gradual targets for quantifiable and verifiable reduction of anthropogenic emissions, taking into account the specificities of each sector, including through the Clean Development Mechanism (CDM) and Nationally Appropriate Mitigation Actions (NAMAs).” (added taps).

15 Art. 12 sets the target (voluntary) of reducing greenhouse gas emissions between 36.1% and 38.9% by 2020.

16 These are the preambles to CONAMA Resolution n. 462/14. Available at: <http://www.mma.gov.br/port/conama/legiabre.cfm?codlegi=703>. Access 05.11.2016.

17 Environmental impact is, as defined in art. CONAMA Resolution n. 1 of January 23, 1986, any alteration of the physical, chemical and biological properties of the environment caused by any form of matter or energy resulting from human activities that directly or indirectly affect health, safety and well-being of the population (section I); social and economic activities (item II); the biota (subsection III); the aesthetic and sanitary conditions of the environment (section IV); the quality of environmental resources (section V).

18 Brazilian environmental legislation does not define what is a wind farm of low environmental impact. Art. 4 of the CONAMA Resolution n. 279 of 27 June 2001, states that “the competent environmental agency shall, based on the Simplified Environmental Report, the framework of the electricity enterprise in simplified environmental licensing procedure, by reasoned decision on technical advice. “. Article 2, item I, of the same Resolution, defines a Simplified Environmental Report as “the studies related to environmental aspects related to the location, installation, operation and expansion of an activity or undertaking, presented as a subsidy for the granting of the required prior license, which will contain, among others, information related to the environmental diagnosis of the region of insertion of the enterprise, its characterization, identification of environmental impacts and control, mitigation and compensation measures.” It is worth mentioning that CONAMA Resolution n. 279/2001 was approved at a time when the country was experiencing a serious energy crisis, requiring a fast and simplified environmental procedure for the implementation of energy projects. CONAMA Resolution n. 462/2014 does not repeal the CONAMA Resolution n. 279/2001, being only specific for the environmental licensing of *onshore* wind farms .

environmental licensing will be carried out by means of a simplified procedure, without the submission of EIA /RIMA (Article 3, § 2)¹⁹.

The following Paragraph 3 of Article 3 establishes the list of locations where the installation of a wind farm is subject to the presentation of EIA /RIMA and the holding of public hearings, a hypothesis in which the condition of “low-impact wind farm environmental “: in dune formations, fluvial and deflation plains, mangroves and other wetlands (section I); in the Mata Atlântica biome and involve cutting and suppression of primary and secondary vegetation in the advanced stage of regeneration, according to Law n. 11.428, dated December 22, 2006 (item II); in the Coastal Zone and imply significant changes in its natural characteristics, as provided by Law n. 7.661, of May 16, 1988 (subsection III); in zones of damping of protected areas of integral protection, adopting the limit of 3 km from the limit of the conservation unit, whose zone of damping is not yet established (subsection IV); in regular areas of route, fallow, rest, feeding and reproduction of migratory birds included in the Annual Report of Routes and Areas of Concentration of Migratory Birds in Brazil to be issued by ICMBio, within 90 days (item V); in places where they may generate direct socio-cultural impacts that imply unviability of communities or their complete removal (section VI); and areas of endangered species and areas of restricted endemism, according to official lists (section VII).

A systematic interpretation of Article 3, taking into account the order in which the devices appear – first paragraph on wind farms of low environmental impact and only after the paragraph on the locations where wind farms lose the condition of low environmental impact – allows the conclusion, therefore, that, as a rule, *onshore wind farms have a low environmental impact, when compared to other projects for electricity generation* (especially hydroelectric and thermoelectric), contributing to the economic viability of the project, in environmental costs.

Knowing if *offshore* wind farms will be considered, under Brazilian law, of low environmental impact, like *onshore* wind generators, is uncertain. Because it is a new technology installed in an environment other than the terrestrial environment, where environmental impacts have not yet been fully measured and known, caution is advised that, at least initially, *offshore* wind farms should not be characterized as having low environmental impact. It is worth mentioning that some of the hypotheses of

¹⁹ The legal permissive for the establishment of simplified procedure for activities and ventures of small potential of environmental impact is found in § 1º of Article 12 of CONAMA Resolution n. 237, of December 19, 1997.

departing from the characterization of the enterprise as “low environmental impact” as stated in § 3 of Art. 3 of CONAMA Resolution n. 462/2014 could already be applied, by analogy, to *offshore* wind farms (sections III, V and VII in particular).

2.2 Regarding environmental licensing

With regard to environmental licensing, it should be noted that, under Article 4 of CONAMA Resolution n. 237 of December 19, 1997, IBAMA is responsible for environmental licensing, referred to in Article 10 of Law 6.938, of August 31, 1981, of projects with significant environmental impact located in the territorial sea, the continental shelf and the Exclusive Economic Zone (EEZ), among others (item I).

This understanding is in line with the provisions of Article 7, item XIV, letter “b”, of Complementary Law n. 140, of December 8, 2011²⁰, which provides for administrative action by the Union – in this case through its environmental agency, IBAMA – to promote the environmental licensing of enterprises and activities located or developed in the territorial sea, the continental shelf or the EEZ.

In addition, Decree n. 8,437 /15 provides in its Article 3, item VII, letter “c”, that “wind power plants, in the case of *offshore* activities and land-sea transition zone” shall be licensed by the federal environmental agency. Unlike *onshore* wind farms, whose environmental licensing is carried out by state environmental agencies, *for offshore wind farms, IBAMA is competent, regardless of the distance from the venture to the Brazilian coast.*

2.3 *Offshore* wind and Brazilian environmental planning

In the context of environmental planning, *offshore* wind farms receive some mention. Initially, Law n. 7,661, dated May 16, 1988, establishes the *National Coastal Management Plan – PNGC*, with the objective of “guiding the national use of resources in the Coastal Zone, in order to contribute to raising the quality of life of its population, and the

²⁰ Establishes norms, in terms of items III, VI and VII of the *caput* and the sole paragraph of Article 23 of the Federal Constitution, for cooperation between the Union, the States, the Federal District and the Municipalities in the administrative actions arising from the exercise of common competence relating to the protection of outstanding natural landscapes, the protection of the environment, the combating of pollution in any form and the preservation of forests, fauna and flora; and amending Law n. 6938 of August 31, 1981.

protection of its natural, historical, ethnic and cultural heritage” (Art. 2 of Law n. 7,661 /88).

Article 2, single paragraph, defines Coastal Zone – ZC as the “geographical space of interaction of air, sea and land, including its renewable or non-renewable resources, covering a maritime and terrestrial range, which will be defined by the Plan”. PNGC I, approved by CIRM Resolution²¹ n. 001/1990, established physical-environmental criteria – such as the non-fragmentation of the natural unit of coastal ecosystems, the line of ridges of the topographical configuration of the coast, the submerged space to where movements occur (waves, currents and tides) that may cause natural processes capable of affecting the nature of the coast, as well as areas marked by intense socioeconomic activity – capable of delimiting ZC. As each Brazilian coastal state presents a configuration, the PNGC I left the definition of the terrestrial and maritime limits of the ZC for the State Coastal Management Plans. It is only in the absence of sufficient technical studies for the application of these criteria that the PNGC I has defined a clear rule: for the sea band – which is the one that is important for the purposes of this article – 6 nautical miles (11.1 km) on a perpendicular, counted from the Coast Line. Therefore, *offshore* wind farms deployed up to 6 nautical miles away from the coast should come contemplated in PNGC I. Art. 5 of Law n. 7,661 /88 expressly mentions the “production systems, power transmission and distribution” as a aspect to be considered in PNGC.

PNGC I gave way to PNGC II, approved by CIRM Resolution n. 005/1997, where, in a more direct and simple way, it establishes that the Maritime Range – “a strip that extends farther than *12 nautical miles* from the established Baselines in accordance with the United Nations Convention on the Law of the Sea, comprising the entire territorial sea “- is part of the ZC. Therefore, *offshore wind farms installed up to 12 nautical miles away from the coast should be included in the PNGC* .

The use of sea winds for electricity generation is also mentioned in Decree n. 8,907 of November 22, 2016, which approves the *IX Sectorial Plan for the Resources of the Sea – PSRM*. In defining the PNRM, “the resources of the sea are all living, non-living resources, *including energy* sources in marine areas under national jurisdiction and in international areas of interest, as well as in the Coastal Zone, whose use and conservation are relevant under economic, social and environmental points

21 Interministerial Council for the Resources of the Sea.

of view, promoting the use, conservation and sustainable exploitation and exploitation of these resources.”

The IX PSRM highlights in its introduction the potential of natural marine resources for the production of energy from renewable sources such as wind, wave and tidal energy. It highlights the need to make compatible the management of protected areas with the conservation of biodiversity and the sustainable use of natural resources. The IX PSRM covers four main areas : (i) living resources, (ii) non-living resources, (iii) ocean monitoring and observation and climate studies, and (iv) human resources in marine sciences. cycles of tides, waves, currents, *winds*, thermal gradients, among others, are expressly considered non-living marine resources, by the definition of the PSRM. The activities of generation of energy in the marine environment, as well as mining activities, require technical, economic and environmental feasibility studies, necessary requirements for the establishment of public policies aimed at such activities.

Although it has emphasized the potential of energy resources, the PSRM, when dealing with non-living resources, focuses only on mineral resources and, in the nine actions to be undertaken under IX PSRM, there is no concrete action related to the use of the sea winds, nor even related to anemometric measurements. It is salutary, however, to mention the use of maritime resources for the generation of electricity.

3 THE UNCLOS ENVIRONMENTAL LAW APPLICABLE TO OFFSHORE WIND FARMS

In a pioneering way, the production of energy from the winds is expressly mentioned in Article 56 of the United Nations Convention on the Law of the Sea²². In the scope of environmental protection, Art. 56, item 1, letter “b”, of UNCLOS states that the coastal State has jurisdiction in the EEZ for the protection and preservation of the marine environment. Art. 21, item 1, letter “f” is equally available for the territorial sea.

All Part XII of the Convention is devoted to the protection and preservation of the marine environment. All States have the obligation to protect and preserve the marine environment (Article 192), taking all necessary measures to prevent, reduce and control pollution of the marine environment (Article 194, item 1), which includes measures to reduce, as far as possible, pollution from installations and devices operating in

²² Entry into force in Brazilian law by Decree n. 1,530 of June 22, 1995.

the marine environment – including *offshore* wind turbines – in particular measures to prevent accidents and to deal with emergency situations, ensure the safety of offshore operations and regulate the design, construction, equipment, operation and crew of such installations or devices (Article 194, item 3, letter “d”). Among the measures, the evaluation and publication of reports by the coastal State of the potential polluting and harmful effects of activities projected under its jurisdiction, which could significantly impair and modify the marine environment (Article 206)²³. Also, by Article 208, coastal States must adopt laws and regulations to prevent, reduce and control pollution of the marine environment, arising directly or indirectly from seabed activities under their jurisdiction and coming from artificial islands, facilities and structures they, *offshore* wind generators – under their jurisdiction, under the terms of Arts. 60 and 80.

It remains to be seen whether the environmental impacts potentially caused by the installation and operation of *offshore* wind turbines can be considered “pollution of the marine environment” for UNCLOS implementation purposes. Art. 1 of the Convention defines pollution of the marine environment as “the introduction by man, directly or indirectly, of substances or energy into the marine environment, including estuaries, which results or is likely harmful effects, such as *damage to living resources and marine life*, risks to human health, hindering maritime activities, including fishing and other legitimate uses of the sea, changes in the quality of sea water as regards their use, and deterioration of places. “It should be noted that the concept is comprehensive, including not only the introduction of harmful substances into the marine environment, but also any form of energy, which includes the energy generated, for example, by the electromagnetic field coming from the electricity stream present in the cable. transmission (thermal energy) or vibration and noise caused by the installation and operation of *offshore* wind turbines (kinetic energy).

In this sense, the exploitation of *offshore* wind potential is an activity potentially causing pollution of the marine environment, and its exercise must comply with the provisions of Part XII of the Convention.

4 OFFSHORE ENVIRONMENTAL REGULATIONS RELEVANT TO OFFSHORE WIND FARMS

²³ At the international level is the Convention on Environmental Impact Assessment in a Transboundary Context, 1991, which established criteria for assessing Parties on the environmental impact of certain activities, by imposing notification and consultation on projects that have a harmful cross-border environmental impact. Annex I to the Convention, updated in 2004, contains a list of activities likely to have a harmful transboundary environmental impact, including facilities for wind power generation. Brazil is not a State Party to this Convention.

Benefiting from the still-inexistent flowering of a national *offshore* wind industry, one can draw important lessons (*Do's and Dont's*) from international experiences in the legal regulation of *offshore* wind farms. The issues that are indispensable legal treatment are related to the concession regime, government agents, access and connection to the transmission system – and who pays for it – and environmental constraints. In view of the scope of the article, the legal instruments found in foreign law will be brought in order to manage and protect the environment when installing wind turbines in the sea²⁴.

4.1 Denmark

The legal permissive for economic exploitation of the Danish *offshore* wind energy potential contained in *Promotion of Renewable Energy Act* (Act n. 1392) of 27 December 2008²⁵, where Chapter 3 *specifically* regulates *offshore* wind farms, with particular emphasis on Article 22, paragraph 1, which *expressly* states *the exclusive right of the Danish State to exploit energy from water and wind within the Territorial Sea and the Danish EEZ*.

As for the environment, it is based on the premise that *offshore* wind farms cause environmental impact and that, therefore, *the elaboration of EIA*, in terms of article 26, paragraph 1 ss. of Act n. 1392, 2008, and *Executive Order* n. 68 of January 26, 2012, it is *indispensable*. *To date, all offshore* wind projects on the Danish coast have required environmental impact studies, which follow directives developed by the Danish Regulatory Agency (*Energistyrelsen*)²⁶.

Article 27, on the other hand, determines that *offshore* wind projects that threaten the integrity of international conservation areas should only be approved after elaboration of a study on the implications of such a project for the conservation objectives of the affected area. Such approval shall only be granted after the hearings of the parties and bodies concerned and be certified that such projects do not damage the integrity

²⁴ This section does not attempt to make a comprehensive analysis of the regulation of *offshore* wind farms internationally, but simply to pinpoint relevant environmental issues.

²⁵ Available at: https://ens.dk/sites/ens.dk/files/Vindenergi/promotion_of_renewable_energy_act_-_extract.pdf. Accessed on 10.11.2016.

²⁶ Available at: <https://ens.dk/en/our-responsibilities/wind-power/offshore-procedures-permits>. Accessed on: 10.11.2016.

of the international conservation area or there are reasons of public interest that render the construction of the project imperative in view of the lack of alternative solution. In the latter case, compensatory measures will be established.

Also, if the area of international space conservation is considered to be home to priority natural habitat types or priority species, approval for the project will only be granted when there is demonstrated the need for the project for human health, public safety or to achieve consequences of primary importance to the environment. For international environmental conservation areas, therefore, Danish law established stricter requirements for the implementation of *offshore* wind projects .

Finally, for international conservation areas, a *ban on the construction of offshore* wind turbines may be established, at the discretion of the Minister of Climate and Energy, in order to avoid the deterioration of natural habitats and the disturbance of species that inhabit the designated area (article 28).

Important point of the environmental impact assessment is the *noise pollution* caused during the construction and foundation of the wind-towers (*pile-driving noise*). In a typical license to build an *offshore* wind farm²⁷, there is an obligation for part of the environmental studies to contain a prognostic of the characteristics of the noise source as well as the characteristics of the sound propagation. For the Danish case, the *sound exposure level (SEL)*²⁸ maximum that an aquatic mammal can undergo when of the foundation works can not exceed 190dB.

The monitoring activity of the sound pulses for the activities related to the construction of *offshore* wind turbines must be reported to the Danish Regulatory Agency, and the date of the sound activity, location, sound level and the activity causing the sound impulse shall be informed. In addition, the dealer must submit a study to the Danish Agency, which includes: (i) prediction of the noise level and noise propagation of at least four pillars; (ii) calculation of the accumulated SEL, taking into account the use of sonars and other equipment to repel the presence of marine mammals by at least 1,3 km; (iii) statement of planned noise abatement

27 See example available at: https://ens.dk/sites/ens.dk/files/Vindenergi/bilag_6_model_for_etableringstilladelse_vesterhav_nord_eng_final.pdf. Accessed on: 01/29/2017.

28 The calculation formulas to obtain the SEL included in a Danish regulator directive (*Danish Energy Agency's guidelines on underwater noise when underwater pile driving*), available at https://ens.dk/sites/ens.dk/files/Vindenergi/guideline_underwater_noise_april_2016_0.pdf. Accessed on: 01/29/2017.

measures; and (iv) measurement control program when installing pillars²⁹. It is, therefore, a rule with some advanced degree of detail.

It is also worth mentioning the *Future Offshore Wind Power Sites Report*, prepared by the Agency and containing the areas that will be tendered. The Danish regulator (*Energistyrelsen*) highlights the constant updating of the action plan for *offshore* wind farms, which guides the energy policy for this niche in the sector as regards grid integration, vessel traffic, *environmental considerations and identification of protected areas*³⁰.

4.2 Germany

Germany has started to exploit the *offshore* wind potential due to the exhaustion of areas suitable for the installation of *onshore* wind farms. Having stipulated the bold goal of 80% of renewable energy share in gross electricity consumption by 2050 (Article 1, paragraph 2, of the *Gesetz für den Ausbau erneuerbarer Energien*, also known as *Erneuerbare-Energien-Gesetz – EEG 2017*³¹), coupled with the government's decision to close all of its nuclear plants by 2022, the exploration of *offshore* wind potential has become an indispensable component of the German power grid.

Since January 1, 2017, the German *Offshore* Wind Energy Law (*Windenergie-auf-See-Gesetz – WindSeeG*), introduced by the Law for the introduction of auctions for electricity from renewable energies and for other Renewable energy³², adopted on 8 July 2016. *WindSeeG*'s objective is to increase the installed capacity of *offshore* wind farms to 15GW by 2030 (*Art.1*, second paragraph, *WindSeeG*). According to the plan for *offshore* wind farm projects, by 2020, 7.7GW of installed capacity must be connected to the grid.

An important point of German regulation from the environmental perspective concerns maritime spatial planning. An area development plan is drawn from an intimate interaction between the Federal Agency for Maritime Navigation and Hydrography (*Bundesamt für Seeschifffahrt und*

29 Available at: https://ens.dk/sites/ens.dk/files/Vindenergi/bilag_6_model_for_etableringstilladelse_vesterhav_nord_eng_final.pdf. Accessed on: 01/29/2017.

30 WORLD BANK; NATIONAL ENERGY ADMINISTRATION OF CHINA. *China – Meeting the challenges of offshore and large-scale wind power: regulatory review of offshore wind in five European countries*. Washington: World Bank, 2010, p. 9.

31 Law for the development of renewable energies, also known as the Renewable Energy Law, with 2017 being the last update of the Law.

32 *Gesetz zur Einführung von Ausschreibungen für Strom aus erneuerbaren Energien und zu weiteren Änderungen des Rechts der erneuerbaren Energien*.

Hydrographie), the German regulatory agency (*Bundesnetzagentur*) and the Federal Agency for the Preservation of the Environment (*Bundesamt für Naturschutz*) in order to define where wind farms can be erected, how and when these areas will be explored (Article 17-A et seq. of the *Energiewirtschaftsgesetz – EnWG*, for determinations and commitments outlined in the plan until 2026, as well as Art. 5 and Article 6, seventh paragraph, of *WindSeeG*, for determinations and commitments from 2026)³³. This is the main planning tool for *offshore* wind farms in Germany.

Prospecting studies for the delimitation of the area to be tendered should consider the following elements: strategic environmental analysis; spatial analysis of technical environmental aspects and other assets to be protected; pre-analysis of the marine subsoil; analysis of possible collisions of vessels; and evaluation and measurement of winds³⁴. Only wind farms located in the areas approved in the plan may be tendered.

The winner of the event, in order to obtain the approval to build and concession to explore the *offshore* wind potential offered at auction, must submit a plan before the Federal Agency for Maritime Navigation and Hydrography, which must be approved (Article 45 of *WindSeeG*). The plan submitted by the winner of the event will only be approved when (i) the marine environment is not endangered, in particular as regards the pollution of the marine environment of UNCLOS and the preservation of bird routes; (ii) the safety and fluidity of maritime transport is guaranteed; (iii) national defense is not threatened; (iv) it is in line with priority mining activities; (v) it is in line with the existence of cables, other connections, as well as the location of existing and planned converter platforms and transformers; (vi) there is no pending or conditional before the Federal Agency for Maritime Navigation and Hydrography (Article 47, fourth paragraph, *WindSeeG*).

With respect to noise in the water column, since 2008 the authorizations given by the Federal Agency for Maritime Navigation and

33 This plan (*Flächenentwicklungsplan*), established in the *WindSeeG* and which, according to Art. 7 of the *WindSeeG*, replaces the plan (*Bundesfachplan Offshore*) created by Art. 17-A and following of the *EnWG*, should include the areas of the German EEZ subject of wind turbines *offshore* installation, the order in which the areas to be auctioned, the year of entry into operation of the plants, the installed capacity of each wind turbine, location of transmission facilities (transformers, substations etc.), traced the lines of transmission, possible connections and strokes lines that exceed the German EEZ and which can be integrated to other countries, and technical *standards* and planning to be observed (Art. 5, paragraph one of *WindSeeG*).

34 BUNDESMINISTERIUM FÜR WIRTSCHAFT UND ENERGIE. *Ausschreibungen für die Förderung von Erneuerbare-Energien-Anlagen*. Berlin: Bundesministerium für Wirtschaft und Energie, 2015, p. 13.

Hydrography have the obligation to limit the level of sound exposure by 160dB up to 750 meters away from the works site³⁵. In addition, some technologies are being developed to minimize sound disturbances, including: bubble curtain, *Hydro Sound Damper*, and curtains around the *pile-driving area*³⁶. Especially for the boto (*Phocoenidae*) in the North Sea, a concept for its protection against noise was developed by the Ministry of the Environment (*Bundesumweltministerium*) in December 2013, which contains additional measures to reduce the environmental impacts caused by noise originating of *offshore* wind turbines³⁷.

Environmental impact studies are mandatory for wind farms above 20 turbines, and for wind farms with 6 to 20 turbines the EIA is mandatory when preliminary analysis identifies possible environmental disadvantages caused by the project. For smaller projects of 3 to 6 turbines, the same is true if *local* preliminary analysis identifies risks to the local environment (Article 3° C of the *Umweltverträglichkeitsprüfungsgesetz*³⁸).

4.3 United Kingdom

From the regulatory point of view, the United Kingdom has delimited its EEZ by means of the *Exclusive Economic Zone Order 2013*, Article 2 of which expressly states that the areas defined therein are areas within which the rights contained in Part V of UNCLOS can be exercised by the United Kingdom. In addition, Section 84 of the *Energy Act 2004* refers expressly to the rights contained in Part V of UNCLOS, exercised by the United Kingdom beyond its territorial sea and related, inter alia, to the generation of electricity from the winds.

A marine area where such rights may be exercised (*Renewable Energy Zone*) shall be designated, pursuant to Section 84 (4). In detail, the *Energy Act 2004* regulates the application of criminal law and civil law to *offshore* wind installations, as well as the bidding procedure, the form of granting licenses for exploration, authorization for electricity generation,

35 BUNDESMINISTERIUM FÜR WIRTSCHAFT UND ENERGIE. *Offshore-Windenergie – Ein Überblick über die Aktivitäten in Deutschland*. Berlin: Bundesministerium für Wirtschaft und Energie, 2015, p. 28.

36 Available at: <https://www.bfn.de/22515.html>. Accessed on: 30.01.2017.

37 BUNDESMINISTERIUM FÜR UMWELT, NATURSCHUTZ UND REAKTORSICHERHEIT. *Konzept für den Schutz der Schweinswale vor Schallbelastungen bei der Errichtung von Offshore-Windparks in der deutschen Nordsee (Schallschutzkonzept)*. Berlin: Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit, 2013.

38 Law of the Environmental Impact Study.

establishment of safety areas around of prohibited facilities and activities within these areas, and rights and duties with respect to navigation and civil aviation within a *Renewable Energy Zone* (Sections 85 to 101).

In the United Kingdom, *Crown Estate* is the body responsible for managing much of the waters of the United Kingdom, rights to the exploitation of natural resources (except fossil fuels) on the Continental Shelf, as well as managing the rights to generate electricity from the wind, waves and tides, and transport and storage of natural gas and carbon dioxide in the Continental Shelf. The *Department for Energy and Climate Change* is responsible for conducting *Strategic Environmental Assessment*³⁹, in order to verify which areas are likely to receive *offshore* wind turbines, due to the environmental implications of the potential exploitation of the wind potential⁴⁰. These studies are passed on to *Crown Estate*. In developing the *Strategic Environmental Assessment*, however, *offshore* wind farms are treated similarly to *offshore* oil and gas exploration, as if both had the same potential impact on the environment, a situation that has been criticized in the literature⁴¹.

The project developer is required to carry out a series of technical and environmental studies in order to obtain *statutory consents* for construction and development of the project. Only with these authorizations are you guaranteed the *Agreement for Lease*, which guarantees a company the option to develop a project in a certain area of the marine subsoil. The studies should contain, in general lines, the details of the project, the EIA, documentation proving the consultations with the interested parties and identification of possible obstacles to the feasibility of the project and what solutions can be adopted⁴². According to *Town and Country Planning Regulation 2011*, the EIA is not mandatory for *offshore* wind farms. However, it will be necessary if the project “possibly has significant impacts on the environment because of factors such as its nature, size and location”⁴³.

39 The most current being the *Offshore Energy Strategic Environmental Assessment (OESEA3)* of 2016.

40 DEPARTMENT OF ENERGY & CLIMATE CHANGE. *UK Offshore Energy Strategic Environmental Assessment*. 2016, p.1. Available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/504874/OESEA3_Non-technical_summary.pdf. Accessed on: 30.01.2017. In addition, the *Marine and Coastal Access Act 2009* allows the creation of *Marine Conservation Zones* – England, Wales and Northern Ireland – and *Marine Protected Areas* – Scotland.

41 CAINE, Catherine. *The dogger bank offshore wind farm proposal: a study of the legal mechanisms employed in the construction of an offshore wind farm*. In: *North East Law Review*, vol. 2, 2014, p.123.

42 Available at: <https://www.thecrownestate.co.uk/media/5411/ei-the-crown-estate-role-in-offshore-renewable-energy.pdf>. Accessed on: 18.11.2016.

43 CAINE, Catherine. *The dogger bank offshore wind farm proposal: a study of the legal mechanisms employed in the construction of an offshore wind farm*. In: *North East Law Review*, vol. 2, 2014, p.101.

Also worthy of mention is the creation of the *Collaborative Offshore Wind Research into the Environment – COWRIE*, an independent body created by *Crown Estate*, with the objective of conducting research on the environmental impacts caused by the execution of *offshore* wind projects⁴⁴.

4.4 United States

In the United States the development of the *offshore* wind industry is relatively recent compared to Europe. The motivations behind the development of *offshore* wind farms are based not on the depletion of *onshore* wind potential, but rather on the rising prices of coal, natural gas and oil, as well as the need to depend less and less on external sources of energy supply (quest for energy independence, taken as a matter of national security)⁴⁵.

The legal permissive is found in Section 388 of the *Energy Policy Act 2005*, which amended Section 8 of the *Outer Continental Shelf Lands Act*, allowing the use of the Continental Shelf for power generation from renewable sources. Protection of the environment, waste prevention and conservation of natural resources are three requirements expressly mentioned, among others, in the legal provision.

The body responsible for issuing concessions for the development of wind projects on the North American Continental Shelf is the *Bureau of Ocean Energy Management (BOEM)*, as established in Section 388 of the *Energy Policy Act 2005*. In order to support the establishment of its program for the issuance of renewable energy project concessions, *BOEM* prepared the *Programmatic Environmental Impact Statement (PEIS)*⁴⁶, an extensive report that examines in detail the potential environmental effects on the Continental Shelf and identifies policies and *best practices* that must be adopted by the wind project developer.

CONCLUSION

44 For a listing of studies already conducted by COWRIE, cf. https://www.thecrownestate.co.uk/media/5491/cowrie_reports_held_by_the_crown_estate.pdf. Accessed on: 30.01.2017.

45 SNYDER, Brian; Mark J. Kaiser. *A comparison of offshore wind power development in Europe and the US: Patterns and drivers of development*. In: *Applied Energy*, Vol. 86, 2009, p.1845.

46 Available at: <https://www.boem.gov/Renewable-Energy-Program/Regulatory-Information/Guide-To-EIS.aspx>. Accessed on: 30.01.2017.

From all of the above, it can be seen that there is already, at least in foreign law, a high degree of regulation of *offshore* wind farms by Marine Environmental Law. A number of instruments have been created in foreign law to address the need to reconcile the development of renewable energy sources – in particular wind power – and the protection of the marine environment: detailed regulation and clear limits on the level of sound exposure aquatic mammals during the works of foundation and operation of the plant; establishment of renewable energy zones, such as the block bidding in the oil and gas sector; creation of an independent body for research related to the environmental impacts caused by the exploitation of *offshore* wind energy. It is also worth mentioning the possibility of establishing exclusion zones, within which economic exploitation of the sea winds is prohibited⁴⁷. Finally, the mandatory or not of Environmental Impact Study is a present point in all the regulations analyzed.

Regarding the Brazilian legislation, there is still no specific regulation for the exploitation of *offshore* wind, although some Environmental Law provisions are applicable to the case. Due to the technological novelty and the innovative engineering arrangements for *offshore* wind project construction, in deeper and deeper waters, little is known about the environmental impacts on marine life, which is why some caution is needed in the environmental licensing of these enterprises. It is important that protection of marine species affected by the installation of wind power plants is guaranteed. In this sense, *offshore* wind power projects should not be allowed to adopt the simplified procedure for environmental licensing, as in force, pursuant to § 2 of Article 3 of CONAMA Resolution 462/14, for low-impact *onshore* wind farms, and the creation of EIA/RIMA is indispensable for *offshore* projects.

An EIA should address, to a greater or lesser extent, depending on the case, aspects related to: use and conservation of land and subsoil, dredging and waste disposal, submarine cables, interference with existing

47 The *Strategic Environmental Estudio del español para la instalación coast of marinos wind farms* "Spanish divides the zoning of the marine space into three: "Zones de exclusión", which are areas considered unfit for the installation of *offshore* wind farms, due to the identification of potential environmental effects incompatible with the activity; "Appropriate zones with environmental constraints", represented by areas where the possibility of certain negative environmental effects can be deduced, thus necessitating a deepening of the environmental impact assessment caused by the corresponding projects; and "Zones aptas", which are areas in which no significant environmental impact has been detected that may jeopardize the performance of the economic activity, available at: http://www.aeeolica.org/uploads/documents/562-estudio-strategico-ambiental-del-litoral-espanol-para-la-instalacion-de-parques-eolicos-marinos_mityc.pdf. Accessed on: 30.01.2017.

oil and gas extraction platforms, fishing, migratory birds and routes, navigation, ports and aviation, archeology, coastal processes, recreational, cultural, leisure and military activities, mineral extraction, among others. Conditions for the implementation of projects and forms of compensation must be included in any analysis of the environmental agency.

Also, in order to preserve the coastal environment and to mitigate visual pollution, it is recommended to create exclusion zones, especially in confluent areas with Conservation Units⁴⁸. The National Coastal Management Plan – PNGC and the Sectorial Plan for the Resources of the Sea – PSRM should be observed. On another front, it is important that there be a regulation establishing the form of joint work of the agencies of regulation and environmental inspection and preservation of the marine environment – IBAMA and ICMBio – with the regulating body of the electric sector – ANEEL.

It is imperative that the exploitation of *offshore* wind is regulated, so that climate protection – sought by the use of renewable energy sources as a substitute for fossil fuels – does not conflict with the protection of the environment.

REFERENCES

AMARANTE, Odilon Camargo et al. *Atlas do potencial eólico brasileiro*. Brasília: Ministério de Minas e Energia, 2001.

BAILEY, Helen; BROOKES, Kate L.; THOMPSON, Paul M. Assessing environmental impacts of offshore wind farms: lessons learned and recommendations for the future. *Aquatic Biosystems*, v. 10, n. 8, 2014. Disponível em: <<https://aquaticbiosystems.biomedcentral.com/track/pdf/10.1186/2046-9063-10-8>>. Acesso em: 13 maio 2019.

BUNDESMINISTERIUM FÜR UMWELT, NATURSCHUTZ UND REAKTORSICHERHEIT. *Konzept für den Schutz der Schweinswale vor Schallbelastungen bei der Errichtung von Offshore-Windparks in der deutschen Nordsee (Schallschutzkonzept)*. Berlin: Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit, 2013.

48 Available at: <http://www.icmbio.gov.br/portal/unidadesdeconservacao/biomas-brasileiros/marine/units-de-conservacao-marinho>. Accessed on: November 24, 2016. In this regard, cf. LEUZINGER, Márcia Dieguez; SILVA, Solange Teles da. Unidades de Conservação marinhas. In: OLIVEIRA, Carina da Costa (org.). *Meio ambiente marinho e Direito*. Curitiba: Juruá Editora, 2015, p. 253.

BUNDESMINISTERIUM FÜR WIRTSCHAFT UND ENERGIE. *Ausschreibungen für die Förderung von Erneuerbare-Energien-Anlagen*. Berlin: Bundesministerium für Wirtschaft und Energie, 2015.

_____. *Offshore-Windenergie – Ein Überblick über die Aktivitäten in Deutschland*. Berlin: Bundesministerium für Wirtschaft und Energie, 2015.

CAINE, Catherine. The dogger bank offshore wind farm proposal: a study of the legal mechanisms employed in the construction of an offshore wind farm. *North East Law Review*, v. 2, p. 89-127, 2014.

DEPARTMENT OF ENERGY & CLIMATE CHANGE. *UK Offshore Energy Strategic Environmental Assessment*, 2016.

GILL, A. B.; BARLETT, M. (2010). *Scottish Natural Heritage, Commissioned Report, n. 401: literature review on the potential effects of electromagnetic fields and subsea noise from marine renewable energy developments on Atlantic salmon, sea trout and European eel*. Inverness: Scottish Natural Heritage, 2010.

GUIMARÃES, Lucas Noura de Moraes Rêgo. Geração de eletricidade a partir de usinas eólicas *offshore*: premissas a serem consideradas. In: BORGES, Thiago Carvalho; ZANELLA, Thiago V.; TOLEDO, André de Paiva; SUBTIL, Leonardo de Camargo; BORGES, Orlindo Francisco (Orgs.). *Direito do mar: reflexões, tendências e perspectivas*. (v. 1.). Belo Horizonte: D'Plácido, 2017.

LEUZINGER, Márcia Dieguez; SILVA, Solange Teles da. Unidades de conservação marinhas. In: OLIVEIRA, Carina da Costa (Org.). *Meio ambiente marinho e Direito*. Curitiba: Juruá, 2015.

PETERSEN, Ib Krag et al. *Final results of bird studies at the offshore wind farms at Nysted and Horns Rev, Denmark*. Roskilde: National Environmental Research Institute, 2006.

SNYDER, Brian; KAISER, Mark J. A comparison of offshore wind power development in Europe and the US: Patterns and drivers of development. *Applied Energy*, v. 86, n. 10, p. 1845-1856, 2009.

THOMPSON, Paul M. et al. Framework for assessing impacts of pile-driving noise from offshore wind farm construction on a harbour seal population. *Environmental Impact Assessment Review*, v. 43, p. 73-85, 2013.

WORLD BANK; NATIONAL ENERGY ADMINISTRATION OF CHINA. *China – Meeting the challenges of offshore and large-scale wind power: regulatory review of offshore wind in five European countries*. Washington: World Bank, 2010.

ZAMPIERI, Natália; CABRAL, Mariana. Os vieses da biodiversidade apresentados pelo caso do parque eólico de Bald Hills. *Revista de Direito Internacional*, v. 13, n. 2, p. 261-274, 2016.

ZEUSCHNER, Ruven Fleming. Pipelines and cables: the offshore transportation of oil, gas and renewable energy. *International Energy Law Review*, v. 29, n. 8, p. 311-326, 2011.

Artigo recebido em: 18/07/2018.

Artigo aceito em: 06/02/2019.

Como citar este artigo (ABNT):

GUIMARÃES, L. N. M. R. Usinas eólicas offshore no direito ambiental marinho. *Veredas do Direito*, Belo Horizonte, v. 16, n. 34, p. 153-176, jan./abr. 2019. Disponível em: <<http://www.domhelder.edu.br/revista/index.php/veredas/article/view/1214>>. Acesso em: dia mês. ano.