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# ANUARIO IBEROAMERICANO DE DERECHO DE LA ENERGÍA

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VOLUMEN III

## EL DERECHO DE LA ENERGÍA SOSTENIBLE

UNIVERSIDAD EXTERNADO DE COLOMBIA

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# *Risk Management: Brazilian Environmental Assessments And Unconventional Natural Gas Developments*****

SUMMARY

Introduction. I. Key environmental impacts of unconventional gas exploration. II. Decision-making in a context of risk and scientific uncertainty and the environmental assessments. III. environmental Assessment of Sedimentary Area (easa). IV. Strategic Environmental Assessment (sea). V. Recommendations. Conclusion.

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## INTRODUCTION

Natural gas is an energy source among fossil fuels (oil, coal and natural gas) with less impact on greenhouse gas emissions[1] and can play an important role in the relevant energy matrix and to the transition to a low carbon economy. Natural gas can be obtained both from conventional and unconventional sources. The unconventional gas resources are found in unusual geological locations and therefore require special extraction technologies (such as fracking). Unconventional gas may be important to enhance the availability of natural gas and reducing prices, as it happened in North America. Other countries have been trying to replicate such success story like Argentina, China, UK, South Africa, Brazil, among others[2]. However, the experience of large-scale exploitation of this energy source, notably in the USA, show potential environmental risks, which could be present in other unconventional developments as well[3].

This paper takes Brazil as the case study and analyses the relevant environmental assessments that may give the essential planning guidelines to the decision making to develop such resources in the Brazilian context. Such environmental concerns were highlighted in certain regional provinces (as Paraná) and local municipalities (as Foz do Iguaçu) as they have banned frack-

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organized by the University of São Paulo, and the strategic importance of the support granted by the ANP (National Agency of Petroleum, Natural Gas and Biofuels of Brazil) through the R&D clause. We also thank the support from the National Agency for Petroleum, Natural Gas and Biofuels Human Resources Program (PRH-ANP), funded by resources from the investment of oil companies qualified in the R,D&I clauses from ANP Resolution number nº 50/2015 (PRH 33.1 – Related to Call Nº 1/2018/PRH-ANP; Grant FINEP/FUSP/USP Ref. 0443/19).

1 According to the U.S. Energy Information Administration, burning natural gas for energy results in fewer emissions of nearly all types of air pollutants and carbon dioxide ($CO_2$) than burning coal or petroleum products to produce an equal amount of energy. Cfr. [https://www.epa.gov/ghgemissions/natural-gas-and-petroleum-systems], access on 29.06.2020. Thus, although further research on the subject is considered necessary, studies conclude that unconventional gas may play a role in mitigating the climate impacts of energy production. Cfr. [http://www.shale-gas-information-platform.org/what-are-the-benefits.html], access on 15.06.2020.

2 Peter Cameron; Juan Felipe Neira Castro, Tomás Lanardonne, and Geoffrey Wood. "Across the universe of shale resources–a comparative assessment of the emerging legal foundations for unconventional energy", *The Journal of World Energy Law & Business*, vol. 11, Issue 4, August 2018, pp. 283–321.

3 Don C. Smith; Jessica M. Richards, and R. J. Colwell. "Where 'shale' we go from here: opportunities and challenges in shale plays located outside the USA", *The Journal of World Energy Law & Business*, vol. 10, Issue 3, June 2017, pp. 159–219.

ing and judicial decisions have suspended public bids to unconventional gas exploration. Properly addressing those risks is a key aspect to make feasible unconventional gas in Brazil. The relevancy of this study is to identity the adequacy of the Brazilian regulatory framework and to what extent planning and environmental assessments can create an adequate environment that contribute to unconventional gas in Brazil.

## I. KEY ENVIRONMENTAL IMPACTS OF UNCONVENTIONAL GAS EXPLORATION

The exploration of unconventional reservoirs by the hydraulic fracturing technique (also known as fracking) aim at obtaining natural gas in onshore formations. The unconventional gas[4] is a natural gas produced (i) by sedimentary rocks of low permeability, in relation to the conventional formations[5], formed by the deposition of fine sediments and organic matter in shallow waters in the geological past (leaf) or (ii) from sandstones of low porosity (*tight gas)* or (iii) from layers of mineral *coal* that act as generators and reservoirs (*coalbed methane*)[6]. Such sedimentary rocks are found at great depths (more than 1,000 m)[7] and unconventional natural gas is usually obtained by means of hydraulic fracking techniques[8]. Such technique consists of breaking up soil layers and rocks by means of injection of drilling fluid at

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4 In the rock formations in which it is obtained, unconventional gas (reference to the most complex form of extraction) may have the *shale gas*, the *tight gas* and the CMB (*coalbed methane*). As in Brazil most of the sedimentary energy reserves identified are natural gas, it is now treated exclusively with gas, although it is possible to obtain oil in the same formations and by the same technique.

5 These sedimentary rocks have high organic matter content and low permeability (pore connection measurement) –between 0.01 and 0.00001miliDarci(mD)–, especially when compared to a conventional sandstone oil reservoir located between 0.5 mD and 20 mD. (G. E. KING. "Thirty years of gas shale fracturing: What have we learned?", *Working Paper* n.º Society of Petroleum Engineers, SPE 133456. 2010).

6 RENATA R. DE ARAÚJO et al. "Panorama do Desenvolvimento de Gás Não Convencional: perspectivas para o caso brasileiro, in *Regulatory News of the Brazilian Gas Market*; HIRDAN DE MEDEIROS COSTA et. al. "Strictly speaking, all would be obtained by the hydraulic fracturing technique", Rio de Janeiro, Synergia, 2018.

7 Mobilization Program for the National Oil and Natural Gas Industry. Thematic Committee of Environment (PROMINP/CTMA). *Hydrocarbon use in non-conventional reservoirs in Brazil*, Brasília, Project MA 09, 2016, p. 113.

8 Available at: [https://www.imperial.ac.uk/media/imperial-college/grantham-institute/public/publications/briefing-papers/Shale-gas-and-climate-change---Grantham-BP-10.pdf], Accessed on: 10.05.2020.

high pressure, causing fracking in order to release the leaf gas[9]. The main concern about hydraulic fracking is that such a technique generates risks of environmental damage which are usually listed as the impact on the local environment, methane emissions during exploration and those associated with the disposal of drilling fluids and potential seismic disturbance.

It is relevant to point out that such technique not only uses large quantities of water, which is a scarce environmental resource[10], but also tend to cross aquifers and groundwater carrying chemical products, which generates the possibility of contamination of the soil and groundwater reserves, especially in cases of accidents[11]. Up to this moment there is scientific uncertainty about the risk of groundwater contamination caused by hydraulic fracturing operations. However, experts believe that it is unlikely that the water mixture can contaminate aquifers directly through the drilling process if it is performed in accordance with the required quality standards, since the groundwater is located at a depth of about 300 m, while fracturing usually occurs at a depth of 1,800 m to 3,000 m[12–13].

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9 Resolution ANP 21/2014 defines Hydraulic Fracturing in Non-Conventional Reservoir as: "technique of injection of fluids pressurized in the well, in volumes above 3,000 $m^3$, with the purpose of creating fractures in a given formation whose permeability is less than 0.1mD (mili Darcy), enabling the recovery of hydrocarbons contained in that formation". Mobilization Program for the National Oil and Natural Gas Industry. Thematic Committee of Environment (PROMINP/CTMA). *Hydrocarbon use in non-conventional reservoirs in Brazil*, Brasilia, Project MA 09, 2016, p. 21 and p. 81.

10 The need for hydraulic fracturing in unconventional operation requires large volumes of water. Studies indicate the need for 10 to 17 million liters of water for drilling and hydraulic fracturing of a well. As this water is mixed with propellant and chemical substances, the amount that can be recovered is reduced. Despite the low amount of fracturing fluid released into the well, this fluid contains up to 750 chemicals and other components. Some of them do not bring risks of damage, such as salt and citric acid, but others are toxic, including Benzene, Toluene, Ethylbenzene, Xylene BTEX. The improper disposal of this water after return to the surface can generate contamination. Still regarding the amount of water, it should be noted that the volumes used are high, but relatively small compared to those required to produce other energy sources. Considering the values of a typical well of leaf gas in the USA (from Barnett), the amount of water used to produce the gas represents 0.05% of the water needed to produce the same equivalent energy of ethanol.

11 Mobilization Program for the National Oil and Natural Gas Industry. Thematic Committee of Environment (PROMINP/CTMA). *Hydrocarbon use in non-conventional reservoirs in Brazil*, Brasília, Project MA 09, 2016, pp. 70/94.

12 United States Environmental Protection Agency. US EPA. *Reduced Emissions Completions for Hydraulically Fractured Natural Gas Wells*, s.d.

13 INTERNATIONAL ENERGY AGENCY (IEA). *World Energy Outlook 2011. Special Report: Are we entering*

In the case of unconventional gas there is the possibility of seeing accentuated general environmental issues of natural gas exploration and production, such as fugitive emissions of methane and volatile organic compounds from leaks and those inherent in drilling, completion, fracturing and production operations, as well as $CO_2$ emissions from burning natural gas[14], and contamination of other formations[15].

In addition, the exploration and production of unconventional gas is usually intensive in number of wells, which both increases the already known impacts of the natural gas industry, and makes greater use of area for its extraction, with the possible fragmentation of habitats and social disturbances resulting from high truck traffic and noise[16]. Furthermore, all the techniques used in the exploration of unconventional gas may induce changes in sedimentary formations capable of producing disturbances such as small seismic events with repercussions on the surface[17].

It can be considered that some of the impacts would not, in principle, reveal to be faced with scientific uncertainty. Both hydraulic fracturing is a known technique, and its consequences are identified, monitored and mitigated in other hypotheses of natural gas exploration. In other turn, the impacts from contamination of underground aquifers[18], which have not been widely studied in the international experience, and other impacts on human health resulting from the increase in the exploitation ofhydrocarbon resources, which have not yet been sufficiently evaluated[19], are faced with scientific uncertainty. The uncertainty regarding the risks would be

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*a golden age of gas?*, International Energy Agency/Organisation for Economic Co-operation and Development (IEA/OECD), Paris, 2011.

14 National Energy Technology Laboratory (NETL). *Environmental Impacts of Unconventional Natural Gas Development and Production*, 2014, pp. 39-45.

15 Contamination occurs when the well or fractures induced by some stage of exploration create connections between the rock layer containing the gas and other layers containing other fluids, such as water.

16 National Energy Technology Laboratory. Op. cit., pp. 115-122.

17 Ibid, p. 305.

18 Water resources are object of special protection by Brazilian legislation. According to Law 9.433/97, which instituted the National Water Resources Policy, water is a limited natural resource and a good in the public domain (art. 1.º, I and II), and the objectives of the Policy are "to assure current and future generations the necessary availability of water, in quality standards adequate to their respective uses" and "the rational and integrated use of water resources [...] with a view to sustainable development" (art. 2.º, I and II). The protection also covers groundwater, according to article 12, II c/c article 49, V, of Law 9.433/97.

associated, in the Brazilian case, especially the lack of sufficient evaluation of the sedimentary basins and of the impacts and their magnitudes in relation to those basins. Strictly speaking, since the peculiarities of the use of the hydraulic fracturing technique in Brazil are not widely known, it is in a context of uncertainty of significant risks.

Moreover, in this scenario, adequate regulation is essential so that only activities of strategic and economic interest can be carried out in a safe manner, so that the preservation of the environment and human health is guaranteed. Even in the case of the USA, where there is long experience with the technique and its impacts, the regulation of environmental impacts has still been the object of attention. In that country, the exploration of hydrocarbon reservoirs began in 1821 in *Devonian-Aged Shale*, near the city of Fredonia, New York State, the technique was improved in the 1970s and 1990s, and the share of natural gas in national gas production in the USA rose from less than 1% in 2000 to more than 20% by 2010[20].

Hydraulic fracturing has been regulated by the *US Environmental Protection Agency* (EPA), especially through (i) the *Safe Drinking Water Act*, (ii) the 2016 standard for effluent standards, and (iii) the *Clean Air Act*, which includes mandatory reporting of greenhouse gas emissions[21]. The study of the impacts of unconventional gas exploration has also been the subject of concern in the European Union, which in January 2014 issued Recommendation 2014/70/EU, establishing guidelines and minimum requirements for the exploration and production of hydrocarbons by the hydraulic fracturing technique by Member States[22]. According to the Recommendation, these activities must observe the need to preserve and protect the environment, the health of the population and ensure information to citizens[23].

It should be noted that the groups and parties with European environmental agendas against fracture tend to be fairly influential, which might have contributed to the technique not developing to the same extent as in

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20 Renata R. de Araújo et al. "Panorama do Desenvolvimento de Gás Não Convencional: perspectivas para o caso brasileiro", in Hirdan de Medeiros Costa et. al. *Regulatory News of the Brazilian Gas Market*, Rio de Janeiro, Synergia, 2018.

21 EPA. "Unconventional Oil and Natural Gas Development", available at [https://www.epa.gov/uog], access on 15 February 2020.

22 Available at [https://op.europa.eu/en/publication-detail/-/publication/85528c58-90a5-11e3-a916-01aa75ed71a1].

23 Idem.

the USA[24]. Furthermore, Europe is more densely populated than the US, which brings environmental impacts closer to the populations and imposes greater caution on regulators. This is possibly why a variety of countries emphasized in the potential negative environmental impacts of fracking such as France, Germany, South Africa and several American states (Vermont, New York, New Jersey and Maryland) have established a ban or moratorium on the hydraulic fracturing technique in their territories[25].

The main question this paper aims to address is to what extent is the Brazilian environmental regulations suitable to address the challenges and concerns aforementioned?

Brazilian regulation imposes that each project that have potential significant environmental impact should have its environmental impact assessment (EIA–CONAMA Resolution 1/86). Nevertheless, the usual environmental impact assessment that is directed to one specific project is not sufficient to evaluate new risks or technologies or even energy policy decisions like increase natural gas in the energy mix. In this sense, this study appraises the Strategic Environmental Assessment (SEA) and the Environmental Assessment of Sedimentary Area (EASA) and to verify if it is accurate to suggest that those assessments should be carried out in the case of unconventional gas, despite they are not mandatory according to the regulation framework.

## II. DECISION-MAKING IN A CONTEXT OF RISK AND SCIENTIFIC UNCERTAINTY AND THE ENVIRONMENTAL ASSESSMENTS

Comprehensive procedures for evaluating the objectives of the activity and its potential impacts, with transparency and wider public participation are key instruments to decision-making in a context of risk and scientific uncertainty. In this sense, the more limited Environmental Assessment of Sedimentary Areas (EASA) and the broader Strategic Environmental Assessment (SEA) would be adequate instruments. Especially SEA would be a means

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24 H. K. M. COSTA et al. "EU unconventional resource development stalls", *Oil & Gas Journal*, June 2016.

25 DAVID B. SPENCE. "Responsible shale gas production: moral outrage vs cool analysis", *Fordham Environmental Law Review*, vol. 25, Issue 1, 2013-14, p. 143.

of evaluating the objective, the value of the intended activity or technique in relation to the degree of risk inherent to all human activity, to consider whether the activity in question is part of what should be the motto of policies to preserve ecological processes and increase quality of life[26].

For the assessment of the possibility of exploiting an environmental asset or an energy generation or distribution technique, such as the introduction of hydraulic fracturing, more comprehensive risk assessment tools are needed that are not restricted to a single project or enterprise, capable of informing decision making. As Machado points out, the application of the precautionary principle[27] is related to the prior evaluation of human activities[28].

The Bucci definition of public policies is adopted, which indicates that they are: "government action programs aimed at coordinating the means available to the state and private activities to achieve socially relevant and politically determined objectives"[29]. For Bercovici, public policies are based on "the need to realize rights by means of positive state benefits, with national development being the main public policy, conforming and harmonizing all the others"[30]. Thus, the environmental variable must be integrated into public policies, making concrete the right of all to an ecologically balanced environment.

Moreover, public policies have several phases (or cycles): the formation of the agenda, the formulation and implementation of actions, monitoring and, finally, evaluation[31]. In all these phases environmental issues must be

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26 Cristiane Derani. *Economic Environmental Law*, 3rd ed., São Paulo, Saraiva, 2008, p. 152.

27 According to the European Parliament, "the precautionary principle enables decision-makers to adopt precautionary measures when scientific evidence about an environmental or human health hazard is uncertain and the stakes are high", cfr. [https://www.europarl.europa.eu/thinktank/en/document.html?reference=EPRS_IDA%282015%29573876], access on 30 June 2020.

28 Paulo Affonso Leme Machado. *Brazilian Environmental Law*, 22nd ed., São Paulo, Malheiros, 2014, p. 115.

29 M. P. D. Bucci. *Administrative law and public policy*, São Paulo, Saraiva, 2006, p. 241.

30 G. Bercovici. "Planning and public policies: for a new understanding of the role of the State", in Maria Paula Dallari Bucci (org.). *Políticas públicas*: *reflexões sobre o conceito jurídico*, São Paulo, Saraiva, 2006, p. 144.

31 Marcela Albuquerque Maciel. "Public Policies and Sustainable Development: Strategic Environmental Assessment as a Tool for Integrating Sustainability into the Decision Making Process", in *Brazilian Congress on Environmental Law* (16), São Paulo, PNMA, 2011; Antonio Herman Benjamin, Eladio Lecey, Silvia Cappelli, Carlos Teodoro, and Jose Hugueney Irigaray (cords). *30 years of National Environmental Policy*, São Paulo, Press Oficial of the State of São Paulo, 2011, pp. 462/463.

taken into account, but it is especially in planning and risk assessment in a context of uncertainty about damage that the integration of the environmental variable is essential. In the next sections, we will explain in further details about EASA and SEA implications in the Brazilian context.

## III. ENVIRONMENTAL ASSESSMENT OF SEDIMENTARY AREA (EASA)

Before bidding for hydrocarbons blocks, Brazilian government agencies and agencies, especially the National Petroleum Agency (ANP) and the Ministry of the Environment (MMA), promote a series of studies and evaluations of the economic and environmental feasibility of the bid. In this context, as of Resolution CNPE 08/2003, it was planned to carry out a prior environmental analysis by GTPEG (cfr. Ordinance MMA 218/2012). In this analysis, the GTPEG could recommend the exclusion of certain areas by environmental restrictions or indicate the possibility that they be included in the bidding (cfr. art. 1, I of CNPE Resolution 08/2003).

In June 2017, Resolution CNPE 17/2017 was issued, which established the Petroleum and Natural Gas Exploration and Production Policy and revoked Resolution CNPE 08/2003. According to CNPE Resolution 17/2017, multidisciplinary studies and environmental assessments of sedimentary basins with regional scope should be prepared and considered for the granting of areas, to subsidize the strategic planning of public policies, "in order to give greater security and predictability to the environmental licensing process of oil undertakings"[32]. Such studies will subsidize the classification of the sedimentary basin suitability for the development of oil activities and will define the recommendations to be integrated into the decision-making processes related to the granting of areas and the respective environmental licensing. It was also foreseen, in cases where the studies have not been concluded, that assessments regarding environmental restrictions will be

32 Such regional studies shall contemplate the analysis of the socio-environmental diagnosis of sedimentary basins and the identification of potential socio-environmental impacts associated with oil and natural gas exploration and production activities or ventures and "shall subsidize the classification of the suitability of the evaluated sedimentary basin for the development of such activities or ventures, as well as the definition of recommendations to be integrated with the decision-making processes related to the granting of areas and the respective environmental licensing" (art. 6, § 1).

prepared by joint manifestation of the MME and the MMA, complemented, in the cases of onshore blocks, by opinions of the competent state environmental agencies[33]. The new grants, therefore, are subject to this system[34].

So, an EASA is the first assessment of the environmental feasibility of developing a certain area. However, it is only a preliminary indication of this viability. In order for the activity to be considered feasible from a socio-environmental point of view, its specific environmental licensing is necessary. The EASA gain particular importance with CNPE Resolution 17/2017. The EASA was instituted by the Interministerial Ordinance of the MME/MMA 198/2012, as an instrument of responsibility of the MME and the MMA able to subsidize the planning of oil and gas exploration blocks granting and to be taken into account in the environmental licensing processes[35].

From the socio-environmental diagnosis of a given sedimentary area, the potential socio-environmental impacts associated with oil and natural gas exploration and production activities or enterprises should be identified. The EASA will thus allow the classification of the suitability of the evaluated area for the development of the referred activities, as well as the definition of suggestions for the decision processes related to the granting of exploration blocks and the respective environmental licensing. Furthermore, the EASA has as its central instrument the Environmental Study of the Sedimentary Area (ESSA), which must consider the social and environmental conditions and characteristics of a certain sedimentary area, according to the environmental impacts and risks associated with the petroleum activities, the results of which must be taken to public consultation.

Based on the EASA conclusions, sedimentary areas are classified as suitable, not suitable or in moratorium, considering the possibility or not of

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33 The CNPE Resolution 17/2017 establishes on this point that the MMA and the MME: "i) may, individually and independently, delegate the competence for the establishment of the said joint event; and ii) shall establish in one hundred and twenty days, counted from the publication of this Resolution, the procedures, criteria and deadlines that will mark the joint events" (art. 6, § 3).

34 The 15th Round of Bids of the ANP in progress, which offered 70 blocks in the maritime sedimentary basins of Ceará, Potiguar, Sergipe-Alagoas, Campos and Santos and in the onshore basins of Parnaíba and Paraná, totaling an area of 94.6 thousand km², counted on the Preliminary Technical Opinion of the GTPEG and Joint Manifestation of the MMA and MME, leading to the adaptation of two blocks that were partially overlapping the conservation unit and in bathymetry below 50 m.

35 For the purposes of this standard, sedimentary area is the territorial space formed by sedimentary basin, set of basins, sub-basins or other extensions, maritime or terrestrial, with effective or potential interest in oil and natural gas exploration and production.

inclusion in the processes of granting exploratory blocks or even the possibility of carrying out other studies.

In this sense, the EASA is an appropriate procedure for impact studies and risk management, providing for the possibility of continuity of studies in cases of uncertainty regarding risks, transparency and participation, and being intended to inform public policy planning and decision-making.

Article 19, II, of MMA Ordinance 422/2011, applicable to oil and natural gas exploration and production activities and ventures in the marine environment and in the land-sea transition zone, expressly exempts the entrepreneur from generating information already available in ESSA and EASA previously performed. This means that the information generated in ESSA and EASA may subsidize an EIA/RIMA or other studies prior to a certain activity.

There are two ongoing EASA processes: the Sergipe-Alagoas and Jacuípe marine sedimentary basins in Bahia; and the Solimões terrestrial sedimentary basin, located in the Amazon region. In both cases, after public consultation, terms of reference were drawn up for the contracting of technical consultancy. Also in these cases, the respective technical monitoring committees were constituted (Interministerial Ordinances 621/2014 and 622/2014).

The instrument has the potential to guide the licensing of activities related to the natural gas industry, especially in the supply field. However, its scope, the capacity of its execution to the intended extent and the adequate time frames for its elaboration still remain unknown, especially in the absence of precedent.

The CNPE Resolution 17/2017 brings the guideline of predictability of environmental licensing through dialogue between government and sector actors (item IX, art. 1). For this purpose, Article 6 of the Resolution establishes that the planning of granting areas may take into consideration the conclusions of environmental assessments of sedimentary basins, with regional coverage, which will subsidize the strategic planning of public policies, in line with what is described in relation to EASA.

The environmental assessments of sedimentary basins cover: i) analysis of the socio-environmental diagnosis of sedimentary basins; ii) identification of potential socio-environmental impacts, which will subsidize the classification of the sedimentary basin's suitability; iii) definition of recommendations to be integrated into the decision-making processes related to the granting of areas and the respective environmental licensing (art. 6, § 1 of ANPE Resolution 17/2017).

EASA is still a form of SEA, a broader evaluation than a project. However, because of its regional character linked to a sedimentary basin, it would have no scope for evaluating the policy option of developing a certain activity or technology such as unconventional gas.

## IV. STRATEGIC ENVIRONMENTAL ASSESSMENT (SEA)

SEA can be defined as "a systematic and progressive process" to be adopted in the early stages of public accountability decision-making to "assess the environmental quality and consequences of alternative proposals and development intentions incorporated in PPP initiatives [*policies*, *plans and programs*] ensuring the full integration of biophysical, economic, social and political considerations"[36]. According to Sánchez, SEA would designate all forms of impact assessment of broader actions than individual projects, typically referring to "the assessment of the environmental consequences of Policies, Plans and/or Programs (PPP), generally within government initiatives, although it may also be applied to private organizations"[37].

SEA is untied from a project and provides a broad assessment, integrating the environmental variable and involving transparency and participation. The SEA should discuss public policies in its formulation process, evaluating their environmental consequences, integrating the environmental variable with the same weight as the social or economic one, with the objective of subsidizing decision making[38].

There is no objective approach of dealing with the form and methods of SEA elaboration. There would be, in general lines, two main models of SEA: i) considers an extension of environmental impact assessment in a *bottom-up* project approach, and ii) integrated into policy formulation in a comprehensive, *top-down* manner[39]. Such models would address the two main objectives

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36 MARIA PARTIDÁRIO. "Strategic environmental assessment: principles and potential", in *Handbook of environmental impact assessment*, vol. 1, J. Petts. Oxford, Blackwell, 1999, pp. 60/73.

37 LUIS ENRIQUE SÁNCHEZ. "Why doesn't the strategic environmental assessment in Brazil advance?", *Revista Estudos Avançadas*, vol. 31, n.º 89, São Paulo, April 2017, pp. 167/183, available at [http://www.scielo.br/scielo.php?script=sci_arttextid=S0103-40142017000100167ng=enrm=iso], access on 15 June 2020.

38 MARCELA ALBUQUERQUE MACIEL. "Public Policies and Sustainable Development....", cit., pp. 462-463.

39 Ibid., p. 465. On SEA methodology for energy planning see LUIZ CLAUDIO GONÇALVES. *Energy planning and strategic environmental assessment methodology: concepts and criticisms*, Curitiba, Ju-

of SEA: to report on the limited character of the socio-environmental impact assessment per project and to instruct the decision-making process within the public policy framework that integrates the environmental variable and is appropriate for sustainable development[40].

The SEA's ability to inform the design, execution and review cycles of the PPP planning and management processes is of interest[41]. It is related to the decision cycle and the idea of continuity in the taking of successive strategic decisions, in which the environmental variable must be integrated. The SEA would be adjustable to the type and extent of the assessment and to the development of the subject or activity being assessed[42]. It would be compatible with the characteristics of re-evaluation in the face of scientific developments and of subsidy to the planning of the precautionary principle.

The SEA would close a decision-making process, which should discuss the strategic options influencing their definition. It applies to public policy and not only to the prior assessment of PPPs that will give rise to environmental licensing procedures[43]. It would not only apply in the context of scientific uncertainty and risks of unfair environmental damage but would lend itself well to such cases where the precautionary principle applies. The SEA would assess whether or not an activity or implementation of a technique, alternatives for the achievement of social and economic objectives, with the integration of the environmental variable and stakeholder participation, would be carried out. SEA requires greater transparency and better governance[44], which makes the decision-making process more legitimate and less subject to delay and questioning. It should also facilitate integration between different public policy making bodies in order to integrate the environmental

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ruá, 2009. The author clarifies that, from the international experience and study of the MMA, it would be possible to identify eight stages: 1) selection of strategic decision proposals (*screening*); 2) establishment of deadlines (*timing*); 3) definition of the content of the assessment (*scoping*); 4) assessment of strategic impacts; 5) documentation and information; 6) review; 7) decision, and 8) monitoring the implementation of the strategic decision (pp. 80/88).

40 MARCELA ALBUQUERQUE MACIEL. Op. cit., p. 465.

41 Ibid, p. 466.

42 Ídem.

43 LUIS ENRIQUE SÁNCHEZ. "Why doesn't the strategic environmental assessment in Brazil advance?", *Revista Estudos Avançadas*, São Paulo, vol. 31, n.º 89, April 2017 pp. 167-183, available at [http://www.scielo.br/scielo.php?script=sci_arttextid=S0103-40142017000100167ng=enrm=iso], access on 15 June 2020.

44 Ibid, pp. 167-183.

variable still in the processes of preparation and planning for government decisions, with accountability, participation and transparency being the axes of such an instrument[45].

Social participation in a context of decision making under uncertainty, as a means of democratic risk management, is especially important since it informs the objectives that present society sees preserved, without being restricted to a purely economic cost-benefit analysis and "always aiming at preventing/minimizing the undesirable effects of technical failure"[46].

According to Prieur, SEA has the potential to produce decisions efficiently taking into account environmental issues in a consistent manner, using fewer resources and requiring less discussion when making the decision. It also highlights that SEA provides increased governance and, as a result, increases public confidence in PPPs based on greater transparency[47].

It can be concluded that the adoption of the SEA in the planning phase (i) would integrate the environmental variable in the initial stage of the decision making procedure, giving greater consistency and speed to the phases of execution of the PPP; and (ii) would tend to avoid judicial clashes, by bringing rationality to the procedure and counting on the prior participation of the company and control bodies in the procedure, which implies greater acceptability of administrative decisions and gains in legal security for entrepreneurs.

At international level, under the 1991 Espoo Convention, to which Brazil is not a party, which deals with environmental impact assessment in a transboundary context, the Kiev Protocol on SEA was signed[48]. The European Union has a Directive on SEA (Directive 2001/42/EC), which

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45 Raisa Lustosa de Oliveira. *Environmental licensing: strategic environmental assessment and (in) efficiency of environmental protection*, Curitiba, Juruá, 2014, p. 153.

46 Patrick de Araújo Ayala et al. "International cooperation for environmental preservation: Brazilian law and the Aarhus Convention", *Revista Forense*, vol. 413, year 107, January-June 2011, p. 539.

47 Michel Prieur. "Environmental Impact Assessment in a Transboundary Context, specifically on nuclear energy related activities", in Maria Cláudia S. A. Souza (coord.). *Strategic Environmental Assessment: possibilities and limits as a tool to support sustainability*, Belo Horizonte, Arraes Editores, 2015, p. 6.

48 Ibid, p. 5. Indicates Prieur: "The objective of the SEA Protocol is to provide a high level of environmental protection, meaning that all programs and plans to reduce the level of protection will be regressive and contrary to this legal objective.

aims to ensure that certain plans and programmes with potential significant effects on the environment are subject to an environmental assessment[49].

In Brazil, although there are a number of initiatives for the implementation of SEA[50], the instrument is not subject to legal provision. This would be one of the reasons for its poor implementation. PL 3.729/2004 proposes to institute the general law on environmental licensing and SEA, which it defines as "an instrument to support decision-making, which subsidizes long-term strategic options, promotes and facilitates the integration of environmental aspects with socioeconomic, territorial and political aspects in the processes of planning and formulation of government policies, plans and programs" (arts. 2, V and 37)[51].

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49 EUROPEAN UNION. General Directorate of the Environment. "Implementation of Directive 2001/42/EC on the assessment of the effects of certain plans and programmes on the environment", available at [http://ec.europa.eu/environment/archives/eia/pdf/030923_sea_guidance_pt.pdf], access on 30 June 2018.

50 LUIS ENRIQUE SÁNCHEZ. "Why doesn't the strategic environmental assessment in Brazil advance?", Revista Estudos Avançadas, São Paulo, vol. 31, n.º 89, April 2017 pp. 167-183, available at [http://www.scielo.br/scielo.php?script=sci_arttext&id=S0103-40142017000100167&ng=enrm=iso], access on 15 June 2020. The author indicates the PL 2,072/2003, presented to the House of Representatives, which proposed an amendment to Law 6938/1981, introducing the PPP. SEA requirement, which would not have advanced, and the survey of about 40 SEA in the country, which would have little effectiveness in influencing the decision. Furthermore, OLIVEIRA points out PL 4.996/2013, which proposes to amend the PNMA to insert SEA as one of its instruments, of responsibility of the formulator of the PPP. RAISA LUSTOSA DE OLIVEIRA. *Environmental licensing: strategic environmental assessment and (in)efficiency of environmental protection*, Curitiba, Juruá, 2014, pp. 148-150.

51 Chapter III. Strategic Environmental Assessment. "Article 37. The Strategic Environmental Assessment (SEA) aims to identify the consequences, conflicts and opportunities of proposed government policies, plans and programs, considering environmental aspects, and ensure the interaction between sectoral, territorial and environmental sustainability policies in the decision-making process in a timely manner. Sole paragraph The EFA shall be carried out by the bodies responsible for the formulation and planning of government policies, plans and programs, or sets of structuring, sector or territorial development projects". "Article 38 The SEA shall not exempt those responsible from submitting the activities or 35 enterprises that integrate the policies, plans or programs to environmental licensing. § 1 The SEA results may contain guidelines to guide environmental licensing, if applicable, allowing for the simplification of the required environmental rites and studies. § 2 The SEA may not be required as a requirement for environmental licensing and its absence shall not hinder or impede the licensing process. § 3 Planning and policy instruments, plans and government programs that contain studies with similar content to SEA, in the form of the regulation, may benefit from the provisions of item II of § 1 of article 13, available at [http://www.camara.gov.br/proposicoesWeb/prop_mostrarintegra?codteor=1478848&filename=SBT+2+CFT+%3D%3E+PL+3729/2004], access on 20 June 2020.

The Instituto Acende Brasil promoted discussion on the valuation of environmental licensing, highlighting the importance of anticipating the discussion of socioeconomic and environmental aspects for the planning phase, which included SEA and its integration with energy planning[52].

A study by the House of Representatives on the "bottlenecks in federal environmental licensing in Brazil" points to the absence of SEA, along with the judicialization of procedures, as one of the problems of Brazilian licensing. SEA is pointed out in this study as a fundamental element for sustainable development[53].

The MMA already in 2002 highlighted the need to incorporate the environmental dimension in the planning of the energy sector "in order to allow, before the analysis of the environmental viability of each project, the formulation and environmental evaluation of the policy of definition of the energy matrix desired for the country" and in this sense suggested the implementation of SEA[54].

## V. RECOMMENDATIONS

In the case of unconventional resources, the proposal is that an SEA should be carried out to assess the possibilities and impacts of the development of unconventional gas in Brazil and to provide an integrated assessment

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52 "The valorization of Environmental Licensing: paths for development and protection", *Energy Bulletin 20*, April 18, available at [http://www.acendebrasil.com.br/media/boletins/arquivos/Energia_20.pdf], access on 15 July 2020. In addition, the publication New Proposals for Environmental Licensing in Brazil by the Brazilian Association of State Environmental Entities (organization José Carlos Carvalho, Brasília, ABEMA, 2013) suggests: "to stimulate, under the coordination of governments, the realization of SEA of government programs that unfold in large and high-impact projects (energy, mining, infrastructure, etc.)" (p. 22).

53 MMA. Strategic Environmental Assessment, Brasília, MMA/SQA, 2002, pp. 76-79.

54 Available at [http://www2.camara.leg.br/documentos-e-pesquisa/publicacoes/estnottec/areas-da-conle/tema14/2015_1868_licenciamentoambiental_rose-hofmann], access on 10 February 2020. The lack of strategic and integrative vision of the environmental variable leads to losses, as this study also highlights, bringing the Judgment2316/2014 (TCU) Plenário, handed down in Case TC 029.387/2013-2. According to the Federal Audit Court (TCU), the lack of synchrony among the agencies (not only due to environmental issues, but also being an important factor) brings i) delays and mismatch in the conclusion of electric power generation and transmission works; ii) financial impacts, and iii) risk to the security of the energy system. The TCU lists as one of the main causes of the delays, which generated losses to the environmental issues, such as the delay in issuing licenses and the judicialization of procedures, generate losses of around R$ 8 billion.

framework for decision-making, as well as to contribute to the establishment and/or improvement of the political, regulatory and sustainable conditions necessary for such exploitation, if the government so decides, to take place in the country in a safe and responsible manner[55]. This would be a way of applying the precautionary roadmap, with the possibility of establishing proportionate measures and taking into account cost and benefit analyses.

As seen, despite EASA been an important instrument for regional evaluation, because of its regional character linked to a sedimentary basin, it would have no scope for evaluating the policy option of developing a certain activity or technology such as unconventional gas.

The SEA would allow the decision on unconventional gas exploration in the national territory to be based on an assessment carried out with the effective participation of the various stakeholders in the project (with positions in favor and against), which would consider the environmental, social and economic effects of this development[56]. Therefore, it would not be limited to the studies and reports presented by the operator for a specific project to meet the requirements of the regulatory agency[57] (ANP and IBAMA) currently required by the applicable regulation.

It should be noted that, as Sanchez indicates, SEA deals with cumulative, synergistic and large-scale impacts and strategic alternatives so that the analysis of each individual project would not be capable[58]. SEA does not replace the safety and environmental feasibility assessment of a given project, but helps the broad assessment of the issue and, consequently, would end up, if it were decided to proceed with the activity, being able to instrumentalize each of the licenses, bringing legal and institutional security.

The SEA for unconventional resources (especially unconventional gas with the use of the hydraulic fracturing technique) would perform evaluation: i) of risks, impacts and factors that influence social acceptability and

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55 RENATA RODRIGUES DE ARAÚJO. *Regulatory and institutional aspects of unconventional gas development: a comparative analysis between Brazil and the United States*, Thesis, Institute of Energy and Environment, University of São Paulo, São Paulo, 2016, available at [http://www.teses.usp.br/teses/disponiveis/106/106131/tde-15092016-115205/], access at: 25 June 2020.

56 Ídem.

57 Ídem.

58 LUIS ENRIQUE SÁNCHEZ. "The Strategic Environmental Assessment and its application in Brazil", 2008, available at [http://www.iea.usp.br/publicacoes/textos/aaeartigo.pdf/at_download/file], access on 10 July 2020.

would recommend appropriate environmental mitigation measures; ii) on the relevance of creating scientific observatories to acquire knowledge on a continuous and solid basis; iii) of the socioeconomic benefits of exploiting the unconventional resource and the economic conditions that would maximize revenue for the government/society[59]. In addition, SEA would be able to establish guidelines and parameters for environmental assessment of exploration projects in sedimentary basins bidding for unconventional gas development in Brazil and provide information so that decisions on exploration of leaf gas can be based on evidence[60].

To achieve these objectives, SEA would need to consider exploration and production activities related to the development of leaf gas through different scenarios in a broad and integrated manner and include an assessment of all social, economic and biophysical risks and opportunities associated with industry, with transparency and participation[61].

## CONCLUSION

Unconventional gas can play a role in energy transition and in a low carbon economy in Brazil. There are risks of environmental and social impacts that must be duly analyzed before the projects being implemented otherwise it may suffer ban or moratorium.

Decision-making in contexts of scientific uncertainty must be informed by complete and broad studies for planning. This forward-looking orientation is embedded in the idea of sustainable development and is related to the careful seizure of natural resources considering the rights of future generations to a balanced environment (intra and intergenerational solidarity)[62].

As Sánchez indicates, SEA addresses cumulative, synergistic and large-scale impacts and strategic alternatives[63]. In that sense, its inclusion in the

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59 RENATA RODRIGUES DE ARAÚJO. *Regulatory and institutional aspects of unconventional gas development*..., cit.

60 LUIS ENRIQUE SÁNCHEZ. "The Strategic Environmental Assessment and its application in Brazil", 2008, available at [http://www.iea.usp.br/publicacoes/textos/aaeartigo.pdf/at_download/file], access on 10 July 2020.

61 RENATA RODRIGUES DE ARAÚJO. Op. cit.

62 CRISTIANE DERANI. *Economic Environmental Law*, 3rd ed., São Paulo, Saraiva, 2008, pp. 149-150.

63 LUIS ENRIQUE SÁNCHEZ. "The Strategic Environmental Assessment...", cit.

legal order would be important[64]. The SEA for unconventional resources (especially leaf gas using the hydraulic fracturing technique) would carry out assessment: i) of risks, impacts and factors that influence social acceptability and would recommend appropriate environmental mitigation measures; ii) of the relevance of creating scientific observatories to acquire knowledge on a continuous and solid basis; iii) of the socioeconomic benefits of exploiting the unconventional resource and the economic conditions that would maximize revenue for the government/society[65].

In face of uncertainty, there should not be applied only instruments of abstention, but of action, of evaluation, stimulating a reflexive attitude towards science itself and demanding transparency and the participation of society[66].

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64 According to a study by the Legislative Consultancy of the House of Representatives: "the inclusion of SEA in the national legal system may generate better quality government planning, greater legal security for the various business sectors, potential reduction of environmental impacts and assurance of higher environmental quality. It should be reiterated that environmental quality covers, conceptually, not only the ecological aspects, but also the socioeconomic ones". ROSELI SENNA GANEM (coord.). *Strategic Environmental Assessment*, House of Representatives, 2014, p. 28.

65 RENATA RODRIGUES DE ARAÚJO. *Regulatory and institutional aspects of unconventional gas development*… cit. In addition, SEA would be able to establish guidelines and parameters for environmental assessment of exploratory projects in sedimentary basins bidding for unconventional gas development in Brazil and provide information so that decisions on exploration of leaf gas can be based on evidence. LUIS ENRIQUE SÁNCHEZ. "The Strategic Environmental Assessment and its application in Brazil", cit.

66 RICARDO ABRAMOVAY. "Scientific controversy and accounting markets: the case of genetically modified organisms", *Revista de Direito Público da Economia*, Belo Horizonte, year 6, n.º 21, January-march, 2008, p. 201.

El "Anuario Iberoamericano de Derecho de la Energía" es una obra singular, al tratarse de la única publicación en castellano dedicada al tema de la regulación energética con perspectiva iberoamericana. Este tercer volumen gira alrededor del tema de "El derecho de la energía sostenible". La elección se considera oportuna en función de la confluencia de la trascendencia del problema del cambio climático global frente a la necesidad de asegurar la suficiencia energética como condición para el desarrollo de los países de la región, circunstancia que ha hecho necesario el acercamiento de dos disciplinas jurídicas hasta ahora aparentemente disociadas, como son la regulación medioambiental y la energética.