



STRATEGIC ENVIRONMENTAL ASSESSMENT IN THE BRAZILIAN ELECTRIC SECTOR: A STUDY OF POTENTIALITY

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ABSTRACT

Highlights

Strategic Environmental Assessment (SEA) provides a comprehensive overview of the environmental and social implications of Plans, Policies and Programs (PPP) proposals applied to various sectoral activities. In Brazil, it is possible to identify bottlenecks associated with the planning of the electric sector, mainly in relation to the environmental licensing process. Thus, there is significant potential for the application of SEA in this context, provided that the Brazilian characteristics of development are considered.

Objectives

The objective of this article is to identify and evaluate how the inclusion of the environmental variable in the planning of the Brazilian electric sector occurs and then to verify the applicability of the SEA in the scope of this planning.

Methodology

For the development of this work, the methodology of bibliographic research of qualitative approach was used. Specifically, existing publications, such as scientific articles, monographs, dissertations, theses, and official publications were consulted. It is worth highlighting the use of the "Good Practices Guide for Strategic Environmental Assessment - methodological guidelines" and the "Ten-Year Energy Expansion Plan 2024".

Results

The main result achieved by this work was the development of ways of adapting SEA in Brazil, based on considerations about the singularities of the Brazilian reality at each stage of SEA development. Based on this adaptation, it was concluded that the SEA can contribute significantly to an environmental and sustainable decision-making process in the planning of the Brazilian electric sector, including remedying environmental licensing bottlenecks.

Limitations of Research

The main limitation of the research and its results is the subjectivity of the political planning processes in the country, which directly affect the stages of development of the SEA.

Practical Implications

The study identifies the real potential of SEA in Brazil and presents guidelines and recommendations for the creation of a Brazilian SEA model in the electric sector.

Originality/Value

The article presents recommendations for adapting a SEA methodology applicable to the Brazilian electric sector, considering its singularities.

Keywords: Strategic Environmental Assessment; Environmental Impact Assessment; Brazilian Electrical Sector.



1. INTRODUCTION

In an increasing discussion since the 1970s, the impacts caused by anthropic activities became the object of evaluation and decision criteria for projects in different sectors of the economy. Thus, it is necessary to apply environmental assessment tools in order to form a theoretical framework to define the environmental, social and economic feasibility of these projects.

Strategic Environmental Assessment (SEA) has been a concept in development since the early 1980s, considered as a toolkit that aims to provide proponents of Policies, Plans and Programs with a comprehensive understanding of the environmental and social implications of their proposal, expanding focus far beyond its initial motivations (Brown et Thérivel, 2000).

In Brazil, there are small initiatives to implement the SEA. The most usual is the application of the instrument of Environmental Impact Assessment, the most common and simplified format of analysis, and its tool, the Environmental Impact Study (EIS), associated with each project individually in the Rite of Environmental Licensing. However, this type of evaluation can become simplistic for large strategic sectors, such as energy, given its scope in time and space, disregarding synergistic and cumulative aspects of important impacts.

The principle is that a SEA process should be run in parallel to the preparation of a strategic planning action, and must ensure that environmental issues associated with the action are carefully evaluated prior to the commencement of project-level planning; the EIS can then focus on refining project proposals that already meet the parameters elaborated by the SEA (Jay, 2010). The application of SEA in public policies tends to improve the environmental impact assessment and the environmental licensing processes, since it prioritizes the fundamental interests of the different stakeholders from the beginning of the policy development process; furthermore, it ensures that policy decisions will benefit society as a whole by taking into account all aspects of development, the environment and human rights (Bérubé et Cusson, 2002).

Regarded as a fundamental sector of any economy, the generation, transmission and distribution of electric energy demands the mobilization of several public and private actors. In Brazil, the Energy Research Company (EPE, acronym in Portuguese) is responsible for planning the sector, and annually publishes the Ten-Year Energy Expansion Plan (PDE, acronym in Portuguese); in addition, it publishes twice a year the Transmission Expansion Program and the Long-Term Expansion Plan (PET/PELP, acronym in Portuguese). These documents define the guidelines for the Brazilian electricity sector, from scenarios to meet demand in certain

expansion horizons, and are possibly the only documents that are close to the guidelines of a SEA. In this context, it is necessary to critically evaluate such products in order to verify their efficiency and the need for updates, as well as the insertion of new criteria that become relevant over time.

1.2 Objective

The objective of the present work is to identify and evaluate how the environmental variable can be included in the planning process of the Brazilian electric sector and, based on this analysis, to verify the applicability of the SEA, contributing to an environmental and sustainable decision making process within this planning.

1.3 Justification

This work is justified by the growing need for content regarding new forms of sustainable development adapted to the Brazilian reality. The growing demand for diversification of the energy matrix and support for the current concept of consumption has pushed government bodies to adjust the current regulation in this direction, following internal (still small) and international initiatives, already developed and in application.

2. METHODOLOGY

For the development of this work, a qualitative bibliographical research was carried out, in which existing publications such as journals, monographs, and dissertations were consulted.

The definitions of SEA and the concepts associated with it are presented initially. In addition, the main differences between the Environmental Impact Assessment (EIA) and the SEA will be highlighted, as well as some initiatives for the application of SEA in Brazil and worldwide. The information used in this chapter comes mainly from master's dissertations, doctoral theses, scientific articles and guides, such as the "Guide to Good Practices for Strategic Environmental Assessment – Methodological Guidelines" (Partisan, 2012); and the article "Strategic environmental assessment for energy production" (Jay, 2010).

Subsequently, a study was carried out on the current planning of the Brazilian electric sector, highlighting the socio-environmental analysis carried out in this context. This study supported the critical analysis of the current guidelines, from the perspective of the environmental implications, in order to understand the influence of the environmental variables in the planning of the expansion of generation as well



as the transmission of electric energy. In this chapter, the official publications of the Brazilian Federal Government, such as the “Ten-Year Energy Expansion Plan 2024” (Brasil, 2015a) and the “Transmission Expansion Program (PET) / Long Term Expansion Plan (PELP)”, both published by EPE.

Finally, a proposal for the application of SEA is presented as a way of including the environmental variable in the planning of the Brazilian electric sector, bringing comments about the methodology currently used in other countries, aiming at adapting to the Brazilian environmental and socioeconomic reality. In this way, it is possible to verify the applicability of the SEA in Brazil, with the consideration of the singular characteristics of the national planning. For the development of the proposal and presentation of the analyses, the “Good Practice Guide for Strategic Environmental Assessment – methodological guidelines” (Partisan, 2012) was used in particular; the paper “Environmental Licensing Process of Power Transmission in Brazil update analysis: Case study of the Madeira Transmission System” (Cardoso Jr. et al., 2014); among others.

3. STRATEGIC ENVIRONMENTAL ASSESSMENT: DEFINITION AND INITIATIVES

Environmental Assessment, as a generic process, includes a broad set of planning and impact assessment tools. In Brazil, due to the linkage of environmental studies, particularly EIA, to the environmental licensing process, the Environmental Assessment was limited to the application of the EIA to the project instance (Bastos, 2010).

In this context, it is observed that the EIA does not currently allow the insertion of the environmental variable in other levels of planning, having a limited approach, since it ignores the synchrony, synergy and cumulativeness between the projects planned and executed by an institution – the government, for example; as well as it does not address the activity with a strategic perspective. Thus, it is interesting to use a tool that can cover all potential projects and allows the evaluation of the environmental impacts promoted by the planning as a whole. To fill this gap, the SEA is highlighted.

By definition, the SEA is the systematic and ongoing procedure for assessing the quality of the environment and the environmental consequences of alternative views and intentions for development, incorporating initiatives such as the formulation of policies, plans and programs (PPPs) in order to ensure the effective integration of biophysical, economic, social, and political aspects as early as possible into public planning and decision-making processes (Brasil, 2002).

It is understood that the SEA is a strategic instrument of

impact assessment, whose objective is to facilitate environmental integration and the assessment of opportunities and risks of action strategies in the framework of sustainable development (Partidário, 2012). Moreover, SEA is defined as a process that aims to provide the policy proponent and decision-makers with a holistic understanding of the environmental and social implications of the proposal by expanding the focal plane far beyond the aspects that usually rule out the creation of a new policy (Brown et Thérivel, 2012). The SEA enables the incorporation of new objectives and constraints in the formulation of PPPs, substitution of alternative objectives, policy instruments and implementation strategies, as well as providing identification, clarification and resolution of conflicts and commitments.

According to the Ministry of the Environment (MMA, acronym in Portuguese) (Brazil, 2002), a sustainable development policy is clearly associated with the SEA. Its benefits, confirmed by international practice, only become effective if the SEA is conducted in an integrated manner with other decision mechanisms. Among the instruments whose use must be compatible with that of the SEA, are those for the promotion of sustainability, such as national sustainable development strategies, national environmental policy programs, and others.

Based on these ideas, it is possible to verify that the SEA can act directly in the facilitation of the Project Environmental Impact Assessment process. This is because these projects are already part of a specific policy, plan or program that considers their decisions from a strategic point of view, including the environmental variable. However, it is important to highlight some differences between SEA and EIA. Despite having a common root in impact assessment, SEA and EIA present different valuation objects: the first analyzes strategies for future development with a high level of uncertainties; while the second evaluates concrete and objective proposals and measures for the execution of projects. This difference determines the methodological requirements related to the evaluation scale and the decision process. From the definition of evaluation objects, other differences between SEA and EIA become clear, as for example (Partidário, 2012):

- *Perspective*: in SEA, the perspective is strategic and long term, while in the EIA the perspective is executive, short and medium term;
- *Process*: the SEA process is cyclical and continuous, while the EIA process is discrete and timely, motivated by concrete proposals for intervention;
- *Definition*: in the SEA, the goal is not to know the future, but to construct a desirable future perspective. Thus, the definition of what is intended is vague



and characterized by uncertainties, with data often insufficient. In the EIA, the intervention project must be known at an appropriate level of detail, with relatively precise definitions being required by reasonably available data or that can be collected in the field.

Internationally, it should be noted the development of SEA in Europe, promoted by Directive 2001/42/EEC. The regulation requires the assessment of the effects of certain plans and programs on the environment and directs the countries of the European Union to develop proper procedures and methodologies for the implementation of the SEA. Although the consolidation of the instrument took place only in 2001, some countries already had procedures defined in the 1990s, such as Great Britain, the Netherlands, Sweden, and Denmark. Currently, studies are underway to evaluate the application of SEA in some European countries. For example, Baresi et al. (2017) aim to identify, in their work, possible flaws and areas of improvement for each regional legislative framework in Italy in order to improve the practical application of SEA in the country.

In Brazil, there is still no regulation for SEA. Its current application depends on the individual performance of managers, public or private, who, in isolation, believe in the efficiency of the SEA as a facilitator in the decision-making process (Oberling, 2008). The first Brazilian initiatives of SEA began in the 1990s, and were characterized as specific and focused on specific demands, such as the approach based on the evaluation of impacts of large projects (Santos et Souza, 2011).

The Law Bill 2072/2003 should be highlighted, as it proposes the amendment of the National Environment Policy, so as to include the mandatory SEA of PPP. This project, which would represent a breakthrough in the implementation of environmental policy, has been under discussion since 2003 and, to date, MMA has not expressed itself. The Ministry of Planning, in an attempt to simplify the SEA process, developed and implemented an integrated sustainability assessment procedure for the country's investment portfolio. In this procedure, the environmental variable is only one component of a set of integrated issues to be contemplated, and its construction did not have the direct participation of the MMA (Pellin et al., 2011)

At present, the initiatives of the studies are led by the governmental sector (federal or state), but also with cases in the private initiative and in the third sector. The Federal Government, through the MMA, has stimulated and trained public managers to use the instrument in decision-making within their sectoral bodies; however, adherence to these training programs is still voluntary. Among the most important federal initiatives, it is possible to mention the SEA for

the Brazil-Bolivia Gas Pipeline, the Decennial Electricity Expansion Plan, and the Northeast Tourism Development Program (Oberling, 2008).

The SEA creates the opportunity for the development of a policy, plan or program to internalize externalities often overlooked in many sectoral policies and decision-making processes. The intention of the SEA is to move the PPPs towards sustainable results (Brown et Thérivel, 2012).

4. THE PLANNING OF THE BRAZILIAN ELECTRICAL SECTOR

The Federal Government exercises, under the law, the planning functions of the electric sector, which is determinant for the public sector and indicative for the private sector. The EPE is responsible for the preparation of studies necessary for the development of plans to expand the generation of short and medium and long term electricity generation. These studies converge on two main products: the PDEs and the PEL and PELP reports.

4.1 Decennial Energy Expansion Plan – PDE 2024

The Ten-Year Energy Expansion Plan 2024 (PDE 2024) presents an integrated vision of energy supply and demand between 2015 and 2024. The PDE has great importance as a planning instrument for the national energy sector, since it contributes to the definition of development strategies to be drawn up by the federal government. In general, regarding the electric sector and the expansion of generation in the horizon of the plan, the relevant participation of renewable sources in the electric matrix was increased, contributing to the sustainable development of the generation sources.

The Decennial Plans are built with bases on some basic premises related to the current and projected reality of the country. These assumptions include the macroeconomic and sectoral scenario, the oil price outlook and the demographic growth. Economic variables, such as the growth rate of the economy, have a relevant impact on the projection of energy consumption.

Some of the more prominent projections of PDE 2024 are in Table 1 below.

As can be seen, the 4.2% increase in electricity consumption in 2014 to 2024 results in two paradigms: increase in the generation, transmission and distribution of electric energy and development of energy efficiency in the various areas of consumption. For this, sustainable guidelines from the economic and socio-environmental perspective are necessary.



Social and Environmental Analysis of PDE 2024

The socio-environmental studies developed under the PDE 2024 are guided by the concept of sustainability, in order to consider issues associated with the reduction of local and global impacts on the use of energy sources, especially the water source; the use of alternative renewable sources; minimizing negative impacts on the environment; and national and international discussions on climate change.

The socio-environmental analysis of PDE 2024:

- *The analysis of greenhouse gas (GHG) emissions* resulting from the energy supply adopted in PDE 2024, considering the importance of the PDE as a sectoral plan for mitigation and adaptation to climate change;
- *The analysis of each energy source*, with the objective of evaluating the conditions in which the interferences of the planned projects could occur on the environment and society;
- *The integrated analysis*, which identifies the potential interferences of each source on the most significant socio-environmental sensitivities of each Brazilian region, allowing composing an overall view of the expansion of energy supply.

Regarding GHG emissions, the PDE is presented as the plan for mitigation and adaptation to climate change in the energy sector. Therefore, it is the instrument for the formulation of the strategy of attendance and monitoring of the goal with regard to the production and the use of energy. Total emissions over the 10-year horizon are increasing, reflecting the country's economic growth prospects. In the year 2024, the end of the PDE horizon, emissions will be 585 MtCO₂eq. The measures incorporated in the plan, such as: the expansion of hydroelectricity, other renewable sources in electricity generation, the use of biofuels, energy efficiency measures, among others, will enable Brazil to maintain performance indicators of its energy matrix at the levels of the countries that less emit greenhouse gases in energy production and consumption.

The analysis of each energy source takes into account the environmental impacts and socioeconomic benefits generated by each one. The evaluation by source presents a simplified result already expected, with economic benefits related to job creation due to the projects, and impacts related to the risks associated with the implantation and operation, among others. Individual and localized studies, varying according to the characteristics and demands of each source in particular, are performed. These studies assess the ability of the environment to manage the specific impacts of a given enterprise, not necessarily the ability to manage all the combined impacts. It should be emphasized that there is no content developed as a basis for the locational or technological decision to implement the generation plants foreseen in PDE 2024. These aspects imply in an expansion of generation in an economically planned manner, that is, that meets the increasing demand; however, it fails to consider the environmental variable strategically in the technological and locational discussions.

The PDE 2024 also performs an integrated socio-environmental analysis of the expansion of the Brazilian energy park. According to the Plan, this analysis presents a holistic view of the environmental issues associated with the expansion of energy supply. The expectation is that the results can serve as a support to the planning process and to the strategic dialogue between the sectors involved in this process directly or indirectly. The general methodology used begins with the mapping of the projects and the subsequent joint analysis of their interferences on the main regional sensitivities of the country.

Mapping on a regional scale allows the visualization of a possible concentration of projects in a given area, indicating possible cumulative or synergistic effects and conflicts in some regions resulting from pressure on a resource, fragile environments or even populations. On the other hand, this mapping allows observing a possible complementarity between the sources, contributing to the efficiency of the expansion, reduction of expenses with transmission and also to the minimization of potential conflicts.

The interferences associated with the projects foreseen in the expansion were grouped in the following socio-environmental themes: (1) water resources; (2) aquatic biodiversity;

Table 1. Economy and final energy consumption.

Discrimination	2015	2019	2024	2014-2019	2019-2024	2014-2024
				Variation (% a.a.)		
GDP (R\$ Billion)	3 959	4 378	5 465	1,8	4,5	3,2
Resident Population (10 ³ inhabitants)	205 266	211 368	217 762	0,8	0,6	0,7
Electricity Consumption (TWh)	525,3	616,5	790,9	3,2	5,1	4,2

Source: Compiled from Brasil, 2015a



(3) native vegetation; (4) protected areas; (5) landscapes; (6) air quality; (7) indigenous populations; and (8) territorial organization. In relation to each of the items, the main pressures related to the projects foreseen in the expansion are highlighted and only indicated the need for attention to the form of management for each scope. Table 1 summarizes the socio-environmental issues related to the projects of the Plan and the regions where they are located.

In addition to the indication of the socio-environmental themes to be observed in the planning, the PDE defines as the most important contribution of the integrated socio-environmental analysis the selection of priority themes for environmental management. This selection aims to highlight the issues capable of increasing the uncertainty related to the projects presented in the PDE and, for this reason, imposes the need to channel efforts to an adequate treatment. Among the priority themes are: indigenous populations, protected areas, aquatic biodiversity, and native vegetation.

The Plan presents indications and expectations directed especially to the institutional articulation and the integration and compatibility of different sectoral policies. In addition, the relevance of the discussion of socio-environmental issues is emphasized on a wider scale to assess the real risks and opportunities associated with decisions on the use of available resources.

The Integrated Analysis can be confused with the SEA, since it presents as an expectation the support to the planning process, as defined in the PDE. However, this definition is contradictory, since this analysis is based on the spatial distribution of the projects already foreseen. That is, there is no real integration of the analysis in the planning process of the projects to be carried out for the expansion, but only the identification of the critical points of the related environmental theme.

Chart 1. Synthesis matrix of Integrated Socio-environmental Analysis.

	North	Northeast	South	Southeast	Midwest
Hydroelectric plant - HPP	Protected areas Aquatic biodiversity Territorial organization Indigenous populations Native vegetation	-	Aquatic biodiversity Territorial organization Native vegetation	Aquatic biodiversity Territorial organization Native vegetation	Protected areas Aquatic biodiversity Territorial organization Indigenous populations Native vegetation
Small Hydroelectric Plant - PCH	There is no interference in terms of sensitivities	There is no interference in terms of sensitivities	Aquatic biodiversity Native vegetation	Aquatic biodiversity Native vegetation	Aquatic biodiversity Indigenous populations
Thermoelectric Plant - UTE (biomass)	There is no interference in terms of sensitivities	There is no interference in terms of sensitivities	There is no interference in terms of sensitivities	There is no interference in terms of sensitivities	There is no interference in terms of sensitivities
UTE (fossil)	There is no interference in terms of sensitivities	There is no interference in terms of sensitivities	Air quality	Air quality	-
UTE (nuclear)	-	-	-	There is no interference in terms of sensitivities	-
Wind energy	-	Protected areas Landscape	Protected areas	-	-
Solar energy	-	There is no interference in terms of sensitivities	-	There is no interference in terms of sensitivities	There is no interference in terms of sensitivities
Transmission	Protected areas Indigenous populations	Native vegetation Landscape	Protected areas Native vegetation	Native vegetation Territorial organization	There is no interference in terms of sensitivities

Source: EPE (Brasil, 2015a)

Notes: (1) The fact that there is no interference with sensitivities means that, although the impacts do exist, they are not so expressive in the face of regional expansion and sensitivities; (2) Blank cells mean that there is no planned project.



The PDE itself opens space for a SEA, since it affirms that the socio-environmental management of the priority themes happens mostly at local and regional scale, and it is expected that the set of measures adopted will lead to a result of global reach. However, efforts are not directed towards this, since a comprehensive proposal for holistic management of planned projects is not developed in relation to their priority socio-environmental themes.

4.2 Transmission Expansion Program and Long-Term Expansion Plan (PET/PELP)

Since 2015, EPE has concentrated the PET and PELP in a single document, with the main objective of providing an integrated view of sectoral planning to agents of the electric sector (Brasil, 2015b).

The PET/PELP does not present any type of analysis related to the planned works, bringing only information specific to each project, as justification and total investments foreseen. The works presented in PET/PELP are defined based on planning studies carried out by EPE, that is, they are based on PDE 2024, and have not yet been tendered.

Socio-environmental Analysis of Electric Power Transmission

The expansion in the electric power transmission network is defined in PDE 2024, as well as its socio-environmental analysis. This evaluation considers the set of basic network transmission lines scheduled for operation in the next 10 years: 267 new transmission lines, with a total length of approximately 46 000 km. In this scenario, it is worth men-

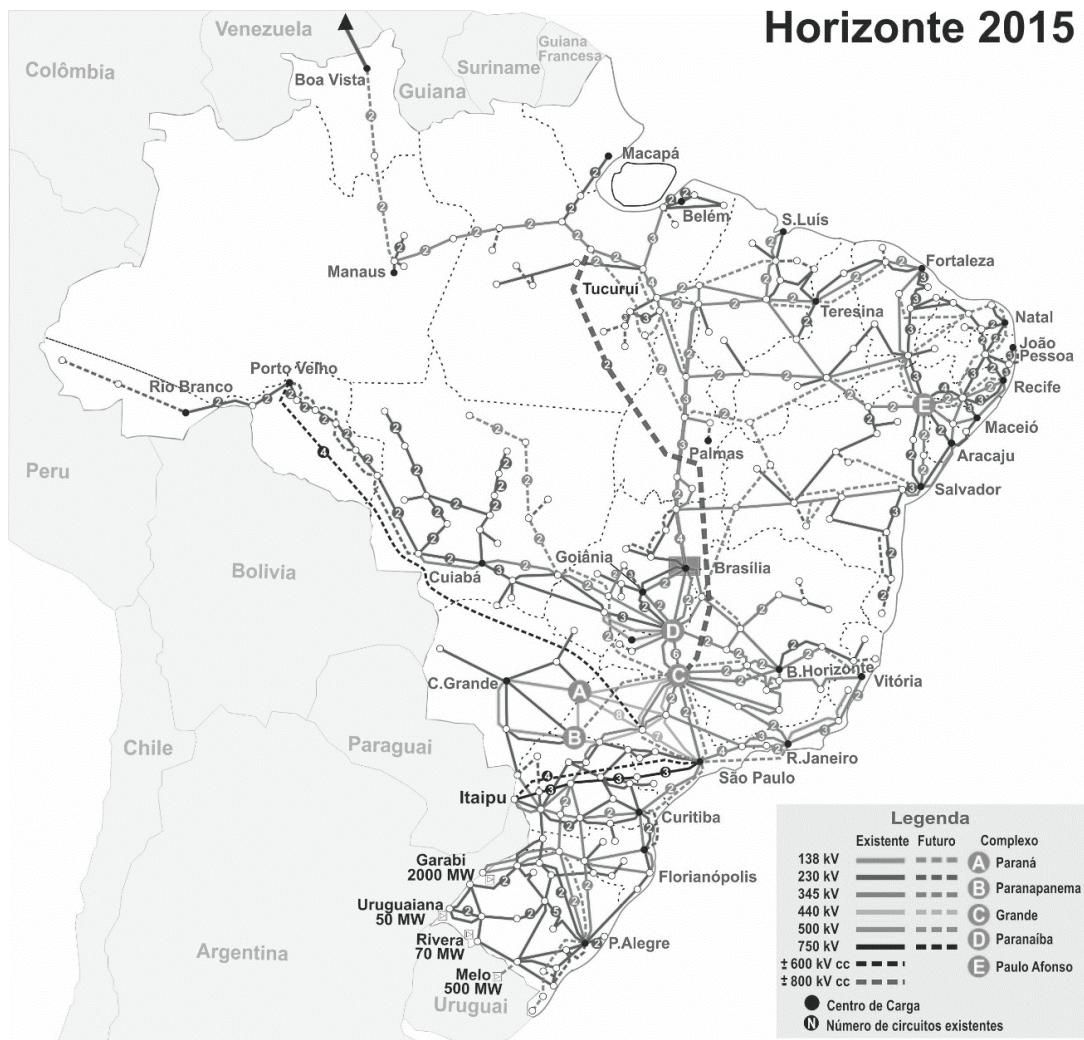


Figure 1. Horizonte 2015 Transmission System.

Source: ONS (2015).



tioning the great connections that aim to the flow of the Amazonian electric generation (HPP Belo Monte and the Teles Pires and Tapajós basins), as well as the planned lines for the flow of wind production in the South and Northeast regions. In Figure 1, below, it is possible to visualize the Brazilian electric power transmission system.

The evaluation contemplates the spatial distribution of the interconnections expected to come into operation in the ten-year horizon and their incidence in the biomes, the type of land use and occupation (native vegetation, pasture and farming, agriculture, forestry, urban areas, and others) and in areas with socio-environmental restrictions (Conservation Units and Indigenous Lands), as well as rural settlements and Priority Areas for Biodiversity Conservation (APCB, acronym in Portuguese).

The socio-environmental analysis was carried out based on the area occupied by the administrative easements of the lines, whose width varies according to the line voltage and the number of circuits. The total area occupied by the strips is 5,582 km², of which 2,567 km² (46%) are areas with native vegetation, of which 46% are located in the Cerrado, 20% in the Amazon, 20% in the Caatinga, 12% in the Atlantic Forest, and 2% in the Pampas. Approximately 41% of the area of the easement ranges through pasture and agriculture (2,289 km²). The remaining 13% cross areas of agriculture and other uses, including urban occupation (726 km²). The distribution of the land use of the areas occupied by the bands of administrative easement can be verified in Figure 2.

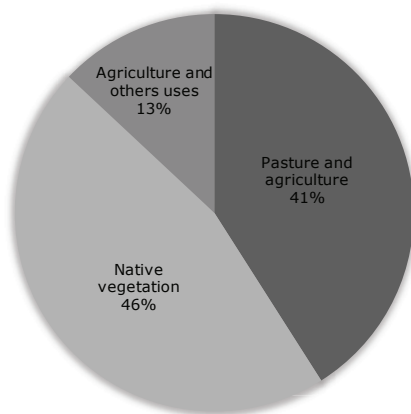


Figure 2. Land use in the areas of administrative easement of the Brazilian transmission system.

Source: Prepared from EPE (2016).

About 11% of the area occupied by the bonded areas, or the equivalent of 635.4 km², affects areas with some type of socio-environmental restriction, among which are the settlements of the National Institute of Colonization and Agrarian Reform (INCRA, acronym in Portuguese) (57 %) and Conservation Unit (UC, acronym in Portuguese) for sustain-

able use (39%) (PDE 2024). Of the considered set of lines, only one, the 500kV Manaus-Boa Vista LT (currently under construction) crosses the Indigenous Land area, TI Waimiri Atoari (Trans Norte Energia S.A., 2014); another 16 are less than 8 km of this type of Territory in the Legal Amazon or less than 5 km in the other regions, which implies in carrying out specific studies on the indigenous community affected, according to Interministerial Ordinance No. 60/2015 (Brasil, 2015c).

As with the analysis for the generation of electricity, this evaluation does not address possible changes in the planning of new transmission projects. On the contrary, it only fulfills the role of reporting on the projects already included in the 10-year horizon, indicating briefly the influence of expansion in the sensitive areas presented. In this context, a new evaluation format that brings strategic management and planning proposals is appropriate, since it increases the construction of the plans.

5. THE INCLUSION OF THE ENVIRONMENTAL VARIABLE IN THE PLANNING OF THE BRAZILIAN ELECTRICAL SECTOR

From the information presented so far, it is possible to perceive a growing direction of the planning instruments of the electric sector towards a more complete environmental assessment. It is noticeable the need to improve the current tools and also to create and diffuse new ones, based on a sustained theoretical basis.

In addition, SEA can also become an excellent instrument for reducing the bottlenecks of the environmental licensing rite of electric sector enterprises. These gaps are explored by Cardoso Jr. et al. (2014), who indicate two main problems to be faced in the process, especially for transmission lines: (i) there is no verification of the environmental feasibility of the project before the concession contract, greatly increasing the risk of implementation of these projects, which, if not environmentally feasible, generate a serious strategic and governmental problem; and (ii) the establishment of unrealistic deadlines by the National Electric Energy Agency (ANEEL, acronym in Portuguese) for undertaking the environmental studies of the projects, which demonstrates the inconsistency among those involved in concession contracts.

In this context, it should be noted that EPE has as competence to obtain the Environmental Preliminary License (LP, acronym in Portuguese) required for the bidding of hydroelectric generation and electric power transmission projects, as defined by Law 10847/2004, which authorizes the creation of the Company. Thus, it is understood that EPE must carry out the studies necessary to guarantee the environmental feasibility of hydroelectric generation and trans-



mission projects before concession contracts.

For hydroelectric projects, this premise is applied, requiring the issuance of the LP before the concession, based on the study and environmental impact report and the issuance of a Statement of Available Water Reserve (DRDH, acronym in Portuguese) (Cardoso Jr. *et al.*, 2014). In this way, investors in the sector have greater security in planning, since a significant part of the environmental licensing process has already been carried out before the concession contract was signed.

For energy transmission projects, the procedure for obtaining the LP occurs in a different way. The document "Guidelines for the Elaboration of Technical Reports on New Basic Network Installations", prepared by EPE, establishes the need to prepare reports to provide investors with information on the feasibility of carrying out the work, including on the socio-environmental theme. However, these reports are simplified and are not sufficient for the issuance of the LP, which is the responsibility of the entrepreneur after the signing of the concession agreement.

Thus, it is clear the contradiction between the competencies assigned to the EPE and the procedures effectively adopted, resulting in planning and investment difficulties encountered by the entrepreneurs in relation to the environmental licensing of transmission systems.

The SEA has the potential to act positively on these difficulties, since a large scale study of the environmental variables is developed and guidelines are defined for the planning of new projects, already in accordance to the sensitivities identified, long before its concession. In this way, it is possible to reduce the risks of undertaking an environmentally unviable project.

SEA is also an interesting possibility to approach the second challenge described by Cardoso Jr. *et al.* (2014), since ANEEL, as a regulatory agency, is one of the main stakeholders in national energy planning, and would undoubtedly be involved in a hypothetical process of SEA, thus being technically able to adequately define deadlines for the environmental studies of enterprises of the electric sector.

According to Santos (2017), the use of effective and integrated environmental planning mechanisms, such as SEA, has the potential to assist the Brazilian electricity sector in regulating the inconsistencies mentioned above. The SEA would provide strategic input in the definition of policies, plans and programs that would legitimize a coherent legal basis between technical and environmental issues of the implementation of an enterprise of the electric sector (Santos, 2017).

5.1 Methodological Proposal for Strategic Environmental Assessment for the Brazilian Electricity Sector

In this chapter, a proposal for a methodology based on the metric defined by Partisan (2012) will be presented in his Guide to Good Practices for Strategic Environmental Assessment to include the environmental variable in the planning of the Brazilian electricity sector. Each step of the method will be commented with the particularities of the Brazilian reality, as well as indicative for a robust and efficient SEA in the country.

First, we need to understand the dynamics between the various agents involved in the SEA process. Initially, the authorities are responsible for promoting, approving and implementing the desired PPP strategies. Usually in the public sector, these authorities are responsible for undertaking the SEA. Then there are the PPP development teams, responsible for developing the strategies to be evaluated by the SEA. In addition, there is the SEA team, with coordinators and specialists who can be from the organization itself (internal) or external.

The strategic model of SEA proposed by Party (2012) is based on intervention on the so-called Critical Decision Factors (CDF). These factors will outline the SEA, as they represent the most relevant points in planning, and all steps are developed from them. This model is structured in three fundamental stages of a cyclical process:

1. Context for SEA and strategic focus;
2. Paths to sustainability and guidelines;
3. Continuous follow-up (monitoring, control and evaluation) and commitment to stakeholders.

Stage 1 - Context for Strategic Environmental Assessment and Strategic Focus

Establishing context and focus is a priority in the SEA development process. Through this step, it is possible to ensure that the evaluation focuses on the most important points of the planning strategy, and that it understands and adapts to the natural, cultural, political and economic reality of the object being evaluated.

At this stage, the objective is to understand the decision problem and its context. This can be done by converging four structures:

1. Problem: includes an initial diagnosis of the main problems and the identification of their origins, which will be object of the intervention of the SEA.



2. Governance: includes the identification of the SEA stakeholder network.
3. Strategic Reference: it represents the influence of other policies and establishes a reference for the evaluation, based on the objectives it outlines.
4. Assessment: includes the CDFs, the evaluation criteria that delimit them and the indicators, which translate the criteria into quantitative or qualitative content. The CDFs determine the structure and focus of the strategic analysis to be developed.

In the Brazilian context of planning of the electric sector, it is in stage 1 that the federal government and its sectoral institutions, such as the Ministry of Mines and Energy (MME), EPE, ANEEL and the National Electric System Operator (ONS, acronym in Portuguese). It is also essential that federal institutions of social, environmental and health management, such as the Brazilian Environmental Institute (IBAMA, acronym in Portuguese), the Chico Mendes Institute for Biodiversity Conservation (ICMBio, acronym in Portuguese), the National Foundation for the Indian (FUNAI, acronym in Portuguese), the Palmares Cultural Foundation (FCP, acronym in Portuguese), the Institute of National Historical and Artistic Heritage (IPHAN, acronym in Portuguese), and the Ministry of Health. These agents hold the technical, social and political-economic knowledge that will delimit the scope of the SEA, from the definition of Critical Decision Factors. These institutions will be able to highlight technicians for the formation of a Multidisciplinary Working Group, which will discuss the main demands and their limiting factors.

Once the priority CDFs have been defined, their individual assessment criteria and indicators are developed and then an initial scope proposal is developed. After the elaboration of this report, its validation is necessary by the political instances that will support the development of the planning and its articulation in the country. With the validation of the stakeholders, the scope of the SEA is under development.

Stage 2 - Pathways to Sustainability and Guidelines

The so-called “paths to sustainability” are, in fact, strategic development options, which help planning ahead for your vision of the future. This future is an idealized image, associated with different strategic and political objectives, which also considers different development scenarios.

This stage requires a very strong relationship between policy and planning teams. The role of SEA is to provide environmentally-friendly development options and sustainability, and to promote stakeholder engagement makes this process more efficient and appropriate.

In addition, it may be necessary to carry out analyzes of opportunities and risks, several times and at different times. The application of the different scenarios developed within the framework of the SEA adds several possibilities, for which it may be useful to assess potential opportunities and risks not initially identified. The SEA team should be prepared to contribute to this strategic discussion, bringing relevant perspectives at key moments in the decision-making process.

Strategic evaluation should analyze the options presented in order to select a direction for planning. In these cases, the result of the evaluation of the options, together with its guidelines, is enough to establish this direction, allowing its strategic implementation. Other instruments, such as the EIS, can be used in subsequent steps for a deeper look at the concrete effects of planning.

Finally, the guidelines should contain recommendations for institutional and/or regulatory adaptation, covering the following levels of planning and design, for example; or other policy measures and choices that may be relevant. Strategic development in other fora should be validated in terms of its policy coherence with the objectives, opportunities and risks defined in the SEA. The guidelines should also contain guidelines for planning, management and monitoring, as well as a set of indicators for continuous monitoring of SEA.

A final report containing the results of the evaluation, the selected strategic direction and its guidelines should be elaborated and discussed widely among stakeholders and society, through appropriate communication approaches.

The application of this stage in the planning of the Brazilian electricity sector can occur through the development based on the Critical Decision Factors of strategic options coherent with the objectives initially established. It is suggested the construction of options with interdisciplinary aspects, that is, that are able to cover the socioeconomic, environmental and cultural reality of the country. At this stage, the participation of a more restricted team that has also been present in the previous stage, with the capacity to gather and compile information in order to create reasonable and applicable results (options) is interesting. The selection of the strategic direction based on the most coherent option can also be performed with already known methods of valuation of criteria and prioritization. After this selection, the team will develop the guidelines of the strategic option and forward the results to internal initial validation, for example, of the federal government and its involved instances. Thus, the decision will be communicated to the society for public consultation. This last stage is essential for the construction of a participatory SEA in which the various sectors of society are involved and active.



Stage 3 or Continuous Stage

This third step is in fact a set of processes to be carried out continuously within the framework of the SEA, connecting it to strategic decision-making processes during its implementation, as well as to new processes for drawing up policies, plans or programs. Follow-up with monitoring, evaluation and communication should become routine in strategic environmental assessments, systematically connecting the processes of developing new policies and continuously involving its stakeholders.

In addition, the importance of SEA as a tool for public participation is highlighted, allowing an increase in transparency in decision-making processes involving stakeholders in strategic actions. With the actions of engagement, SEA's contributions as an instrument of awareness of the decision-makers is clear (Santos et Teixeira, 2017).

As for the Brazilian development context, it is possible to clearly identify the extent of the challenge of sustaining long-term political and decision-making processes. In order to initiate and sustain the SEA over time, it is suggested that an independent institution be created that could be a bridge between the various actors of Brazil's development policies. This institution can operate as a development agency, aiming to gather technical, political and socioeconomic contents, and to support the process of creation and implementation of policies, plans, and programs, and it is responsible for the continuous implementation of the SEA for several sectors, not restricted to the electricity, but also transport, education, and sanitation, for example. The specific characteristics of this agency can be built from the adaptation of successful cases observed in other countries, especially with regard to the definition of responsibilities among the different public and private agents of the country. Figure 3 below shows, in a didactic way, the flowchart for the preparation of the SEA, compiled after the presentation of the previous stages.

Figure 3 identifies the "building blocks", representing the different activities and steps to be performed for the operationalization of the SEA in the three stages. The arrows indicate the different routes and possibilities available for the realization and validation of SEA in multiple contexts. From the flowchart, it is possible to visualize the characteristics that should be guaranteed in the SEA, especially the technical, procedural, institutional, and communication components. In addition, their integration, evaluation and validation functions should be ensured. The process of designing and maintaining the SEA is continuous and dynamic, and its different stages are closely related to each other, as can be seen throughout this topic.

Based on the observations developed throughout this chapter, it is noticeable the great need to develop research to efficiently apply SEA in Brazil. Noble et Nwanekezie (2017) highlight a growing demand for methods and tools to facilitate the application of SEA and ensure its influence on decision-making processes by developing new analytical methods.

6. CONCLUSIONS AND RECOMMENDATIONS

From the moment that the study of the elaboration of the current sectoral policies and Brazilian structural planning begins, one notices the size of the challenge to be faced. In addition to the continental dimensions of the country, the lack of perception and education for life in society, due to the sustainable development of the nation, is one of the main obstacles to be faced when it comes to structural changes and large-scale planning. These aspects reflect on all faces of Brazilian social, economic, political and environmental reality, and it is up to the public initiative to develop new forms of evolution towards sustainability.

This work sought to analyze the SEA in a way adapted to the socioeconomic reality of the country, specifically with respect to the current planning model of the electric sector. The main stages of construction of the SEA were discussed and recommendations and observations were made regarding the accomplishment of these stages for the planning of the Brazilian electric sector.

For the application of these methodologies, it is necessary to overcome some obstacles characteristic of the Brazilian reality. Lack of continuity in policy management is among the major challenges identified, as well as assessment gaps already observed and indicated in plans currently built, such as PDE. In addition, it should also be noted the gaps that occurred during the process of environmental licensing of large enterprises, usually motivated by lack of definition of strategic PPPs for national development.

Maintaining a holistic and strategic environmental assessment, such as SEA, brings with it an enormous potential to support the decision-making processes that take place during the construction of policies, plans and sectoral programs, besides supplying the gaps observed by current development models through comprehensive and multidisciplinary studies. Characterized by the continuity and dynamism of its environmental studies, SEA can also fill the bottlenecks of the licensing process by reducing the need for prospecting of primary data for each enterprise, since a technical-scientific basis will be available for the environmental aspects of the strategic planning in which the enterprise is inserted. Thus, the SEA is an opportunity for the insertion of the environmental and social variable in Brazil's structural scale planning.

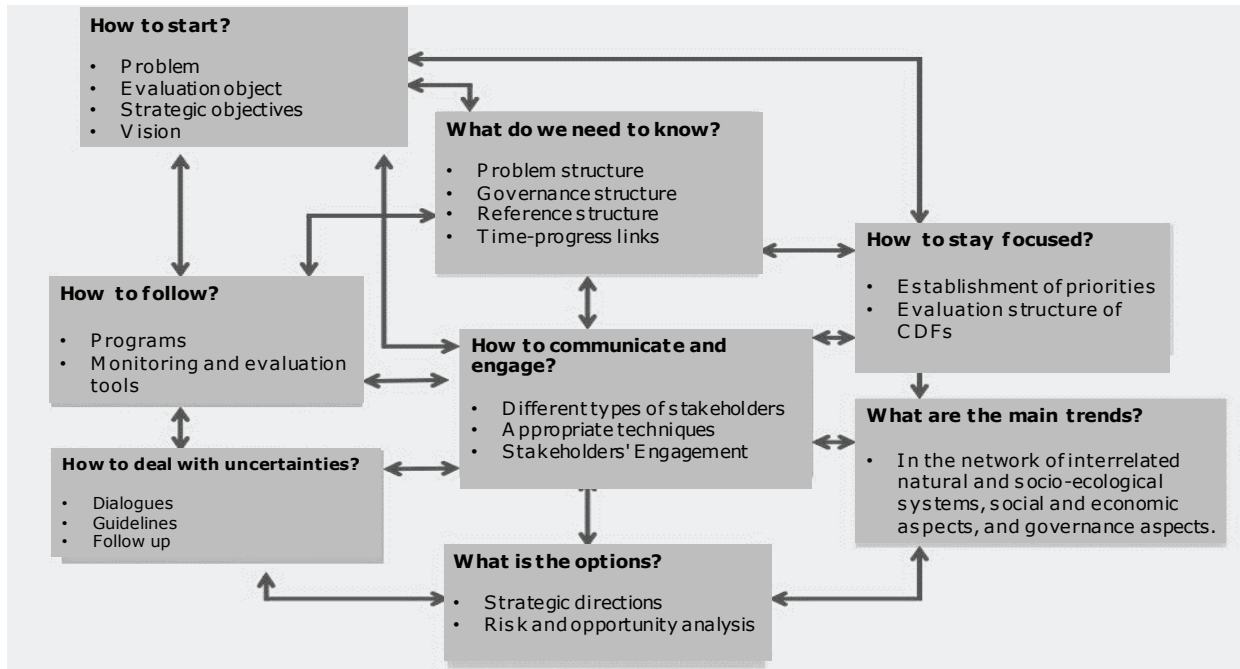


Figure 3. Building blocks. Multiple itineraries to carry out SEA (Adapted)

Source: Strategic Environmental Assessment Better Practice Guide (Partidário, 2012).

Undoubtedly, there is still room for an in-depth development of a Brazilian model for SEA, especially regarding the definition of responsibilities and the political independence of the SEA coordination team. Therefore, the articulation of several public, private and society bodies is necessary for the current model to be recreated and for it to become a new format for coherent and sustainable development.

REFERENCES

- Baresi, U.; Vella, K. J.; Sipe, N. G. (2017), "Bridging the divide between theory and guidance in strategic environmental assessment: A path for Italian regions", *Environmental Impact Assessment Review*, Vol. 62, pp. 14-24.
- Bastos, D. N. (2010), *A Avaliação Ambiental Estratégica como Subsídio para o Planejamento do Setor de Turismo no Brasil: Uma Análise do Caso da Costa Norte*. Rio de Janeiro, RJ.
- Bérubé, G. G.; Cusson, C. (2002), "The environmental legal and regulatory frameworks: assessing fairness and efficiency", *Energy Policy*, Vol. 30, No. 14, pp. 1291-1298.
- Brasil (2004), Lei nº 10.847, de 15 de março de 2004, autoriza a criação da Empresa de Pesquisa Energética – EPE e dá outras providências, *Diário Oficial da União*, 16 mar. 2004.
- Brasil, Ministério de Minas e Energia - MME, Empresa de Pesquisa Energética - EPE (2005), *Diretrizes para Elaboração dos Relatórios Técnicos Referentes às Novas Instalações da Rede Básica*, MME/EPE, Brasília.
- Brasil, Ministério de Minas e Energia - MME, Empresa de Pesquisa Energética - EPE (2015a), *Plano Decenal de Expansão de Energia 2024*, MME/EPE, Brasília.
- Brasil, Ministério de Minas e Energia - MME, Empresa de Pesquisa Energética - EPE (2015b), *Programa de Expansão da Transmissão/Plano de Expansão de Longo Prazo (PET/PELP)*, MME/EPE, Brasília.
- Brasil, Ministério do Meio Ambiente - MMA (2002), *Avaliação Ambiental Estratégica*, MMA/SQA, Brasília.
- Brasil, Ministério do Meio Ambiente - MMA (2015c), Portaria Interministerial nº 60, de 24 de março de 2015, estabelece procedimentos administrativos que disciplinam a atuação dos órgãos e entidades da administração pública federal em processos de licenciamento ambiental de competência do Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis - Ibama, *Diário Oficial da União*, 25 de mar. 2015.
- Brown, L.; Théritel, R. (2000), "Principles to guide the development of strategic environmental assessment methodology", *Impact Assessment and Project Appraisal*, Vol. 18, No. 3, pp. 183-189.
- Cardoso Jr., R. A. F.; Magrini, A.; Hora, A. F. (2014), "Environmental Licensing Process of Power Transmission in Brazil update analysis: Case study of the Madeira Transmission System", *Energy Policy*, Vol. 67, pp. 281-289.
- Jay, S. (2010), "Strategic environmental assessment for energy production", *Energy Policy*, Vol. 38, No. 7, pp. 3489-3497.



- Noble, B.; Nwanekezie, K. (2017), "Conceptualizing strategic environmental assessment: Principles, approaches and research directions", *Environmental Impact Assessment Review*, Vol. 62, pp. 165-173.
- Oberling, D. F. (2008), *Avaliação Ambiental Estratégica da Expansão de Etanol no Brasil: Uma Proposta Metodológica e sua Aplicação Preliminar*, Rio de Janeiro, RJ.
- Parlamento Europeu, Conselho da União Europeia (2001), Directiva 2001/42/CE, de 27 de junho de 2001, relativa à avaliação dos efeitos de determinados planos e programas no ambiente, *Jornal Oficial* nº L197, 21 jul. 2001, pp. 0030-0037.
- Partidário, M. R. (2012), *Guia de boas práticas para Avaliação Ambiental Estratégica - orientações metodológicas para um pensamento estratégico em AAE*, Agência Portuguesa do Ambiente, Lisboa.
- Pellin, A.; Lemos, C. C.; Tachard, A. (2011), "Avaliação Ambiental Estratégica no Brasil: considerações a respeito do papel das agências multilaterais de desenvolvimento", *Engenharia Sanitária e Ambiental*, Vol. 16, No. 1, pp. 27-36.
- Santos, A. W. (2017), *O licenciamento ambiental e o planejamento integrado da geração e transmissão de energia elétrica: limitações e desafios para o Brasil*, Dissertação de Mestrado, Pontifícia Universidade Católica do Rio de Janeiro, Rio de Janeiro, RJ.
- Santos, R. F.; Teixeira, L. P. (2017), "O Sistema de Gerenciamento da Amazônia Azul como um Instrumento de Contribuição para a Avaliação Ambiental Estratégica de Planos, Programas e Projetos em Setores Governamentais no Brasil", *Sistemas & Gestão*, Vol. 12, No. 3, pp. 316-327.
- Santos, S. M.; Souza, M. P. (2011), "Análise das contribuições potenciais da Avaliação Ambiental Estratégica ao Plano Energético Brasileiro", *Engenharia Sanitária Ambiental*, Vol. 16, No. 4, pp. 369-378.
- Trans Norte Energia S.A. (2014), *Relatório de Impacto Ambiental/RIMA - Linha de Transmissão 500 kV Manaus - Boa Vista e Subestações Associadas*.

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