CHAPTER 10

REGULATION, COMPLIANCE AND BEST INSTITUTIONAL PRACTICES FOR CO_2 ONSHORE AND OFFSHORE GEOLOGICAL STORAGE: SANTOS AND PARANÁ SEDIMENTARY BASINS CASES

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ABSTRACT

This chapter addresses the regulatory and institutional framework for geological carbon storage in Brazil, especially in the Santos and Paraná Basins, in terms of important territorial peculiarities for the regulatory context. Thus, it addresses the general perspectives for incorporating international normative criteria and the pertinence of internal norms to CCS technologies, showing the current internal legal and regulatory issues, using them as a locus of application. To this end, the deductive analytical method will be adopted for research elaboration, combined with the systematic and teleological approach for legal hermeneutics and the comparative method for the exposition of best practices. The analysis of the basins shows that they require long-term storage and monitoring planning. In this sense, the research techniques will be documentary and theoretical analysis and institutional composition.

Keywords: Geological Storage of CO_2, CCS (Carbon Capture and Storage), CCS Regulation, Oil and Gas depleted fields, Santos Basin.

1. INTRODUCTION

Legal and Regulatory aspects involving safety, control, and licensing for CO_2 transport and storage are combined with other criteria for the characterization and assessing potential carbon geological storage complexes. The surrounding areas involving depleted oil and gas fields are also essential factors for implementing CCS (Carbon Capture and Storage) technologies in territories where they are not yet consolidated, as in Brazil. First, it is worth distinguishing between legal and regulatory. Therefore, the text aims to present both legal and regulatory aspects and good practices related to the geological storage of carbon dioxide. Legal is that which, in a broad sense, not only expresses what is authorized or enabled by law but also everything that can be done or everything that complies with use and custom is understood by jurisprudence. Regulatory is a term that refers to a set of rules, laws and guidelines that regulate the functioning of the sectors in which agents provide utility services.

Carbon sequestration can be accomplished through natural means, through photosynthesis, carbon removal from the atmosphere, or by artificial means, through Carbon Capture and Storage Technologies. Once captured, the carbon dioxide is compressed and transported to suitable reservoirs (IEA, 2018). Carbon dioxide can be withdrawn from the atmosphere to the hydrosphere, through ocean storage, also through the biosphere, with storage by biomass, finally, through the lithosphere, with the geological repository. The geological storage of CO_2 can be done in the national territory depending on economic, technological and logistic vectors (Costa e Musarra, 2020).

Brazilian Post-2015 Development Agenda to the SDGs, called "Guiding Elements of the Brazilian Position", established the plan intended by 2030. Concerning energy, the intention is to promote an efficient, safe and quality supply that contributes to economic growth, poverty reduction, and social inclusion. It also includes increasing capacity building, promoting innovation and the transfer of modern energy technologies, developing quality, reliable, sustainable and resilient energy infrastructure to support economic development and human well-being, focusing on equitable and affordable access for all (MRE, 2014).

Promoting treatment of climate change by including it in related objectives and goals is pertinent to atmospheric CO_2 reduction and climate change mitigation. These objectives should: emphasise that combating climate change is essential for promoting sustainable development and eradicating poverty; emphasise the centrality of the principles and provisions of the United Nations Framework

Convention on Climate Change (UNFCCC), including the principle of common but differentiated responsibilities. They should also promote the deployment of clean energy, including low or zero-emission technologies, and support the transfer of technology to low-carbon infrastructure and industry solutions (MRE, 2014).

Considering Sustainable developments goals (SDG) 7, 13, and 14 as well as the Paris Agreement (United Nations Organization, 2015), to avoid climate change, carbon capture and storage activities can be an instrument to mitigate the anthropogenic emission of greenhouse gases (Costa and Musarra, 2019; Costa, 2019; Costa and Ladeira, 2019). As soft law, the literature considers the Paris Agreement for its applicability once each contracting state incorporates it into its internal regulations (Bastian, 2016).

However, geological storage may result in ecological damage, such as CO_2 leakage, making risk assessment and specific regulation necessary (Mikunda and Dixon, 2017). So far, there is no specific legislation for those activities in Brazil. Still, the entire national legal system may be triggered through systematic interpretation to make up a framework for CCS in Brazil (Morbach and Costa, 2020). The study of these factors applied to onshore and offshore carbon geological storage is justified by the need to adapt the national regulatory system and internationally adopted standards to the local Brazilian context for potential storage sites.

2. METHODOLOGY

The research-based method is monographic with a case study, bibliographic, documental (official statistical data) and normative research techniques, and analogy supported by Brazilian and international legislation. Socio-political criteria, norms and previous judicial and administrative decisions directed to other activities are considered in analogy to possible concrete cases for the definition of potential sites in Brazil (in Decree-Law Nº 4657 of 1942, Law of Introduction to Brazilian Law Norms). Therefore, in the absence of specific legislation dedicated to carbon storage, the Law institutions decide the case according to the law's analogy, customs, and general principles. The analysis of the regulatory compliance based on legal hermeneutics and analogy of norms considers, in principle: Federal Constitution of 1988; ANP Resolution 37/2001, CONAMA Resolution No. 23/1994, Federal Decree No. 8437, MMA Ordinance 422/2011 (which establishes procedures for federal environmental licensing of activities and projects of exploration and production of oil and natural gas in the marine environment (offshore) and onshore in the land-sea transition zone), Directive 2009/31/EC of the European Parliament and the Council, 23/04/09, and other norms related to the matter, directly or indirectly.

3. HEALTH, SAFETY AND ENVIRONMENTAL ISSUES

Various countries and organisations published different guidelines for implementing carbon storage projects in the environmental legislation debate; however, according to Tavakkolaghae and Meneghini (2019), policies are generally provided for specific conditions. Typically, these rules do not apply to different areas. Practices are usually affected by the laws of certain countries. Environmental regulations involving the project's location are considered for enforcement in the concerned states. Instructions for storage are limited and do not cover all environmental challenges. The literature on risk mitigation shows that some of the targeted objectives are: Ensuring the efficiency of the CCS project; Protecting the health of the workforce and those who live in the vicinity of the project; Limiting degradation of ecosystems in CCS sites; Elaborating comprehensive and responsive regulatory structure (Tavakkolaghae and Meneghini, 2019; Costa and Musarra, 2020; Costa et al., 2018). In this way, the purposes of monitoring are to assess the following concerning CCS: verify injected and stored quantities of CO_2; record the thermodynamic properties of stored CO_2; ensure the acceptable range of pressure inside the underground reservoir; detect and measure any leakage in the storage on early steps; monitoring the efficiency of the remediation; tracking the operated and shut-in wells for leakage (Nunes and Costa, 2020). This can be achieved by active and passive seismic monitoring, including gravimetry methods, temperature logs, geoelectrical approaches; microbiology; and geochemical sampling (Tavakkolaghae and Romano, 2019).

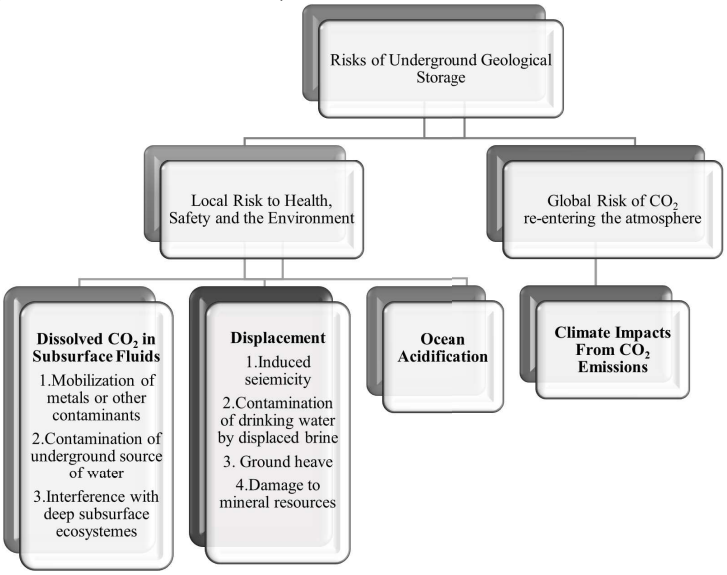

Figure 1: The schematic of risk chart of underground storage (Tavakkolaghae and Meneghini, 2019).

CCS outlines the risk of water contamination due to leakage of an injection well (IPCC, 2005; Solomon, 2006). Undetected geologic faults allow the CO_2 to migrate into water zones, elevate CO_2 levels, and contaminate groundwater and underground aquifers near the leakage. Contamination has a secondary impact on aquatic plant life and any other life forms that use the groundwater or aquifer as a source of drinking water. It could be lethal to plant and animal life, making remedial measures and intercepting CO_2 leakage essential to avoid aquifer contamination (Sawey, 2008; Tavakkolaghae and Meneghini, 2019).

4. REGULATORY FRAMEWORK

From a normative point of view, Brazilian law 9.478 / 97 aims to protect the environment, promote energy conservation, and propose measures to mitigate emissions of greenhouse gases and pollutants in the energy and transportation sectors. Law 9478/97 and its articles present the scope of the theme in Brazil still to be discussed and examined, demonstrating that, since its creation, the National Energy Policy has been connected to strategic topics such as CO_2 Capture and Storage.

Also worthy of mention is the edition of Law 12,187, of December 29, 2009, which establishes the National Policy on Climate Change - PNMC (MMA, 2018).

It is essential to understand the relevance of Law 12,187 of 2009 in the historical context of the government of ex-president Luís Inácio Lula da Silva. At the time, Brazil made commitments under the United Nations Framework Convention on Climate Change, the Kyoto Protocol and other documents on climate change, and the country became a signatory.

Thus, in art 5 stands out the promotion and development of scientific and technological research and the diffusion of technologies, processes, and practices aimed at mitigating climate change by reducing emissions by anthropogenic sources and strengthening anthropogenic emission removals through gas sinks.

The decree that regulates the policy is currently 9578/2018 that provides action plans for prevention, mitigation and adaptation to climate change .[2] Industrial

[2] Art. 17. For the purposes of the provisions of this Decree, the following action plans for the prevention and control of deforestation in biomes and sectorial plans for mitigation and adaptation to climate change are considered:

I - Action Plan for Prevention and Control of Deforestation in the Legal Amazon - PPCDAm;

II - Action Plan for Prevention and Control of Deforestation and Burning in the Cerrado - PPCerrado;

III - Ten-Year Energy Expansion Plan - PDE;

emissions were not planned, except for those related to the steel industry. However, paragraphs 2 and 4 of article 19 of the decree announce the possibility of instituting new mitigation plans and technologies, especially regarding those established by the United Nations Convention, as in the case of CCS .[3]

In Brazil, the main environmental policies are defined in the National Environmental Policy Law (Federal Law 6,938 of 1981) and the various resolutions of the National Environment Council (CONAMA). For example, Resolution 01 of 1986, which requires an assessment and an environmental impact report before granting environmental licensing by the environmental regulatory agency or Resolution 420 of 2009, sets out rules and tools for managing contaminated areas. Although generic, the Normative Instruction IBAMA 12/2010 can be considered an important milestone for institutionalising CCS activities in Brazil. Its art 2nd determines that the IBAMA council evaluates, in the process of licensing activities capable of emitting greenhouse gases, measures proposed by the entrepreneur to mitigate these environmental impacts in compliance with the commitments assumed by Brazil in the United Nations Framework Convention on Climate Change.

Adopting the National Policy on Climate Change, it is believed that it would be more appropriate to adopt a structure in which the structures provided there are used to head the CCS technology technologies in Brazil, always owing to the Ministry of the Environment. Ambiente act as a consultant and regulator of environmental issues. It means that the assessment of mitigation measures constitutes merit in the licensing of activities. To this end, Article 3 of the Normative

IV - Sectoral Plan for Mitigation and Adaptation to Climate Change for the Consolidation of a Low Carbon Economy in Agriculture - ABC Plan; and

V - Sectorial Plan for the Reduction of Emissions from the Steel Industry.

[3] Art. 19. To achieve the voluntary national commitment referred to in art. 12 of Law No. 12,187, of 2009, actions will be implemented that aim to reduce between 1,168 million ton CO2eq and 1,259 million tonCO2eq of the total emissions estimated in art. 18. (. . .)

§ 1 In order to comply with the provision in the caput, the following actions contained in the plans referred to in art. 17

§ 2 Other mitigation actions that contribute to the achievement of the voluntary national commitment provided for in the caput will be defined in the plans referred to in art. 6th and art. 11 of Law No. 12,187, of 2009, and in other government plans and programs.

§ 3 The actions referred to in this article will be implemented in a coordinated and cooperative manner by government agencies and should be reviewed and adjusted, whenever necessary, to achieve the intended final objectives, subject to the provisions of § 1 and § 2 of art . 3rd.

§ 4 The actions referred to in this article may be implemented even through the clean development mechanism or other mechanisms under the United Nations Framework Convention on Climate Change, promulgated by Decree No. 2,652, of July 1, 1998.

Instruction required that the Term of Reference issued by Ibama should guide Environmental Impact Studies for the licensing of projects capable of emitting greenhouse gases and include measures to mitigate or compensate for such impacts (Costa et al., 2018b).

During the eventual implementation process, the ideal is that civil society's participation is encouraged to build legitimacy in promoting CCS activities and that this participation is deliberative. According to the International Energy Agency (IEA, 2016), legal and regulatory frameworks are essential to ensure that the geological storage of CO_2 is safe and effective and that the storage locations and accompanying risks are managed.

With this highlight, the need to follow up with the actions of actors interested in carrying out, monitoring, approving and regulating CCS activities in Brazil is emphasised to allow the manifestation of these technologies as soon as possible to mitigate climate change.

During geological storage, the pore spaces are filled with carbon dioxide gas while displacing the original gas for permanent trapping. The implementation of CCS requires infrastructure to transport and permanently store CO_2, which requires significant capital investment, especially for projects storing CO_2 in offshore storage reservoirs (TOWNSEND et al., 2020). The literature points out that storage at the international level has typically occurred in the following structures: (i) saline aquifers, (ii) depleted reservoirs, and (iii) fields still in production.

However, the choice of geological formations should be based on the absence of a significant risk of leakage or of significant environmental or health hazards (Art. 4 Directive 2009/31/EC). Fields still in production have questionable 'storage' capacity, and the CO_2 stream classified for this purpose is best referred to as 'use' (Carpenter; Koperna, 2014) for enhanced oil and gas recovery.

5. PROVISIONS FOR THE SANTOS BASIN

Studies based on literature review and data of the rock formations of the Santos Basin and criteria pointed out as desirable in a CO_2 reservoir compared to the available information of the rocks point out that storage in the depleted fields of this basin is geologically favourable (CIOTTA, 2019). The choice of these formations is made concomitantly with the mapping of areas and their situation as producers.

However, the feasibility of this storage implies the consideration of the legal issues involving the use of depleted fields for CO_2 storage and criteria recommended

in international legislation. There are existing related Brazilian standards and their adequacy to concrete cases, considering possible legal consequences and application in fields located in potential sites, such as those of this nature in the Santos basin.

Depleted fields are oil or gas production fields that are at the end of their lives. They provide opportunities to reuse existing oil and gas infrastructure, repurposing it for CO_2 transport and storage, providing benefits such as reducing the cost of building transportation and storage infrastructure and potentially reducing permitting time (Townsend et al., 2020). Reusing infrastructure can also defer the costs and environmental impact of decommissioning, freeing up resources that can be invested in other value-creating activities. According to Townsend et al. (2020), worldwide decommissioning expenditures are projected to amount to $85 billion between 2019 and 2028, with the most significant component of costs associated with oil wells decommissioning. Thus, oil and gas wells may be suitable for CO_2 injection.

However, the same authors point out that the design standards and operational criteria for oil and gas production wells differ from CO_2 injection, meaning that remedial actions will be required to modify well equipment. Hence, operators need to weigh the additional repair work costs and any other risks associated with using existing wells against the time and cost of drilling a new well. Currently, well reuse is being considered for the Porthos project in Rotterdam (Townsend et al., 2020).

Based on the analogy concerning Oil and Gas production, valid for being the storage of gas (CH_4) admittedly more harmful to the environment (ABNT, 2007) than CO_2, the operation and buffering of storage facilities would follow the existing Brazilian rules, such as ANP Resolution 37/2001, CONAMA Resolution No. 23/1994, Federal Decree No. 8437 and MMA Ordinance 422/2011.

There are international criteria for characterization and assessment of potential areas and surrounding areas of storage complexes (Directive 2009/31/EC of the European Parliament and Council, 23/04/09, which consider three phases: 1. data collection; 2. construction of three-dimensional static geological model; 3. characterization of the dynamic storage behaviour, sensitivity characterization, risk assessment. This regulatory benchmark will serve as a basis for future CCS operations in depleted fields in the Santos Basin.

The choice of the Santos Basin as the base for a CCS project may be explained by the basin's proximity to the region with the highest greenhouse gas emissions in Brazil (Southeast Region), an area of significant economic development. This

financial interest also results in greater availability of local companies to operate in this type of project, whose local CO_2 emissions can also be directed to local storage projects.

The Santos Basin fields are recent ventures, allowing for a storage project in depleted fields with long-term planning; however, with an important field that is approaching the desired stage (decommissioning phase), the Merluza Field. Ketzer et al. (2007) proposed that the Santos Basin has a total storage capacity of 167 $MtCO_2$ in oil fields. In 2016, Brazil committed to reducing greenhouse gas emissions by 37% below 2005 levels by 2025 (MMA, 2018, p. 03). In Brazil, in 2016, the exploration and use of oil, natural gas, or derivatives generated 296 million tonnes of CO_2 (SEEG, 2018), so the Santos basin could store more than half the sector's amount in annual emissions.

Geologically, the viability of the formations is, at first, intrinsically associated with the use of oil and gas depleted fields. Adapting previously available structures, e. g., depleted reservoirs and oil and gas pipelines to implement CO_2 storage, come with economic importance; it saves time and costs. According to Article 5, item II of the Federal Constitution, "no one will be forced to do or not to do something except by force of law". It is equivalent to saying that individuals have ample freedom to do whatever they want, provided it is not an act, behaviour, or activity prohibited by law. Strictly speaking, CCS activities are not prohibited by law; on the contrary, they fit the second-order as mitigation technologies, encouraged by the Brazilian National Policy on Climate Change (PNMC) Law No. 12.187/09).

However, as it is an activity with potential interference with the environment, it must respect rules provided for in this area, such as the National Environmental Policy (Federal Law No. 6.938/81), Federal Law No. 6.514/08, which includes violations and administrative penalties to the environment; Federal Law No. 9.605/98 (Environmental Crimes Law); Federal Law No. 9.966/00 (prohibits the discharge of hazardous or harmful substances in national waters (according to the classification of substances); Complementary Law No. 140/11, which provide for the distribution of licensing powers among the federative entities.

The carbon dioxide stream has not yet been classified as a hazardous substance in our legislation, however, if so classified, activities related thereto are subject to the collection of the Environmental Control and Inspection Fee - TCFA, whose taxable event is the regular exercise of the police power vested in the Brazilian Institute of the Environment and Renewable Natural Resources - IBAMA to control and inspect potentially polluting activities and users of natural resources (Federal Law no. 6.938/81), and, by the same law, it is understood as degradation

of the environmental quality, the adverse change of the characteristics of the environment and as pollution that which harms the health, safety and welfare of the population, creates adverse conditions to social and economic activities, adversely affects the biota or affects the aesthetic or sanitary conditions of the environment, or, still, the release of materials or energy in disagreement with the established environmental standards, considering the polluter, the individual or legal entity, of public or private law, directly or indirectly responsible for an activity that causes environmental degradation.

Within the chain of activities, the individuals involved are liable, without prejudice, to the penalties defined by federal, state, and municipal legislation for failure to comply with the measures necessary to preserve or correct the inconveniences and damages caused by the degradation of the environmental quality. Regardless of fault, the polluter is obliged to indemnify or repair the damage caused to the environment and third parties affected by its activity (article 14, §1).

CO_2 currents in the offshore environment have not yet established environmental standards, and, as this occurs, they must be respected. And all damages eventually resulting from the activity must be repaired by our legislation, regardless of possession, ownership, or time of participation of the subjects in activities considered degrading or polluting to the environment.

Internationally, however, it has been adopted for CCS some standards for liability for damages caused to third parties, ranging from 15 to 60 years, in most jurisdictions, followed by certification proving the safety of the storage for subsequent transfer of responsibility to state entities (MUSARRA et al., 2019). At the current stage of the Brazilian regulatory framework, this possibility of transferring responsibilities is not yet a reality.

Since 2007, the international regulatory framework has evolved notably in Europe with the European CO_2 Storage Directive. The EC Storage Directive deals with monitoring to assess whether the injected CO_2 is behaving as expected, whether any migration or leakage occurs and whether this damages the environment or human health. OSPAR (named after the original Oslo and Paris conventions ("OS" for Oslo and "PAR" for Paris) focuses primarily on detecting and preventing leakage and emissions and, therefore, identifies several objectives for a monitoring program

The absence of standards is not a reason for the inertia of the activity operators since the Law of "Introduction to Brazilian Law" allows court decisions to be resolved based on analogy. Thus, considering the Brazilian normative concerning the exploration of Oil and Gas (normative attributions granted to the ANP - NATIONAL

AGENCY OF PETROLEUM, NATURAL GAS AND BIOFUELS by force of Law no. 9.478 of 1997), and more specifically, of storage of CH_4, already existing, we may conclude that, if provided for in exploration contracts as additives (and, knowing that depleted fields already have environmental impact studies, approved development plans and previous licensing), it is possible to carry out Simplified Licensing (Ministry of the Environment Ordinance 422/2011) for the specific requirements of the inspection agency. And, in the case of fields located in the Santos Basin, storage, as an offshore activity, would have the competence assigned to IBAMA (according to Supplementary Law 140/11), subjecting the activities to the resolutions of its Council (CONAMA).

Regarding the Underground Storage of Natural Gas (ESGN), the internal regulations state that there must be a Development Plan, which must include in the forecast of Underground Storage of Natural Gas (ESGN) aspects (ANP Resolution 17/2015) as a description of the Reservoirs and Storage Processes.

These parameters are associated with the criteria established in Directive 2009/31/EC of the European Union, especially regarding the risk assessment, which should include the following: characterization of the leakage potential of the storage complex, determined through dynamic modelling and security characterization described above.

Considering its location, capacity, concession regime, licensing, and environmental impact studies already carried out, depleted fields in the Santos Basin present conditions for the short-term storage of CO_2 in Brazil. The knowledge of national and international standards can help the eventual CCS operator meet the most relevant safety and other legal requirements for applying CCS technology according to local and national standards.

6. PROVISIONS FOR THE PARANÁ BASIN

As Pelissari (2021) pointed out, on the geological aspect, there are main geological formations that present potential for CO_2 storage in the basin. They include the coal, saline aquifer and sandstones of the Rio Bonito Formation and Itarare Group, black shales of the Irati and Ponta Grossa Formations, and the Sierra General Formation basalts. However, the associated risks must be foreseen and duly mitigated because, in addition to the national regulatory framework, there are specific adjustments regarding the state of Paraná. There are specific adjustments concerning the Paraná State that should be addressed.

In 2019 (Law 19878 - July 3, 2019), the state of Paraná issued a controversial law that prohibits the exploitation of shale gas by the hydraulic fracturing method. There is room for interference in possible activities in the subsoil of the state. In the sole paragraph of the first article it describes, the law says: In addition to the method in this article (shale gas), the ban extends to other types of soil exploration that may cause groundwater contamination and other environmental or health-damaging accidents. It may include carbon dioxide geological storage, making frameworks and institutional positions even more important.

Although the constitutionality of this Law has not been questioned, it is essential to emphasize the union's private competence to legislate over - deposits, mines, other mineral resources and metallurgy (article 22, XII of the CF). Still, it is important that the mineral resources, including those of the subsoil, are assets of the Union (article 20, item IX of the Federal Constitution), which allows, in principle, that decisions regarding CCS in the onshore environment are the responsibility of the Union. There may be questioning involving the judicial. However, the fact that competence to legislate about the environment can be claimed makes it competitive among all entities of the federation (including the states), making the measure of the state of Paraná valid regarding the impediment of underground activities.

In addition to the provisions of the Constitution, it is essential to go through the legislative and normative framework. It starts with the Civil Code, which prescribes a complete and exclusive property until proven otherwise (Art. 1,231). Also, art. 1,229, thus, says: the ownership of the soil covers that of the corresponding airspace and subsoil, in heights and depths, useful for the exercise, and the owner cannot oppose activities that are carried out, by third parties, at such a height or depth, that he has no legitimate interest to stop them.

However, according to art. 1,230 "The ownership of the soil does not cover deposits, mines and other mineral resources, hydraulic energy potentials, archaeological monuments and other assets constituted by special laws".

Therefore, when considering CCS activities as part of the concept of deposits, mines, resources or other assets, it can be understood that this property is not presumed, needs to be proven and does not necessarily fit as full.

Law no. 12,305, of August 2, 2010, institutes the National Solid Waste Policy. Because, when classifying a CCS activity as residual, there is the application of the principles, objectives and instruments of compliance with the Law, as well as the references related to integrated management and management, the responsibilities of generators and public authorities and the instruments applicable rules.

Suppose the CCS activity is conceived as dangerous. In that case, it is necessary to install and operate it; it can only be authorized or licensed by the competent authorities "if the responsible person proves, at least, technical and economic capacity, in addition to conditions to provide the care necessary for the management of this waste. " (art. 37).

Legal entities are required to prepare a hazardous waste management plan and submit it to the competent body of the National Environment System (SISNAMA).

However, the CCS activity is not seen as dangerous, as the leakage of carbon and causing the damage reported in session 3 is consistent with the intensification of the greenhouse effect.

Within the scope of Mining Law, there is Decree-Law no. 227/67, which defines the Union's competence "to manage mineral resources, the mineral production industry and the distribution, trade and consumption of mineral products".

If carbon storage is considered as mining; therefore, this activity is governed by this Code, and "the exploitation of the deposits depends on a permit for research authorization, by the Director-General of DNPM, and a mining concession, granted by the Minister of State for Mines and Energy. " (art. 7).

Therefore, when CCS activities are accepted within the mining profile, the matter is governed within that specific legislation. On the other hand, if it is seen as a complementary activity to the oil and gas sector, the Petroleum Law will be applied, viewing CCS as a form of advanced well recovery. Anyway, all these choices and profiles followed the environmental legislation, outlined in the National Environment Policy, as well as in the Resolutions of the National Environment Council (CONAMA), which are: Resolution no. 237/97, which deals with environmental licensing and Resolution no. 001/86, on environmental impact.

Ministry of Mines and Energy, National Agency of Petroleum, Natural Gas and Biofuels, jointly launched, in 2020, Resolution 817/2020, on decommissioning of oil and natural gas exploration and production facilities, the inclusion of land area under contract in the bidding process, the sale and reversal of assets, the fulfilment of remaining obligations, the return of the area and other measures related to decommissioning. In its annexes, it provides for specific requirements for decommissioning onshore (annexe III) and offshore (annexe IV), for both, it gives, in annexe V, that there must be basic environmental information;

a) owner of the area where the facilities to be decommissioned are located,

b) maps, data and georeferenced information of the areas where the facilities are to be decommissioned and their surroundings are located, including water

bodies, protected areas, land use and the location of the production facilities to be decommissioned and

c) future use of the area where the facilities to be decommissioned is located.

Suppose the decommissioned regions are used for geological storage. In that case, the project for the future use of the area for this purpose must be provided for in the decommissioning plan for existing oil and natural gas exploration and production facilities.

7. CONCLUSIONS

Sustaining the recovery of ecosystems and economic growth are premises that should guide activities of production, circulation and distribution of goods and services, and the existence of standards gives a positive value to economic growth by sustaining the recovery of ecosystems.

And among actions that intend to meet the criteria of sustainable development for the recovery of ecosystems, maintaining economic growth and mitigating undesirable effects of anthropic origin in the environment, such as climate change and acidification of the oceans, are the activities of carbon capture, storage, and transport.

Again adopting a global plan around the decarbonization project gained momentum as part of the Paris Agreement in 2015. CCS (Carbon Capture and Storage) activities are among the options to achieve these goals (IPCC, 2019).

Verifying the feasibility of this type of undertaking requires analysis at different levels. This work was dedicated to deepening the regulatory and geological feasibility of applying CCS projects. The Santos Basin region is an economically favourable area for the adoption of this measure. The use of depleted fields is interesting for the prior availability of infrastructure and the lower environmental impact, lower costs and more excellent technical knowledge. To Paraná basin, the potential can guarantee the permanent carbon abatement, increased by BECCS harmful emissions. For both basins, legal and regulatory frameworks are critical to ensuring that geological CO_2 storage is safe and effective and that storage location and accompanying risks are responsibly managed.

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