

Climate and Energy Policies in Brazil: a dialogue on CCS activities to promote carbon dioxide emissions reduction

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Abstract

Considering the interaction between climate and energy policies, this paper analyzes the activities of Carbon Capture and Storage in the Brazilian context of public choices. The methodology of the work consists of normative and bibliographical revision, using the qualitative and deductive methods. The hypothesis of this research corroborates the thesis that the governance of Carbon Dioxide Capture and Storage activities in Brazil is found in the already existing configuration proposed for public policies directed to climate and energy changes in the country.

Keywords: Climate Change; Energy Policy, Carbon Capture and Storage; GHG Emission Mitigation; Greenhouse Gases

1. Introduction

According to the International Energy Agency (IEA, 2016), power generation is currently one of the main carbon-emitting sources in Brazil, accounting for 43.6% of CO₂ emitted by stationary sources. Carbon Capture, Transport and Storage (CCS), Carbon Capture, Transport and Storage activities are among the alternatives for mitigating greenhouse gases in Oil and Gas production and exploration activities (COSTA et al., 2018). Thus, we propose a reflection on its subsumption to national policies related to climate change and its dialogue with National Energy Policy.

2. The National Energy Policy

As discussed in Costa (2003; 2004), throughout the 1990s, changes were perpetrated by the legislator in the 1988 Federal Constitution regarding the viewpoint of the Constitutional Economic Order.

The original wording of the Constitution, which established a legal system based on the state's intervening presence in the economy through the exclusive monopoly of *Petróleo Brasileiro SA* (Petrobras), changed to a regime that accommodates the entry of other companies in the oil and gas sector.

State monopolies were relaxed by the Amendment n.5 at the paragraph 2 of article 25 of Federal Constitution, dated 8.15.95, by allowing the operation of the public service of distribution of piped gas to the private sector; Amendment n. 6/95, which modified the art. 176, caput, which allowed the exploration

and mining of mineral resources and the exploitation of the potentials of electric power to be granted or authorized to companies incorporated under Brazilian law, without the requirement of control of national capital; Amendment n. 7, 15.8.95, providing for the opening to foreign capital in cabotage navigation; Amendment n. 8, dated 8.15.95, on the participation of economic agents in telecommunications and sound broadcasting and sound and image services; and finally, Amendment no. 9, dated 11.19.1995, which changed the legal regime of the oil and gas sector in the country and allowed the entry of private companies (COSTA, 2003; 2004).

Due to this context of the constitutional amendment, the so-called Petroleum Law, Law no. 9,478, of August 6, 1997, which deals with the National Energy Policy and activities related to the oil monopoly, as well as establishing the National Council for Energy Policy and the National Agency of Petroleum, Natural Gas and Biofuels.

In its art. 1, Law 9.478 / 1997 presents the Principles and Objectives of the National Energy Policy (PEN), which are emphasized: I - preserve the national interest; II - promote development, expand the labor market and energy resources; III - protect consumer interests regarding price, quality, and supply of products; IV - protect the environment and promote energy conservation; V - guarantee the supply of petroleum products throughout the national territory.

And, pursuant to § 2 of art. 177 of the Federal Constitution; VI - increase, on an economic basis, the use of natural gas; VII - identify the most appropriate solutions for the supply of electricity in the various regions of the country; VIII - use alternative sources of energy, through the economic use of available inputs and applicable technologies; IX - promote free competition; X - attract investments in energy production; XI - increase the country's competitiveness in the international market; XII - increase, in economic, social and environmental bases, the participation of biofuels in the national energy matrix; XIII - guarantee the supply of biofuels throughout the national territory; XIV - encourage the generation of electricity from biomass and biofuel byproducts, due to its clean, renewable nature and complementary to the hydraulic source; XV - promote the country's competitiveness in the international biofuels market; XVI - attract investments in infrastructure for transportation and storage of biofuels; XVII - foster research and development related to renewable energy; XVIII - mitigate emissions of greenhouse gases and pollutants in the energy and transport sectors, including the use of biofuels. In this last item, CCS technology is considered as a possible north.

Given the above principles and objectives of PEN, there is an intrinsic relationship between the perception of the end-use of energy with the needs of preservation and environmental conservation, including options based on diversification towards alternative and renewable sources, rational use of fossil fuels, increasing natural gas, adopting mitigation measures and, above all, based on national interest and promoting development.

Accordingly, the same law establishes the National Energy Policy Council (CNPE), linked to the Presidency of the Republic and chaired by the Minister of Mines and Energy, with the task of proposing to the President of the Republic national policies and specific measures, among the following. These include: promoting the rational use of the country's energy resources; periodically review the energy matrices applied to the various regions of the country; define the strategy and policy for economic and technological development of the oil, natural gas, other fluid hydrocarbons and biofuels industry; and, define the strategy

and the policy of technological development of the electric power sector.

Also, worth mentioning are the ANP's attributions, which in general will try to implement, in its sphere of attributions, the national policy of petroleum, natural gas and biofuels contained in PEN, "with emphasis on guaranteeing the supply of derivatives. of petroleum, natural gas and their derivatives, and biofuels, throughout the national territory".

Through this incursion into the Petroleum Law, founder of PEN's guidelines and institutions, it is observed that a dialogue between climate change policies must be made when specific sectors such as energy are inferred. And in this sense, topic 3 presents data that concretely allows this reflection.

2. The Contribution of CCS Activities to the Energy Sector

The year 2020 marks the beginning of NDC implementation. In the same year, the deadline for the fulfillment of the goals set in the law of the National Policy on Climate Change (PNMC - Law 12.187 / 2009), which determined that the country reduces its emissions from 36.1% to 38.9% in 2006, will expire. a trend scenario (which, according to the Law, would be instituted by the second Brazilian Inventory of Greenhouse Gas Emissions and Removals not Controlled by the Montreal Protocol at that time expected for 2010). However, more recent reports have shown that the current trend of Brazil's greenhouse gas emissions and national climate governance point to the impossibility of meeting the targets, warning that from 2013 there was a reversal of trends, with emissions rising. motivated by increased deforestation in the Amazon and increased use of fossil fuels in the energy matrix (SEEG, 2018).

Therefore, notwithstanding other factors, such as deforestation of the Amazon Rainforest, which has emerged as an increase in Brazilian emissions, it must be considered that the increased use of fossil fuels becomes an element to be observed by Brazilian environmental and energy policies.

A study from the IES-Brazil 2030 Project (LA ROVERE et al., 2015), coordinated by COPPE / UFRJ's Climate Center, within the Brazilian Climate Change Forum (FBMC), with support from the Brazilian government through the Ministry of Environment (MMA), and the International Mitigation Actions, Plans and Scenarios (MAPS) project, showed the feasibility of a significant reduction in Brazil's emissions by 2030 without compromising economic growth and the population's quality of life. Their findings were presented to the MMA and other ministries, and to the FBMC plenary, providing valuable input for the preparation of the Brazilian NDC presented to the Climate Convention (UNFCCC) and ratified by the National Congress (FBMC, 2018).

There are already some initiatives under consideration or planned for Brazil to contain GHG emissions, such as the Sectoral Transport and Urban Mobility Plan for Mitigation and Adaptation to Climate Change (PSTM), the National Plan for Logistics and Transport. (PNLT), the 2026 Ten Year Energy Expansion Plan (PDE), the 2050 National Energy Plan (PNE 2050), RenovaBio and Rota 2030, successor to the Inovar-Auto program, and initiatives for the industrial sector focused on optimization and efficiency of production systems and reduction of energy intensity, and the universalization of waste collection and effluent treatment (FMBC, 2018).

For the energy sector, the assumptions considered were summarized as follows (FBMC, 2018):

Oil and gas projection: extraction of 7.7 million barrels/day in 2060;

Fossil sources in the electricity sector: no share of non-renewable sources in 2060 except self-generation and nuclear;

Nuclear power plants: Angra I reach the end of life over the horizon. In 2060, only the Angra II and III plants remain (2.7 GW);

Renewable in the electricity sector: moderately expanding hydroelectric plants, greater diversification (wind, solar photovoltaic and heliothermal), plus biomass thermoelectric (bagasse and planted forest), compensating for the absence of fossil fuels;

Ethanol production: total production of 44.6 billion liters in 2060;

Although the position of the scenario concerning the exclusion of gas-fired power plants is questionable (see the forecast of no participation from non-renewable sources in 2060, except self-generation and nuclear), it presents the forecast of emission reduction measures in the gas sector. oil and natural gas, but it does not clearly state what measures would be taken by the NDC in this regard.

Emissions from the energy sector between 1970 and 2016 increased almost fourfold, including fuel and electricity production and consumption, and represent the third-largest source of gross GHG emissions in Brazil, with 19% of the 2016 total (423.4 million tons of CO₂e), behind agriculture and land-use change (SEEG, 2018).

Since the National Climate Change Policy (2009) was approved, energy emissions have increased by 23%, especially due to the increase in gasoline and diesel consumption, as well as the increase in thermoelectric generation in Brazil, especially between 2010 and 2014 due to the water crisis. fuel price policy that discouraged ethanol consumption. In contrast, emissions from the energy sector fell by 7.3% between 2015 and 2016, driven by the slowdown in electricity generation, which declined by 23% due to the economic slowdown, increased share of renewables and reduction in industrial consumption (5.3% decrease in emissions) and agriculture (3.2% decrease) (SEEG, 2018).

Although the decrease in consumption is explained by the factors mentioned above, the sector's emissions volume shows a predominance of oil (70% in 2015), followed by natural gas (17%) and coal (6%), with proportional growth. emissions from natural gas production and consumption, which almost six-fold the emissions between 1990 and 2016.

Because of the amount emitted, CO₂ is the gas that has the greatest contribution to global warming. The residence time of the gas in the atmosphere is at least 100 years. This means that today's emissions have long-lasting effects, which can result in impacts on the climate regime over several centuries (ABNT, 2018).

It is important to note the participation of different GHGs in Brazilian emissions in 2005 and 2016 (total% in CO₂e) since much focus is given to carbon dioxide (CO₂) and the tendency to increase emissions from other gases, especially methane (CH₄).

The amount of methane emitted into the atmosphere is much smaller, but its “greenhouse power” (warming potential) is twenty-one times higher than that of CO₂. In the case of nitrous oxide and chlorofluorocarbons, their concentrations in the atmosphere are even lower. However, the “greenhouse power” of these gases is 310 and up to 7,100 times greater than that of CO₂ (ABNT, 2018).

Thus, the data show the relevance of the implementation of mitigation technologies in the energy

sector, which, due to their productive characteristics, provides greater conditions for emissions sequestration.

Gas capture and storage activities, specifically carbon dioxide within the context of International Climate Change Agreements, are relevant in this scenario.

Thus, the capture of anthropogenic carbon emission sources consistent in the process of directing this gas to a certain structure containing it avoids its dispersion in the atmosphere through storage, which is generally geological (COSTA et al., 2018).

This type of CO₂ storage can be done in several geological units in the national territory and depends on the economic, technological and logistic vectors. Due to the expected increase in the production of gaseous hydrocarbons in the Brazilian coastal region, it would be possible to produce, separate and inject gas portions of carbon dioxide and methane (COSTA et al., 2018).

3. CCS Compliance in Brazilian Climate Change Policies

Given the lack of legal provision for such activities, the announcement of the need for CCS's specific regulatory framework in Brazil assumes that it will likely include several existing regulations that will require joint coordination between the various ministries and stakeholders. ALMEIDA et al., 2017).

Law no. 12,187 of 2009, which establishes the National Policy on Climate Change (PNMC), provides for principles, objectives, guidelines, and instruments, understood as mitigation: technological changes and substitutions that reduce resource use and emissions per unit of production, as well as the implementation of measures that reduce greenhouse gas emissions and increase sinks. The concept broadly contemplates CCS (Carbon Capture and Storage) technologies.

Besides, Law no. 12.187 / 2009 understands as “adaptation” initiatives and measures to reduce the vulnerability of natural and human systems to the current and expected effects of climate change. Leaving the legal concept of adaptation appropriate to the Brazilian academic understanding of the issue, such as Di Giulio (2018) “Adaptation to climate change is understood here as real adjustments, or changes in decision environments, which can improve resilience. or reduce vulnerability to observed or expected climate change.”

The same law provides that the National Policy on Climate Change will aim at the implementation of measures to promote adaptation to climate change by the three (3) spheres of the Federation, with the participation and collaboration of the interested and beneficiary economic and social agents, in particularly those particularly vulnerable to its adverse effects (Article 4 (V)) and the encouragement and support for the maintenance and promotion of low greenhouse gas practices, activities, and technologies (Article 4 (XIII)).

It provides as instruments of the National Policy on Climate Change, among other things, a National Plan on Climate Change; the National Fund on Climate Change; the resolutions of the Interministerial Commission on Global Climate Change; fiscal and tax measures designed to encourage the reduction of greenhouse gas emissions and removal, to be established by specific law; credit and financing lines and research lines by funding agencies; specific appropriations in the Union budget and those under the United Nations Framework Convention on Climate Change and the Kyoto Protocol.

Of great importance in the law is the provision that existing or forthcoming measures that stimulate the development of processes and technologies that contribute to the reduction of greenhouse gas emissions and removals, as well as adaptation, may be benefited by the establishment of preference criteria in public tenders and tenders, including public-private partnerships and the authorization, permission, grant, and concession for the exploitation of public services and natural resources, in proposals that provide greater energy, water, and other savings. natural resources and the reduction of greenhouse gas emissions and waste.

Besides, the law proposes, considering the specificities of each sector, the existence of sectoral climate change mitigation and adaptation plans aimed at consolidating a low carbon economy, including through the Clean Development Mechanism (CDM). and Nationally Appropriate Mitigation Actions (NAMAs).

Among the institutional instruments for the performance of the National Climate Change Policy are the Interministerial Committee on Climate Change; the Interministerial Commission on Global Climate Change; the Brazilian Forum on Climate Change; the Brazilian Network of Global Climate Change Research - (Climate Network); and the Meteorology, Climatology and Hydrology Activities Coordination Commission.

The Interministerial Committee on Climate Change (CIM) is permanent and was established by Decree No. 6.263 / 2007 with the role of guiding the elaboration, implementation, monitoring, and evaluation of the National Plan on Climate Change.

According to the decree, the CIM is composed of 16 Ministries and the Civil House, which coordinates the Committee, composed of a representative, holder, and alternate, of each body, indicated below: I - Civil House of the Presidency of the Republic, which coordinate; II - Ministry of Agriculture, Livestock and Supply; III - Ministry of Science, Technology, Innovations, and Communications; IV - Ministry of Defense; V - Ministry of Education; VI - Ministry of Finance; VII - Ministry of National Integration; VIII - Ministry of Health; IX - Ministry of Cities; X - Ministry of Foreign Relations; XI - Ministry of Mines and Energy; XII - Ministry of Agrarian Development; XIII - Ministry of Development, Industry, and Foreign Trade; XIV - Ministry of the Environment; XV - Ministry of Planning, Budget and Management; XVI - Ministry of Transport; and XVII - Center for Strategic Affairs of the Presidency of the Republic. It is important to note that the Brazilian Climate Change Forum will be invited to the CIM meetings.

The Executive Group on Climate Change was set up within the framework of the CIM to elaborate, implement, monitor and evaluate the National Climate Change Plan under the guidance of the CIM. The Executive Group on Climate Change shall be composed of one representative, holder, and alternate, from each of the following bodies and entities: I - Ministry of Environment, who will coordinate it; II - Civil House of the Presidency of the Republic; III - Ministry of Agriculture, Livestock and Supply; IV - Ministry of Science, Technology, Innovations, and Communications; V - Ministry of Foreign Relations; VI - Ministry of Mines and Energy; VII - Ministry of Agrarian Development; VIII - Ministry of Development, Industry and Foreign Trade; and IX - Brazilian Forum on Climate Change. See here the express presence of the Brazilian Climate Change Forum in the composition.

4. Institutional Level for the Climate Change Policies

From dialogue between the PEN and PNMC, it is worth considering that with the MME it is an important representative of CNPE and the ANP itself, since the data show the context of implication of the final use of energy, especially in cities, due to local impacts on the various energy consumption sectors, such as transportation, for example.

Also, one of the highlights of the institutional apparatus in climate governance in Brazil was the reactivation of the Brazilian Climate Change Forum. The Forum, created in 2000 and relevant during the presidencies of Presidents Fernando Henrique Cardoso and Luís Inácio Lula da Silva, linked to the Presidency of the Republic, was demobilized in the Dilma Rousseff government and deactivated after impeachment. 11 thematic chambers in 2007, which met for a year to produce an initial proposal for the implementation of the Brazilian NDC, which was delivered to presidential candidates and is the result of consultations with more than 500 actors from academia, civil society, government and private sector (SEEG, 2018).

At the institutional level, it is important to cite Ordinance no. 150 of 2016, which establishes the National Climate Change Adaptation Plan and other measures, which, with the theme of adaptation, aim to promote the management and reduction of climate risk in the country, “because of the adverse effects associated with climate change, to seize emerging opportunities, avoid loss and damage and build instruments that allow the adaptation of natural, human, productive and infrastructure systems”.

The objectives of the National Climate Change Adaptation Plan are: I - To guide the expansion and dissemination of scientific, technical and traditional knowledge by supporting the production, management, and dissemination of information on the risk associated with climate change, and the development of climate change measures. training of government entities and society in general; II - Promote coordination and cooperation among public agencies to manage the risk associated with climate change, through participatory processes with society, aiming at the continuous improvement of the actions for risk management associated with climate change; and III - Identify and propose measures to promote adaptation and risk reduction associated with climate change (article 2).

The National Climate Change Adaptation Plan shall be implemented by the Union in cooperation with States, the Federal District and Municipalities, civil society organizations and private sector entities.

Ordinance 150/2016 establishes the Permanent Consultative Technical Group on Climate Change Adaptation, to promote articulation between public and private bodies and entities, to promote the implementation, monitoring, evaluation, and review of the National Plan. Adaptation to Climate Change.

Among other things, it is responsible for promoting articulation with federal, state and municipal agencies, with private entities and civil society, aiming at the execution of joint actions, the exchange of experiences and training. The Technical Adaptation Group consists of I- Ministry of the Environment, who will coordinate it; II - Ministry of Science, Technology, Innovations, and Communications; and III - Brazilian Forum on Climate Change. It is an observed absence of a chair with a representative of MME and/or CNPE.

The Brazilian Climate Change Forum will nominate representatives of civil society and the private sector, whose participation should be regulated in the Internal Regulations of the Technical Adaptation

Group. Participating in the meetings, invited by the Technical Adaptation Group, experts and representatives of public or private bodies and entities that carry out activities related to climate change adaptation (art. 6).

5. Conclusion

Some elements favorable to governance in Climate Change Policies in Brazil that effectively incorporate the participation of public and private actors, individual or collective, can be perceived in the prediction of their inclusion in norms and component planning studies for the theme, as seen for example. National Policy on Climate Change, the National Climate Change Adaptation Plan and research contributions to the Brazilian Nationally Determined Contribution (NDC).

It is not yet foreseen how the government will incorporate the recommendations into the development of the NDC implementation and financing strategy (SEEG 2018), or how it will make it possible to integrate the principles and guidelines of the National Climate Change Policy into all federal government policies, federal public policies and major development plans for each sector of the economy - particularly energy and concerning emissions from oil and gas production and exploration. It is recognized that the task of multidisciplinary governance is the multi-institutional approach presents challenges, however, it must be noted that it is necessary to overcome and put in place effective instruments within a comprehensive plan. The importance of transposing the absence of chair in the Technical Adaptation Group representative of MME and/or CNPE is verified.

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7. References

- ABU-KHADER, Mazen M. Recent Progress in CO₂ Capture/Sequestration: A Review. *Energy Sources, Part A*, 28: 1261-1279, 2006.
- AGÊNCIA INTERNACIONAL DE ENERGIA (International Energy Agency). Captura e Estocagem de Carbono. Disponível em: <<https://www.iea.org/topics/carbon-capture-and-storage/>>. Acessado em: 12 de set. de 2018.
- BECK, Brendan; CUNHA, Paulo; KETZER, Marcelo; MACHADO, Haroldo; ROCHA, Paulo Sergio; ZANCAN, Fernando; ALMEIDA, Alberto Sampaio; PINHEIRO, Diogo Zaverucha. The current status of CCS development in Brazil. *Energy Procedia* 4 (2011) 6148-6151.
- COPPE/UFRJ. Sumário Executivo, Sumário Técnico e Relatórios completos. Disponíveis em: <www.centroclima.coppe.ufrj.br> Acessado em: 12 de set. de 2018.
- COSTA, Hirdan Katarina de Medeiros; MUSARRA, Raíssa. M. L. M.; MIRANDA, Mariana. F.;

MOUTINHO DOS SANTOS, E. Environmental License for Carbon Capture and Storage (CCS) Projects in Brazil. *Journal of Public Administration and Governance*, v. 8, p. 163-185, 2018. 2018.

COSTA, H. K. M. Joint Ventures e licitação na Indústria do Petróleo e Gás. *Direito do Petróleo em Revista*, Natal, v. 01, p. 121-130, 2003.

DI GIULIO, Gabriela; LAPOLA, David; TORRES, Roger.; LEMOS, Maria C. Lemos; FERREIRA, Lúcia C.; FERREIRA, Leila C.; MARENGO, José; SOBRAL, Maria C.; MALHEIROS, Tadeu, RODRIGUEZ, Daniel Andres, VASCONCELOS, Maria P., BEDRAN, Ana. Plano Nacional de Adaptação à Mudança do Clima: possibilidades e desafios, *Jornal da Ciência*, 10 de outubro de 2016. Disponível em <<http://www.jornaldaciencia.org.br/edicoes/?url=<http://jcnoticias.jornaldaciencia.org.br/24-plano-nacional-de-adaptacao-a-mudanca-do-clima-possibilidades-e-desafios/>>>. Acessado em: 12 de set. de 2018.

FBMC, Fórum Brasileiro de Mudança do Clima. *Brasil Carbono Zero em 2060. Relatório do Fórum Brasileiro de Mudança do Clima (FBMC) para a Presidência da República*, 2016.

GLOBAL CCS INSTITUTE. *Understanding CCS*. Disponível em: <<https://www.globalccsinstitute.com/why-ccs/what-is-ccs/>> Acessado em: 12 de set. de 2018.

LA ROVERE, E. L. Projeto IES-Brasil – 2030 - Implicações Econômicas e Sociais de Cenários de Emissão de Gases de Efeito Estufa no Brasil até 2030. FBMC – COPPE/UFRJ, 2015. Sumário Executivo, Sumário Técnico e Relatórios completos disponíveis em <www.centroclima.coppe.ufrj.br>, Acessado em: 12 de set. de 2018.

LA ROVERE, E. L. Projeto IES-Brasil – 2050 - Implicações Econômicas e Sociais de Cenários de Emissão de Gases de Efeito Estufa no Brasil até 2050. FBMC –2017.

MCTIC, GEF. *Opções de mitigação de emissões de gases de efeito estufa em setores-chave do Brasil*. Organizador Régis Rathmann. Brasília: Ministério da Ciência, Tecnologia, Inovações e Comunicações, ONU Meio Ambiente, 2016, 400p. 2016.

MUSARRA, Raissa; COSTA, Hirdan Katarina M. *Elements of Public Action and Governance in Capture, Stocking and Carbon Transportation Activities*. *International Journal of Humanities and Social Science Invention (IJHSSI)*. 2018.

SEEG. *Sistema de Estimativas de Emissões e Remoções de Gases de Efeito Estufa. Emissões por setor*. Disponível em: <<http://seeg.eco.br/>>. Acessado em: 12 de set. de 2018.

SEEG. *Sistema de Estimativas de Emissões e Remoções de Gases de Efeito Estufa. Emissões de GEE no Brasil e suas implicações para políticas públicas e a contribuição brasileira para o Acordo de Paris*. Documento de Análise. Observatório do Clima. 51p. 2018. [1] A.B. Smith, C.D. Jones, and E.F. Roberts, “Article Title,” *Journal*, Publisher, Location, Date, pp. 1-10.

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