



MINISTRY OF MINES AND ENERGY

Empresa de Pesquisa Energética — EPE

Energy Research Office - EPE

META PROJECT

Energy and Mineral Sectors Strengthening Project

WORLD BANK

INTERNATIONAL BANK FOR RECONSTRUCTION AND DEVELOPMENT - IBRD

Loan: **9074 - BR**

Term of Reference n° 16

EVALUATION OF UNDERGROUND STORAGE OF NATURAL GAS (UNGS) IN
BRAZIL

March/2023



CONTENT

1.	CONTEXT	3
2.	JUSTIFICATION	5
3.	OBJECTIVE	5
4.	SCOPE	6
5.	SOCIO-ENVIRONMENTAL ASSESSMENT	6
6.	PRODUCTS	10
7.	ACTIVITIES	16
8.	DEADLINES/SCHEDULE	23
9.	TECHNICAL QUALIFICATION	25
10.	PRODUCT PRESENTATION FORMAT	28
11.	PAYMENT METHODS	29
12.	SUPERVISION	29
13.	AVAILABLE ELEMENTS	29
14.	CLASSIFICATION OF EXPENSES	30
15.	SAFEGUARD POLICIES - ENVIRONMENTAL AND SOCIAL FRAMEWORK OF THE WORLD BANK	30
16.	LEGAL PROHIBITION	32



TERM OF REFERENCE – TOR 16

EVALUATION OF UNDERGROUND STORAGE OF NATURAL GAS (UNGS) IN BRAZIL

1. *CONTEXT*

The Energy Research Office – EPE is a public company authorized by the Federal Law No. 10,847 in March 15, 2004 and established by the Presidential Decree No. 5,184 of August 16, 2004, under the Ministry of Mines and Energy - MME, and focuses on providing studies and research aimed primarily at supporting the planning of the energy industry. It covers sectors such as electricity, oil and natural gas and its derivatives, mineral coal, renewable energy sources and energy efficiency, among others.

EPE's department of Petroleum, Natural Gas and Biofuels (DPG), through the Petroleum and Natural Gas Superintendency (SPG), has, among its responsibilities, to coordinate, guide and monitor the activities of: management studies on the resources and reserves of petroleum, its derivatives and natural gas; studies on the infrastructure, supply, production, transformation, commercialization and supply of oil and its derivatives, natural gas and biofuels and studies on the national and international sectors related to oil, natural gas and biofuel industries. The DPG's activities are incorporated into different documents related to the Brazilian energy planning, such as the Ten-Year Energy Expansion Plan (PDE), the National Energy Plan (PNE), the Ten-Year Expansion Plan for the Gas Pipeline Transport Network (PEMAT) and the National Oil and Gas Resource Zoning (ZNMT), among others.

Within the scope of the DPG, the Petroleum and Natural Gas Superintendency (SPG), since the beginning of its activities, has the prerogative of elaborating studies on the infrastructure of resources and reserves of oil and natural gas. Hence, the SPG plays a leading role as an



THE WORLD BANK
IBRD • IDA | WORLD BANK GROUP



executor of studies, in the context of energy planning for the resources of oil and natural gas, which will support the Ministry of Mines and Energy (MME) in its decisions.

The possibility of substantial surpluses mainly due to the associated gas production of the pre-salt fields, besides other factors such as the considerable fluctuations in demand for natural gas in the country and variations in the LNG price in the worldwide, requires improvements on the planning, not only of the natural gas production in Brazil, but also of its storage and movement. Moreover, there is a need to create supply reliability and operational flexibility solutions to enable the development of a more diversified market, with greater liquidity and risk allocation alternatives, due to Petrobras divestments in the natural gas industry and with the possibility of creating pricing arbitrage mechanisms in order to ensure predictability for consumers.

Up to today, the storage of natural gas in Brazil has been carried out in pipelines with idle capacity and in the form of Liquefied Natural Gas (LNG), in methane ships. Underground storage, although not yet developed in national territory, is presented as a positive alternative, which aims to contribute to the following issues:

- controlling the movement of natural gas produced and/or imported in the event of a impossibility of reinjection of natural gas into the reservoir or direct flow to a distribution network, in a situation of gas pressure, due to an operational problem or natural motivation. In that case, it would be possible to maintain production and storage of the natural gas;
- management of the natural gas imports in the eventuality of an elevated market demand that produces an increment in prices. Stock increases in times of low demand and more affordable prices would be a strategic way to reduce the tariff's seasonality and ensure security on the supply of natural gas;
- flexibilization of the Brazilian energy matrix, being a point of support for the hydropower and intermittent renewable plants, supplying electric energy by thermal generation in times of drought or high seasonable demand;



THE WORLD BANK
IBRD • IDA | WORLD BANK GROUP



- reinforcement of the natural gas transport network, regardless of whether there is a production surplus. This reduces uncertainties related to seasonality, flexibility and operational process.

2. JUSTIFICATION

This study aims at the understanding of the entire existent process of Underground Natural Gas Storage (UNGS) already in place in other countries. It is also important to know the types of reservoirs and their characteristics, know the sites of reservoirs in depleted fields, as well as to identify them in the Brazilian sedimentary basins. Insofar, it is crucial to hire a specialized consultancy in the area of UNGS. Hiring an external contractor to perform this service is justified by the complexity of the matter in question, which requires technicians with different qualifications. These activities extrapolate the mandate and specializations within EPE.

The consultancy will offer, among other results, detailed studies for the execution of a pre-feasibility study in UNGS, which will subsidize the country with information that will allow the improvement of existing regulations and legislation, the preparation of eventual bids and contracts for the concession of storage sites, in addition to allowing more consistent monitoring.

3. OBJECTIVE

The core objective of this Term of Reference (TOR) is employing a specialized technical consultancy in the area of Underground Storage of Natural Gas. The main purpose is to impart EPE with a profound understanding (technical, regulatory and potential socio-environmental risks and impacts) of the entire process involving Underground Storage of Natural Gas and secondarily the capture, utilization and storage of carbon (CCUS).

In order to reach this knowledge, the specific objectives are:

- analyze the regulation of UNGS in other countries to identify the challenges for the implementation of the process in Brazil and to suggest possible adaptations on the regulation and on the legislation already applied in the country;



THE WORLD BANK
IBRD • IDA | WORLD BANK GROUP



- identification of the reservoirs of depleted fields and their characteristics in the Brazilian sedimentary basins, singling out potential targets from defined methodologies;
- elaboration of conceptual studies of geoenvironment, in line with the general concept of the project, for potential reservoirs of the type depleted fields, covering geological, technical, economic and environmental factors.

4. SCOPE

The resulting products from this work are intended to improve planning activities related to the Brazilian oil and gas sector, contributing, for example, to the enrichment of the National Oil and Gas Resource Zoning study. This study is an energy planning instrument of the Ministry of Mines and Energy (MME Ordinance No. 350 of October 10, 2013), prepared by the EPE, which indicates, through maps, areas of petroleum importance in the country, based on geological and economic analysis. Consequently, it will result in gains for other government agencies, such as the Ministry of Mines and Energy, the Brazilian National Agency of Petroleum, Natural Gas and Biofuels (ANP), and the whole of society. Thereby, this study can provide the dissemination of information between institutions of diverse sectors, promoting the interest for public, private and academic investments.

5. SOCIO-ENVIRONMENTAL ASSESSMENT

This study is co-executed by EPE, with the objective of gathering technical, economic, and regulatory data and information and applying methodologies of international good practices to carry out georeferenced studies of the potential of Underground Natural Gas Storage (UNGS) in Brazil, making it possible to identify eligible locations for investments in UNGS infrastructure.

Assessing the potential of UNGS in Brazil is essential to reduce information asymmetries and transaction costs on the subject, to promote investments in UNGS facilities in the country. UNGS installations in Brazil will be essential for the full operation and consolidation of the New Gas Market in the long term in the country. This is because UNGS installations ensure flexibility, liquidity, and functionality for the gas market. There are no



THE WORLD BANK
IBRD • IDA | WORLD BANK GROUP



UNGS facilities in operation in Brazil, which was counterbalanced, until then, by the presence of Petrobras in various links in the natural gas value chain in the country.

With the repositioning of Petrobras, and its divestment in the natural gas industry, the need for UNGS facilities in Brazil becomes essential for the operational flexibility of the natural gas infrastructure, for greater integration between the natural gas industry and the sector electricity, for the proper management of supply and demand for natural gas and its market risks.

In particular, the UNGS contributes to:

- Reduce barriers to entry, on the supply side of natural gas, given that gas portfolio management has been a limiting factor for expanding supply by companies that do not have multiple supply sources that enable them to guarantee a firm supply (especially in the case of independent producers and associated natural gas production);
- Ensuring operational flexibility and optimization of gas transport infrastructure, essential for balancing the entry and exit model to be implemented by the New Gas Market;
- Contribute to greater integration between the natural gas industry and the electrical and industrial sectors, by expanding the operational flexibility of the natural gas infrastructure;
- Promoting energy security, by creating stocks that make it possible to offset unplanned supply restrictions; and
- Develop new businesses in the natural gas chain by offering storage services that can serve various industry players (producers, shippers, transporters, traders and consumers) and promoting the efficient functioning of the market via price arbitrage and liquidity guarantee.

All these points are necessary conditions for the consolidation of an effectively competitive gas market. The assessment of UNGS in Brazil is in line with the government's strategy of



THE WORLD BANK
IBRD • IDA | WORLD BANK GROUP



redesigning the legal and regulatory arrangement of the country's natural gas industry, which is aimed at with the New Gas Market. UNGS installations in the country will be fundamental for the full operation and consolidation of the New Gas Market in the long term, as well as for contributing to the modernization of the national electricity sector. In particular, it will allow natural gas thermoelectric plants to supply energy and power to the system with greater flexibility, complementing and modulating loads from non-dispatchable sources (such as run-of-river, wind and solar hydroelectric plants, for example).

The expected results of the subproject are:

- The analysis of UNGS regulation in other countries, in order to identify the challenges for the implementation of the process in Brazil and suggest possible adaptations of the regulation and legislation that already exist in the country;
- The identification of types of reservoirs and their characteristics in Brazilian sedimentary basins, pointing out potential targets based on defined methodologies;
- The preparation of conceptual geoengineering studies for the different types of reservoirs, covering geological, technical, economic and environmental factors; and
- EPE's institutional capacity building on issues (technical, geological and regulatory) of the entire process involving underground storage of natural gas.

This study has possible environmental and social implications, due to the potential risk associated with the production, transport, and storage of natural gas, and in this case, underground storage. The literature on the subject cites a series of impacts and environmental risks associated with underground storage of natural gas, including leaks, impacts on aquifers, gas leaks, risks of fires and explosions, any significant threat to the protection, conservation, maintenance and recovery of natural habitats and biodiversity, among others. With regard to risks and social impacts, the literature cites threats to human security as examples; negative economic and social impacts related to the expropriation or restriction of land use; risks or impacts associated with ownership and use of land and natural resources, including (where applicable) potential project impacts on local land use patterns, tenure, land access and availability, food security and land value, and any corresponding risks related to



THE WORLD BANK
IBRD • IDA | WORLD BANK GROUP



conflicts or contestation of land and natural resources; impacts on the health, safety and well-being of project-affected workers and communities; and risks to cultural heritage.

The assessment of environmental and social impacts should include:

- Reference scenarios for the development of deposits, considering the best practices in the industry;
- Location alternatives;
- Technological alternatives;

Assessment of the potential impacts of the different alternatives must consider, obligatorily, the following aspects: Effectiveness of Resource Use and Pollution Prevention and Management; Community Health and Safety; Working Conditions – Health and Safety; Land Acquisition, Land Use Restrictions and Involuntary Resettlement; Biodiversity Conservation and Sustainable Management of Natural Resources; Historically Disadvantaged Traditional Local Indigenous Peoples / Communities; Cultural heritage. The assessment of socio-environmental aspects should consider the requirements of Brazilian legislation, the World Bank Environmental and Social Framework and the Health, Safety and Environment Guidelines (WBG/IFC-EHSGs) of the World Bank Group, in particular the specific guidelines for the oil sector and gas and the ten World Bank Environmental and Social Standards (ESS), which set out the requirements to be met by the Borrower and the project throughout the project lifecycle, in particular Environmental and Social Standard 1 (ESS1) - Assessment and Management of Social and Environmental Risks and Impacts, which provides detailed guidance on the environmental and social assessment of projects proposed for Bank financing, in order to help ensure that they are sound and sustainable from an environmental and social point of view, in addition to considering other Good International Industry Practices. The analysis should also consider the assessment of associated risks, including the probability of incidents during the construction, operation and decommissioning of underground natural gas reservoirs.



The selection of sites for UNGS should consider the occurrence of indigenous territories, excluding sites that may generate direct impacts on indigenous territories, including means of survival of indigenous communities.

6. PRODUCTS

The products generated by the contracted firm consisted of technical reports, subsidized by maps, databases and workshops to discuss the studies carried out.

Each of the 7 (seven) products, to be delivered by the contracted firm, are described, as follow.

Product 1 – Technical Report – Work Plan

This product must contain a description of the methodology utilized to define the activities/phases needed to achieve the proposed objectives. It must be directly related to the products and timelines defined in this TOR, citing specific objectives, activities, deadlines, stakeholders and partners. The Work Plan is essential for planning the organization and monitoring the study.

Product 2 – Technical Report – International Legislation References

This product must contain the research results on legislation and regulation of UNGS in countries that have well defined legislation and regulation. The countries to be studied must be chosen jointly by the EPE and the contracted firm in a meeting prior to the beginning of the work and must consider the 3 (three) high priority countries defined by the EPE.

The report must address the issue, especially with regard to the implementation of the activity, with a critical analysis, aiming at adaptations for the improvement of Brazilian regulation and legislation. The report must also point out the main challenges to be faced in the implementation of underground storage of natural gas in Brazil and indicate which employment model would be more appropriate for a Brazilian reality.

The report must contain indications of the bibliographic references used, as well as the calculation records of any numerical data generated in the scope of the study, or the indication



THE WORLD BANK
IBRD • IDA | WORLD BANK GROUP



of the sources for obtaining them, when coming from third parties. The cost data presented must be referenced to a base date, they must submit any indexes used for temporal adjustment (where necessary), should show the price of the international currency to which the costs relate, and the country or region where the costs were obtained must be indicated.

Product 3 – Technical Report – Area Inventory for UNGS in Brazil

This product must present, in a structured and descriptive way, a preliminary portfolio of areas with the purpose of UNGS in the Brazilian sedimentary basins, based on geological and geophysical studies. The selected areas of interest for UNGS in the Brazilian sedimentary basins must be represented in georeferenced maps.

The maps must be delivered in the *shapefile* format and with associated data structure (attributes) that allow the reproduction of the results, following the methodology defined and applied in the study, and must follow the structure proposed by the National Spatial Data Infrastructure (INDE), instituted by Decree No. 6,666, of November 27, 2008.

A database must be delivered, registering and obeying any information confidentiality requirements, relating cost estimates to the characteristics of the type of possible storage locations. The database must be delivered in Excel, csv, Access, or Microsoft SQL database.

The report must contain indications of the bibliographic references used, as well as the calculation memories of any numerical data generated in the scope of the study, or the indication of the sources for obtaining them, when coming from third parties. The cost data presented must be referenced to a base date, must submit any indexes used for temporal adjustment (where necessary), must show the quotation of the international currency to which the costs refer, and the country or region where the costs were obtained must be indicated.

Product 4 – Technical Report – UNGS Site Selection Methodology and Application to the Brazilian Sedimentary Basins

This product must detail a series of methodologies to be used for the definition of targets for the UNGS, based on international experiences, taking into account the economic aspects (CAPEX, OPEX, decommissioning and tariff impact), local demand and supply of natural



gas, as well as technical aspects, including socio-environmental aspects. Methodologies must be proposed for storage sites in reservoirs of depleted fields).

This report must also include the process and results of the applied elaborated methodologies in the areas of interest to UNGS, defined in Product 3 - Inventory of Areas for UNGS in Brazil. The application of the methodologies must result in the indication of potential targets for the UNGS, represented in georeferenced maps, considering levels of interest: i) no interest, ii) target to be developed in the short term and iii) target to be developed in the long term.

Twenty (20) areas of depleted fields, in a land and/or shallow water environment, should be selected in Brazilian sedimentary basins. The definition of the sites, with technical and economic detail, will be carried out in its own forum between the contracted firm and the EPE. For each target will be highlighted the items necessary to adapt the area for development of the ESGN site.

The contracted firm will use the public data in the evaluation of the sites. The EPE may support the contracted firm in the search for non-public data, or difficult to access, such as: complete well data; the Development Plans of the fields; and fluid geochemistry.

The results of the application of the methodologies should justify the classification of targets according to the levels of interest (without interest, to be developed in the short term and to be developed in the long term) and indicate the conditions to be met and the steps that should be carried out in order to allow the development of targets classified as "development in the short term" and "development in the long term".

The maps that compose this product must be delivered in the *shapefile* format and with associated data structure (attributes) that allow the reproduction of the results, following the methodology defined and applied in the study, and must follow the structure proposed by the National Spatial Data Infrastructure (INDE), instituted by Decree No. 6,666, of November 27, 2008.

The report must contain indications of the bibliographic references used, as well as the calculation memories of any numerical data generated in the scope of the study, or the



THE WORLD BANK
IBRD • IDA | WORLD BANK GROUP



indication of the sources for obtaining them, when coming from third parties. The cost data presented must be referenced to a base date, must submit any indexes used for temporal adjustment (where necessary), must show the quotation of the international currency to which the costs refer, and the country or region where the costs were obtained must be indicated.

Product 5 – Technical Report – Conceptual Studies in Geoengineering Conceptual for UNGS

This product must present, in a structured and descriptive way, a conceptual study of geoengineering for each of the types of UNGS sites, such as reservoirs in porous material that store large volumes and are used to supply seasonal demands (reservoirs of depleted fields).

The conceptual study must consider the preparation of an analysis of alternatives including costs, integration with existing infrastructure, socio-environmental aspects to support the recommendation of the selected sites. The report must contain indications of the bibliographic references used, as well as the calculation memories of any numerical data generated in the scope of the study, or the indication of the sources for obtaining them, when coming from third parties.

The cost data presented must be referenced to a base date, must submit any indexes used for temporal adjustment (where necessary), must show the quotation of the international currency to which the costs refer, and the country or region where the costs were obtained must be indicated.

Product 6 – Technical Report - Evaluation of Targets for Carbon Capture, Storage and Utilization (CCUS) in inventoried Areas for ESGN in this study.

Due to discussions about the energy transition and the reduction of emissions in the country, mainly due to internationally established commitments, in addition to other factors such as access to clean energy financing mechanisms, there is a need to improve the planning, not only of carbon dioxide capture in Brazil, but also of its storage and movement. Carbon Capture, in turn, may be carried out in the future in installations that consume fossil fuels



with CO₂ generation, as well as installations that reform methane or other fuels for hydrogen generation.

Carbon Capture and Storage are not yet carried out in Brazil for the specific purpose of reducing emissions. However, today there is already CO₂ injection in national oil and natural gas producing fields, only for advanced oil recovery or storage after purification of natural gas currents in pre-salt rich carbon dioxide. The Capture, Storage and Utilization of carbon, although not yet developed in the national territory, are a positive alternative, which aims to contribute to the following issues:

- capture of carbon dioxide produced after burning fuels and/or separated from other currents, in order to purify CO₂-rich gas streams or directly capture CO₂-rich exhaust gases generated after burning fuels;
- capture of CO₂ to establish initiatives focused on blue hydrogen (hydrogen generation from natural gas coupled to CCS), neutralizing emissions in relation to the base case where natural gas was consumed;
- CO₂ capture to establish initiatives focused on green hydrogen (hydrogen generation from biogas), which can also be coupled to CCS so that it becomes negative in emissions, offsetting emissions in other links in the chain or other energy sources;
- access of agents to financing lines for clean energy, or improvement in indicators (e.g. RenovaBio), of enterprises that build or hire CCS.

Considering the similarities of the technical studies for UNGS and CCUS, the preliminary indication of targets for CCUS, from the analysis of the areas selected for natural gas storage study, presents itself as an opportunity to gain scope in the context of the evaluations treated in this study.

This product should present, from the areas inventoried in Product 4, the locations with potential targets for CCUS. The areas found to be favorable for CCUS should be included in maps to be delivered in shapefile format and with associated data structure (attributes) that allow the reproduction of the results. It should contain descriptively, and with the calculation memory that is necessary, the technical justifications pointed to the favorability and selection



THE WORLD BANK
IBRD • IDA | WORLD BANK GROUP



of the area; and what are the possibilities of use and/or monetization of the CCUS; and a preliminary study of technical and economic feasibility.

Product 6 7 – Final Report – Evaluation of Underground Natural Gas Storage in Brazil

This product must consolidate all project results of the study, contemplating the content of all the other 6 (six) products, through reports, databases and maps. The maps must be delivered in the *shapefile* format and with associated data structure (attributes) that allow the reproduction of the results, following the methodology defined and applied in the study, and must follow the structure proposed by the National Spatial Data Infrastructure (INDE), instituted by Decree No. 6,666, of November 27, 2008. The databases must be delivered in Excel, csv, Access, or Microsoft SQL database.

The Contracted firm must conduct a workshop integrating all the products generated, presenting the methodologies used and discussing the results, for dissemination and contribution of external agents. The participation of external agents will be defined by both parties, with the participation of relevant environmental agencies. Any contributions from the workshop must be included in the Final Report as an Annex. Contributions considered relevant, duly substantiated, that require alteration or modification to the documents discussed in the workshop, or in any public presentations of the results of the Contracted firm will be evaluated by the EPE together with the consulting team and may be increased to the report of Product 7.

The Final Report, to be delivered after the workshop, within the period indicated in item 7, must contain indications of the bibliographic references used, as well as the calculation records of any numerical data generated in the scope of the study, or the indication of the sources to obtain it, when coming from third parties.

The cost data presented must be referenced to a base date, must submit any indexes used for temporal adjustment (where necessary), must show the quotation of the international currency to which the costs refer, and the country or region where the costs were obtained must be indicated.



7. ACTIVITIES

For the development of each product listed above, specific activities must be carried out in accordance to the following clauses:

<i>PRODUCTS</i>	<i>ACTIVITIES</i>
Product 1 – Work Plan	<ul style="list-style-type: none"> - General discussion about the Work Plan to be used in the development of the study and to level the expectations in relation to the other products envisaged. It is considered appropriate to participate at least 2 (two) team members (Project Manager and 1 more consultant) in this meeting, whose duration may be up to 2 (two) periods of 4 (four) hours each. The displacement of a Consulting Team to EPE's office in Rio de Janeiro to meeting-person is optional and is at the Contractor's discretion; - Describe the activities / work steps required to achieve the proposed objectives with the applied methodologies. The Work Plan must be directly related to the products and timelines defined in this TOR, citing specific objectives, activities, deadlines, stakeholders and partners; - Provide preliminary version of Product 1, according to the schedule defined in the Work Plan; - Conduct meetings by teleconference or videoconference, throughout the execution of the product, whenever necessary, between EPE and specialized technical consultancy; - Produce and deliver Product 1.
Product 2 – International Legislation Reference	<ul style="list-style-type: none"> - Survey of legislation and regulation of Underground Natural Gas Storage (UNGS) activities in countries with well-defined regulation and legislation, to be chosen by the EPE and the contracted firm in the Work Plan, including environmental legislation aspects that apply to the implementation and development of UNGS. At least 3 (three) countries should be considered; - Perform a critical analysis of the chosen international models, identifying experiences that can contribute to the success of the UNGS in Brazil and improvement of the existing Brazilian regulation and legislation;

	<ul style="list-style-type: none">- Identify the main challenges, and possible solutions, in the implementation of the Underground Storage of Natural Gas in Brazil;- Describe the most suitable contracting models to be adopted for the implementation of UNGS in Brazil, with suggestion of the best model;- Provide preliminary version of Product 2, according to the schedule defined in the Work Plan;- Conduct meetings by teleconference or videoconference, throughout the execution of the product, whenever necessary, between EPE and specialized technical consultancy;- Provide other documents used or elaborated by the consultancy (reports, databases, bibliographies, among others), which can be considered relevant for a better understanding and monitoring of the project by the Supervisory Technical Committee - STC;- Deliver and present Product 2. At the product presentation meeting, it is considered appropriate to participate in at least 2 (two) team members (Project Manager and another 1 consultant) in this meeting. The meeting is also intended to level in expectations regarding Product 3. The duration of the meeting may be up to 2 (two) periods of 4 (four) hours each. The meeting is also intended to level expectations regarding Product 3. The displacement of a Consulting Team to EPE's office in Rio de Janeiro to meeting-person is optional and is at the Contractor's discretion;
--	--

<p>Product 3 – Area Inventory for UNGS in Brazil</p>	<ul style="list-style-type: none"> - Develop a database of the preliminary portfolio of areas for the purpose of UNGS in depleted fields in the Brazilian sedimentary basins, based on geological and geophysical studies (data and wells profiles and others that are necessary); <p>The selected areas of interest for UNGS in the Brazilian sedimentary basins will compose the preliminary portfolio for application of the methodologies defined in activities related to Product 4. Thus, they must be represented in georeferenced maps, in the <i>shapefile</i> format, associated with attribute tables;</p> <ul style="list-style-type: none"> - Provide preliminary version of Product 3, according to the schedule defined in the Work Plan; - Provide other documents used or elaborated by the consultancy (reports, databases, bibliographies, etc.), which can be considered relevant for a better understanding and monitoring of the project by the Supervisory Technical Committee - STC; - Conduct meetings by teleconference or videoconference, during the execution of the product, whenever necessary, between EPE and specialized technical consultancy; - Deliver and present Product 3. For this activity, it is considered appropriate to participate in at least 2 (two) team members (Project Manager and another 1 consultant. The meeting is also intended to level expectations regarding Product 4. The duration of the meeting may be up to 2 (two) periods of 4 (four) hours each. The displacement of a Consulting Team to EPE's office in Rio de Janeiro to meeting-person is optional and is at the Contractor's discretion;
<p>Product 4 – UNGS Site Selection Methodology and Application to the Brazilian Sedimentary Basins</p>	<ul style="list-style-type: none"> - Survey of UNGS cases in the world, considering the different types of storage sites in reservoirs of depleted fields; - Definition of the geological, economic, technical and environmental criteria to be considered in the UNGS project, based on successful cases around the world, aiming at the preliminary indication of potential targets in the Brazilian sedimentary basins. The geological criteria of the reservoirs of depleted fields must include, among others, what are relevant for the choice of these UNGS targets: the date of discovery of the field, type of reservoir, associated geological structures,

	<p>number of wells, type of production, production history and production strategies;</p> <ul style="list-style-type: none">- Hold a discussion forum between the contracted consultancy and the EPE to discuss and decide on the selection of areas for detailed studies;- Define 20 (twenty) sites with potential for ESGN for detailed evaluation of technical and economic aspects;- To evaluate, with technical-economic detail, 20 (twenty) areas of depleted fields, in land and/or shallow water environments, in Brazilian sedimentary basins; <p>The economic criteria must present cost estimates to be considered in the UNGS project, in terms of CAPEX, OPEX and ABEX, for typical projects of reservoirs for storage in depleted fields by cost group (wells, surface facilities, handling infrastructure, among others);</p> <p>Regarding the technical criteria for each identified target, among others, the following must be considered: storage capacity, cushion gas or base gas, working gas or top gas, delivery rate (deliverability) and number of cycles (cycling);</p> <p>The environmental criteria must include, among others, the types and timing of licensing, as well as all good practice applied to the type of enterprise or infrastructure used for UNGS;</p> <ul style="list-style-type: none">- Evaluate information on possible targets for UNGS, in order to identify bottlenecks, identify and exclude areas of no interest and list these targets for UNGS in order of priority, considering the following levels: i) target without interest, ii) target to be developed in the short term, iii) target to be developed in the long term. The definitions of short and long term must be discussed with the EPE; <p>For the reservoirs of depleted fields, there must be interaction with the National Agency for Petroleum, Natural Gas and Biofuels (ANP) in order to deepen the studies already carried out by this Agency, within the framework of the " Expression of Interest 2016: Areas for Underground Storage of Natural Gas". In this context, the ANP considered only the depleted fields already returned to the Union. The initial portfolio of this contract must cover the fields already returned to the Union and those still in the production phase with foreseen termination of</p>
--	---

	<p>contract up to 10 years. The initial contacts with the ANP and other agents will be carried out by the EPE;</p> <p>For this interaction with the ANP, it is considered appropriate to participate at least of 2 (two) team members (Project Manager and 1 consultant), in each meeting. The duration of the meetings may be up to 2 (two) periods of 4 (four) hours each. The displacement of a consulting team to an ANP's office in Rio de Janeiro for a face-to-face meeting is optional and is at the contractor's discretion.</p> <ul style="list-style-type: none"> - In addition to the above meetings, at least one visit to an UNGS site, to be defined by the EPE in conjunction with the Contractor, must be held. It is considered appropriate to participate at least 2 (two) team members (Project Manager and 1 more consultant) in each visit, in addition to the EPE team. The duration of visits may be up to 2 (two) periods of 4 (four) hours each. Forecast of two nights for each consultant on each visit. - Provide preliminary version of Product 4, according to the schedule defined in the Work Plan; - Conduct meetings by teleconference or videoconference, during the execution of the product, whenever necessary, between EPE and specialized technical consultancy; - Provide other documents used or elaborated by the consultancy (reports, database, bibliography, etc.), which can be considered relevant for a better understanding and monitoring of the project by the Supervisory Technical Committee - STC; - Deliver and present Product 4. For this activity, it is considered appropriate to participate in at least 2 (two) team members (Project Manager and another 1 consultant). The meeting is also intended to level expectations regarding Product 5. The duration of the meeting may be up to 2 (two) periods of 4 (four) hours each. The displacement of a Consulting Team to EPE's office in Rio de Janeiro to meeting-person is optional and is at the Contractor's discretion.
<p>Product 5 – Conceptual Studies in</p>	<ul style="list-style-type: none"> - Development of a conceptual geoengineering study for each type of UNGS site, in depleted field reservoirs, specifying for which use they were designed (supply of seasonal demands or peaks of demand). Minimum reference volumes must be

<p>Geoengineering Conceptual for UNGS</p>	<p>considered for the withdrawal of natural gas, for each type of UNGS site, to be defined by the EPE. The studies must take into account the predominant geological characteristics of the targets identified in Product 4: UNGS Site Selection Methodology and Application in Brazilian Sedimentary Basins. Each study must contain, among other aspects, storage and flow conditions, equipment specification, commissioning and decommissioning conditions;</p> <p>Each study must also include cost estimates to be considered in the design of an UNGS site, in terms of CAPEX,-OPEX and ABEX, for typical projects of reservoirs of depleted fields by cost group (wells, surface facilities, transportation infrastructure, among others);</p> <ul style="list-style-type: none"> - Provide preliminary version of Product 5, according to the schedule defined in the Work Plan; - Conduct meetings by teleconference or videoconference, during the execution of the product, whenever necessary; - Provide other documents used or elaborated by the consultancy (reports, database, bibliography, etc.), which can be considered relevant for a better understanding and monitoring of the project by the Supervisory Technical Committee - STC; - Deliver and present Product 5. For this activity, it is considered appropriate to participate in at least 2 (two) team members (Project Manager and another 1 consultant). The meeting is also intended to level expectations regarding Product 6. The duration of the meeting may be up to 2 (two) periods of 4 (four) hours each. The displacement of a Consulting Team to EPE's office in Rio de Janeiro to meeting-person is optional and is at the Contractor's discretion.
<p>Product 6 – Technical Report - Evaluation of Targets for Carbon Capture, Storage and Utilization (CCUS) in</p>	<ul style="list-style-type: none"> - Evaluate from the inventoried areas in Product 3, the locations with potential targets for CCUS; - Indicate the favorable targets for CCUS in maps that should be delivered in shapefile format and with associated data structure (attributes) that allow the reproduction of the results; - Describe, together with the calculation memory that is necessary, the technical justifications pointed out for the



<p>inventoried Areas for ESGN in this Project</p>	<p>favorability and selection of the area and what possibilities of use and/or monetization of the CCUS;</p> <ul style="list-style-type: none"> - Prepare a preliminary study of technical and economic feasibility of CCUS in the possible selected areas; - Provide preliminary version of Product 6, according to the schedule defined in the Work Plan; - Provide other documents used or prepared by the consultancy (reports, database, bibliography, etc.), which can be considered relevant for a better understanding and monitoring of the project by the Technical Supervisory Committee - CTS; - Conduct meetings by teleconference or videoconference, during the execution of the product, whenever necessary; - Deliver and present Product 6. For this activity, it is considered appropriate to participate in at least 2 (two) team members (Project Manager and another 1 consultant). The meeting is also intended to level expectations regarding Product 7. The duration of the meeting may be up to 2 (two) periods of 4 (four) hours each. The displacement of a Consulting Team to EPE's office in Rio de Janeiro to meeting-person is optional and is at the Contractor's discretion.
<p>Product 7 – Final Report - Evaluation of Underground Natural Gas Storage in Brazil</p>	<ul style="list-style-type: none"> - Present in a Workshop all the products generated, in an integrated way, including methodologies used and discussion of the results, for the contribution of external agents, according to the schedule defined in the Work Plan; <p>The total duration of the Workshop must be from 12 (twelve) to 16 (sixteen) hours, on 2 (two) consecutive days.</p> <p>The choice of venue to hold the Workshop is the responsibility of the contracted firm and must be easily accessible, and in the city of Rio de Janeiro, and hold up to 50 (fifty) participants. The workshop must also be transmissible via videoconference;</p> <p>It is considered appropriate the participation of at least 2 (two) team members (Project Manager and 1 consultant). Prediction of 2 (two) daily rates for each consultant;</p> <p>The participation of external agents will be defined by both parties. The participation of environmental agencies is pertinent. The preparation and dispatch of the invitations is</p>



	<p>under the responsibility of the contracted firm and must be sent in advance of 60 (sixty) days, by correspondence and resent via e-mail within 30 (thirty) days, and again 7 (seven) days of the event;</p> <ul style="list-style-type: none"> - Conduct meetings by teleconference or videoconference, during the execution of the product, whenever necessary; - Provide preliminary version of Product 7, according to the schedule defined in the Work Plan; - Submit the Final Report, with the entire consolidated study results, to the EPE through reports, databases in Excel, csv, Access or Microsoft SQL and maps in the <i>shapefile</i> format with an attribute table that must also include all the topics covered, discussions, external contributions and other relevant information that emerged during the Workshop, in addition to the attendance list of the participants. For this activity, it is considered appropriate to participate in at least 2 (two) team members (Project Manager and another 1 consultant). The purpose of the meeting is to discuss the final product and study closure. The duration of the meeting may be up to 2 (two) periods of 4 (four) hours each. The displacement of a Consulting Team to EPE's office in Rio de Janeiro to meeting-person is optional and is at the Contractor's discretion. - Provide other documents used or elaborated by the consultant (reports, database, bibliography, etc.), which can be considered relevant for a better understanding and monitoring of the project by the Supervisory Technical Committee (STC).
--	---

8. DEADLINES/SCHEDULE

The period forecast to execute the consultancy and delivery of the 7 (seven) products, described in item 5, is up to 540 (five hundred and forty) days from the issuance of the service note. Products must be delivered at the intervals indicated in the following schedule. Changes in the schedule may be discussed between EPE and the Contractor during the preparation of Product 01-Work Plan.

Expected Product	Deadline	
-------------------------	-----------------	--

Type	Title		% of Contract Value
Technical Report	<u>Product 1</u> Work Plan	Until 30 (thirty) days after issuance of the Service Order	10%
Technical Report	<u>Product 2</u> International Legislation Reference	Until 90 (ninety) days after issuance of the Service Order	15%
Technical Report	<u>Product 3</u> Area Inventory for UNGS in Brazil	Until 210 (two hundred and ten) days after issuance of the Service Order	25%
Technical Report	<u>Product 4</u> UNGS Site Selection Methodology and Application in Brazilian Sedimentary Basins	Until 270 (two hundred and seventy) days after issuance of the Service Order	10%
Technical Report	<u>Product 5</u> Conceptual Studies in Geoengineering Conceptual for UNGS	Until 330 (three hundred and thirty) days after issuance of the Service Order	10%
Technical Report	<u>Product 6</u> Technical Report - Evaluation of Targets for Carbon Capture, Storage and Utilization (CCUS) in inventoried Areas for ESGN in this Project	Until 450 (forty hundred and fifty) days after issuance of the Service Order	20%

Technical Report	<u>Product 7</u> Final Report - Evaluation of Underground Natural Gas Storage in Brazil	540 (fifty hundred and forty) days after issuance of the Service Order	10%
------------------	--	--	-----

9. TECHNICAL QUALIFICATION

8.1. Staff Profile

QUANT.	PROFESSIONAL	QUALIFICATION	PLANNED ACTIVITIES
01	Project Manager	<p>Professional with at least a PhD and/or proven professional experience of 15 (fifteen) years in coordinating studies in the oil and gas sector and/or Reservoir Engineering and noted knowledge in UNGS projects.</p> <p>And proven environmental qualification or minimum experience of 5 (five) years in management of socio-environmental impacts associated with these areas.</p>	<ul style="list-style-type: none"> • Elaborate and present to the EPE the Work Plan for the study; • Ensure the quality of collected data and the criteria defined for the establishment of the UNGS target definition methodology in Brazil; • Coordinate the activities of the different professionals involved in the studies, subject of this contract; • Guarantee the delivery of the Products, as well as all other documents forecast in the Terms of Reference (TOR).

01	Senior Consultant	Professional with a bachelor degree in Geology or Geophysics and a minimum of 8 (eight) years' experience in evaluation of geological formations (e.g., petrophysics, reservoir evaluation, etc.). Experience in management in socio-environmental impacts is also desirable.	<ul style="list-style-type: none"> • Analyze the consistency of geological and geophysical data collected in field surveys; • Prepare reports that will compose the Products forecast in the TOR; • Ensure the consistency and accuracy of the information contained in the geological, geophysical and environmental database, according to predefined criteria considered satisfactory to the objectives of this study.
01	Senior Consultant	Professional with a bachelor degree Economics or Engineering and a minimum of 8 (eight) years' experience in the energy and natural gas sector.	<ul style="list-style-type: none"> • Ensure better adherence of economic aspects in the product elaboration, as in the visualization of scenarios that may influence the expected results; • Prepare reports that will compose the Products forecast in this TOR.
01	Senior Consultant	Professional with a degree in Environmental Engineering and/or another higher level and experience of at least 10 (ten) years in the Oil and Natural Gas sector, with proven experience in Risk Management and Socio-environmental Impacts associated with the theme (ESGN).	<ul style="list-style-type: none"> • Ensure the best verification of environmental aspects and potential Socio-environmental Impacts, as mentioned in Chapter 5 of this document, both in the elaboration of products and in the visualization of scenarios that may influence the expected results;

01	Consultant	Professional with a bachelor degree, with a minimum of 5 (five) years of experience in the oil and gas regulation sector.	<ul style="list-style-type: none"> Analyze the laws and regulations of several countries with a critical vision related to the situation in Brazil; Prepare reports that will compose the Products forecast in this TOR.
02	Consultant	Professional with a bachelor degree, with a minimum of 5 (five) years of experience in oil and gas exploration and production and in the coordination of a multidisciplinary technical staff.	<ul style="list-style-type: none"> Coordinate the base staff involved in the execution of the work; Inform the Project Manager and the Consultants with specific expertise about the monitoring of the operational activities, as well as the results obtained; Share with the base staff the managerial feedback about the work done, as well as the decision-making needed.
01	Junior Consultant	Professional with a bachelor degree, with a minimum of 2 (two) years of experience in Geoprocessing for oil, gas and energy industry projects.	<ul style="list-style-type: none"> Perform the georeferencing of the data of the different areas of action, analyzing the information processed and the results obtained in each phase of the study.

8.2. Qualifications of the Consultant Company

The necessary work requires, from the Contracted firm, a minimum of 5 (five) years previous experience in work related to studies and projects of Underground Storage of Natural Gas. The Contracted firm, with proven technical capacity to carry out all the activities foreseen in this TOR, can also use properly qualified advice, with proven expertise in studies and projects of Underground Storage of Natural Gas.



10. PRODUCT PRESENTATION FORMAT

All the documents included in the various Products will be produced in Portuguese and English, with the following characteristics:

- Must be delivered in digital media (DVD, USB flash drive or external HD) in two copies;
- Each product must be delivered printed in 3 (three) complete copies in Portuguese, and 3 (three) copies in English, and a copy of each must not be bound, in order to enable its storage in the hiring process;
- Texts: elaborated using Microsoft Word® software, Office 365 version;
- Worksheets, charts and tables: elaborated using Microsoft Excel® software, Office 365 version;
- Database: Access, SQL Server 2014 ~~2005~~ or up-to-date version with its routine and other pertinent information delivered in 3 (three) copies in electronic media (USB flash drive or external HD) along with the Final Report;
- Presentations: elaborated using Microsoft PowerPoint® software, Office 365 version;
- Images: should be saved in JPG, GIF or BMP formats;
- Maps: saved in *shapefile* format (ArcGIS version 10.8.2).

The products in the form of reports must present the following logos, to be inserted in the following order: EPE, Project Meta, World Bank and MME / Federal Government. Image files corresponding to the logos will be provided to the Contracted firm that may also include its own logo in the reports.

In the products / reports, in addition to the mentioned logos, the following information should be recorded: Research / Product / Work executed with funds from Loan Agreement No. 8.095-BR, formalized between the Federative Republic of Brazil and the International Bank for Reconstruction and Development - IBRD, on March 1, 2012.



11. PAYMENT METHODS

The percentage estimate of the total contract value for each product is set forth in Item 7 of this document. The payment methods, as well as the deadlines for delivery and approval of the products, will be linked to the Draft Contract, an instrument that is an integral part of the Bidding Instrument.

12. SUPERVISION

The Supervisory Technical Committee - STC of the Contract related to this TOR must be composed of at least 3 (three) immediate members and 3 (three) alternate members, all linked to the EPE, responsible for the coordination, general oversight and approval of the documents produced.

The beginning of the work subject of this TOR, as well as the presentation of the products herein, should be preceded by a meeting with the technical manager and / or with the STC for a general process orientation.

Following the approval of the services, representatives of the EPE and the Contracted firm will be formally appointed, with the purpose of technical coordination and centralizing communication throughout the development of the study.

Meetings will be held periodically and according to a schedule defined by a common agreement between the Contractor and the STC. Either party may request a meeting, which must result in a record of the deliberations or arrangements to be made by the parties.

The STC must analyze each product within 15 (fifteen) days from the date of delivery. The contracted firm must comply with the comments and changes requested by the STC, on each product, within 7 (seven) days. These above-mentioned periods can be extended, exceptionally, by recording in the process the reasons for the requested extensions.

13. AVAILABLE ELEMENTS

The EPE must arrange, whenever necessary, the appropriate physical environment to enable work meetings scheduled between the Parties in the EPE office – Rio de Janeiro.



THE WORLD BANK
IBRD • IDA | WORLD BANK GROUP



14. CLASSIFICATION OF EXPENSES

Expenses incurred on the hiring of consulting services subject to this Terms of Reference fall into the Work Program No. 10.32.101.25.572.0032.13E4.0001.

15. SAFEGUARD POLICIES - ENVIRONMENTAL AND SOCIAL FRAMEWORK OF THE WORLD BANK

All activities supported by the project, including studies to propose policies and regulations should be analyzed in accordance with the World Bank's Environmental and Social Standards, which establish guidelines for identifying, evaluating, mitigating and managing potential risks and impacts associated with Projects financed by the Bank.

The adoption of Environmental and Social Standards aims to support borrowers in the adoption of international best practices related to environmental and social sustainability, fulfilling their environmental and social, national and international obligations, as well as increasing non-discrimination, transparency, participation, accountability, governance and improving the results of sustainable development of projects through the continuous engagement of stakeholders. In addition to the World Bank's Environmental and Social Framework, the World Bank Group's Health, Safety and Environment Guidelines (IFC-EHSGs) will be observed, including the specific guidelines for the mineral, electricity and oil and gas sectors.

World Bank Social and Environmental Standards

The World Bank's new Environmental and Social Framework, which has entered into force since October 1, 2018, as previously reported, applies to new investment project financing operations, and has a framework that allows the World Bank and its client countries to better manage the environmental and social risks of the projects, as well as improving development outcomes. Thus, there is a need to define the methodology and content of the Characterization Study to evaluate the potential social and environmental impacts of the subprojects linked to the aforementioned Technical Assistance (TA) and also a management system of the Ministry of Mines and Energy, including the accountability of the World Bank. Thus, the preparation of the Characterization Study aims to ensure that appropriate environmental and



social considerations are included in the terms of reference (TDR) of the activities supported by the Project.

The Environmental and Social Standards establish the requirements to be met by Borrowers with regard to the identification and assessment of socio-environmental risks and impacts associated with the projects that the Bank supports through the Financing of Investment Projects. The Bank considers that the implementation of these standards, aimed at identifying and managing environmental and social risks, will help Borrowers achieve their goal of reducing poverty and boosting prosperity in a sustainable way to benefit the environment and its citizens. The standards will:

- Support borrowers following good international practices on environmental and social sustainability;
- Help borrowers meet their environmental and social obligations, both national and international;
- Strengthen non-discrimination, transparency, participation, accountability and good governance; and
- Improve project outcomes in terms of sustainable development through the continued involvement of stakeholders.

The 10 (ten) Environmental and Social Standards (NAS) that establish the requirements to be met by the Borrower and the project throughout the project life cycle are as follows:

- Environmental and Social Standard 1 - Assessment and Management of Risks and Social and Environmental Impacts;
- Environmental and Social Standard 2 - Working Conditions and Labor;
- Environmental and Social Standard 3 - Resource Effectiveness and Pollution Prevention and Management;
- Environmental and Social Standard 4 - Community Health and Safety;



- Environmental and Social Standard 5 - Land Acquisition, Land Use Restrictions and Involuntary Resettlement;
- Environmental and Social Standard 6 - Biodiversity Conservation and Sustainable Management of Living Natural Resources;
- Environmental and Social Norm 7 - Indigenous Peoples / Community Traditional Places Historically Disadvantaged;
- Environmental and Social Norm 8 - Cultural Heritage;
- Environmental and Social Standard 9 - Financial Intermediaries; and
- Environmental and Social Standard 10 - Involvement of Stakeholders and Dissemination of Information.

16. LEGAL PROHIBITION

Hiring is forbidden, on any account, of active employees of the Federal, State, Federal District or Municipal Public Administrations, direct or indirect, as well as employees of its subsidiaries and controlled companies, within the international technical cooperation projects. *Clause 7 of Decree No. 5.151 of 07.22.2004.*

Technical in Charge:

Name: Regina Freitas Fernandes

Position: TECHNICAL ADVISOR I

Agency: EMPRESA DE PESQUISA ENERGÉTICA

Signature:

Technical in Charge:

Name: Marcelo Ferreira Alfradique

Position: ASSISTANT SUPERINTENDENT

Agency: EMPRESA DE PESQUISA ENERGÉTICA



Signature:

Approval:

Name: Heloisa Borges Bastos Esteves

Position: DIRECTOR

Agency: EMPRESA DE PESQUISA ENERGÉTICA

Signature:

TDR 16 - EPE - English_v5.docx

Documento número #4ca748e3-ab55-4876-aa02-590b21bca9ce

Hash do documento original (SHA256): 1fc50976524ffca02a01382dc4b7d58a0b17d8e89e19a2e7b5a1541487dbfa5f

Assinaturas

✓ **Heloisa Borges Bastos Esteves**

Assinou em 28 mar 2023 às 17:17:32

✓ **Marcelo Ferreira Alfradique**

CPF: 082.394.477-83

Assinou em 28 mar 2023 às 17:17:37

✓ **Regina Freitas Fernandes**

CPF: 007.558.987-70

Assinou em 29 mar 2023 às 09:21:07

Log

- 28 mar 2023, 17:15:16 Operador com email alessandra.coratini@epe.gov.br na Conta 9ff5c315-4340-4725-bec4-76ac5b6b51d6 criou este documento número 4ca748e3-ab55-4876-aa02-590b21bca9ce. Data limite para assinatura do documento: 27 de abril de 2023 (17:12). Finalização automática após a última assinatura: habilitada. Idioma: Português brasileiro.
- 28 mar 2023, 17:15:34 Operador com email alessandra.coratini@epe.gov.br na Conta 9ff5c315-4340-4725-bec4-76ac5b6b51d6 adicionou à Lista de Assinatura: heloisa.esteves@epe.gov.br para assinar, via E-mail, com os pontos de autenticação: Token via E-mail; Nome Completo; endereço de IP. Dados informados pelo Operador para validação do signatário: nome completo Heloisa Borges Bastos Esteves.
- 28 mar 2023, 17:15:34 Operador com email alessandra.coratini@epe.gov.br na Conta 9ff5c315-4340-4725-bec4-76ac5b6b51d6 adicionou à Lista de Assinatura: marcelo.alfradique@epe.gov.br para assinar, via E-mail, com os pontos de autenticação: Token via E-mail; Nome Completo; CPF; endereço de IP. Dados informados pelo Operador para validação do signatário: nome completo Marcelo Ferreira Alfradique e CPF 082.394.477-83.
- 28 mar 2023, 17:15:34 Operador com email alessandra.coratini@epe.gov.br na Conta 9ff5c315-4340-4725-bec4-76ac5b6b51d6 adicionou à Lista de Assinatura: regina.fernandes@epe.gov.br para assinar, via E-mail, com os pontos de autenticação: Token via E-mail; Nome Completo; CPF; endereço de IP. Dados informados pelo Operador para validação do signatário: nome completo Regina Freitas Fernandes e CPF 007.558.987-70.
- 28 mar 2023, 17:17:32 Heloisa Borges Bastos Esteves assinou. Pontos de autenticação: Token via E-mail heloisa.esteves@epe.gov.br. IP: 177.47.116.40. Componente de assinatura versão 1.473.0 disponibilizado em <https://app.clicksign.com>.

28 mar 2023, 17:17:38	Marcelo Ferreira Alfradique assinou. Pontos de autenticação: Token via E-mail marcelo.alfradique@epe.gov.br. CPF informado: 082.394.477-83. IP: 177.47.116.40. Componente de assinatura versão 1.473.0 disponibilizado em https://app.clicksign.com .
29 mar 2023, 09:21:08	Regina Freitas Fernandes assinou. Pontos de autenticação: Token via E-mail regina.fernandes@epe.gov.br. CPF informado: 007.558.987-70. IP: 177.47.116.40. Componente de assinatura versão 1.473.0 disponibilizado em https://app.clicksign.com .
29 mar 2023, 09:21:08	Processo de assinatura finalizado automaticamente. Motivo: finalização automática após a última assinatura habilitada. Processo de assinatura concluído para o documento número 4ca748e3-ab55-4876-aa02-590b21bca9ce.

**Documento assinado com validade jurídica.**

Para conferir a validade, acesse <https://validador.clicksign.com> e utilize a senha gerada pelos signatários ou envie este arquivo em PDF.

As assinaturas digitais e eletrônicas têm validade jurídica prevista na Medida Provisória nº. 2200-2 / 2001

Este Log é exclusivo e deve ser considerado parte do documento nº 4ca748e3-ab55-4876-aa02-590b21bca9ce, com os efeitos prescritos nos Termos de Uso da Clicksign, disponível em www.clicksign.com.