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STORAGE ARCHITECTURES

A COMPARATIVE ANALYSIS OF REGULATION AND
GOVERNANCE OF GEOLOGICAL CO₂ STORAGE

CREDITS

General Coordination of the CCS Brasil | Pathways to Scale Series

Isabela Morbach Machado e Silva

Nathália Weber Neiva Masulino

Coordination of Paper 1

Isabela Morbach Machado e Silva

Authors

Carina Pereira Cancela

Geraldo Lavigne de Lemos

Isabela Morbach Machado e Silva

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CONTEXT

Brazil is at a decisive juncture in the development of carbon capture and storage (CCS) projects. In just a few years, CCS has evolved from an activity without specific legal framework to one that is explicitly integrated into national energy and climate policy. The Fuel of the Future Act recognized the activity and assigned responsibility for its regulation to the National Agency for Petroleum, Natural Gas, and Biofuels (ANP). More recently, Decree No. 13,095/2026 laid the groundwork for implementing this framework and outlined some of the key decisions to be detailed in its regulations.

Transforming this framework into safe, efficient, and economically viable projects will depend on the quality of the regulations, the capacity of the institutions involved, coordination among public authorities, and the availability of reliable information. It will also require dialogue among the government, industry, academia, and civil society, especially since this is an activity that involves long-term commitments and interfaces with various public policies.

The CCS Brazil Association was created to contribute to this process. Dedicated to the development and strengthening of CCS projects in the country, it seeks to expand knowledge about the technologies involved, contribute to the interaction of various stakeholders, and provide technical support to advance the regulatory, institutional, and market conditions necessary for the responsible implementation of CCS projects.

The production and dissemination of information play a central role in this mission. In a sector still in its formative stages, access to international experiences, data, and expert analysis enables us to understand alternatives, anticipate challenges, and avoid replicating models that do not always fit the Brazilian case. International comparison should not serve to automatically import solutions, but rather to understand the choices made by other jurisdictions and the problems those choices sought to address.

It is with this purpose in mind that **CCS Brasil presents CCS Brasil | Pathways to Scale**, a series of three studies on the conditions necessary for the safe, responsible, and economically viable development of CCS in Brazil. The publications examine, respectively, the regulatory and institutional framework applicable to geological CO₂ storage; the monitoring, measurement, and verification requirements necessary for project integrity; and the incentive tools and mechanisms for integrating CCS into carbon markets.

This series does not aim to present a single solution for Brazil. CCS projects can take on different configurations, involve distinct emission sources, infrastructure, and geological formations, and require solutions compatible with the economic, environmental, and institutional conditions of each region. The goal is to provide a common technical foundation, organize the discussion, and clarify the decisions necessary for implementing CCS in the country.

Regulating the geological storage of CO₂ requires much more than simply authorizing its injection into an underground formation. The development of this activity requires the establishment of reasonable rules to identify and evaluate areas with storage potential, allocate rights to these areas, install and operate the infrastructure, monitor the behavior of CO₂, shut down operations, and address the responsibilities that remain after the site is closed.

These decisions are interdependent. The method of allocating reservoir exploration rights, for example, influences the incentives for private entities to invest in characterizing geological formations. The structure of authorizations affects the transition between the assessment and operational phases. Monitoring requirements and closure conditions affect the distribution of risks over decades. Similarly, the division of responsibilities among sector-specific regulators, environmental authorities, and government agencies can either clarify the process or create overlaps, gaps, and uncertainties.

Jurisdictions that have already regulated geological storage activities have adopted different approaches to these issues. In some cases, specific regimes for CCS have been created. In others, the activity has been incorporated into frameworks previously used for oil and gas, environmental protection, or the regulation of injection wells. The instruments adopted, the number of authorizations required, the rights granted during the exploration phase, the models of institutional coordination, and the treatment of liability after closure also vary.

This paper examines the regulatory frameworks adopted by Norway, the Province of Alberta in Canada, the United Kingdom, Australia, Malaysia, and the United States, as well as the Brazilian framework to date. The selection includes jurisdictions with different legal traditions, geological characteristics, administrative structures, and levels of maturity in the implementation of CCS projects. The objective is not to identify a single model to be replicated, but to understand how different regulatory systems address similar issues and which choices can inform the development of Brazilian regulations.

In each jurisdiction, the study examines the applicable regulatory model, the life-cycle phases subject to control, the main authorization instruments, area allocation procedures, environmental licensing, and the distribution of responsibilities among the authorities involved. The comparative analysis ultimately summarizes the main points of convergence and divergence and identifies issues relevant to the development of Brazilian regulations.

The study is informative and comparative in nature. International experiences are analyzed as references for understanding the available regulatory alternatives, not as solutions that can be automatically transferred between countries. The suitability of each choice depends on the legal, institutional, economic, environmental, and geological characteristics of the jurisdiction in which it will be applied.

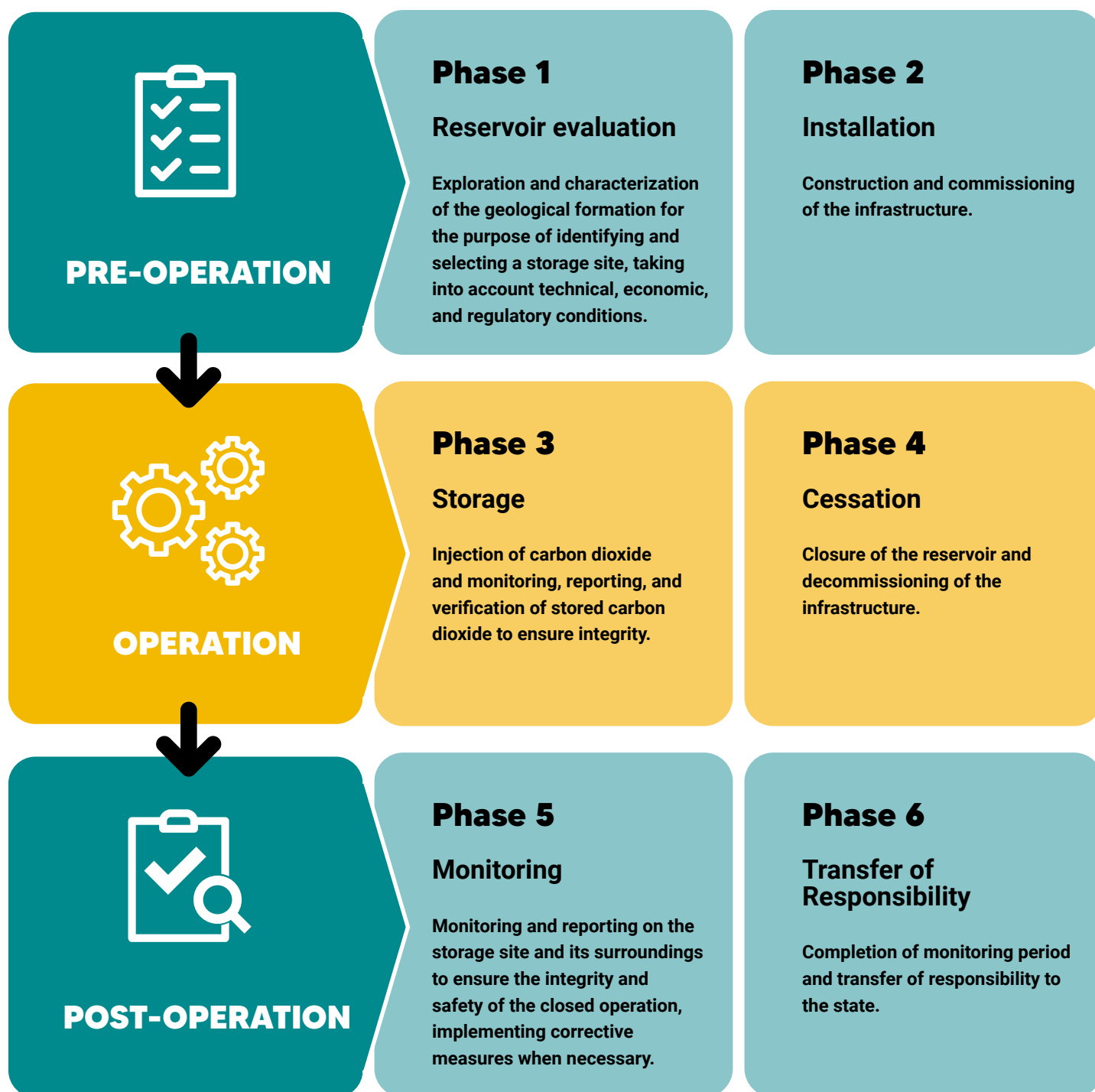
THE LIFE CYCLE OF THE STORAGE PHASE IN CCS PROJECTS

Comparing different regulatory models requires, as a starting point, a common framework that allows us to observe how each jurisdiction organizes and supervises the stages of CO₂ geological storage. Although the formal life cycle of a CCS project and the terminology used in each country vary across the regimes analyzed, it is possible to identify recurring phases that serve as a reference for the comparative analysis developed in this study.

For the purposes of this report, the life cycle of the storage stage has been organized into three major stages (pre-operation, operation, and post-operation), subdivided into the phases shown in Figure 1. This structure is used throughout the document to examine, in each jurisdiction, the applicable regulatory process, its main instruments and requirements, and how the different phases are organized.



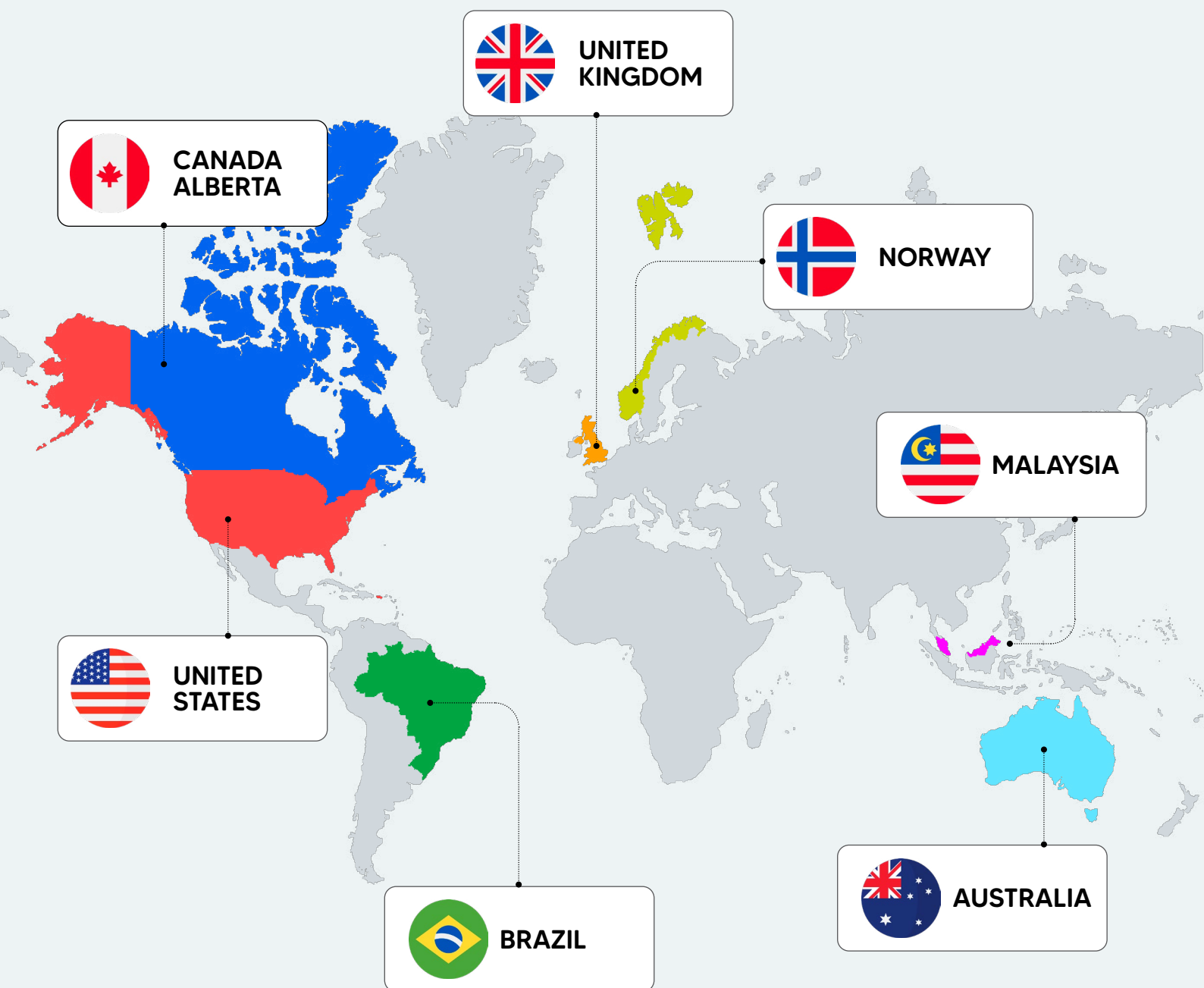
Figure1 - Life cycle of the storage phase in Carbon Capture and Storage projects



Source: Prepared by the author.

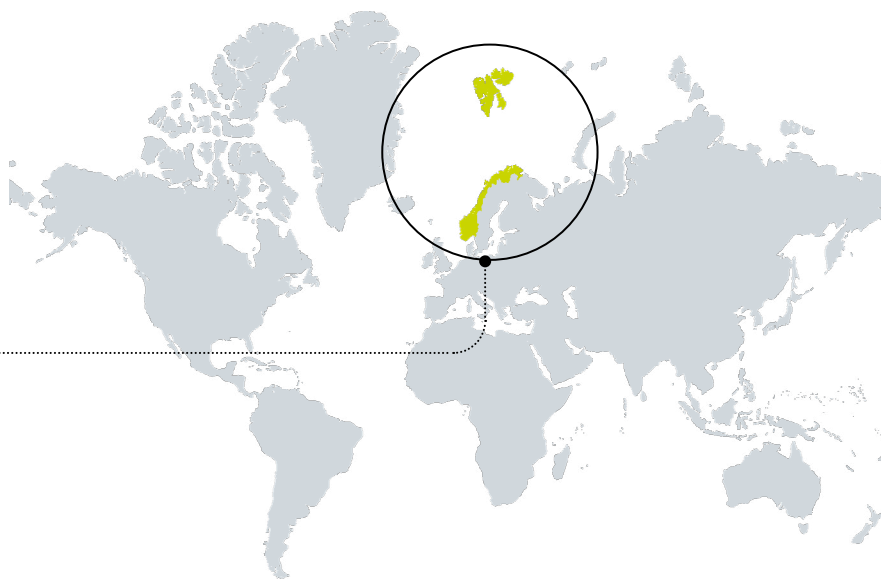
The analysis of the main licenses and permits throughout the storage phase of the CCS project lifecycle considers those relevant to research and/or survey, exploration, and exploitation activities, without prejudice to specific instruments provided for in each analyzed jurisdiction.

COUNTRIES ANALYZED





NORWAY



REGULATORY FRAMEWORK FOR CCS ACTIVITIES

The comparative analysis begins with Norway, one of the jurisdictions with the most established regulatory experience in geological CO₂ storage. The regulatory framework applicable to CCS activities in Norway is divided into two distinct regimes. The first is autonomous and was created specifically for CO₂ storage, where the capture and injection of CO₂ is the primary activity in subsea reservoirs on the continental shelf (*offshore*), while the second is directly linked to petroleum activities.

The autonomous regime is addressed in *the Regulations relating to the exploitation of subsea reservoirs on the continental shelf for the storage of CO₂ and relating to the transportation of CO₂ on the continental shelf* ("Storage Regulations")¹, and must comply with European Union Directive 2009/31/EC, as Norway is a member of the European Economic Area^{2,3}. This is a regulatory model based on the licensing of CCS activities that grants access to geological reservoirs located on the continental shelf.

Norway regulates the storage of CO₂ in subsea reservoirs on the Norwegian continental shelf, recognizing them as the property of the Norwegian State, which has exclusive right over their management, as provided for in *the Storage Regulations* (Sections 1-1 and 1-2). This regulation applies to surveying, exploration, and exploitation activities in such

reservoirs under Norwegian jurisdiction for the storage of CO₂ (Section 1-3), without prejudice to provisions regarding transportation or to its application in cases provided for under international law or agreements with other States (Chapters 1 and 6).

Under this framework, the *Storage Regulations* establish the issuance procedure, requirements, scope, and obligations associated with survey licenses (Chapter 2), exploration licenses (Chapter 3), and exploitation licenses (Chapter 4), and further detail the requirements and obligations for injection and storage activities (Chapter 5) and the cessation of such activities (Chapter 7). It also defines the rules for the division of the continental shelf and for selecting a storage location, providing for the possibility of state participation in transportation and exploitation activities (Chapter 1). Finally, with regard to CCS activities, it addresses liability for damages resulting from pollution, special rules concerning compensation for Norwegian fishermen, and special safety requirements (Chapters 8, 9, and 10).

In turn, surveying, exploration, and exploitation of subsea reservoirs on the Norwegian continental shelf for CO₂ storage associated with petroleum activities are regulated by *the Petroleum Act* (Act No. 72 of November 29, 1996) and its implementing regulations (Section 1-3). Similarly, the *Storage Regulations* do not apply to Svalbard (Section 1-3).

NORWAY

LIFE-CYCLE PHASES OF THE STORAGE STAGE IN CCS PROJECTS SUBJECT TO REGULATORY OVERSIGHT

Private activities involving the surveying, exploration, and exploitation of subsea reservoirs on the continental shelf for CO₂ storage are subject to obtaining the licenses, approvals, and consents required by applicable regulations, as stipulated in the *Storage Regulations* (Sections 1-4 and 1-5). The regulations cover all project phases, from the search for a storage site to the monitoring that precedes the transfer of responsibility following the cessation of operations.

The evaluation phase requires a prior survey license covering specific areas or blocks, which grants the right to survey the continental shelf in search of reservoirs outside areas already licensed for exploration or exploitation in CCS activities or for oil production, unless, under special circumstances, the Ministry of Energy permits such overlap (Sections 2-1, 2-2, and 4-13). To conduct these studies, geological, petrophysical, geophysical, geochemical, and geotechnical activities, as well as shallow drilling, are permitted, all within the stipulated limits (Section 2-4). A survey license does not grant exclusive rights to explore or preferential rights for exploration licenses or exploitation licenses and must be issued for a maximum term of 3 years unless another term has been stipulated (Section 2-1).

Still during the reservoir evaluation phase, taking into account the licensee's financial strength, technical competence, and reliability for the activities, and based on objective, published, and non-discriminatory criteria, the *Storage Regulations* provide for an exploration license, which grants exploration rights for specific areas or blocks, with a view to assessing the potential for exploitation of a subsea reservoir for CO₂ storage (Section 3-1). The exploration license may include requirements regarding the number of wells to be drilled, depths, designated geological formations, and monitoring of injection tests (Section 3-3).

Unlike the survey license, the exploration license grants the exclusive right to explore within the defined area and must be issued for a maximum term of 10 years, extendable up to this limit if the established term was shorter (Sections 3-1 and 3-4). If the exploration license is within its validity period, the licensee shall be given preference in obtaining the exploitation license (Section 4-1).

For the operational phase, an exploitation license is required, granted based on objective, published, and non-discriminatory criteria, taking into account the licensee's financial strength, technical and geological competence, and reliability for the activities. The exploitation license grants the rights to exploit an area defined by longitude and latitude and detailed geological unit specifications, with a view to enabling the injection of CO₂ for storage (Section 4-1). **The exploitation license grants the exclusive right to store CO₂ in the defined area and is issued for a duration stipulated in the license itself (Chapter 4, Sections 4-1 and 4-4).**

Table1 : Key characteristics of Norwegian licenses at each phase of a CCS project

Stage/License	Purpose	Exclusivity and Area	Typical obligations	Does it allow for commercial CO ₂ injection?
EXPLORATION/ SURVEY (SURVEY LICENSE)	Conduct initial geological mapping and assess whether an area may have CO ₂ storage capacity	Non-exclusive and covers specific areas and blocks	Acquire and interpret geological and geophysical data	No
EXPLORATION (EXPLORATION LICENSE)	Confirm whether a delineated reservoir is technically suitable and safe for CO ₂ storage	Grants a preference right for a exploitation license and covers specific areas and blocks	Carry out a work program, including evaluation, an exploratory well, and monitoring of injection tests, for up to 10 years	No
EXPLOITATION (EXPLOITATION LICENSE)	Develop and use the reservoir for CO ₂ injection and storage	Exclusive right to commercially exploit the storage site within the licensed area	Demonstrate technical, geological, and financial capacity; submit a development and operation plan for the storage facility	Yes

Source: prepared by the author.

According to the *Storage Regulations*, before the exploitation license expires, the licensee voluntarily relinquishes the license, or operations cease, the licensee must submit a cessation plan proposing either the continuation of CO₂ storage or the termination of operations (Sections 7-1 and 7-2). The cessation plan must address technical, safety, environmental, and financial aspects, as well as the disposition of the facilities and the impact assessment (Sections 7-1 and 7-3). The operation must be terminated when it meets the conditions stipulated in the license issued by the pollution authorities⁴ and in the consent for injection⁵, or when the authority grants consent upon the operator's request (Section 5-7).

Once operations have ceased, the post-operational phase begins, which requires the operator to monitor the area for a minimum period of 20 years; this period may be reduced if the stability and safety of the stored CO₂ are demonstrated (Section 5-8). Once the monitoring period ends, the law provides for the transfer to the State of responsibility for monitoring and implementing corrective measures, provided that the available data indicate the safety and stability of the stored CO₂, there is no evidence of leakage, the injection facilities have been removed, the storage site is unoccupied, and the required financial contribution has been made to the State through the so-called "financial mechanism". This contribution is intended to cover the projected monitoring expenses for a period of 30 years (Sections 5-8 and 5-10).

NORWAY

ALLOCATION PROCEDURES AND PRIORITY AMONG COMPETING APPLICANTS FOR THE SAME STORAGE FORMATION

Under the *Storage Regulations*, an exploration license grants the exclusive right to explore within the defined area and, while it remains valid, also grants the preference right to obtain an exploitation license (Sections 3-1 and 4-1). Similarly, an exploitation license grants the exclusive right to store CO₂ within the defined area (Section 4-1).

Under special circumstances, the Ministry of Energy may permit surveys to be conducted in areas already licensed for exploration or exploitation (Sections 2-2 and 4-13), resulting, in such cases, in an overlap. There is no express provision in the *Storage Regulations* for the loss of the exclusivity granted for exploration or exploitation activities arising from this overlap with the survey.

In cases where a geological formation extends across areas covered by multiple licenses held by different licensees, the *Storage Regulations* provide guidance for entering into agreements to coordinate CO₂ storage associated with that reservoir, subject to approval by the Ministry of Energy; while the Ministry shall make the final decision if the interested parties fail to reach an agreement among themselves (Section 11).

Although exploration or exploitation licenses grant exclusive rights for the respective activities in the area, such exclusivity does not prevent third parties from conducting research—whether scientific or otherwise—or from exploiting other natural resources in the same area. In the event of competition between activities, it is up to the King to decide, in accordance with criteria set forth in the regulations, which activity should be postponed if disadvantages arise from the competition of activities in the same area, with the necessary adjustments made to the licenses, deadlines, and financial balance (Section 4-15).

ENVIRONMENTAL LICENSING

Environmental licensing in Norway is governed by the *Pollution Control Act*⁶, specifically Section 11, in conjunction with Chapter 35 of the *Pollution Regulations*⁷. In particular,

Section 35-4⁸ of the *Pollution Regulations* governs the prior authorization by the competent environmental authority for the injection and storage of CO₂ in geological formations. The authority that grants the environmental permit for the CO₂ injection and storage phase is the *Norwegian Environment Agency (NEA)*, which is part of the *Ministry of Climate and Environment*. As in most of the jurisdictions analyzed, the environmental permit is separate from the permit for the exploitation of the geological reservoir⁹, just as in Brazil, and the two should not be confused.

Furthermore, due to the geological conditions of Norway's land territory, CO₂ storage in Norway is currently feasible only on the continental shelf—that is, in a marine environment—with no established *onshore* alternative¹⁰.

Under Section 11 of the *Pollution Control Act*, pollution authorities may grant permits for activities involving emissions, discharges, or the risk of pollution, setting conditions regarding emission limits, monitoring, chemicals, waste, incident prevention, and other measures necessary for environmental protection. For *offshore* operations, environmental jurisdiction is generally exercised by the Norwegian Environment Agency.

Chapter 35 of the *Pollution Regulations* establishes a specific environmental regime for the geological storage of CO₂. Under § 35-4, the injection and storage of CO₂ are subject to a permit known as an “injection and storage permit.” This chapter implements the European framework for the geological storage of CO₂ into Norwegian law and requires that any person intending to inject and store CO₂ in geological formations obtain prior authorization from the *NEA*. This is not merely a technical well or reservoir exploitation license, but rather an environmental decision based on Section 11 of the *Pollution Control Act*, in conjunction with Chapter 35 of the *Pollution Regulations*.

Authorization for CO₂ injection and storage may only be granted when the environmental authority verifies that the geological formation is suitable as a storage site and that the proposed activity does not pose a significant risk to the environment or human health. For this purpose, “significant risk” is defined as the risk of environmental or human health harm that cannot be disregarded without compromising the objective of ensuring environmentally safe geological storage of CO₂. The assessment must consider both the probability of the harm occurring and its potential extent¹¹.

Under the *Pollution Control Act*, the activity of introducing solids, liquids, or gases into the air, water, or soil is considered pollution because it causes or has the potential to cause disruption or harm to the environment.¹² Based on the premise that the injection of CO₂ into the subsurface can be considered a polluting activity, or one with polluting potential, it is understood that such an activity must undergo an environmental permitting process in order to obtain authorization or a permit to carry it out. This is stipulated in Chapter 3, §11 of the *Pollution Control Act*.¹³

The same law also stipulates that the licensing authority may require an *Environmental Impact Assessment* if it determines that the activity or project is capable of causing pollution.¹⁴ This environmental impact assessment must address:

- the types of pollution the activity may generate during normal operations and in the event of all conceivable types of accidents, as well as the probability of such accidents occurring;
- what short- and long-term effects pollution may have. If necessary, studies must be conducted on the natural conditions of the areas that may be affected by the pollution. In particular, an assessment must be made of how pollution will affect people's use of the environment and who will suffer specific nuisances as a result;
- which alternative sites, production processes, purification measures, and methods of waste recovery were evaluated, as well as the reasons why the applicant chose the solutions adopted;
- how the activity will be integrated into the area's general and local development plans and, if applicable, how it will constrain future planning.

According to the *Pollution Regulations—Regulations on the Limitation of Pollution*, specifically in “Part 7A—Storage of CO₂ in Geological Formations, Chapter 35—Storage of CO₂ in Geological Formations,” in § 35-5, the application for authorization (*Permission to Inject and Store CO₂*) for the storage of CO₂ must be accompanied by an *Impact Assessment (for the measure)*, the content of which must include a systematic assessment of environmental impacts, taking into account their magnitude and significance, and must include a description of mitigation measures for these impacts.

This requirement stems primarily from the European Union Directives concerning the environmental impact assessment of projects and activities.

Thus, it is understood that the developer responsible for the CCS project will submit environmental impact assessment studies to the competent Norwegian regulatory and supervisory authority—in this case, the Ministry of Energy—and to the Norwegian Environment Agency, which must approve said study, which will serve as the basis for the *Permission to inject and store CO₂*.¹⁵

Although the environmental permit is independent, it is linked to the environmental impact assessment required during the site development phase. The *Storage Regulations* require that the reservoir development and operation plan be accompanied by an environmental impact assessment. The study is submitted prior to the development decision; its scope is subject to consultation with authorities and stakeholders; and the assessment must cover, among other elements, consequences for the environment and other economic activities, discharges to the sea, atmospheric emissions, risks of transboundary effects, and prevention, reduction, and mitigation measures¹⁶.

The environmental content specifically relevant to CCS is therefore not limited to the formal EIA. The environmental decision on storage and its supporting documents require a demonstration of the suitability of the reservoir and the storage complex; modeling of the behavior and migration of the CO₂ plume; analysis of potential leakage pathways; assessment of risks to human health and the environment; parameters regarding the composition and purity of the CO₂ stream; a monitoring program; corrective measures; a cessation plan; and post-closure monitoring obligations.

Public participation occurs primarily during the impact assessment process for the development plan. The proponent must submit the study program for consultation with affected authorities and organizations; subsequently, the plan documentation and the impact assessment are made available during the administrative procedure leading up to the decision. The rule also provides for consideration of transboundary environmental effects when the project may affect other States. The *Storage Regulations* allow for total or partial exemption from the assessment only under special circumstances, when it is presumed that there will be no significant transboundary environmental effects¹⁷.

NORWAY

An important methodological distinction is that the development plan, the exploration license, and other approvals from the Ministry of Energy fall under the resource management and site development regime; whereas the license under the *Pollution Control Act* and Chapter 35 of the *Pollution Regulations* constitutes the environmental authorization to inject and store CO₂ in the reservoir.

INSTITUTIONAL GOVERNANCE

Within the Norwegian institutional framework for CCS activities, the *Norwegian Offshore Directorate* is the body responsible for advising the Ministry of Energy on CCS matters, monitoring licensees, and ensuring compliance with regulations and licenses, among other activities¹⁸. Section 3 of the *Act relating to subsea natural resources* stipulates that scientific research on the seabed and its subsoil requires authorization from the Ministry or an entity authorized by it.

The *Storage Regulations* define the competent authorities for regulating CCS and their respective regulatory responsibilities. During the assessment phase, the Ministry of Energy is responsible for granting the survey license (Section 2-1), but the license holder must, prior to commencing activities, report information regarding the intended research to the *Norwegian Offshore Directorate*, the Directorate of Fisheries, the Institute of Marine Research, and the Ministry of Defense; maintain weekly reporting to these agencies for the duration of the activities; and, upon completion, submit a report containing data, records, and research results to the *Norwegian Offshore Directorate* (Section 2-6).

Still during the evaluation phase, the King in Council¹⁹, is responsible for granting the exploration license and may impose specific obligations regarding research, surveys, and monitoring for the area (Sections 3-1 and 3-3); however, it is the responsibility of the Ministry of Energy to (i) approve partnership agreements when a license involves multiple participants, (ii) grant exemptions from the license's specific obligations, (iii) extend the duration of the exploration license up to a maximum of 10 years, and (iv) require compliance with the obligations arising from the exploration license in the event of relinquishment or surrender (Sections 3-1, 3-3, 3-4, and 3-5).

Subsequently, for the operation phase, in addition to submitting the application for an exploitation license to the

Ministry of Energy, the applicant must send copies of the application to the *Norwegian Offshore Directorate* and the Norwegian Ocean Industry Authority (Section 4-2). In any case, it is up to the King in Council to grant the exploitation license (Sections 4-1).

The applicant must submit to the Ministry of Energy the reservoir development and operation plan, which must include a description of the development and an impact assessment addressing financial, technical, safety, commercial, and environmental aspects, as well as those related to the resources involved, the project's entire life cycle, and detailed information on the planned operation. In addition, a comprehensive version of the plan, including topics related to safety and the work environment, must be submitted by the applicant to the Ministry of Energy and the Ministry of Climate and Environment, with copies of the plan provided to the *Norwegian Offshore Directorate*, the Norwegian Ocean Industry Authority, and the Norwegian Environment Agency; a statement from the authority responsible for building planning may also be required (Sections 4-5 and 4-6).

The reservoir development and operation plan must be preceded by a proposed study program for impact assessment submitted by the applicant for review by the affected authorities and interested organizations; this will enable the Ministry of Energy, based on the proposal and their feedback, to define the study program (Section 4-7). This program will then serve as the basis for the interested party to prepare the development impact assessment, which must subsequently be submitted to the Ministry of Energy, the affected authorities, and relevant organizations, and published in the Official Gazette of Norway (Section 4-8).

Both the study program and the impact assessment itself may be subject to public consultation at the discretion of the Ministry of Energy (Sections 4-7 and 4-8). Prior to the consultation, the Ministry of Energy must also submit the study program to countries that may be affected, which will participate in the impact assessment process and may even provide comments on the documents (Section 4-10). Unless otherwise required by the Ministry of Energy, the impact assessment may be waived if another assessment deemed sufficient already exists or if it is presumed that there will be no significant transboundary environmental effects; in the latter case, the Ministry of Energy must inform the EFTA Surveillance Authority²⁰ (Sections 4-8 and 4-9).

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When applying for a storage permit from the pollution authorities, the applicant must provide a financial guarantee or present an equivalent instrument, in accordance with the provisions of the Norwegian Environment Agency, to cover all obligations arising from the *Pollution Regulations*. The regulation does not establish an exhaustive list of guarantees or financial instruments, leaving the matter open to be defined by the authority (Section 5-9). This guarantee should also not be confused with the financial mechanism that provides for contributions after the monitoring period.

Once the licensing stages are completed, and the financial guarantees determined by the Norwegian Environment Agency and jointly addressed by the Ministry of Climate and Environment and the Ministry of Energy have been provided, CO₂ injections will begin following approval by the Ministry of Energy or an entity authorized by it and by the Norwegian Ocean Industry Authority, in accordance with the storage permit granted by the pollution authorities (Sections 5-2 and 5-9). At this stage, the Ministry of Energy must also approve the monitoring plan submitted by the operator and, in the future, any updates to it (Section 5-4).

The *Storage Regulations* also establish various regulatory responsibilities for the Ministry of Energy, including, notably: (i) approving partnership agreements when a license involves multiple participants; (ii) reviewing the license application and accompanying documentation; (iii) defining the study program for impact assessment; (iv) approving construction prior to the approval of the reservoir development plan; (v) waiving requirements and approving the development plan and its amendments; (vi) submitting the study program and impact assessment to other affected countries; (vii) requiring or waiving the impact assessment in specific cases; (viii) approving alternatives for insurance and guarantees; (ix) approving the progress of CO₂ injections; (x) extending the terms of operations and the exploitation license; (xi) approve the transfer of licenses; (xii) approve the cessation plan; (xiii) require compliance with license obligations in the event of area relinquishment; and (xiv) decide on the disposal of facilities in the event of closure, require compliance with such decisions, or waive this obligation; (xv) waive joint and several liability for financial obligations related to the disposal of facilities when there are multiple responsible parties.

In addition, the Ministry of Energy or the entity authorized by it is responsible for inspecting and reporting on the facil-

ities, the storage site, and environmental impacts, in coordination with the competent authority on pollution matters, from the operational phase until responsibility is transferred to the State; the operator must (i) monitor the area, (ii) notify the Ministry of Energy or the entity authorized by it of risks or actual CO₂ leaks, (iii) implement corrective measures, and (iv) report incidents to the *Norwegian Offshore Directorate* (Sections 5-2, 5-5, 5-6, 5-7, and 11-17). If corrective measures are not taken, the Ministry of Energy may implement corrective measures on its own or require to stop the injection (Section 5-6).

During the phase of winding down operations, if the requirement to submit a cessation plan is not waived, the operator must submit the cessation plan to the Ministry of Energy, with copies to the *Norwegian Offshore Directorate* and the Norwegian Ocean Industry Authority; it is up to the King to approve the winding down in cases where it is requested by the operator (Sections 5-7 and 7-1). Given that the State may take over the fixed installations after the cessation of operations, it is up to the King to decide, with binding effect, whether and to what extent the State will pay compensation to the operator for such installations (Section 7-6).

The Ministry of Energy or an entity authorized by it is responsible for approving the post-operation plan and its updates, submitted by the operator, regarding monitoring activities, reporting, implementation of corrective measures, closure of the storage site, and removal of the facilities (Section 5-7). Similarly, the authorities will be responsible for establishing the duration of post-operational monitoring, as well as for receiving the operator's report on the safety and stability of the reservoir at the end of this period, forwarding the respective report to the *European Free Trade Association Surveillance Authority* for its opinion along with the draft approval of the transfer of responsibility, and communicating the decision to the EFTA Surveillance Authority (Section 5-8). If errors resulting from the operator's negligence or willful misconduct are subsequently identified in the final report—including the provision of deficient data or the omission of relevant information—the Ministry of Energy may recover the costs incurred after the transfer of responsibility (Section 5-8).

Finally, it is worth highlighting three responsibilities that span the various phases of the storage stage in CCS projects. First, at any time, under the circumstances provided for in the *Storage Regulations*, the King has the authority

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to revoke the authorizations granted (Section 11-21). Second, the *Norwegian Offshore Directorate* is responsible for collecting fees for surveying, exploration, and exploitation licenses, but the Ministry of Energy is responsible for adjusting the fees and setting the transfer fee (Sections 2-5, 3-2, 3-3, 4-3, 11-5, and 11-13). Third, where applicable, the Ministry of Energy is responsible for authorizing third-party access to storage facilities and sites, as well as for acting as a dispute resolution mechanism between the parties in such cases (Sections 5-12 and 5-13).

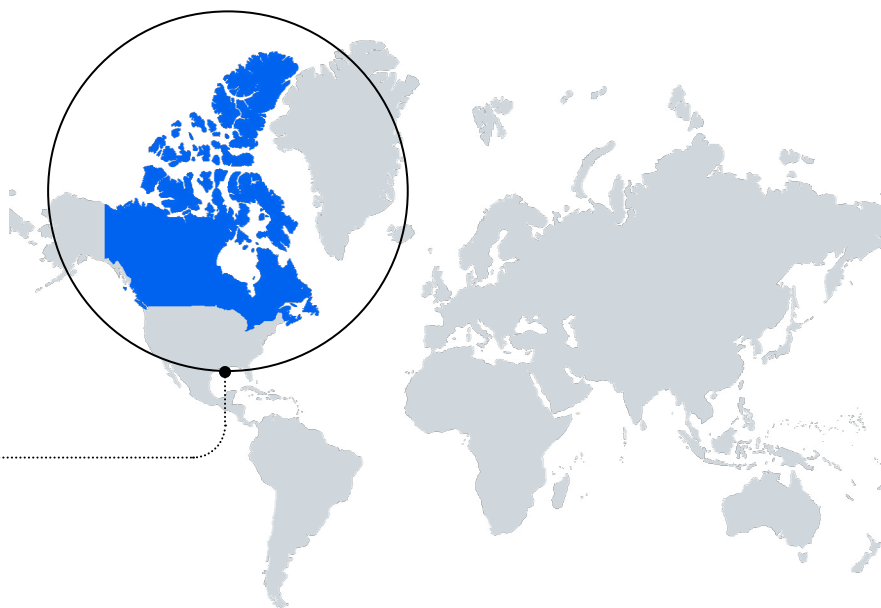
As noted, the *Storage Regulations* centralize institutional coordination within the Ministry of Energy for the storage phase of CCS projects (Sections 11-3 and 11-23) and expressly provide for when the involvement and approval of other authorities are required, including for reporting, consultation, or approval purposes, as applicable.

With the exception of the conditions of preference and exclusivity guaranteed in licenses already issued, the *Storage Regulations* do not define tie-breaking criteria when there is competition among interested parties under similar conditions vying for the same area or license, although criteria were disclosed in the call for applications for recent rounds of public area announcements²¹. The invitation rounds are part of Norway's open-door policy for evaluating applicants seeking a license for CCS activities²². Thus, Norway publishes the areas it is considering for applications from parties interested in obtaining a license to develop CCS activities, in order to meet the standard's requirement for "objective, published, and non-discriminatory criteria."²³

Furthermore, since the exploitation license is a new authorizing act that requires a new application—unrelated to the exploitation license or the survey license—there is a risk of failing to obtain the license necessary to actually carry out the project.



CANADA (ALBERTA)



REGULATORY FRAMEWORK AND SCOPE OF CCS ACTIVITIES

The second jurisdiction analyzed is Canada, whose regulatory framework has a strong provincial component. The regulation of CCS activities in Canada falls primarily under the jurisdiction of the provinces, which hold ownership of subsurface resources, including geological CO₂ storage reservoirs, known as pore space^{24,25}. Among other provinces currently in a similar situation, the province of Alberta has a structured regulatory framework, favorable geological conditions, and CCS projects²⁶, and was the pioneering jurisdiction in establishing a regulatory and risk management framework for large-scale projects²⁷; for these reasons, it was chosen as the focus of this study.

Current CCS regulations in Canada cover activities in reservoirs located on the mainland (*onshore*), while reservoirs on the continental shelf (*offshore*) still lack a regulatory framework for CCS activities²⁸.

The regulatory framework for CCS activities in the province of Alberta is established in the province's *Mines and Minerals Act*²⁹, following an amendment enacted by the *Carbon Capture and Storage Statutes Amendment Act*³⁰. The starting point of this framework is the express provision that pore space is owned by the Crown in right of Alberta³¹.

With regard to CCS, the *Mines and Minerals Act* provides for:

- I. the procedure and requirements for obtaining rights to evaluate and inject captured carbon dioxide for sequestration into geological reservoirs for carbon storage purposes (Sections 115 and 116); compliance with the license and regulations (Section 117);
- II. the conditions for the transfer of an agreement (Section 118);
- III. the duty to monitor after the closure of operations (Section 119);
- IV. the procedure and requirements for obtaining a closure certificate (Section 120);
- V. the Crown's assumption of liability for wells and facilities, environmental issues, and surface rights (Section 121);
- VI. the establishment and management of the *Post-closure Stewardship Fund* (Section 122);
- VII. the rules regarding orphan facilities (Section 123); and
- VIII. the authority to regulate various matters, including CCS (Section 124).

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The regulations for this Act are set forth in the *Carbon Sequestration Tenure Regulation*³², which details the procedure, requirements, rights and obligations, term, area, and monitoring plan for the evaluation permit (Sections 3 through 8); the procedure, requirements, rights and obligations, term, and conditions for renewal of the carbon sequestration lease, the area, the monitoring plan, and the circumstances under which the monitoring plan may be renewed, all in relation to the carbon sequestration lease (Sections 9 through 17); the closure plan and the circumstances under which the closure plan may be renewed (Sections 18 and 19); and rules governing the agent's contributions to the *Post-closure Stewardship Fund* (Section 20).

Additionally, the *Mines and Minerals Administration Regulation*³³ applies, which addresses the definition of application and issuance fees for the evaluation permit and the carbon sequestration lease, as well as the lease rental³⁴, for both the underground reservoir and the respective surface. In specific cases involving the interaction between CCS activities and oil exploration activities, provisions of the *Oil and Gas Conservation Act*³⁵ of the province of Alberta may also apply. Regarding the regulatory framework, it is also important to address the *Directive 065: Resources Applications for Oil and Gas Reservoirs* issued by the Alberta Energy Regulator³⁶.

LIFE-CYCLE PHASES OF THE STORAGE STAGE IN CCS PROJECTS SUBJECT TO REGULATORY OVERSIGHT

With regard to the project life cycle, the *Mines and Minerals Act* (Part 9) and the *Carbon Sequestration Tenure Regulation* govern the various phases of the project life cycle, specifically addressing the evaluation, operation, and closure phases. The reservoir evaluation phase requires the prior execution of an agreement granting the right to conduct exploration activities in the area, in the form of an evaluation permit; a *well license* is also required for drilling and operating the well, and approval from the authority is necessary before commencing drilling or use, as well as prior approval of a monitoring, measurement, and verification plan³⁷.

The evaluation permit is issued for a term of 5 years, subject to an annual rental fee proportional to the size of the area, and allows for testing and evaluation of the geological or geophysical properties of the reservoir, including well drilling and the injection of substances, all for the purpose of determining whether the reservoir meets the necessary

characteristics to enable CO₂ within the limits and area specified in the permit itself³⁸. The area covered by the evaluation permit may not exceed 73,728 hectares and may be subsequently reduced at the request of the permittee³⁹.

In turn, the reservoir's operational phase requires the prior execution of an agreement granting the right to inject captured carbon dioxide into a subsurface reservoir for the purpose of geological storage, in the form of a carbon sequestration lease; a *well license* is also required for the drilling and operation of the well, and approval from the authority before commencing drilling or use, as well as prior approval of a monitoring, measurement, and verification plan and a closure plan⁴⁰.

The carbon sequestration lease has a term of 15 years, renewable for an additional 15 years; in both cases, an annual rental fee proportional to the size of the area is required. The lease authorizes the drilling of wells, the conduct of assessments and tests, and the injection of CO₂ into reservoirs for storage purposes, within the limits and the area specified in the lease itself⁴¹. It should be noted that no project may proceed prior to approval of the *scheme* and that, furthermore, approval must be reaffirmed at the time of renewal of the carbon sequestration lease⁴². Like the evaluation permit, the area may not exceed 73,728 hectares and may be subsequently reduced at the request of the lessee⁴³.

Upon cessation of activities, the operator must monitor all wells and facilities, carry out the closure activities provided for in the regulations, and implement the measures set forth in the closure plan. These measures include submitting a summary of all activities conducted at the storage site since the lease was executed; providing information on the quantity, behavior, geological interpretations, and pressure front of the injected CO₂; provide detailed information on the wells and the decommissioning, abandonment, and reclamation activities conducted in the area; submit an inventory of all reports and documents submitted to regulators since the first closure plan; and present guidelines and recommendations for the phase following the issuance of the closure certificate⁴⁴.

Once the obligations of the *closure period* have been fulfilled—including the monitoring and maintenance of the wells and facilities, the environmental restoration requirements, and confirmation that the CO₂ remains stable and poses no risk of leakage—the operator may then receive the

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closure certificate, an act that transfers responsibility and ownership of the stored CO₂ to the Crown, as well as the obligations regarding the wells and facilities⁴⁵.

It should be noted, however, that although Section 120(3) (d) of the *Mines and Minerals Act* provides for regulations to establish a *closure period* between the end of operations and the transfer of liability to the Crown, such a period has not been established in the *Carbon Sequestration Tenure Regulation*. Currently, on a discretionary basis, available information suggests that a minimum period of 10 years has been adopted⁴⁶, as exemplified in a closure plan made available by the *Alberta Energy Regulator*⁴⁷.

Finally, it is worth noting that Section 39 of the Oil and Gas Conservation Act provides that CCS projects will only be approved by the *Alberta Energy Regulator* if it is demonstrated that CO₂ injection will not interfere with oil and

natural gas activities⁴⁸. On the other hand, the evaluation permit and the carbon sequestration lease do not grant the holder the right to exploit minerals found at the respective storage site⁴⁹.

Holders of oil and natural gas exploration tenures are also the owners of storage rights in all subsurface formations⁵⁰, but the Minister may enter into a contract to secure the interested party's right to conduct research activities for the development of CCS and to inject CO₂ into the underground reservoirs in those areas⁵¹.

Neither the *Carbon Sequestration Tenure Regulation* nor Part 9 of the *Mines and Minerals Act* contains any mention of an exclusive right to the area covered by the evaluation permit or the carbon sequestration lease, nor does it prohibit leasing in an area that overlaps with a third party's lease. Nor is there any provision for third-party access to CCS facilities.

Table3 Key characteristics of Canadian permits at each phase of a CCS project

Stage/License	Purpose	Exclusivity and Area	Typical Obligations	Does it allow CO ₂ injection?
RESEARCH / SURVEY / EXPLORATION (EVALUATION PERMIT)	Conduct initial geological mapping and assess whether an area has storage capacity. Confirm whether a delineated reservoir is technically suitable and safe for CO ₂ storage	Information not specified in the Carbon Sequestration Tenure Regulation or the Mines and Minerals Act	Acquisition and interpretation of geological and geophysical data. Determine suitability for CCS activities. Submit a monitoring, measurement, and verification plan, and a well license.	For testing and evaluation only
UTILIZATION (CARBON SEQUESTRATION LEASE)	Develop and utilize the reservoir for injection and storage	Information not specified in the Carbon Sequestration Tenure Regulation or the Mines and Minerals Act	Submit a monitoring, measurement, and verification plan, a closure plan, a well license, and a scheme	Yes

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ENVIRONMENTAL LICENSING

Onshore geological CO₂ storage in Alberta⁵² is regulated primarily at the provincial level, without prejudice to specific federal jurisdictions. Therefore, the province is responsible for the technical and environmental licensing of wells, facilities, and internal pipelines.

General permits and authorizations for energy activities are centralized under the *Alberta Energy Regulator*, the sole regulatory body established by the *Responsible Energy Development Act*⁵³, which consolidates—for energy sector activities—both technical approvals (wells, injection schemes, pipelines, facilities) and sector-specific environmental responsibilities that, under other arrangements, would fall to a separate environmental agency. In practice, the *Alberta Energy Regulator* exercises authorities set forth, among other statutes, in the *Environmental Protection and Enhancement Act* (EPEA), the *Water Act*, and the *Public Lands Act*.⁵⁴

This concentration of authority is the model's most distinctive institutional feature. Unlike in Brazil and the Norwegian example—where the environmental regulatory framework is separate from the framework governing reservoir exploitation—in Alberta, the regulatory authorization for the activity and the sector-specific environmental permit are issued by the same authority through a coordinated process. The separation, therefore, is not between the “activity regulator” and the “environmental agency,” but between the “reservoir owner and grantor” (Crown/Minister) and the “integrated activity licensor” (AER).

In terms of requirements, there is no automatic requirement in Alberta for an environmental impact assessment for geological CO₂ storage. The EPEA establishes the environmental impact assessment as a mandatory requirement only for activities listed in its own regulations, in which CO₂ sequestration is not included; for all other activities, the requirement is at the discretion of the Director, based on the size, location, and sensitivity of the project⁵⁵. In practice, the component that triggers the environmental licensing process is the capture plant—usually attached to an industrial facility that already holds EPEA approval, in which case an amendment to the existing approval is processed, supported by appropriate technical studies.

At the federal level, the *Impact Assessment Act* applies only to projects designated in the *Physical Activities Regulations*

or located on federal lands or *offshore*⁵⁶—scenarios that, as a rule, do not include *onshore* CCS in Alberta but may include interprovincial pipelines and projects on the continental shelf.

Characterization of the storage site begins during the provincial phase of acquiring and evaluating rights to the pore space, and the complete set of studies accompanies submissions to the AER (for injection, pipeline, and capture facilities), which are subject to public review prior to approval. Regarding content, although there is no formally defined “CCS terms of reference,” decision-making practice—based on the experience of the Quest Project and technical guidelines—defines a specific core of the activity: geological characterization of the reservoir and seals; capacity and injectivity; maximum injection pressure; modeling of the CO₂ plume and the pressure front (which extends beyond the plume and delimits the analysis area); trapping mechanisms; inventory and integrity of all legacy wells penetrating the storage complex; protection of the *groundwater protection zone* and *hydrogeochemical* baseline; induced seismicity; *ground heave*; dispersion of dense-phase CO₂ in pipeline rupture scenarios⁵⁷. In addition to this core content, the program includes general topics on *reclamation*, waste, water resources, and historical records.

Despite the absence of a separate environmental licensing process, public participation is required at two stages and through two channels. Prior to the filing, the *participant involvement program* under *Directive 056* requires the applicant to notify and, within defined distance, consult property owners, occupants, rights holders, and local authorities, documenting in the application the negotiations and any unresolved objections. After the application is filed, the AER publishes a notice of the application and sets a deadline for *statements of concern* from any person who claims to be directly and adversely affected, deciding—in light of the objections—between written approval (with or without conditions) and the convening of a public hearing, with the decision published and subject to *regulatory appeal*⁵⁸. In EPEA licensing, the specific procedure for *notice and statements of concern* also applies, with appeals to the *Environmental Appeals Board* in non-energy cases⁵⁹. The impact assessment, when required, involves participation in defining the terms of reference and in analyzing the study.

Superimposed on these channels is the indigenous consultation, which has constitutional standing. Whenever a

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decision may adversely affect ancestral rights (*Constitution Act 1982*) or the terms of treaties signed with indigenous tribes⁶⁰, indigenous consultation⁶¹ must be conducted, even if it falls outside the framework of a “statement of concern” or a public hearing⁶². This consultation will be responsible for delving deeper into the subject matter of the consultation; for overseeing the consultation process conducted by the project proponent that affects that specific Indigenous community; and for issuing the *adequacy decision* regarding the consultation procedure, without which the AER cannot decide on the project submitted for its review. In competitive calls for hubs, the Province adopted evaluation criteria that included considerations regarding relationships and engagement with Indigenous communities and groups; this should not, however, be confused with the constitutional obligation to consult applicable to Crown decisions and subsequent regulatory authorizations⁶³. At the federal level, the *UNDRIP Act* and the *Impact Assessment Act* reinforce Indigenous participation and knowledge in processes under federal jurisdiction.

INSTITUTIONAL GOVERNANCE

The institutional governance of CCS activities in Alberta assigns competencies among different authorities, with a central role assigned to the Minister and the Alberta Energy Regulator. According to the *Mines and Minerals Act*, Sections 5(1)(a), (iv), and (v), and 124, it is the responsibility of the Lieutenant Governor in Council⁶⁴ to establish regulations governing CCS activities. In turn, most of the responsibilities set forth in the regulations are assigned to the Minister, while explicit provisions regarding the responsibilities of the *Alberta Energy Regulator*⁶⁵ are less frequent in the regulations. However, the Minister has delegated some of his or her functions to the agency. Furthermore, the Act itself establishes that the *Alberta Energy Regulator* is the regulator for matters related to carbon storage⁶⁶.

In this context, the agency is responsible for issuing well licenses for drilling and operation; approving the commencement of drilling activities or the use of a well, including the injection of substances; and approving the *scheme*⁶⁷. The agency is also responsible for inspecting storage sites at any time,⁶⁸ overseeing monitoring, measurement, and verification plans, as well as closure plans and compliance with the obligations for the issuance of closure certificates^{69,70}, which are part of the powers originally assigned to the Minister, as discussed below.

The Minister⁷¹, on behalf of the Crown in right of Alberta, may enter into a CCS contract for the storage of substances in underground reservoirs⁷². The Minister is also responsible, throughout the life cycle, for various duties, including the authority to:

- I. limit the operations and activities authorized under the evaluation permit and the carbon sequestration lease;
- II. at any time, reduce the area of the evaluation permit or the carbon sequestration lease, as applicable, upon request by the licensee;
- III. approve or deny the transfer of the evaluation permit or the carbon sequestration lease;
- IV. designate orphan facilities; and
- V. hold and administer the *Post-closure Stewardship Fund*⁷³

In this context, for the evaluation phase, prior to the commencement of any activities, the applicant must submit to the Minister an application for an evaluation permit, providing at that time the monitoring, measurement, and verification plan specific to the evaluation phase; proof of payment of the application fee; and payment of the annual lease rent due to the Crown⁷⁴.

Subsequently, for the exploitation phase, and before commencing any activities in this phase, the applicant must submit to the Minister an application for a carbon sequestration lease, and must demonstrate the suitability of the reservoir for CO₂ storage. The application must be accompanied by the monitoring, measurement, and verification plan specific to the utilization phase; the closure plan; proof of payment of the application fee; and payment of the annual lease rent due to the Crown⁷⁵.

The operator may request that the Minister extend the term of the contract for all or part of the previously leased area, provided that the operator submits updated versions of the monitoring, measurement, and verification plan and the closure plan, and demonstrates that the *scheme* remains valid with the *Alberta Energy Regulator*⁷⁶.

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In addition, the lessee is required to submit an update to the monitoring, measurement, and verification plan to the Minister every three years or whenever the carbon sequestration lease is renewed, as well as to report annually on activities to the Minister and maintain compliance with the monitoring, measurement, and verification plan throughout the duration of the activities⁷⁷. The closure plan must also be updated by the lessee every three years or whenever the carbon sequestration lease is renewed.

The *Mines and Minerals Act* and the *Carbon Sequestration Tenure Regulation* do not expressly provide for an act or decision defining the termination of operations and the start of the monitoring phase due to the cessation of injection activities. However, Directive 065 provides that the lessee may request a revision of the scheme for the purpose of ter-

minating operations⁷⁸, in line with the Alberta Energy Regulator's publication on the division of responsibilities in CCS activities.

Upon the termination of operations, and once the lessee has fulfilled its obligations, the Minister is responsible for issuing the closure certificate and notifying the *Alberta Energy Regulator* and other relevant parties of this fact⁷⁹. In addition, the lessee must pay a fee to the *Post-closure Stewardship Fund*⁸⁰, calculated per ton of captured carbon dioxide injected, according to the rate established by the Minister⁸¹. The description of the payment is limited to defining a fee proportional to the volume of CO₂ and does not establish any other details or additional criteria regarding the determination of the amount.



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REGULATORY FRAMEWORK FOR CCS ACTIVITIES

In the United Kingdom, the regulatory framework for CCS activities has been structured and expanded over time through various legal instruments. Among the main ones are the *Energy Act 2008*⁸², the *Energy Act 2016*⁸³, and the *Energy Act 2023*⁸⁴, without prejudice to the existence of other regulations (*Statutory Instruments*)⁸⁵ regarding CCS, which are considered secondary legislation based on prior legal provisions.

CCS projects may be located in the territorial sea, in the waters of the *Gas Importation and Storage Zone*, in England, Wales, Northern Ireland, and Scotland, and—except for Scotland—in the internal waters of England, Wales, and Northern Ireland⁸⁶. CCS regulation in the United Kingdom addresses *offshore* reservoirs more comprehensively, while *onshore* reservoirs lack detailed geological data and are either lightly regulated or even face regulatory obstacles for CCS projects⁸⁷.

The main laws governing CCS activities in the United Kingdom are the *Energy Act 2008*, the *Energy Act 2016*, and the *Energy Act 2023*. Chapter 3 of Part 1 of the *Energy Act 2008* regulates CO₂ storage activities, primarily establishing which activities require a prior license and allocating regulatory authority among licensing authorities for various matters and phases of CCS projects.

The *Energy Act 2008* also regulates the decommissioning and abandonment phase of CCS facilities, adopting applicable provisions from the *Petroleum Act 1998*⁸⁸ for *offshore* facilities⁸⁹. The *Energy Act 2016* addresses the Oil and Gas Authority (OGA), to which certain regulatory functions regarding CCS projects are assigned. Part 1 of the *Energy Act 2023* regulates the licensing of CO₂ transport and storage from an economic perspective and sets forth the regulatory functions assigned to the Gas and Electricity Markets Authority⁹⁰.

It should be noted that, with regard to specific regulations, there may be different instruments ("*Statutory Instruments*" or "*S.I.*") among the constituent nations of the United Kingdom due to administrative divisions of authority, such as the different licensing regimes established in regulations for CCS activities issued for the United Kingdom⁹¹, Scotland⁹², and Northern Ireland⁹³. In the case of the United Kingdom, the *Storage of Carbon Dioxide (Licensing, etc.) Regulations 2010*⁹⁴ ("*UK Storage Regulations*" or "*S.I. 2010/2221*") addresses licenses and storage permits, detailing the requirements, the application and review procedures, the necessary documents and data, and the content of licenses and storage permits, with due detail regarding the project (General Part and Sections 2 through 8). Similarly, it sets forth the powers and duties of the authorities, covering corrective measures

in the event of detected irregularities or leaks (Section 10), as well as the circumstances and procedures for reviewing, modifying, or revoking a storage permit (Section 11) and the respective consequences of revocation (Section 12). The *UK Storage Regulations* also address the project closure stages and post-closure obligations, detailing the post-closure plan (Sections 13 and 14 and Schedule 1). Finally, the regulations provide for the maintenance of a public register containing data on CCS projects (Section 9), environmental liability (Section 15), enforcement (Sections 16, 17, and 18), and compliance measures (Sections 19 and 20).

In turn, the *Storage of Carbon Dioxide (Termination of Licences) Regulations 2011*⁹⁵ (“UK Termination Regulations” or “S.I. 2011/1483”) addresses the procedure for terminating a license following the closure of a CCS project (Sections 4, 5, 9, 11, and 12), the minimum monitoring period between the cessation of activities and the termination of the license (Section 7), the conditions for the transfer of obligations and liabilities resulting from the termination of the license, including financial obligations (Sections 8 and 10), and, finally, the content of the termination notice (Section 13), the description of the transferred obligations and liabilities (Sections 14 and 15), the circumstances for cost recovery due to the operator’s fault (Section 16), and compliance measures (Sections 17, 18, and 19).

In addition to the specific regulatory framework for CCS, other laws address certain aspects of the activity. The *Planning Act 2008*⁹⁶ applies to CCS pipelines, while the *Petroleum Act 1998* applies to cases related to enhanced oil recovery and oil and gas activities⁹⁷, unless the Secretary of State issues an order to apply the *Energy Act 2008* after consulting with the OGA⁹⁸.

This study therefore focuses on analyzing the regulations set forth in the *Energy Act 2008*, referring to other laws only when necessary. About statutory instruments, this study analyzes the licensing regime established in the *UK Storage Regulations*⁹⁹, which regulates the licensing provisions of the *Energy Act 2008*¹⁰⁰ for the United Kingdom.

LIFE-CYCLE PHASES OF THE STORAGE STAGE IN CCS PROJECTS SUBJECT TO REGULATORY OVERSIGHT

CO₂ storage activities will commence upon obtaining licenses, including the exploration and development phases, as well as the construction and maintenance of the respective facilities¹⁰¹. A single license, known as the Carbon Dioxide Appraisal and Storage License, covers the entire life cycle of CCS projects; it is issued during the exploration phase and remains valid through the monitoring phase prior to the transfer of responsibility. During the development phase, this license serves as the basis for the issuance of the storage permit¹⁰². The designation of a “controlled place” in licenses for the development of CCS projects requires a lease of property forming part of the Crown Estate or authorization to exercise rights forming part of that Estate, with the commencement of the license and the license period being contingent upon the commencement and duration of the Crown lease¹⁰³. It should be noted that, in the United Kingdom, it is expressly prohibited to store CO₂ in the water column¹⁰⁴.

The evaluation phase begins with the Carbon Dioxide Appraisal and Storage License¹⁰⁵, for the exploration of a controlled site and selection of a storage site; it is up to the interested party to specify the appraisal term or initial term for the commencement of utilization activities¹⁰⁶. If a specific license is issued solely for exploration purposes, including the construction and maintenance of facilities for the conduct of exploration activities, such a license is referred to as a general exploration license; it does not grant exclusive rights, and its issuance is combined with the Carbon Dioxide Appraisal and Storage License¹⁰⁷. The appraisal term specified for the Carbon Dioxide Appraisal and Storage License must be strictly necessary for exploration and may be extended by the authority upon request by the licensee if exploration has been conducted in accordance with the license¹⁰⁸. The start date for activities may also be extended, under the conditions set forth in the Carbon Dioxide Appraisal and Storage License¹⁰⁹. The license expires if either of the two deadlines passes without the applicant having applied for a storage permit or if such a permit has been denied, as notified to the applicant¹¹⁰. The applicant may also waive the appraisal term, provided they state the reason why the operation is not necessary¹¹¹.

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For the operational phase, in addition to the Carbon Dioxide Appraisal and Storage License already issued during the appraisal phase—and based on that license—it is necessary to apply for a storage permit to use an area designated as a storage site¹¹². Thus, in cases where the Carbon Dioxide Appraisal and Storage License was initiated with an exploration phase, the license holder may apply for the storage permit, provided that exploration has been completed and all terms and conditions of the license have been met¹¹³. The granting of the storage permit reduces the original area of the license to the area described for storage in the respective authorization, unless otherwise determined by the authority¹¹⁴. The regulation does not establish a fixed term or maximum duration for the Carbon Dioxide Appraisal and Storage License or for the storage permit.

Prior to the start of CO₂ injection and for the duration of the Carbon Dioxide Appraisal and Storage License, the operator must maintain sufficient financial security to cover the obligations under the storage permit for the operational and post-closure periods until the Carbon Dioxide Appraisal and Storage License expires, including corrective measures ordered by the authority during operation, costs incurred by the authority due to the termination of the storage permit, the operator's costs under climate change legislation, and post-closure financial obligations¹¹⁵. Financial security may take the form of a charge

on a bank account or any other asset; a cash deposit; a performance bond or guarantee; an insurance policy; a letter of credit; or¹¹⁶. As in Norway, financial security should not be confused with the financial contribution made after the post-closure period.

Operations must be terminated if any of the conditions set forth in the storage permit are met, or upon consent of the licensing authority, at the operator's request¹¹⁷. Once operations have ceased, the monitoring period begins under the responsibility of the licensee¹¹⁸ for a minimum period of no less than 20 years, as provided for in the post-closure plan¹¹⁹. Upon completion of the monitoring period, the Carbon Dioxide Appraisal and Storage License may be terminated, provided that the reservoir has been sealed, the injection facilities have been removed, evidence indicates the stability and safety of the storage, the facility decommissioning program has been completed, and the operator has made the financial contribution¹²⁰ to cover, at a minimum, the monitoring costs for 30 years following the transfer of responsibility¹²¹, as is the case in Norway. The monitoring period may be reduced if the licensing authority determines that the necessary conditions for the transfer of responsibility have been met (S.I. 2011/1483, Section 7). Upon the license's expiration, the obligations for monitoring and implementing corrective measures are transferred, as is liability for leaks (S.I. 2011/1483, Sections 14 and 15).

Table 5 Key characteristics of UK permits at each phase of a CCS project

Stage/License	Purpose	Exclusivity and Area	Typical obligations	Does it allow CO ₂ injection?
RESEARCH / SURVEY / EXPLORATION	Conduct initial geological mapping and assess whether an area may have storage capacity	Non-exclusive	Acquisition and interpretation of geological and geophysical data	No
UTILIZATION	Develop and use the reservoir for injection and storage	Information not specified in the regulations	Submit a monitoring, measurement, and verification plan; a post-closure plan; a well permit; and a storage plan	Yes

Source: Prepared by the author

ALLOCATION PROCEDURES AND PRIORITY AMONG COMPETING APPLICANTS FOR THE SAME STORAGE FORMATION

In cases where there is competition among interested parties, the U.K. regulatory framework allows for the use of a competitive procedure to select the proposal. Regarding the economic activity license, which is issued by the Gas and Electricity Markets Authority, there is a provision for conducting a public bidding process to select the best proposal, pursuant to regulations issued by the Secretary of State, for specific cases and when appropriate (Energy Act 2023, Section 10).

ENVIRONMENTAL LICENSING

The provisions on environmental permitting applicable to CCS activities are found primarily in the *Environmental Permitting (England and Wales) Regulations 2016*; the environmental permit is a separate environmental instrument from the reservoir grant.

In the United Kingdom, the environmental authorities—in the case of England—are the *Department for Environment, Food & Rural Affairs* (DEFRA); the *Environment Agency* (EA), responsible for issues related to industrial pollution control and environmental permits; and *Natural England*, focused on biodiversity, conservation, and species; and the *Marine Management Organization* (MMO), responsible for marine and coastal area management and for environmental licensing of activities in territorial waters.

The *Environmental Protection Act 1990*¹²² (EPA Act 1990) is the United Kingdom's primary environmental law, providing the legal framework for pollution control, waste management, and the management of contaminated sites. It grants regulatory agencies and local authorities the power to issue permits, enforce operational conditions, and adopt measures to protect against environmental damage.

The *Energy Act 2008 (Consequential Modifications) (Offshore Environmental Protection) Order 2010* (SI 2010/1513)¹²³ expressly extended to CO₂ storage, the same environmental protection laws originally designed for offshore hydrocarbon exploration and production, notably the *Offshore Oil and Gas Exploration, Production, Unloading, and Storage (Environmental Impact Assessment) Regulations 2020*¹²⁴ and the *Conservation of Offshore Marine Habitats and Species Regulations 2017*¹²⁵.

In the offshore sector, the authority responsible for the environmental review of CCS activities is the *Offshore Petroleum Regulator for Environment and Decommissioning* (OPRED), part of the *Department for Energy Security and Net Zero* (DESNZ), which is tasked with conducting the screening and scoping phase of the impact assessment process; reviewing and approving the *Environmental Statement*¹²⁶; conducting habitat assessments; issue environmental consents for each activity; issue the UK ETS permit for geological storage on the continental shelf; issue decommissioning liability notices (*Section 29 notices*); approve decommissioning programs; and coordinate with statutory nature conservation bodies¹²⁷.

For offshore CO₂ storage, the environmental assessment is conducted under the general *Environmental Impact Assessment* framework for the oil and gas sector, as extended by the 2010 Regulations¹²⁸; and, although the *Storage Permit*¹²⁹, issued by the NSTA, is regulatory in nature for all intents and purposes, its issuance is subject to requirements that also have an environmental component, such as a monitoring plan, a plume migration risk analysis, and a corrective action plan.

It should be noted that CO₂ capture plants are subject to an environmental permit (*Environmental Permit*) issued by the EA under the *Environmental Permitting (England and Wales) Regulations 2016*¹³⁰ (which incorporated the amendments introduced by the *Environmental Permitting (England and Wales) (Amendment) Regulations 2011*, while the geological storage of CO₂ is subject to an environmental permit.

In the phase preceding any offer of blocks for CCS activities, a Strategic Environmental Assessment and a Habitat Assessment of the candidate areas are required. During the exploration and appraisal phases, the operator must obtain approval from OPRED to acquire seismic data and drill appraisal wells, and, where applicable, a marine license from the MMO or NRW. During the development phase itself, an *Environmental Statement* is prepared, and the project is submitted for a specific Habitat Assessment. During the construction, commissioning, and operation phases, a *Storage Permit* is granted, along with well and pipeline laying authorizations, and an integrated environmental permit linked to the UK ETS¹³¹.

To obtain the licenses, concessions, and regulatory authorizations for each CCS activity, the applicant must submit an *Environmental Statement*¹³²—a report prepared by the pro-

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ponent of the *offshore* CCS project as part of the environmental impact assessment submitted to the OGA¹³³.

Conducting an EIA¹³⁴ is mandatory, and its scope varies depending on the environment. The EIA is provided for in the *Offshore Oil and Gas Exploration, Production, Unloading, and Storage (Environmental Impact Assessment) Regulations 2020*, whose Annex 1 sets forth the thresholds for automatic requirements and whose Annex 2 establishes the scenarios subject to preliminary screening.

The drilling of appraisal and injection wells is contingent upon first obtaining a storage license issued by the NSTA, which in turn is preceded by specific environmental approval from OPRED for the activity, following the corresponding impact assessment, in accordance with the *EIA Regulations 2020*.¹³⁵

Public participation and consultation regarding CCS activities take place at five different stages:

- VI. at the strategic stage—before the blocks are made available for concession, regarding the draft Habitat Assessments and the Strategic Environmental Assessment;
- VII. during the offshore EIA stage, where Section 12 of the *Offshore Oil and Gas Exploration, Production, Unloading, and Storage (Environmental Impact Assessment) Regulations 2020* requires the publication of the *Environmental Statement* and ensures a minimum period of thirty days for written comments addressed to OPRED, with no provision for an in-person hearing¹³⁶;
- VIII. during the *onshore* licensing phase, through a public consultation on the draft permits for the capture plants, conducted by the EA;
- IX. during the onshore infrastructure phase, through formal representations and public hearings under the Planning and Infrastructure Act 2025, which, incidentally, repealed the mandatory prior community consultation and preliminary impact reports (PEIR), effective July 24, 2026¹³⁷; and, finally,
- X. during the permanent operational phase, through active disclosure maintained in the CCS Public Registry¹³⁸.

The environmental monitoring requirements are based on the *Storage Permit* itself, issued by the NSTA, in accordance with the provisions of Annex II of the European CCS Directive¹³⁹, whereas OPRED and the onshore agencies impose additional monitoring obligations in their own permits regarding, for example, the disposal of chemicals, habitat protection, and the measurement and reporting of fugitive emissions for the purposes of the UK ETS. It is the NSTA that approves the monitoring plan and receives periodic reports—typically annual—while OPRED receives and oversees emissions declarations submitted to the carbon trading system and reports related to environmental permits for marine activities.

In practice, this monitoring extends over three successive periods: (i) during operation, on an ongoing basis until closure, with annual reports and a mandatory review of the plan every five years; (ii) in the post-closure phase, still under the operator's responsibility, for a minimum period of twenty years from closure, which may be reduced upon proof that the CO₂ is permanently, stably, and definitively contained at the storage site¹⁴⁰; and, finally, (iii) during the post-transfer period, which is the responsibility of the government, the cost of which is priced in advance and paid by the operator to the State in the form of a financial contribution sized to cover, at a minimum, an additional thirty years of government monitoring¹⁴¹.

To provide financial assurance for CCS operations, a financial security is established prior to the start of injection and maintained in force, with mandatory annual revaluation, covering operational and environmental obligations throughout the project's lifetime¹⁴²; and a post-transfer financial contribution, paid in cash by the operator as an essential requirement upon the expiration of the license, intended to fund at least thirty years of subsequent government monitoring.

In the event of a CO₂ leak or irregular migration, the operator must immediately notify the NSTA and partner environmental agencies; at the same time, begin implementing the containment measures set forth in the Corrective Action Plan, in addition to any additional measures determined by the NSTA (Regulation 10(2)(a)); readjust monitoring to assess the extent of the event, adopt the emergency measures required under the strict liability regime for environmental damage; and, finally, measure and report the carbon loss to the emissions market, surrendering the corresponding allowances under the UK ETS. In the event

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of inaction by the operator, the authority itself will implement the measures and recover the costs from the operator (Regulation 10(4)), without prejudice to the revision or revocation of the Permit.

INSTITUTIONAL GOVERNANCE

The institutional governance of CCS activities in the United Kingdom varies depending on the project's location and the jurisdiction assigned to each of the constituent nations. The authority responsible for issuing licenses for the exploration and exploitation phases, as well as licenses for the construction and maintenance of facilities, is determined based on the UK nation where the project is located, as well as whether the project is situated within the territory of the nations, in internal waters, or on their respective *offshore* platforms¹⁴³.

The Oil and Gas Authority¹⁴⁴ is the licensing authority for CCS projects in England and on the United Kingdom's continental shelf (*offshore*), excluding Scotland's territorial sea¹⁴⁵.

The licensing authority has the power to regulate the procedure, circumstances, requirements, terms, conditions, and termination of the respective license for CCS activities that it is responsible for issuing, as well as the authority's own obligations regarding CCS facilities after the license has expired¹⁴⁶. However, when the licensor is the Oil and Gas Authority, regulatory authority rests with the Secretary of State, following prior consultation with the Oil and Gas Authority¹⁴⁷.

The Oil and Gas Authority assumed some of the obligations previously held by the Secretary of State through an amendment to the *Energy Act 2008*¹⁴⁸. The Oil and Gas Authority does not act on behalf of the Crown, but the Secretary of State may, by regulation, provide for the transfer of the functions of a Minister of the Crown to that authority¹⁴⁹.

The Secretary of State is responsible for maintaining a public register of the prescribed information regarding licenses, except for information relating to national security or information that could unreasonably prejudice commercial interests¹⁵⁰. The Secretary of State is also responsible for designating offshore facilities and pipelines as eligible for CCS, and must first consult with the Oil and Gas Authority regarding the change of use¹⁵¹.

The licensing authority may review the license in light of specific circumstances or at the intervals specified in the license; amend the license in light of specific circumstances specified in the license, after hearing the interested party; or prevent the conduct of activities in specific situations set forth in the license¹⁵². In addition, the license itself may provide for financial security; circumstances for the transfer of the license or the entry of a third party; the definition of specific situations requiring prior written consent—including with conditions—from the licensing authority or another party; the closure of CCS facilities; the termination of the license; and financial agreements¹⁵³. In the event of the licensee's failure to comply with the license, it is incumbent upon the licensing authority, after prior consultation with the licensee, to guide the licensee through measures aimed at ensuring proper compliance with the license provisions; and, in the event of the licensee's failure to comply with such measures, the licensing authority may directly implement the measures or arrange for their implementation by third parties¹⁵⁴.

The Oil and Gas Authority may, in licenses it issues that prohibit the transfer of control of the licensee without the Authority's prior consent, request—by written notice—the information necessary to clarify control, provided such information is not protected by secrecy or confidentiality¹⁵⁵.

During the storage phase, the economic activity of operating a CCS project also requires a license from the Gas and Electricity Markets Authority¹⁵⁶. In this context, the Gas and Electricity Markets Authority is the economic regulator of CCS activities, with the primary objectives of, in conjunction with the Secretary of State, protecting the interests of users of CCS networks, protecting the interests of consumers impacted by CCS projects, and promoting CCS networks¹⁵⁷. It is the responsibility of the Secretary of State or, with the Secretary of State's approval, the Gas and Electricity Markets Authority, to regulate the form, manner, and fees for obtaining such a license; it is the exclusive authority of the Secretary of State to regulate, in accordance with the law, the procedure for applying for the license¹⁵⁸.

Under the terms of the *Storage of Carbon Dioxide (Licensing, etc.) Regulations 2010*, in the case of the United Kingdom, the Oil and Gas Authority is responsible for issuing the general exploration license, the Carbon Dioxide Appraisal and Storage License, and the *storage permit*¹⁵⁹.

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It should be noted, therefore, that coordination among the competent authorities of the nations comprising the United Kingdom is governed by the *Energy Act 2008* (Section 18(2)), which designates the licensing authority, on a case-by-case basis, to issue licenses for the exploration and development phases, as well as licenses for the construction and maintenance of facilities, including when the project is located in more than one nation. Similarly, Sections 18 and 26 of the *Energy Act 2008* align the terms of the licenses with the terms of the Crown lease and designate the authorities responsible for seeking court orders against infringements

of rights. In addition, the *Energy Act 2008* establishes a model for institutional cooperation in which the licensing authority provides assistance and relevant information to the Gas and Electricity Markets Authority (*Energy Act 2008*, Sections 34A and 34B) regarding the license and authorized activities.

Finally, it should be noted that, while the Oil and Gas Authority is responsible for *offshore* CCS, there is no single authority that centralizes the oversight and regulation of *onshore* CCS in the United Kingdom¹⁶⁰.



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REGULATORY FRAMEWORK FOR CCS ACTIVITIES

In Australia, the regulation of CCS activities involves a significant division of responsibilities between the federal level and the states and territories, particularly depending on the location of the projects. The federal regulatory framework for CCS activities in Australia covers *offshore* CCS projects in so-called *Commonwealth waters*, more than 3 nautical miles from the Australian coast¹⁶¹, outside the coastal waters assigned to the states and territories that make up Australia¹⁶², referring to Greenhouse Gases (GHG) rather than CO₂ or carbon¹⁶³. CCS projects in coastal waters, up to 3 nautical miles, fall under the jurisdiction of the respective state or territory¹⁶⁴. The Australian Crown holds title to *offshore* geological reservoirs beyond 3 nautical miles¹⁶⁵.

The federal law establishing the regulatory framework for *offshore* CCS is the *Offshore Petroleum and Greenhouse Gas Storage Act 2006* ("OPGGS Act 2006" or "Offshore Act")¹⁶⁶, which covers the entire project lifecycle (storage assessment, injection, closure, decommissioning, and post-closure) and sets forth the rights, prerogatives, and responsibilities of the State and the operator¹⁶⁷.

In turn, the Environment Protection (Sea Dumping) Act 1981 ("Sea Dumping Act")¹⁶⁸ addresses marine pollution caused by both wastes and other matter; while the Environment Protection and Biodiversity Conservation Act 1999 ("EPBC Act")¹⁶⁹ addresses the environment, particularly in cases where there is a likelihood of impact on matters of national environmental significance (MNES); both laws apply to offshore CCS projects during the licensing process¹⁷⁰.

At the regulatory level, the Offshore Petroleum and Greenhouse Gas Storage (Greenhouse Gas Injection and Storage) Regulations 2023 ("OPGGS GHG Injection and Storage Regulations")¹⁷¹ were enacted, which address the significant risk of a significant adverse impact, declarations of identified greenhouse gas storage formations, and site plans, among other matters. More specifically regarding the environmental plans for operations, the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2023 ("OPGGS Environment Regulations")¹⁷² were enacted, incorporating transitional rules in relation to the previous regulation from 2009¹⁷³.

LIFE-CYCLE PHASES OF THE STORAGE STAGE IN CCS PROJECTS SUBJECT TO REGULATORY OVERSIGHT

The assessment phase is preceded by a bidding process to determine which entities will be granted the greenhouse gas assessment permit. Once the permit is issued, the entities have the right to explore a designated area to assess the technical and commercial feasibility of geological formations for CO₂, including depleted reservoirs or saline aquifers that are compatible with CCS. Among other activities, they may drill appraisal wells, conduct appraisal injections, monitor the behavior of the injected substance, and carry out geophysical studies and seismic surveys.

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Also for the evaluation phase, the operator must submit safety cases and well operations management plans (WOMP). Well operations management plans shall be issued for one or more wells, depending on the similarity of the risks involved, and must cover the entire well lifecycle through to abandonment, as well as be updated every five years or whenever circumstances require. Safety cases, on the other hand, must address health, safety, and accident risk control at *offshore* facilities; they are prepared for one or more wells and cover the entire life cycle.

With regard to environmental matters, the operator submits environmental plans for the activities, and if there is a likelihood of impact on matters of national environmental significance (MNES), the operator must proceed with the appropriate environmental impact assessment. Furthermore, if the operator intends to inject CO₂ even during the evaluation phase, it will also need a sea dumping permit.

Once an area has been selected, the operator demonstrates to the authority the suitability of a geological formation for storage through the Declaration of Identified Storage Formation (DoSF). This demonstration must be made for a formation that is entirely within the greenhouse gas assessment permit area of the greenhouse gas assessment permit and is essential for subsequently obtaining the injection license or holding lease. However, this declaration does not guarantee the right to an injection license.

After obtaining approval of the Declaration of Identified Storage Formation (DoSF), if the operator is not yet ready to begin operations—provided it can demonstrate that it will likely be ready within the next 15 years—the operator may then apply for a holding lease for a term of five years, renewable once for an additional five years. In the meantime, the operator may conduct further assessments of the area, evaluate economic feasibility, and prepare the necessary documentation for the operating licenses for the CCS project.

Before commencing operations, for the purpose of constructing the facilities, the operator will need an infrastructure license for activities other than drilling and well construction. The storage phase requires a prior injection license, along with the submission of a site plan describing, among other items, predictions of the behavior of the injected substances, planned operations, containment risks, monitoring activities, and remediation measures upon site closure. Similarly, the storage phase requires a sea dump-

ing permit for each new CO₂ stream, covering the storage stages to ensure there is no significant adverse impact on the marine environment or human health.

Some actions taken during the assessment phase are repeated for the construction and operation phases with the necessary adjustments. In this context, the operator must submit the safety cases and the well operations management plan (WOMP), all adapted for drilling and construction activities, and subsequently resubmit them for commissioning and operation. Here, too, the rule remains that the well operations management plans (WOMPs) - and now the safety cases as well—will be updated every five years, with the latest versions including provisions regarding the abandonment and decommissioning of the facilities, respectively. Regarding environmental matters, once again, the operator must submit environmental plans for the activities, covering initially baseline surveys, drilling, and construction, and subsequently commissioning and operation, renewing these plans every five years. Furthermore, if there is a likelihood of impact on matters of national environmental significance (MNES), a proper environmental impact assessment must be conducted. The operator must continue to carry out and monitor the activities during operation, reviewing and updating all necessary operational approvals. Details regarding monitoring, measurement, and verification are included in the site plan and the environmental plans for the activities, and the operator must update the site plan every five years.

To close out operations, the operator must request the site closing certificate and decommission the facilities, remediate the storage site, and carry out the planned post-closure actions, including monitoring the area. The operator must meet the criteria set forth in the environmental plans regarding the closure of operations, plugging and abandonment of wells, decommissioning of facilities, and post-closure monitoring. The Commonwealth may also conduct monitoring activities to verify that the storage facility is performing as expected. The site closing certificate is issued on a provisional basis, via a pre-certificate notice, until the operator provides the required guarantee to cover monitoring costs and expenses that would otherwise be borne by the Commonwealth; the site closing certificate is then issued, allowing the operator to surrender the injection license¹⁷⁴. Finally, monitoring of the area must be conducted for at least 15 years so that the authority can declare that the so-called “closure assurance period” has elapsed, provided that there

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has been no new injection, the previously injected substance is behaving as predicted in the approved plan, and there is no significant risk of a significant adverse impact (SROSAI) (i) on the geotechnical integrity of the formation or geological structure, (ii) on the environment, (iii) on human health or safety¹⁷⁵.

The table below describes the main characteristics of licenses for the exploration, survey, and utilization phases, considering their purpose, effects on the area, typical obligations, and permission to inject CO₂.

Table 7 Key characteristics of Australian permits for each phase of a CCS project

Stage/License	Purpose	Typical Obligations	Does it allow for commercial CO ₂ injection?
RESEARCH / SURVEY / EXPLORATION (GREENHOUSE GAS ASSESSMENT PERMIT + SEA DUMPING PERMIT)	Conduct initial geological mapping and assess whether an area has storage capacity. Confirm whether a delineated reservoir is technically suitable and safe for CO₂ storage	Acquisition and interpretation of geological and geophysical data. Determine the suitability of the geological formation for CCS activities. Submit safety cases, a well operations management plan (WOMP), environmental plans for the activities, and an environmental impact assessment. Declaration of Identified Storage Formation (DoSF).	No
UTILIZATION (INJECTION LICENSE + SEA DUMPING PERMIT)	Develop and utilize the reservoir for injection and storage	Submit safety cases, plans, and an environmental assessment tailored to the storage phase. Conduct monitoring.	Yes

Source: Prepared by the author.

ENVIRONMENTAL LICENSING

In Australia, authority is divided among *the Commonwealth* (federal government), six states (New South Wales, Victoria, Queensland, Western Australia, South Australia, and Tasmania), and territories such as the Australian Capital Territory and the Northern Territory, as well as other external territories.

Environmental permitting for *offshore* CCS activities is handled as follows: (a) within three nautical miles of the territorial sea baseline (*coastal waters*), it falls under state/territory jurisdiction and is governed by state mining and oil laws; and (b) beyond three nautical miles from the baseline of the territorial sea up to the Exclusive Economic Zone (*Commonwealth waters*), it falls under federal jurisdiction and is governed by both the *Environment Protection and Biodiversity Conservation Act* (EPBC Act)¹⁷⁶¹⁷⁷ and the *Offshore Petroleum and Greenhouse Gas Storage Act 2006* (OPGGs Act)¹⁷⁸; the *Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2023*,¹⁷⁹¹⁸⁰; and the *Environment Protection (Sea Dumping) Act 1981*,¹⁸¹¹⁸².

With regard to *onshore* CCS activities, state and territorial regulations are more sparse and rely on a combination of sector-specific and environmental instruments, as there is no single law governing environmental permitting for CCS¹⁸³ in these jurisdictions.

In Commonwealth waters, the authorities directly involved in the environmental permitting of CCS activities are: (i) *the National Offshore Petroleum Safety and Environmental Management Authority* (NOPSEMA)¹⁸⁴, responsible for reviewing and approving the *Environmental Plan*; (ii) *the Department of Climate Change, Energy, the Environment, and Water* (DCCEEW), responsible for *issuing the Dumping Sea Permit* for the disposal of authorized materials at sea; and (iii) *the National Environmental Protection Agency* (NEPA)¹⁸⁵, newly established and operational since July 1, 2026, responsible for the individual assessment of CCS projects under the EPBC Act¹⁸⁶.

An EIA is mandatory for CCS projects, as required by Part 3 of the EPBC Act, which mandates the completion of an EIA and the obtaining of prior ministerial authorization for activities with the potential to have a significant impact on matters of national environmental significance (MNES). The

assessment must be conducted and completed prior to any physical construction, development drilling, or operational injection activities, occurring during the detailed planning and basic engineering phase and, therefore, prior to the final investment decision.

No operational environmental permit may be legally issued before the corresponding study has been evaluated, subjected to public scrutiny, and formally approved. Federal regulatory practice recommends that the assessment permit under the EPBC Act and the permit under the *Sea Dumping Act* precede the submission of environmental plans for drilling and facility development to NOPSEMA.

In addition to conventional aspects (fauna, flora, air emissions, noise, vibrations, and waste), the EIA for CCS projects in Australia includes geological analysis items specific to deep underground storage technology.¹⁸⁷

Public consultation is a condition for the approval of *the Environment Plan*, and pursuant to Section 25 of *the Environment Regulations 2023*, the holder must consult with each “relevant person”—such as federal, state, and territorial agencies, and any person or organization whose functions, interests, or activities may be affected—without a fixed minimum timeframe; only “a reasonable period” is required¹⁸⁸.

Furthermore, there is an additional requirement that the *Environment Plan* describe the cultural values and connections of First Nations to the *sea country*—a matter that is no longer merely an ancillary element of the environmental characterization but has become a condition for the validity of the consultation¹⁸⁹.

This consultation is distinct from the 30-day public comment period, which applies exclusively to seismic survey or exploratory drilling plans¹⁹⁰—a public notice regime that has been in effect since 2019 and does not constitute a change introduced after the *Tipakalippa* case¹⁹¹; for offshore project proposals, the public comment period is at least four weeks¹⁹².

With regard to the instruments required for the operation of CCS activities, a specific *Environment Plan* is required for each activity, accepted by NOPSEMA under cumulative criteria,¹⁹³ in conjunction with a specific permit under the *Sea Dumping Act* and approval under the EPBC Act.¹⁹⁴

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For CO₂ injection and storage, *EPBC Act Approval* must be obtained, issued by the Minister for the Environment under the *EPBC Act 1999*, if the project could have a significant impact on a Commonwealth Marine Area or other matters of national environmental significance (MNES).

The environmental permit and regulatory authorizations for CCS are strictly complementary and technically interdependent. While the greenhouse gas assessment permit, holding lease, and injection license grant the operator the right to explore deep formations and reserve the reservoirs, these titles do not, by themselves, authorize any physical intervention in the environment; such interventions depend on a specific environmental permit, which, in turn, often incorporates, as a prerequisite, models and technical reports previously approved by regulatory agencies. The functional separation between NOPTA and NOPSEMA is analogous, with due regard to the respective proportions and differences, to the dual-track system between the ANP and Brazil's environmental licensing agency.

With regard to the environmental monitoring of CCS activities, the obligations cover three physical domains: (i) geophysical and reservoir; (ii) hydrogeological; and (iii) surface and atmospheric. In environmental licensing, the monitoring, recording, and reporting arrangements are part of the *Environment Plan* itself, whose acceptance depends on their being appropriate¹⁹⁵; and, within the scope of regulatory permitting, the monitoring and verification plans (the federal *site plan* and the state *monitoring and verification plan*) are submitted for approval by the resource regulator prior to any permanent injection, and also serve the measurement requirements for carbon credits.

In the event of a leak or irregular migration of CO₂⁽²⁾, the operator must immediately notify NOPSEMA and the competent environmental authorities and, at the same time, initiate the previously approved emergency measures, based on the *Environment Regulations 2023*, which require that the *environmental plan* contain appropriate emergency arrangements, distinguishing between a merely recordable incident and a reportable event, which requires immediate notification to NOPSEMA and a subsequent written report. The *Greenhouse Gas Injection and Storage Regulations 2023* impose specific reporting duties on the injection permit holder regarding the behavior of the stored flow and any unanticipated migration, as compared to the approved *site plan*¹⁹⁶. Furthermore, the OPGGS Act grants the Minis-

ter and the regulator binding directive powers, which may include suspension of injection, revision of plans, remediation work, and, as a last resort, revocation of the permit¹⁹⁷. Under state regulations, the duty arises from the conditions of the respective environmental permit, in conjunction with the duty to report to the resource regulator.

INSTITUTIONAL GOVERNANCE

The authorities responsible for regulating offshore CCS projects in Australia are the *Department of Industry, Science, and Resources* (DISR)—which administers the *OPGGS Act 2006* through the *Minister for Resources and Northern Australia*, generally referred to in the Act as the *Responsible Commonwealth Minister* (RCM)—and the *Department of Climate Change, Energy, the Environment, and Water* (DCCEEW). When a ministerial decision under the *OPGGS Act 2006* is made within the framework of the *Joint Authority*, in addition to the aforementioned *Commonwealth Minister*, the minister of the relevant state or territory also participates in the decision-making process¹⁹⁸.

There are also four regulatory bodies involved in offshore CCS projects: the National Offshore Petroleum Titles Administrator (NOPTA), the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA), the Environment Permitting and Compliance Division (within the DCCEEW), and the Nature Positive Regulation Division (also within the DCCEEW). NOPTA evaluates CCS project applications, administers titles and manages related data, provides technical advice to the RCM, and monitors project compliance with the *OPGGS Act 2006*; NOPSEMA is the regulatory authority specializing in health, safety, the environment, and structural and well integrity in CCS activities, and is responsible for evaluating risk and impact plans, as well as for inspecting, improving, and requiring compliance actions, and providing guidance for performance improvement; and the Minister of the DCCEEW—that is, the Minister for the Environment and Water, currently responsible for the *Sea Dumping Act* and the *EPBC Act*—is responsible, respectively, for (i) through the Environment Permitting and Compliance Division, issuing the sea dumping permit—which authorizes the injection of CO₂ into an offshore geological reservoir—and (ii) through the Nature Positive Regulation Division, if applicable, evaluating the project and establishing conditions for approval from the perspective of the environment and the environmental impact of the activities¹⁹⁹.

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It is the responsibility of the RCM, following the completion of the bidding process and based on NOPTA's recommendation, to issue the greenhouse gas assessment permit and approve exploration operations, taking into account the potential existence of a significant risk of a significant adverse impact (SROSAI) on current or future petroleum exploration or recovery operations in the same area. In addition, the operator must obtain approval from NOPSEMA for the environmental plans for the activities in accordance with the *OPGGS Environment Regulations*, as well as for the safety cases and the well operations management plan (WOMP) in accordance with the *OPGGS Act*. If the project involves the potential for an impact on matters of national environmental significance (MNES), the *Minister for the Environment and Water (Nature Positive Regulation Division)* is also responsible for reviewing the environmental impact assessment submitted by the operator, as well as establishing conditions and monitoring requirements for approval purposes, in accordance with the *EPBC Act*²⁰⁰.

The issuance of the infrastructure license, which covers the construction of facilities other than wells, is the responsibility of NOPTA and, where applicable, may also require a decision by the *Joint Authority*. During the operational phase, similar to the assessment phase, it is the responsibility of the RCM, based on NOPTA's recommendation, to issue the injection license and approve storage operations upon the operator's submission of the site plan for the area; the authority must again take into account the potential existence of a significant risk of a significant adverse impact (SROSAI) on current or future petroleum exploration or recovery operations at that location. Also during this phase, the operator must obtain NOPSEMA's approval for the environmental plans for the activities in accordance with the *OPGGS Environment Regulations*, as well as the safety cases and well operations management plan (WOMP) in accordance with the *OPGGS Act*. NOPSEMA may also request the revision of such plans when it deems necessary, without prejudice to the operator's obligation to submit new environmental plans and safety cases in the event of changes in circumstances and operations or in the event of increased risks. Similarly, if the project involves the potential for an impact on matters of national environmental significance (MNES), the *Minister for the Environment and Water (Nature Positive Regulation*

Division) is responsible for conducting an environmental impact assessment for construction, operation, and decommissioning, establishing conditions and monitoring requirements for approval purposes, in accordance with the *EPBC Act*²⁰¹.

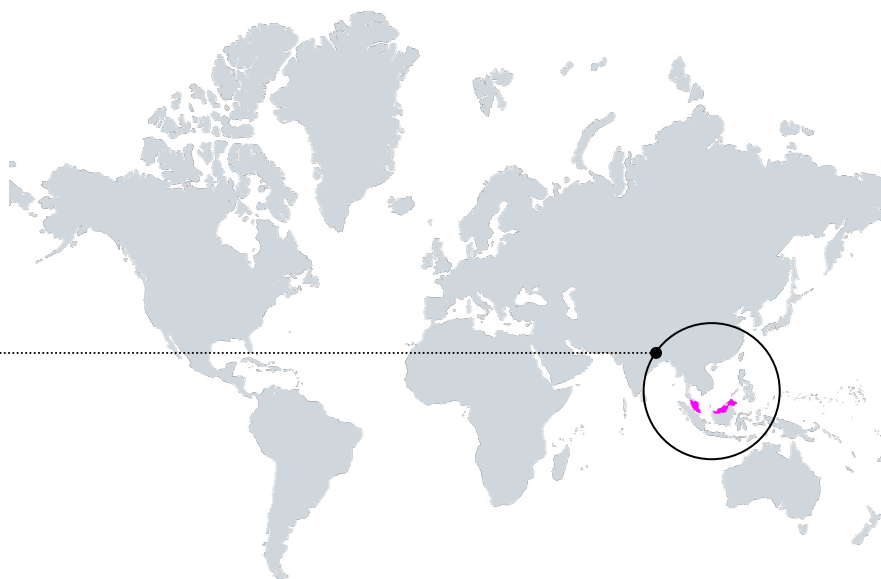
In addition, the *Minister for the Environment and Water (Environment Permitting and Compliance Division)* is also responsible for issuing the sea dumping permit for CO₂ injection, in accordance with the *Sea Dumping Act* and the *London Protocol*, for the operational phase and, where applicable, for the evaluation phase as well. It should be noted that, once a sea dumping permit has been issued, it cannot be significantly altered or transferred. Finally, during the closure phase, the *Responsible Commonwealth Minister (National Offshore Petroleum Titles Administrator)* is responsible for issuing the site closing certificate²⁰² and, once the closure assurance period has elapsed, for issuing the corresponding declaration²⁰³.

The law requires the lodgment of a security for the issuance of the greenhouse gas assessment permit, the holding lease, and the injection license; the form and amount of the security are defined in the offer, and the *Commonwealth Minister* may also require additional security when deemed necessary²⁰⁴. Furthermore, upon closure, the notice issued by the *Commonwealth Minister* for the issuance of the pre-certificate must provide for the lodgment of a security equivalent to the costs of implementing the program for the monitoring period, which will be required for the issuance of the respective site closing certificate²⁰⁵.

Without prejudice to the security required for the issuance of the greenhouse gas assessment permit, the holding lease, and the injection license, the *Commonwealth Minister* may also require an insurance as a condition of any of these acts, providing coverage for expenses, liabilities, specific matters as determined and compliance with guidelines in cases of remediation, all in connection with or resulting from any activities provided for in the respective permit, lease, or license²⁰⁶. When comparing this to the corresponding provision for oil activities, it is noted that, in that case, the law establishes alternatives for financial guarantees²⁰⁷; whereas for CCS activities, the only requirement is insurance.



MALAYSIA



REGULATORY FRAMEWORK FOR CCS ACTIVITIES

Malaysia established its regulatory framework for carbon capture, utilization, and storage (CCUS) activities through the Carbon Capture, Utilization, and Storage Act 2025 (CCUS Act)²⁰⁸, which was passed by Parliament on March 25, 2025, received Royal Assent on July 22, 2025, and took effect on October 1, 2025. At the same time, the Carbon Capture, Utilization, and Storage (Offshore Permit and Licensing) Regulations 2025 (*CCUS Regulations*)²⁰⁹ were issued; these regulations detail the procedures for licenses and permits for CCS activities in offshore areas and have also been in effect since October 1, 2025.

The *CCUS Act*'s stated objectives are to reduce carbon dioxide emissions, mitigate the effects of climate change, and catalyze the development of the CCUS industry as a new source of economic growth. The regulation is part of Malaysia's ratification of the Paris Agreement and its goal of achieving carbon neutrality by 2050, in line with national policies such as the National Energy Transition Roadmap (NETR) and the New Industrial Master Plan 2030 (NIMP).

The *CCUS Act* applies exclusively to Peninsular Malaysia and the Federal Territory of Labuan; it does not cover the states of Sabah and Sarawak in East Malaysia. The state of Sarawak has its own regulations for CCUS activities, established in the Land Code (Carbon Storage) Rules 2022, which apply to its territory; these will not be discussed in detail in this paper.

The *CCUS Act* establishes a comprehensive regulatory framework that covers the entire CCUS value chain, ranging

from CO₂ capture to permanent storage, including transportation, importation, and utilization. The law applies to both offshore and *onshore* activities, defining offshore areas as the seabed and subsoil of Malaysia beyond three nautical miles from the baseline of each state, including the exclusive economic zone and the continental shelf, and *onshore* areas as all lands within each state of Malaysia and the Federal Territories up to three nautical miles from the baselines. Regarding the CO₂ storage phase, the *CCUS Act* provides for:

- XI.** the requirements and procedures for obtaining assessment permits, which authorize site characterization studies, seismic surveys, drilling, and injection tests;
- XII.** the requirements and procedures for obtaining storage licenses, which authorize the operation of a storage site for the injection and permanent storage of CO₂;
- XIII.** the criteria for accepting CO₂ streams for storage purposes, including composition standards and limits on incidental substances;
- XIV.** the operational obligations of storage site operators, including monitoring, corrective actions and remediation, and reporting to the Agency;
- XV.** the collection of an injection levy, applicable to offshore operators, the rates of which are determined by the Minister based on the risk associated with each site;

- XVI.** closure and post-closure obligations, including site closure and the issuance of a closure certificate, subject to compliance with the prescribed conditions;
- XVII.** the transfer of monitoring, corrective action, and remediation obligations to the Government, following a prescribed period and fulfillment of the conditions of the closure certificate; and
- XVIII.** the establishment and management of the Post-Closure Stewardship Fund, a fund intended to cover the long-term management costs of storage sites after the transfer of obligations to the Government (Part VIII, Sections 41–44).

The supplementary regulations (*CCUS Regulations*) detail the application procedures for offshore licenses and permits, including submission requirements, financial guarantees, risk assessments, and environmental management plans. It is also worth noting that the regulations define the functions of the competent technical entity, as well as the reporting requirements, risk management, and the operational, closure, and post-closure obligations for storage sites.

Regarding financial guarantees, the regulation requires applicants for a *storage license* to provide proof of a financial guarantee sufficient to cover all operational risks, liabilities, and closure and post-closure costs; this guarantee must be valid prior to the start of injection and remain in effect until the transfer of obligations to the government. The regulation further establishes that the amount and form of the financial guarantee will be determined by the applicant based on all information and documents submitted by the applicant as part of the offshore *storage license* application and subject to the Agency's approval. The *CCUS Act* does not specify financial instruments, delegating to the regulation and the license conditions the definition of the applicable guarantee mechanisms.

The *CCUS Act* also requires persons who own or operate carbon capture facilities, transport CO₂, or use CO₂ to register with the Agency, thereby creating an integrated regulatory framework for the entire value chain. In addition, the importation of CO₂ captured outside Malaysia for permanent storage is allowed, provided that the CO₂ meets the acceptance criteria and is covered by an import license issued by the Agency.

LIFE-CYCLE PHASES OF THE STORAGE STAGE IN CCS PROJECTS SUBJECT TO REGULATORY OVERSIGHT

The *CCUS Act* and its regulations (*CCUS Regulations*) govern the life cycle phases of the storage stage, dividing the licensing regime into two sequential instruments: the *assessment permit* and the *storage license*, both of which apply to both offshore and onshore areas.

The reservoir assessment phase requires the prior obtaining of a geological *assessment permit*. For offshore areas, no person may conduct a geological assessment of any potential storage complex or geological formation without a permit issued by the Agency. The *assessment permit* authorizes the conduct of technical studies such as site characterization, seismic surveys, drilling, and injection tests, with the aim of determining the technical and commercial feasibility of the reservoir for CO₂ storage. The permit is issued subject to the conditions the Agency deems appropriate. The offshore regulations stipulate a fee of RM 80,000 per application for an *assessment permit* and an equivalent fee for its extension.

For the operational (storage) phase, a *storage license* must be obtained. For offshore areas, no one may operate a storage site without an offshore *storage license* issued by the Agency; this applies to the permanent storage of CO₂ captured both in Malaysia and abroad. A *storage license* may only be applied for by holders of an assessment permit that has already been issued. The Agency may impose conditions it deems appropriate when granting the permit. The fee for applying for an offshore *storage license* is RM 120,000. The holder of the *storage license* has exclusive operating rights over the licensed site.

During the operational phase, the operator must comply with the operational obligations set forth in Section 29, in accordance with prudent CCUS practices, which include: (a) providing information relevant to assessing compliance with the license conditions; (b) monitoring the storage complex and the surrounding environment, and preparing a monitoring and plan; (c) taking corrective and remedial measures in the event of a leak or significant irregularity; and (d) submitting reports on monitoring and measures taken to the Agency. The operator must also maintain records of the quantities and properties of the accepted and injected CO₂ stream, including the stream's composition.

In addition, the offshore operator is required to pay the injection levy, determined by the Minister based on the Agency's recommendation and on the risk and probability of risk at each storage site; the rates for this levy are reviewed every five years by the Agency and may not be increased due to withdrawals from the Fund or risks associated with other projects. The proceeds from the levy are directed to the *Post-Closure Stewardship Fund*.

For the closure of operations, no storage site may be closed, nor may a closure certificate be issued by the Agency, without compliance with the conditions prescribed for closure and payment of the fee for requesting the initiation of the offshore site's closure. Applicants must provide proof of sufficient financial assurance to cover all operational risks, liabilities, and closure and post-closure costs.

During the post-closure and monitoring phase, after the site has been closed, the operator remains responsible for monitoring the site and reporting the results to the Agency, for implementing corrective and remedial measures, and for other prescribed activities, until these obligations are transferred to the Government.

The transfer of obligations occurs when, following the issuance of the closure certificate and the expiration of the prescribed period, the obligations regarding monitoring, corrective actions, and remediation are transferred to the Government, which issues a certificate documenting such transfer. This transfer will occur only if: (a) the prescribed period has elapsed since the issuance of the closure certificate, as established by Section 42 of the *CCUS Regulations* at a minimum of 10 years; and (b) the other conditions prescribed in the closure certificate have been met. It should be noted that the transfer of obligations does not include the transfer of any criminal, contractual, or civil liability attributable to fault, negligence, willful misconduct, or lack of due diligence on the part of the operator.

For *onshore* areas, the *CCUS Act* provides that the operational closure and post-closure obligations applicable to offshore storage also apply to *onshore* storage. However, the transfer of obligations to the Government in *onshore* areas must be determined by the Minister, after consultation with the respective State Government.

ALLOCATION PROCEDURES AND PRIORITY AMONG COMPETING APPLICANTS FOR THE SAME STORAGE FORMATION

The *CCUS Act* does not establish explicit allocation procedures or priority criteria among competing applicants vying for the same storage formation or complex. The law merely grants the *MyCCUS* Agency the discretionary authority to grant or deny assessment permits and storage licenses, both offshore and *onshore*, after verifying the applicant's compliance with the requirements.

A *storage license* grants the holder exclusive operating rights over the licensed site, which suggests that, once granted, other operators will not be able to use the same site for storage purposes. However, the law does not specify objective tie-breaking criteria, rules for public bidding, or mechanisms for competition among applicants, such as bidding rounds, technical or financial scoring, or preference for holders of assessment permits.

In this regard, just as in the U.S. under the Underground Injection Control Program (UIC), the *CCUS Act* does not expressly provide for competitive mechanisms for the allocation of sites, and the granting of licenses is an administrative decision made by the Agency. The absence of explicit rules on competition and tie-breaking indicates that such issues may be addressed in the future through supplementary regulations or guidelines to be issued by the Minister or by the Agency itself. It should also be noted that the *CCUS Act* contains no explicit provision for third-party access to the storage site or CCS facilities.

ENVIRONMENTAL LICENSING

As in other jurisdictions, the requirement for an EIA does not stem from CCS legislation but from the general environmental framework. The environmental legal framework applicable to geological CO₂ storage in Malaysia consists of the *Carbon Capture, Utilization, and Storage Act 2025* (Act 870²¹⁰); the *CCUS (Offshore Permit and Licensing)*²¹¹ *Regulations 2025*; the *Environmental Quality Act 1974*²¹² and the *Environmental Quality (Prescribed Activities) (EIA) Order 2015*²¹³, in addition to the *Continental Shelf Act 1966*; the *Exclusive Economic Zone Act 1984*²¹⁴ and the *Petroleum Development Act 1974*²¹⁵.

Malaysia's federal environmental authority is the *Director General of Environmental Quality*, who heads the *Department of Environment* (DOE) and to whom Section 34A of the *Environmental Quality Act 1974* grants the authority to review, approve, or reject the environmental impact assessment report for prescribed activities.

In Malaysia, environmental permitting and control are governed by the *Environmental Quality Act 1974*, also known as *Act 127*, which applies nationwide, is administered by the DOE, and addresses the prevention, reduction, and control of pollution, as well as the protection of environmental quality. For activities deemed to have a significant environmental impact and subject to environmental permitting, Section 34A²¹⁶ of the *Environmental Quality Act 1974* requires the interested party to submit, in advance, a report to the Director-General of the DOE that follows the guidelines established by the Director-General and contains an assessment of the impact the activity will have or is likely to have on the environment, along with proposed measures to prevent, reduce, or control any adverse impact.

The *Prescribed Activities* are listed in the *Environmental Quality (Prescribed Activity) (Environmental Impact Assessment) Order 2015*²¹⁷, organized into two schedules (*First Schedule* and *Second Schedule*). Neither of these schedules expressly includes the geological storage of CO₂ as a *Prescribed Activity*. The classification is therefore based on analogy with the development of oil or gas fields and pipelines thirty kilometers or longer, both of which are included in the *First Schedule*. The distinction between the two schedules is not only a matter of the significance of the impact but is also procedural. Activities listed in the *First Schedule* are not automatically subject to public display²¹⁸, which depends on a written determination by the Director-General, whereas those listed in the *Second Schedule* mandatorily require the EIA Report to be made available for public consultation.

The content of the EIA Report is defined by Section 34(2) of the *Environmental Quality (Prescribed Activity) (Environmental Impact Assessment) Order 2015*, and includes an assessment of the environmental impact and measures for prevention, reduction, and control. It is also detailed in the DOE's administrative guidelines, which stipulate the need for a project description, characterization of the existing environment, impact assessment, mitigation measures, an environmental monitoring program, and a summary. The Malaysian

regime does not, however, require an examination of alternative sites or best available technologies (design, technology, location, scale) nor a baseline scenario, as provided for in European and British law, leaving these matters to administrative practice.

In addition to the EIA, Act 870²¹⁹ and the *CCUS Regulations* (Section 13²²⁰) require, as part of the application for a *storage license*, a risk assessment and management report regarding the impact of the activities on human health and safety and on the environment. This report should not be confused with the EIA: it is addressed to the licensing authority (*MyCCUS Agency*), not the environmental authority; it is not subject to public review or third-party comments; and its focus is on the risk posed by the activity, not on the overall significant effects on the receiving environment. It is a regulatory risk management tool submitted to the regulatory agency, not to the environmental agency.

Section 28 of Act 870²²¹ also establishes the acceptance criteria for the CO₂ stream to be injected *offshore* (with a corresponding provision in Section 37 for *onshore* injection)²²², as follows: the material stream must consist predominantly of carbon dioxide; no waste or other material may be added for the purpose of disposal; only substances incidentally associated with the source, capture, or injection process, and tracers intended to aid in monitoring and verifying CO₂; and all must remain below concentrations that adversely affect the integrity of the site or the transport infrastructure, pose a significant risk to human health or the environment according to prudent practices, or violate applicable Malaysian laws.

Although the content of the EIA in the strict sense is defined in general terms by Section 34A of the *Environmental Quality Act 1974*, Section 15 of the *CCUS Regulation* on the storage regime adds items of typically environmental content, which must support the permit application and which, in practice, constitute the project's risk assessment: the geological characterization of the site and the storage complex; the injection plan and the development plan, specifying injection volumes, rates, and composition; the monitoring plan, covering the injection facilities, the storage complex, the CO₂ plume and the surrounding environment; the risk assessment and management report on health, safety, and the environment; the acceptance criteria for the CO₂ stream (CCUS Act, Sections 28 and 37); and the closure and post-closure plans. These CCS-specific items, however, are

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not part of the EIA itself: they are required by the storage regime and addressed to the licensing authority (the *MyCCUS* Agency, or the *State Planning Authority* in Sarawak), not by the environmental assessment regime.

In addition, as applicable, there are obligations arising from the conditions of environmental approval under Section 34A of the *Environmental Quality Act 1974* and, if the incident involves the discharge of oil or a hazardous substance into Malaysian waters, the penalty provisions of Sections 27 and 29 of the same Act.

INSTITUTIONAL GOVERNANCE

The *CCUS Act* concentrates regulatory authority in two main institutional actors: the Malaysia Carbon Capture, Utilization, and Storage Agency (*MyCCUS*) and the Minister responsible for CCUS matters.

MyCCUS, established under Section 6 of the *CCUS Act*, is the central body responsible for overseeing and regulating CCS activities in Malaysia. It is a collegial agency composed of a Chairman, appointed by the Minister; the Secretary-General of the Ministry responsible for CCUS; the Director-General of the Department of Environment; and up to six other members appointed by the Minister who, in the Minister's opinion, possess relevant experience, knowledge, and expertise. The functions of *MyCCUS* are broad and include, among others:

- a. advising the Government and the Minister on the implementation of the law;
- b. administering and ensuring the effective implementation of the *CCUS Act* and its regulations;
- c. oversee all activities related to carbon capture, transport, utilization, and storage;
- d. oversee the management of storage resources for the permanent storage of CO₂;
- e. administer and oversee the Post-Closure Stewardship Fund;
- f. recommend policies, actions, and measures to the Government;

- g. promote, develop, and implement CCUS policies and initiatives;
- h. collect, analyze, and publish relevant information and statistics;
- i. regulate offshore and *onshore* geological assessment activities by issuing assessment permits;
- j. regulate permanent storage in offshore and *onshore* areas by issuing storage licenses;
- k. report any significant leaks or irregularities to the Minister;
- l. regulate CO₂ transport activities; and
- m. monitor CO₂ import activities.

The Minister responsible for CCUS has regulatory authority to issue the regulations necessary for the implementation of the law and may regulate, among other matters, issues related to carbon capture, transport, utilization, offshore and *onshore* permit requirements, the functions of the competent technical entity, prudent CCUS practices, storage site obligations, closure conditions, transfer of obligations, fees, appeal procedures, and administration of the Fund. The Minister may also issue standards, guidelines, specifications, practices, measures, and reporting requirements related to CCUS.

The Minister is also responsible for: setting the rates for the injection levy by means of an ordinance published in the official gazette; reviewing administrative appeals from applicants who feel aggrieved by the denial of permits, the imposition of conditions, or the revocation or suspension of permits, thereby upholding or overturning the appealed decision; and exempting, by ordinance, geographic areas, persons, vehicles, or facilities from obligations set forth in the law.

The *CCUS Act* also provides for the role of the "competent technical entity," which may be appointed by the Minister separately for each component of the CCUS chain: capture, transport, utilization, offshore storage, and *onshore* storage. This entity is responsible for advising the *MyCCUS* Agency on technical and operational matters related to the component for which it was appointed, and for performing other

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functions as determined by the Minister. The *CCUS Regulations* detail the functions of the competent technical entity, which include advising the Agency on technical plans and operational matters.

With regard to inspection and enforcement, the Minister may authorize in writing any public official to exercise inspection powers under the *CCUS Act*, and police and customs officers have investigative powers. No legal proceedings regarding violations of the *CCUS Act* may be initiated without the written consent of the Public Prosecutor.

The Ministry responsible for the Agency must provide the personnel, funds, and other facilities necessary for the performance of its functions.

Failure to comply with the obligations set forth in the law subjects the offender to penalties that include fines and imprisonment. Conducting offshore geological surveys without the proper license, for example, constitutes an offense punishable by imprisonment for up to 3 years or a fine of up to RM 1 million, or both. Operating an offshore storage facility without a license is punishable by imprisonment for up to 5 years or a fine of up to RM 2 million, or both.



UNITED STATES



REGULATORY FRAMEWORK AND SCOPE OF CCS ACTIVITIES

In the United States, the federal framework governing the geological storage of CO₂ differs structurally from the other regimes examined in this study. At the federal level, there is no single statute that grants an operator the right to explore and utilize a geological reservoir. The federal framework consists of environmental regulations, notably the mandatory GHG reporting program, established under the *Clean Air Act*; and the *Underground Injection Control Program (UIC)*, established under the *Safe Drinking Water Act (SDWA)* to protect underground sources of drinking water²²³.

At the institutional level, the *United States Environmental Protection Agency (EPA)* plays a central role in this framework. The agency administers the federal greenhouse gas emissions reporting program and the *UIC Program*, issues applicable regulations, and directly licenses and inspects Class VI wells in states that have not been granted primacy. When implementation of the *UIC Program* is delegated to a state, territory, or tribe, the EPA remains responsible for approving and overseeing the respective program.

This structure is related to the division of authority and the regime governing subsurface property rights. A federal Class VI well permit does not confer property rights or any exclusive privileges. Rights to the porous space and access to the reservoir are defined by each state's law and obtained by the interested party from the respective rights holders. Although state approaches are not uniform, laws such as those in Wyoming and North Dakota

expressly assign the porous space to the surface owner. Thus, unlike jurisdictions where the state is the owner or original manager of the reservoirs, the U.S. federal system does not function as a mechanism for granting a public resource.

The *Clean Air Act* constitutes the legal basis for the *Mandatory Greenhouse Gas Reporting Program*, which applies to owners and operators of facilities covered by Part 98 of Title 40 of the *Code of Federal Regulations*. For geological storage, Subpart RR establishes rules for quantification, monitoring, reporting, and verification. Among other data, the following must be reported: the volumes of CO₂ received, injected, produced, emitted through surface or equipment leaks, and effectively stored. Subpart UU contains reporting requirements for other injection facilities, while Subpart VV separately addresses storage associated with enhanced oil recovery that uses the ISO 27916 standard^{224,225}.

The *SDWA* serves as the legal basis for the *UIC Program* and for Class VI wells intended for CO₂ injection for geological storage. Federal regulations are primarily distributed among Parts 144 through 147 of Title 40 of the *Code of Federal Regulations*: Part 144 establishes the general framework and licensing procedure; Part 145 governs the requirements for state programs; Part 146 contains the applicable technical criteria and standards, including the specific requirements for Class VI; and Part 147 identifies the programs administered by states, tribes, or directly by the EPA.

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The SDWA allows states, territories, and tribes to obtain primary responsibility from the EPA for implementing and enforcing the *UIC Program*, known as *primacy*. In the absence of approved primacy, the EPA directly administers the program.

As of 2026, Arizona, Louisiana, North Dakota, Texas, West Virginia, and Wyoming are the states with primacy for Class VI wells, while all other states remain under EPA administration. The transfer of licensing authority does not preclude minimum federal requirements or EPA oversight²²⁶.

Parts 144 and 146 define the program's scope, classify wells, establish criteria for site selection and geological characterization, and govern the identification of underground sources of drinking water. They also regulate the licensing procedure, the construction and operation of wells, the plans required from the operator, monitoring and reporting, financial responsibility, well plugging, post-injection care, and site closure. The license may be modified, revoked and reissued, or terminated under the circumstances provided for in the regulations²²⁷.

LIFE CYCLE PHASES SUBJECT TO REGULATORY OVERSIGHT

The *UIC Program* is based on individual Class VI well permits. Area-wide permits are not permitted for this class; therefore, each injection well must have its own permit. The application, however, includes information and plans covering the entire regulated cycle: assessment of the geological system, well construction, operation, monitoring, plugging, emergency response, post-injection care, and site closure²²⁸.

The license application must demonstrate that the well will be installed in a geological system suitable for the anticipated volume of CO₂ and must contain information on the geology, hydrogeology, review area, existing wells, projected plume, and pressure front. The following must be submitted from the outset: the testing and monitoring plan, the injection well plugging plan, the post-injection site care and site closure plan, and the emergency and remedial response plan²²⁹.

The license authorizes the construction and, upon fulfillment of the applicable conditions, the operation of the well. During injection, the operator must observe operational lim-

its, maintain mechanical integrity, carry out the testing and monitoring program, and report the results to the authority. The license does not confer ownership or exclusivity over the formation and remains in effect for the operational life of the facility and the post-injection care period, and is reviewed by the authority at least every five years.²³⁰

During the phases covered by the permit, the operator must demonstrate and maintain sufficient financial responsibility to carry out corrective actions in the review area, injection well plugging, perform post-injection site care and site closure, and implement emergency and remedial response measures. The regulations permit various instruments, including a *trust fund*, *surety bond*, letter of credit, *escrow account*, insurance, financial test, and corporate guarantee. The amounts must be calculated on a phase-by-phase basis, based on the cost of hiring a third party by the authority, and updated throughout the project's lifespan²³¹.

Prior to plugging, the operator must notify the authority, comply with the approved plan, and submit a report on the measures implemented. Once injection is complete, the operator must monitor the position of the CO₂ plume and the pressure front and demonstrate that the project poses no risk to underground sources of drinking water. The federal reference period for post-injection site care is fifty years, but the authority may approve an alternative period, including authorizing early site closure, based on site-specific data. If, at the end of the period, the absence of risk has not yet been demonstrated, monitoring must continue²³².

Site closure occurs upon authorization by the authority and releases the operator from federal post-injection site care obligations. Financial responsibility must be maintained until site closure is approved and the corresponding obligations are fulfilled. The federal regulations also require a permanent notation in the property records indicating the area's use for CO₂ storage and the transfer of project records to the authority after the applicable retention period²³³.

The site closure provided for in federal regulations terminates the post-injection site care obligations imposed by the *UIC Program* but does not amount to a general transfer of ownership of the reservoir or of civil and environmental liability to the state, as it is essentially linked to the well permit for the CCS activity, and not to the activity itself. Issues of ownership, compensation, access to the porous space,

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and liability that go beyond the scope of protection under the SDWA remain outside the scope of the federal license and are governed by applicable state law²³⁴.

This difference must be understood in light of the U.S. property system. In other regimes where the state originally owns the reservoir, the transfer after closure can be structured as a return of management and residual responsibilities to the public owner. Under the U.S. system, where the porous medium may belong to private parties and the operator obtains the necessary rights contractually or through state mechanisms, this logic does not automatically apply. This helps explain why federal regulations are limited to the closure of environmental obligations related to groundwater and well operations.

The absence of a transfer under the federal system, however, has not eliminated the need to address the risks associated with storage designed to remain in place for a potentially indefinite duration. Some states have created certificates of completion, public assumption mechanisms, and operator-funded funds to support post-closure monitoring and management.

In North Dakota, the operator retains ownership of the CO₂ and remains liable for damages until a project completion certificate is issued. The certificate may only be granted at least ten years after the end of injection and is contingent, among other requirements, on demonstrating the stability of the CO₂, the integrity of the facilities, the proper closure of the wells, and the resolution of any outstanding claims. Upon issuance of the certificate, ownership of the facility and the stored CO₂ is transferred to the state; the operator and the generators are released from the regulatory requirements associated with the site; and monitoring and management become the state's responsibility. A dedicated fund, financed by a fee levied on each metric ton injected, funds long-term management²³⁵.

Wyoming has adopted a similar solution, with a minimum term of twenty years following the cessation of injection.

Upon presentation of a certificate of completion and demonstration of compliance with legal conditions, ownership of the CO₂ and the facilities is transferred to the state, as is primary responsibility for the stored CO₂. The operator and generators are released from regulatory requirements regarding storage maintenance, the bonds are released, and the state assumes monitoring and management. Costs and future claims are borne by the *Wyoming Geologic Sequestration Special Revenue Account*, subject to the limits set forth in state law²³⁶.

INSTITUTIONAL GOVERNANCE

The EPA is responsible for the *UIC Program* at the federal level. When a state, territory, or tribe obtains primacy, its director assumes responsibility for issuing and administering Class VI permits, while the EPA retains its role in approving and overseeing the program. This decentralization allows federal environmental permitting to be carried out in conjunction with state rules regarding ownership, unitization, liability, and long-term funds.

The license application must identify the operator, the facilities, other applicable authorizations, and any location on tribal land. It must include characterization data and plans for the entire regulated cycle. After issuance, the authority reviews the license at least every five years and may modify, revoke, reissue, or terminate it under the circumstances specified in the regulations. The transfer of a license requires approval; for Class VI wells, automatic transfer is not permitted²³⁷.

The authority also monitors the implementation of the plans, receives monitoring reports, orders corrective measures in the event of risks to underground sources of drinking water, and decides on plugging and closure. This governance, however, remains limited to the scope of the *UIC Program*. The federal environmental permit for the well, the rights to the reservoir, and the long-term residual liability are distinct categories and may involve different authorities, instruments, and criteria.



BRAZIL



REGULATORY FRAMEWORK FOR CCS ACTIVITIES

Brazil now has a specific legal framework for carbon dioxide capture and geological storage activities under Law No. 14,993, dated October 8, 2024 (Fuel of the Future Act). Articles 26 through 29 of the Law require authorization from the National Agency of Petroleum, Natural Gas, and Biofuels (“ANP”) for carbon dioxide capture activities for the purpose of geological storage, its transportation via pipelines, and the geological storage itself. The legislative choice was, therefore, to establish a regulated chain and grant the ANP jurisdiction over its three main stages, although the scope of this study focuses on the storage stage.²³⁸

The Law did not create a concession regime, nor did it grant private entities ownership of the geological reservoir. Instead, it adopted an administrative authorization regime: companies or consortia of companies incorporated under Brazilian law, with headquarters and management in the country, may apply for authorization to carry out the activities at their own risk and expense. The authorization has a period of thirty years and may be extended for an equal period if the conditions set forth in the respective instrument are met, without prejudice to the Executive Branch to alter the term in the presence of significant public interest. The ANP is responsible for regulating the qualification of interested parties, the conditions for granting the authorization, and any transfer of ownership of the authorization (Art. 26, §§ 1–3).

Decree No. 13,095, dated August 12, 2026, regulated these provisions and detailed the general structure of the model. The Decree preserves the ANP’s authorization as the central instrument and provides that, for geological storage activities, it may comprise two phases: (i) research and evaluation of geological storage; and (ii) geological storage operations. This division is important, since the law does not provide for specific stages with separate permits for evaluation and/or exploration, as seen in other jurisdictions. The deadlines, obligations, documents, and conditions applicable to each phase are yet to be established in the Agency’s regulations. The Brazilian model is thus at an intermediate stage of implementation: the Law and the Decree define the structure, the authorities, and certain essential requirements, but a significant portion of the operational content of the authorizations will depend on subordinate regulations.²³⁹

In addition to the legal guidelines on economic efficiency and sustainability, consideration of local and regional particularities, adoption of industry best practices, and integration of infrastructure, services, and geological and geophysical information, the Decree incorporates objectives related to environmental and operational safety, technological innovation, industrial decarbonization, respect for pre-existing contracts and rights, and ensuring the traceability, additionality, and permanence of reductions and

removals. It also emphasizes the creation of multi-user *hubs*, infrastructure sharing, and the planning of CO₂ transport corridors, including the reuse of existing gas pipelines when technically feasible.²⁴⁰

The framework covers various technological pathways involving permanent geological storage, including CCS, CCUS, BECCS, BECCUS, DACCS, and DACCUS, and allows the ANP to recognize new pathways. For regulatory purposes, the Decree defines permanence as the retention of carbon in a geological formation for a minimum period of fifty years or proof of irreversible mineralogical sequestration. This definition serves as a general parameter for climate integrity and should not be confused with the term of the authorization or the post-injection monitoring period.²⁴¹

Specific provisions address the interaction between CO₂ storage and hydrocarbon exploration and production activities. Injection and storage carried out for enhanced hydrocarbon recovery in a reservoir subject to an exploration and production contract do not require the authorization provided for in Article 26 of the Law. The Decree, however, stipulates that the storage of non-native CO₂ used for this purpose must be authorized by the ANP upon approval of the development plan and is subject to the safety, monitoring, contingency, inventory, and inspection obligations applicable to geological storage. In areas already under a contract, the ANP must consult the holder of the exploration and production rights before granting authorization to a third party.²⁴²

The framework also seeks to regulate conflicts between subsurface uses. When it is not possible to simultaneously carry out geological storage and hydrocarbon exploration and production or mining activities supported by a prior contract or authorization, the Minister of Mines and Energy, after consulting with the interested parties, shall determine the priority use. When a conflict arises between parties interested in the same storage block, the ANP must establish prioritization criteria and conciliation procedures. However, current legislation does not yet define whether the exploration and evaluation authorization or the operating authorization will confer exclusivity over the block, nor does it establish the substantive criteria for selecting among competing applicants. These matters remain subject to future regulation by the Agency, pursuant to Article 7, paragraph 4, of the Decree.

Finally, the ANP's authorization does not replace environmental licensing. The Decree expressly states that the two controls are cumulative. Since the Law and the Decree do not define the licensing authority or the environmental procedure applicable to each project configuration, these issues must be resolved in accordance with general environmental legislation, the location, and the extent of the project's impacts, in parallel with the regulatory process conducted by the ANP.²⁴³

LIFE-CYCLE PHASES OF THE STORAGE STAGE IN CCS PROJECTS SUBJECT TO REGULATORY OVERSIGHT

Brazilian legislation allows for the authorization of geological storage to be organized into two regulatory phases (exploration and evaluation; and operation), in addition to closure, decommissioning, and post-injection monitoring. Although the Decree does not use all six phases adopted in this study, its provisions cover the project's life cycle and can be related to this analytical framework.

During the reservoir evaluation phase, the authorization should permit activities aimed at identifying and characterizing formations with storage potential and demonstrating their technical and environmental suitability. The Law guarantees interested parties access to public technical data on Brazilian sedimentary basins for analysis, studies, and the identification of potential areas. The Decree, in turn, introduces the concept of a storage block and delegates to the ANP the task of defining the technical conditions, procedures, deadlines, and obligations for the exploration and evaluation phase. Among other aspects, the following have not yet been defined in a specific public regulation: the content of the work program, the conditions for drilling appraisal wells, the possibility of injection for testing, the size of the blocks, the exclusivity regime, and the criteria for transitioning to the operational phase.²⁴⁴

During the installation phase, the construction of wells, pipelines, and other facilities will depend on the authorizations and approvals to be regulated by the ANP, without prejudice to environmental licensing and other requirements based on the location and characteristics of the infrastructure. The Agency may require guarantees and other financial instru-

ments capable of ensuring compliance with obligations related to capture, transportation, storage, decommissioning, and monitoring at all stages of the project, pursuant to Article 28, paragraph 3, of the Future Fuels Act, and Articles 3 (I) and 8 of the Decree.

The operational phase will be subject to authorization by the ANP and must comply with the technical and operational conditions established by the Agency. However, the Act already imposes minimum obligations on the storage operator: to ensure the safety and effectiveness of storage in accordance with the monitoring and contingency plans and the environmental license; to identify, report, and respond to undesirable events and signs of leakage; to maintain detection and prevention instruments that are calibrated and operational; to maintain validated records; prepare inventories comparing projected volumes with those actually stored and leaked; carry out monitoring; and allow for audits and inspections.²⁴⁵

In the case of shared infrastructure, ANP regulations must ensure free access, transparency, and non-discrimination, in order to promote multi-user arrangements, economic efficiency, and competition. The Agency may establish additional requirements regarding governance, capacity, and interoperability. The wording of the Decree indicates a preference for open infrastructure but leaves decisive issues—such as rules for contracting and capacity expansion, compensation, dispute resolution, and grounds for denying access—to be addressed in regulations.²⁴⁶

Termination of the authorization entails the cessation of activities and the decommissioning of facilities in accordance with good engineering practices and future ANP regulations. For geological storage, termination may only occur after the stability of the stored CO₂ and the corresponding pressure front has been demonstrated. The initial monitoring period is twenty years, starting from the end of injection. If, at the end of this period, stability has not been proven, the ANP must extend the authorization and require a new monitoring plan. The period may be reduced if the operator demonstrates stability in advance, based on long-term geological modeling covering a minimum horizon of fifty years.²⁴⁷

The Brazilian model does not, as of now, provide for the transfer of long-term responsibility to the State. On the contrary, unlike the models observed in other jurisdictions, the Decree expressly stipulates that the termination of the authorization and monitoring obligations does not remove or limit the liability of the operator or its successors for events, risks, or damages related to storage, including those pertaining to storage safety, environmental remediation, and compensation to third parties. This approach distinguishes Brazil from jurisdictions that transfer certain obligations to the State after stability has been demonstrated and financial requirements have been met. It also leaves for future development the coordination between the termination of the authorization, the continued civil and environmental liability, and the financial guarantees that may be required by the ANP.²⁴⁸

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Stage/License	Purpose	Exclusivity and Area	Typical Obligations	Does it allow for commercial CO ₂ injection?
EXPLORATION AND EVALUATION (ANP AUTHORIZATION)	Identify and characterize geological reservoirs and demonstrate their suitability for storage	Criteria for block delineation and potential exclusivity are still subject to ANP regulations	Work program, characterization, risk assessment, plans, and guarantees to be defined by the ANP; environmental licensing where applicable	Not for commercial operation; the possibility of test injection has yet to be regulated
GEOLOGICAL STORAGE OPERATION (ANP AUTHORIZATION)	Develop and utilize the reservoir for injection and permanent storage	Prioritization criteria among interested parties will be defined by the ANP; conflicts with prior uses may be decided by the MME	Comply with monitoring and contingency plans; monitor, inventory, maintain records, respond to leaks, allow for inspections, and provide any guarantees that may be required	Yes

Source: Prepared by the author, based on Law No. 14,993/2024 and Decree No. 13,095/2026.

ALLOCATION PROCEDURES AND PRIORITY AMONG COMPETING APPLICANTS FOR THE SAME STORAGE FORMATION

Law No. 14,993/2024 and Decree No. 13,095/2026 distinguish between two conflict situations. The first involves a conflict between geological storage and preexisting hydrocarbon exploration and production or mining rights. In this case, the Minister of Mines and Energy must decide on the priority use after hearing from the interested parties. Furthermore, if the area is subject to an exploration and production contract, the ANP must consult with the respective contract holder before authorizing storage.

The second situation arises when more than one economic agent expresses interest in the same storage block. In this case, the Decree grants the ANP the authority to define prioritization criteria and conciliation procedures. The comparative criteria, the selection process, the tie-breaking mechanisms, or the effects of a prior application on subsequent

applications have not yet been established. Furthermore, under the current general framework, there is no express provision granting preference to the party that conducted the exploration and evaluation. Future regulations will need to address these issues to reduce the investment risk associated with reservoir characterization and, at the same time, ensure efficiency in the allocation of a limited geological resource.

ENVIRONMENTAL LICENSING

CCS projects in Brazil are not yet subject to specific environmental regulations at the federal or state level. Environmental licensing²⁴⁹ for this activity is therefore based on the general provisions of the National Environmental System (Sisnama – Law No. 6,938/1981); Article 225, §1, IV, of the 1988 Federal Constitution; CONAMA Resolution No. 237/1997; Complementary Law No. 140/2011; and, more recently, Law No. 15,190/2025, the General Environmental

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Permitting Law (LGLA)²⁵⁰. Since there are no commercial CCS projects in operation in the country²⁵¹, the analysis presented here is based primarily on the application by analogy of the oil and gas licensing regime — CONAMA Resolution No. 23/1994 and Ministry of the Environment and Climate Change (MMA) Ordinance No. 422/2011²⁵² —, given the similarity of the operational stages between oil and gas exploration and CO₂ storage.

The authority to grant licenses follows the general framework set forth in Constitutional Law No. 140/2011: as a general rule, the state environmental agency within the SISNAMA system licenses *onshore* projects, while the Brazilian Institute of the Environment and Renewable Natural Resources (IBAMA) licenses *offshore* activities or those related to them, as a complementary measure to regulate activities subject to federal licensing.

In the absence of a specific environmental license for CCS²⁵³, the procedure follows the standard three-phase process—Preliminary License (LP), Installation License (LI), and Operating License (LO)—adapted, where compatible, to the oil and gas regulatory model. The LGLA, however, broke new ground by establishing a differentiated and prioritized procedure for projects classified as strategic by decree; in such cases, the licensing authority prioritizes the review and decision-making process for the respective applications, which may benefit CCS projects due to their relevance to climate mitigation policies²⁵⁴.

Regarding the required environmental study, Article 225, Paragraph 1, Item IV, of the Constitution mandates a Preliminary Environmental Impact Assessment (EIA) for any construction project or activity that could potentially cause significant environmental degradation, a requirement reinforced by Law No. 6,938/1981. CCS projects currently operating abroad show low direct impacts; thus, strictly speaking, there would be no scientific basis for requiring an EIA or RIMA²⁵⁵.

When adapted to CCS, the permitting process can be divided into two stages: (i) the seismic data acquisition phase, involving the drilling of stratigraphic wells; and (ii) the commercial CO₂ storage phase. Site survey and evaluation may require a Seismic Survey License (LPS) and a Preliminary Drilling License (LPper), at which point the EIA/RIMA would be submitted. The installation of injection structures and systems is subject to an Installation License (LI), as speci-

fied in the Basic Environmental Plan (PBA), while commercial injection is subject to an Operating Permit (LO) and compliance with the monitoring plan. Closure includes the injection cessation, decommissioning, well plugging, and post-operational monitoring, in accordance with the conditions defined in the licensing process.²⁵⁶²⁵⁷²⁵⁸²⁵⁹

Closure requirements must cover, as applicable, decommissioning, well plugging, restoration of affected areas, and the monitoring necessary to verify the retention of CO₂.

In addition to assessing the physical, biotic, and socioeconomic environments, the EIA/RIMA must consider the specific characteristics of geological storage: the capacity and integrity of the reservoir and the cap rock; the behavior of the plume and pressure fronts; pre-existing wells; risks of migration, leakage, and induced seismicity; protection of aquifers; composition of the CO₂ flow; and impacts of potential leaks.²⁶⁰²⁶¹

The Terms of Reference, the license application, the approval of the EIA/RIMA, and the authority's decision must be made public. The RIMA must remain accessible, written in clear language, while safeguarding industrial confidentiality. During the LP phase, public participation takes place through consultation, public hearings, and participatory meetings. Continuous communication with the directly affected communities is also recommended during the planning, implementation, and operation phases.²⁶²

Licensing does not replace authorization from the ANP. Decree No. 13,095/2026 (Article 7 and paragraph 4) requires both, and Law No. 14,993/2024 (Article 29, I) binds the operator to the monitoring and contingency plans and to the conditions of the environmental license.

Environmental and regulatory monitoring are complementary. The former tracks environmental quality and impacts on the surrounding area; the plan submitted to the ANP focuses on safety and the behavior of the storage facility, including the plume, pressure fronts, wells, and any leaks. The information must be shared between the Agency and the environmental authority.

In the event of a leak or abnormal migration, the operator must notify the authorities, activate the applicable plans, and adopt preventive and corrective measures. Decree No. 13,095/2026 (Article 11, paragraph 1) provides for the

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monitoring of the stored volume and the pressure front for twenty years after injection; the environmental monitoring period will be set by the licensing authority.

The termination of the authorization and regulatory monitoring does not relieve the operator or its successors of liability for risks or damages related to storage, including site safety, environmental remediation, and compensation to third parties.

INSTITUTIONAL GOVERNANCE

Governance of the Brazilian framework is concentrated in the Ministry of Mines and Energy (MME) and the ANP, with participation by the Energy Research Company (EPE) in infrastructure planning and without prejudice to the environmental authorities of federal entities.

The ANP plays the central regulatory role. The Agency is responsible for regulating the qualification of interested parties; establishing the technical conditions and procedures for authorization, regulation, oversight, and decommissioning; defining deadlines and obligations for the exploration, evaluation, and operation phases; authorizing and overseeing projects; providing access to public technical data on sedimentary basins; establish criteria for prioritization and reconciliation among interested parties in the same block; regulate the sharing of infrastructure; require, if deemed necessary, financial guarantees; and establish rules for other circumstances leading to the termination of authorizations. The Agency will also be responsible for verifying the stability of the stored volume and the pressure front for the purpose of terminating monitoring obligations.²⁶³

The MME performs strategic planning and decision-making functions. In addition to being able to establish supplementary guidelines for infrastructure planning, the Minister is responsible for deciding on the priority use of the sub-surface when storage is incompatible with prior hydrocarbon exploration and production rights or mining rights. The Decree also assigns to the MME, with support from EPE and in coordination with the ANP, the task of preparing an indicative plan for capture, pipeline transportation, and geological storage infrastructure. The plan, reviewed every two years, must identify *hubs*, consider storage projections, encourage the use and sharing of infrastructure, and guide its integration and cost-effectiveness.²⁶⁴

Environmental authorities retain their own jurisdiction over the licensing and environmental oversight of these projects. The ANP's authorization does not replace this oversight, and the operator's obligations must comply with both the plans approved by the Agency and the conditions of the environmental license. Since the specific CCS legislation does not assign licensing authority to a single entity, the determination of the competent environmental agency will depend on the general rules governing the allocation of responsibilities and the specific characteristics of the project.

In the current implementation phase, the experimental regulation also serves as a mechanism for internal coordination within the ANP. The Agency's Report acknowledges that the new jurisdiction involves areas such as operational safety, the environment, exploration and production, infrastructure, technical data, and economic regulation. The consolidation of the Brazilian regulatory framework will therefore depend not only on the issuance of external resolutions but also on the clear definition of internal responsibilities and coordinated procedures for the review of the first projects.

AI-generated image



The comparative analysis shows that Brazil has, in a short period of time, established a significant legal framework for the development of CCS. Law No. 14,993/2024 recognized the activities of CO₂ capture, transport, and geological storage, assigned regulatory authority to the ANP, and established minimum obligations for operators. Decree No. 13,095/2026 built upon this framework, organizing the authorization phases and incorporating key elements for the sector's development—such as the development of hubs, infrastructure sharing, and the pilot testing of initial projects.

On the other hand, the Brazilian model differs from the experiences analyzed in two structural aspects.

The first concerns the scope and density of the regulatory framework. Norway, Alberta, the United Kingdom, Australia, and Malaysia have regulated geological storage through specific and relatively detailed laws, regulations, or sets of rules. These instruments address the permits applicable to each phase, rights over storage areas, reservoir characterization, financial obligations, closure, and post-closure risk management.

Malaysia is particularly relevant to this comparison. Although its regulatory framework will not take effect until 2025, the country has already established a comprehensive law, a specific regulation, sequential permits for evaluation and storage, operational exclusivity, financial guarantees, a risk-based injection levy, a post-closure fund, and the transfer of certain obligations to the government.

In Brazil, the legal framework for CCS is concentrated in just a few articles of the Future Fuel Act. Some of the structural decisions were subsequently addressed by the Decree, while another significant portion remains subject to future regulation by the ANP. This approach provides the Agency with flexibility to adapt the rules to technological advancements and the experience gained from early projects. At the same time, it delegates to the sub-statutory level the definition of elements essential to investment predictability and market functioning, which are naturally more prone to instability.

With regard to environmental licenses, authorizations, and permits, there is a clear asymmetry between jurisdictions that have created a truly autonomous CCS license—such as Norway, with its authorization for CO₂ injection and geological storage— and those that have incorporated environmental requirements into a single technical-operational permit,

such as the U.S. *Class VI Well Permit* and the AER's approval of the injection scheme for Alberta. Brazil, for its part, like Malaysia, does not currently provide for a specific environmental permit for CCS, but has environmental regulations robust enough to adapt the general three-phase process (LP/LI/LO) and make use, to the extent possible, of the oil and gas regime.

The second contrast lies in the treatment of long-term liability. Under the comprehensive regimes analyzed, the closure of a project may lead to the transfer or public assumption of certain obligations and liabilities. This transfer is not automatic. In general, the legislation requires the proper decommissioning of facilities, a monitoring period, demonstration that post-injection containment and behavior are as expected, and the allocation of funds to cover future costs. Nor does it protect the operator in cases of fraud, omission, fault, negligence, or failure to comply with its obligations. Norway, the United Kingdom, and Malaysia transfer liability to the state after a proven monitoring period. Alberta goes further, mandatorily transferring liability and ownership of the stored CO₂, without a minimum legal term, leaving the timeframe to be defined by subordinate legislation. Australia, in turn, provides in its federal offshore regime for the state to assume long-term liability once the fifteen-year warranty period has elapsed.

The U.S. federal regime constitutes a partial exception. This difference can be explained by the country's own structure of subsurface ownership. While in the other jurisdictions analyzed, reservoirs or spaces designated for storage are, as a rule, owned or managed by the state, in the U.S., rights to the porous space are defined by each state's law and are often associated with private ownership of the surface. In Wyoming and North Dakota, for example, the law expressly assigns the porous space to the surface owner. In this context, the state's assumption of responsibility does not simply operate as a "return" to the original owner of the reservoir, as occurs in regimes where the state is already the owner or manager of the storage space. The federal regime for Class VI wells itself focuses on the protection of underground sources of drinking water and does not regulate ownership of the porous space nor establish a general system for the transfer of long-term liability.

Given the unique nature of geological storage (whose residual effects and risks may persist for a potentially indefinite period), several states have created their own mechanisms

for the post-closure period. In North Dakota, at least ten years after the end of injection and upon demonstration of CO₂ stability, the issuance of a certificate of completion transfers ownership of the facility and the stored CO₂ to the state, releases the operator from regulatory obligations, and makes the state responsible for monitoring and managing the site. The associated costs are financed by a fund composed of fees levied on each metric ton injected. In Louisiana, the legislation also provides that, after the applicable period and upon fulfillment of the closure conditions, ownership of the project and the stored CO₂ is transferred to the state, future obligations and liabilities are partially released, and monitoring and remediation are assumed by the *Carbon Dioxide Geologic Storage Trust Fund*. These examples show that, even in a system characterized by private ownership of the subsurface, the long-term nature of storage has led to the creation of public and collective solutions for post-closure risks.

Brazil has taken a different path. Decree No. 13,095/2026 stipulates that the termination of the authorization and monitoring obligations does not remove or limit the liability of the operator or its successors for events, risks, or damages related to storage. There is, therefore, no regulatory threshold beyond which the State assumes the residual risks of a reservoir whose long-term containment and safety have already been demonstrated.

Brazil thus adopts the strictest position among the seven jurisdictions analyzed, a solution that ultimately reflects the constitutional framework of strict civil liability for environmental damage.

This strictness extends to the government itself, in that the government's civil liability for failure to fulfill its duty to oversee is joint and several—albeit subject to subsidiary enforcement—such that a failure by the environmental licensing agency to supervise a CCS project may ultimately also fall on the State.

This choice has consequences that extend beyond the legal sphere. Liability without a defined end point can make it difficult to price risks, restrict access to insurance and financing, and create obstacles to corporate reorganization, asset transfers, and the operator's cessation of activities. Its effects will also depend on how the National Petroleum Agency (ANP) regulates financial guarantees. The combination of indefinite liability and guarantees maintained for

an equally indefinite period may impose costs that are difficult to quantify and compromise the economic viability of projects.

Regulations should therefore establish a clear relationship between closure, monitoring, liability, and financial guarantees. The terms of the authorization, the post-injection monitoring period, the timeframe used to demonstrate climate stability, and the duration of legal liability are not equivalent. For example, specifying a minimum time horizon of fifty years for modeling permanence does not, in and of itself, resolve the question of when regulatory and financial obligations may be considered terminated.

Another critical issue is the protection of investments made in research and reservoir characterization. This stage may require data acquisition, seismic surveys, well drilling, and injection tests before there is certainty regarding the project's technical and commercial viability. The regimes analyzed adopt different solutions for this risk, including territorial exclusivity, preference for the operating license, and continuity between titles or instruments for retaining the area.

In Brazil, the exclusivity of blocks, the criteria for prioritizing interested parties, and the rights of the party that funded the reservoir characterization have not yet been defined. Regulations should prevent both the speculative retention of areas and the possibility of an operator bearing the costs and risks of evaluation without predictability regarding its subsequent access to the site. To this end, transparent selection criteria, minimum work commitments, deadlines, rules for the return of areas, and clear conditions for the transition from exploration to production will be necessary.

The regulation of shared infrastructure, on the other hand, represents a promising aspect of the Brazilian model. By providing free access, transparency, non-discrimination, the formation of hubs, and the planning of transportation corridors, the Decree incorporates a vision compatible with the development of CCS at scale. These guidelines will still need to be translated into rules regarding contracting, capacity reservation and expansion, compensation, interoperability, legitimate grounds for denying access, and dispute resolution. The challenge will be to ensure third-party access without eliminating incentives for initial infrastructure investments.

Institutional governance will also require attention. Granting central authority to the ANP may promote specialization and regulatory consistency, given the agency's experience with oil, natural gas, infrastructure, and operational safety activities. ANP authorization, however, will coexist with environmental permitting and with the responsibilities of the MME, EPE, and various public authorities. The lack of a clear interface between these processes may lead to duplicative requirements, contradictory decisions, or incompatibility between regulatory and environmental timelines.

A comparative analysis of CCS environmental permitting in the jurisdictions under review reveals that the most decisive factor in regulatory design is not the type of government system, but the degree of institutional integration between the environmental authority and the technical regulator of the geological reservoir. At one end of this spectrum is the Province of Alberta, which consolidates both functions into a single agency. In contrast, Brazil, Australia, the United Kingdom, Malaysia, and Norway maintain a separation between the environmental agency and the activity regulator. Brazil, in fact, replicates this duality at both the federal and state levels, which points to a more fragmented institutional architecture.

This institutional duality has a direct impact on the requirement for environmental studies. Brazil represents the most rigid approach: the EIA/RIMA stems directly from Article 225, Paragraph 1, Item IV, of the Federal Constitution. At the opposite extreme are the United States, where the granting of a Class VI well is structured, among other factors, by the technical determination of the Review Area. Alberta, in turn, holds discretionary power regarding the requirement for an environmental impact assessment.

The strength of public participation is perhaps the aspect in which the Brazilian framework stands out the most. In-person or remote public hearings, the availability of the RIMA, and the possibility of participatory meetings introduced by the General Environmental Licensing Act make up the Brazilian system of public participation in environmental licensing. This framework is even more formal than the U.S. one under 40 CFR Part 124. In the United Kingdom, on the other hand, pre-application community consultation for projects of national interest is no longer mandatory. The fact is that public participation and consultations—whether in writing or in person—are present in all countries and are vital to the implementation of CCS activities.

In virtually all jurisdictions, environmental monitoring is organized around a structural duality between the technical-geological monitoring of the reservoir and the environmental monitoring of the surrounding area—a duality that is reflected in Brazil in the very division of responsibilities between the ANP and the environmental agency within SIS-NAMA. Since the two monitoring plans often deal with information of common interest to both authorities, there is concrete scope for Measurement, Monitoring, and Verification (MMV) protocols to be shared between the environmental and regulatory processes, thereby avoiding duplication of requirements without either side relinquishing the control that rightfully belongs to it. Regarding CO₂ leaks or irregular migration, there is broad regulatory convergence regarding the duties of immediate notification and the obligation to suspend injection.

In this context, experimental regulation can serve as a useful transitional tool. Analyzing the first projects will allow the ANP to understand different technical and commercial configurations, test solutions, and incorporate practical experience into the final regulations. To foster institutional learning, these procedures must adhere to transparent criteria, ensure equal treatment, and generate information that can be systematized and used in subsequent regulatory decisions. Experimentation should serve as a bridge toward establishing a permanent regulatory framework, rather than indefinitely replacing general rules applicable to the sector.

This regulatory learning process can also be observed in the jurisdictions analyzed. Some of the frameworks that today serve as international benchmarks were conceived when experience with CO₂ geological storage projects was still limited and have been adjusted as project implementation, operational and monitoring experience, and technological development have progressed. In the European Union, the guidance documents for implementing the CCS Directive were updated in 2024 to reflect the state-of-the-art technology and clarify ambiguities identified during the implementation of the first projects. In Norway, the Ministry of Energy submitted for public consultation in 2026 amendments to the storage regulations specifically motivated by the experience gained from their application, including

administrative simplifications and technical adaptations. In Alberta, the regulations governing CO₂ sequestration projects have undergone adjustments in recent years: in 2024, the Alberta Energy Regulator revised Directive 065 following a public consultation, modifying, among other things, *containment assurance* requirements and procedures applicable to storage projects. These developments show that even established regulatory frameworks remain subject to adjustments and refinements as practical experience with project development and oversight grows. Thus, the comparative overview suggests, in summary, that Brazil already has a comparatively advanced and rigorous framework for public participation and civil liability, but that the maturation of the CCS regime in the country will depend, above all, on a factor that is still in its infancy: the development of a specific environmental licensing procedure model tailored to the particularities of CCS activities, which is currently absent in Brazil but present, to varying degrees, among the jurisdictions studied. This is not, strictly speaking, a legal problem, but rather one of regulatory sequencing and, consequently, implementation.

International experience does not offer a single model for Brazil to replicate. The jurisdictions analyzed adopt different titles, timeframes, institutional arrangements, and risk-allocation mechanisms. Nevertheless, the comparison reveals a convergence around certain elements: regulatory coverage of the entire life cycle, protection of investment in the valuation, requirements for guarantees proportional to the risks, objective criteria for closure, and some institutional and financial solution for long-term management.

Brazil's main challenge is to transform existing guidelines into a framework that is simultaneously secure, enforceable, and capable of facilitating investment decisions. This will depend on clear rules regarding who can access and use the reservoirs, how the transition between project phases occurs, which risks remain with the operator, how these risks should be secured, and under what conditions a project may be considered effectively terminated. The quality of these definitions will determine whether the Brazilian framework will function merely as legal authorization for CCS or as an effective basis for the development of large-scale projects.

TOPIC	NORWAY	ALBERTA	UNITED KINGDOM	AUSTRALIA	MALAYSIA	UNITED STATES	BRAZIL
REGULATORY FRAMEWORK	Specific and detailed laws and regulations for offshore storage	Provincial laws and regulations	Specific laws and regulations	Federal laws and specific regulations for offshore storage	Specific CCUS laws and regulations; Sarawak has its own regime	Federal framework focused on well licensing, replicable by the states	Chapter of Law No. 14,993/2024, Decree, and future ANP regulations
CENTRAL AUTHORITIES	Ministry of Energy and technical and environmental authorities	Provincial Minister and Alberta Energy Regulator	Licensing authority/NSTA and environmental and economic authorities	NOPTA, relevant ministers, and environmental authorities	MyCCUS and the Minister responsible for CCUS	EPA or the state authority with primacy	ANP and MME, with support from EPE and in collaboration with environmental authorities
EXCLUSIVITY IN THE OPERATION	Yes, within the area covered by the exploitation license	Not expressly defined in the regulations reviewed	Site defined in the storage permit	Not conclusively identified in the study	Yes, regarding the licensed site	Not specified in the federal license	Not yet defined
POST-INJECTION MONITORING	Minimum of 20 years, subject to reduction	No period defined by law; current minimum term is 10 years	Minimum of 20 years, subject to reduction	Minimum of 15 years with state participation	Until the obligations are transferred to the government, following a prescribed period not yet specified in the text	General rule of 50 years, subject to reduction	Initial term of 20 years, extendable or reducible upon demonstration of stability
TREATMENT OF LONG-TERM LIABILITY	Transfer to the State upon proof of stability and fulfillment of the conditions	Transfer to the Crown upon issuance of a closure certificate	Transfer of obligations and liabilities upon termination of the license	The State assumes monitoring activities and costs after closure, subject to legal conditions	Transfer of monitoring, correction, and remediation obligations to the government; liabilities arising from fault, negligence, or willful misconduct remain	The federal regime relieves the operator of post-injection care obligations but does not establish a general transfer of liability; there are state-level solutions	There is no transfer; the operator and its successors remain liable even after closure
POST-CLOSURE FINANCIAL MECHANISM	Financial contribution to cover state monitoring costs for 30 years	Contribution per metric ton injected into the Post-Closure Stewardship Fund	Contribution to cover at least 30 years of monitoring after the transfer	Guarantee intended to cover monitoring costs and expenses assumed by the state	Financial guarantee, injection fee calculated based on risk, and Post-Closure Stewardship Fund	Financial liability maintained until the completion of post-injection care and site closure	The ANP may require guarantees, but their purpose, amount, duration, and release have not yet been defined
ENVIRONMENTAL LICENSING	Specific environmental authorization for injection and storage, in addition to an environmental impact assessment	Technical and environmental responsibilities are concentrated within the AER; impact assessment is not automatic	Environmental framework linked to storage authorizations	Environmental plans, potential assessment under the EPBC Act, and sea dumping permit	EIA based on general environmental legislation; CO ₂ storage is not expressly listed. A separate risk report is submitted to MyCCUS	Federal Class VI regime focused primarily on the protection of underground sources of drinking water	Cumulative environmental permitting in conjunction with ANP authorization, in accordance with general environmental legislation

For the analysis of Brazilian regulations, the official Portuguese-language versions available on government websites were used. For Australia, Canada (with a focus on the Province of Alberta), the United States of America, and the United Kingdom, the official English-language versions available on the respective governments' websites were consulted.

In the cases of Malaysia and Norway, English translations available on official websites were used.

It should be noted, however, that, as reported by the Norwegian authorities themselves, these translations are not official, may not reflect recent updates, and, in the event of any discrepancy, the Norwegian versions prevail.

In addition, the following limitations apply to this study:

The validity and currency of the regulations were verified based on the information available on the official websites consulted as of the date the research was completed. Any regulatory changes not yet incorporated into these databases may not be reflected in this document.

The identification and description of the competent authorities are based on the regulations and institutional information consulted. Subsequent administrative reorganizations, changes in jurisdiction, or name changes may affect the information presented.

This study does not systematically examine the administrative, civil, or criminal penalties applicable to noncompliance with licenses, authorizations, laws, regulations, or other rules mentioned herein, except when necessary to understand a specific aspect of the regulatory framework analyzed.

This study is intended to be informative and comparative in nature and does not constitute a legal opinion on the legislation of the jurisdictions examined.

STATEMENT ON THE USE OF ARTIFICIAL INTELLIGENCE

In accordance with the principles of transparency and research integrity, we hereby declare that the artificial intelligence tools Claude, developed by Anthropic; ChatGPT, developed by OpenAI; and Perplexity were used to assist in the identification, screening, and initial organization of documents and regulations.

The tools were not used as independent sources of information or as substitutes for the analysis conducted by the authors. The cited sources were accessed and examined directly by the authors responsible for each section. The selection of references, the interpretation of standards, the comparative analysis, the formulation of arguments and conclusions, and the validation of content remained the sole responsibility of the authors.

- 1 NORWEGIAN OFFSHORE DIRECTORATE. Regulations concerning the exploitation of subsea reservoirs on the continental shelf for CO₂ storage and concerning the transportation of CO₂ on the continental shelf. Norwegian Offshore Directorate, 2024a. Available at <<https://www.sodir.no/en/regulations/regulations/exploitation-of-subsea-reservoirs-on-the-continental-shelf-for-storage-of-and-transportation-of-co/>>. Accessed Aug. 10, 2026.
- 2 EUROPEAN UNION. Agreement on the European Economic Area (EEA), January 3, 1994. Provides for the establishment of the European Economic Area. Version dated Dec. 6, 2025. Available at: <<https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A01994A0103%2801%29-20251206>>. Accessed Aug. 12, 2026.
- 3 RAZAUSKAS, Algirdas. European Economic Area (EEA), Switzerland, and the Nordic Region. European Parliament: Fact Sheets on the European Union, 2025. Available at: <<https://www.europarl.europa.eu/factsheets/pt/sheet/169/espaco-economico-europeu-eee-suica-e-regiao-setentrional>>. Accessed Aug. 12, 2026.
- 4 This refers to the *storage license* issued by the competent authority for pollution-related matters. This license should not be confused with the *license for exploitation* issued under the *Storage Regulations*.
- 5 This refers to the consent for injection issued under the *Storage Regulations*.
- 6 NORWAY. Lov om vern mot forurensninger og om avfall (Forurensningsloven), Act of March 13, 1981, No. 6, Concerning Protection Against Pollution and Concerning Waste (Pollution Control Act). Available at: <https://lovdata.no/dokument/NL/lov/1981-03-13-6> Accessed on: Aug. 31, 2026.
- 7 Norway. Regulation on Pollution Control (Pollution Control Regulation), FOR-2004-06-01-931, June 1, 2004, Chapter 35, § 35-4 (authorization for CO₂ injection and storage), available at: <https://lovdata.no/forskrift/2004-06-01-931/%C2%A735-4>. Accessed on: Sept. 8, 2026. Official text in Norwegian; free translation into Portuguese performed with the aid of translation tools and used exclusively for analytical purposes. In the event of a discrepancy in interpretation, the original text prevails.
- 8 § 35-4. Licensing requirements: Any person or entity intending to inject and store CO₂ in geological formations must obtain a license from the Norwegian Environment Agency. (Free translation).
- 9 WEBER, Viktor. Regulation of CCS Storage Sites in Norway and Compliance with EEA Law. *SINTEF Proceedings*, vol. 7, pp. 435–442, 2021
- 10 NORWAY. Ministry of Petroleum and Energy. Norway: Legal and Regulatory Framework for CCS. Institutional presentation. Available at: https://iea.blob.core.windows.net/assets/imports/events/3/2.1_Agerup.pdf Accessed Sept. 8, 2026. The presentation states that “Storage of CO₂ is only feasible on the continental shelf—for geological reasons” and that pipeline transport to permanent storage in a subsea geological formation on the continental shelf is currently the only viable solution for CO₂ from onshore industrial facilities.

- 11 *Pollution Regulations*, §§ 35-3(l) and 35-4(b)–(c), and *Storage Regulations*: Section 1-6: Definitions (...) y) Significant risk, a risk of damage to the environment or human health that cannot be overlooked without jeopardizing the purpose of environmentally secure geological storage of CO₂. The assessment of whether there is a significant risk must take into account both the probability of damage occurring and the extent of such damage if it occurs.

Section 1-10: Selecting a Storage Location: The suitability of a subsea reservoir as a storage location shall be determined through a characterization and assessment of a potential storage location and the surrounding area in accordance with the criteria listed in Appendix 1.

A subsea reservoir shall only be selected as a storage site if, under the conditions proposed for such use, there is no significant risk of leakage, and there is also no significant risk to health or the environment.

Available at: <https://www.sodir.no/en/regulations/regulations/exploitation-of-subsea-reservoirs-on-the-continental-shelf-for-storage-of-and-transportation-of-co/>
- 12 Chapter 2. General Provisions Relating to Pollution, § 6. Definition of Pollution
- 13 Chapter 3. § 11 Special permit for any activity that may cause pollution
- 14 § 13. Duty to submit a notification and conduct an environmental impact assessment for any activity that may involve major pollution problems
- 15 § 35-5. *Application for a permit*
- 16 *Storage Regulations*: Section 4-5 (Plan for the development and operation of a subsea reservoir for the injection and storage of CO₂) Available at:

<https://www.sodir.no/en/regulations/regulations/exploitation-of-subsea-reservoirs-on-the-continental-shelf-for-storage-of-and-transportation-of-co/> Accessed on: Sept. 8, 2026
- 17 Section 4-9 (Exemption from the requirement for an impact assessment) and Section 4-10 Impact assessment in the event of significant transboundary environmental effects.
- 18 NORWAY. Norwegian Offshore Directorate. CO₂ storage licenses. Dec. 21, 2023. Available at: <https://www.sodir.no/en/facts/co2-storage/co2-storage-licences/> Accessed Sept. 8, 2026.
- 19 Free translation of *King in Council*.
- 20 European Free Trade Association.
- 21 For example, the call for proposals available at <<https://www.sodir.no/en/facts/co2-storage/co2-storage-licences/announcement-2025-round-1/invitation/>>. Accessed Aug. 14, 2026,
- 22 NORWEGIAN OFFSHORE DIRECTORATE. CO₂ storage. Norwegian Offshore Directorate, 2024. Available at: <<https://www.sodir.no/en/facts/co2-storage/>> Accessed on: Sept. 2, 2026.
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- 151 The Secretary of State and the Scottish Ministers may, by order, delegate their functions to one or more public bodies, except for the power to make regulations or orders. It is the responsibility of the Secretary of State or the Scottish Ministers, as the case may be, to regulate the powers and duties of inspectors and of those whom the Oil and Gas Authority appoints to carry out inspection-related activities. Inspectors are appointed by the respective authority to assist in the performance of its functions.
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- 157 *Energy Act 2023*, Sections 1 (1) and (2), and 332.
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- 187 Section 34 of the *Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2023*; Section 41 of the *Environmental Protection Regulation 2019*; Section 96A of the *Energy Resources Act 2000* (SA) and Part IV of the *Environmental Protection Act 1986* (WA); Section 19(5) and Section 4(4) of the *Environment Protection (Sea Dumping) Act 1981* (Cth), combined with item 1.8 of Annex 1 to the *Protocol* (introduced by Resolution LP.1(1) of 2006)
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- 189 It is worth noting that the precedent *Santos NA Barossa Pty Ltd v Tipakalippa*, decided by the Full Court of the Federal Court on December 2, 2022, confirmed that First Nations groups with sea country interests are relevant parties subject to mandatory consultation, thereby invalidating the approval of the drilling plan due to insufficient consultation. AUSTRALIA. *Santos NA Barossa Pty Ltd v Tipakalippa* [2022] FCAFC 193. Full Court of the Federal Court of Australia, Kenny, Mortimer, and Lee JJ, Dec. 2, 2022. Available at: <https://www.judgments.fedcourt.gov.au/judgments/Judgments/fca/full/2022/2022fcafc0193>. Accessed Aug. 31, 2026.
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- 191 AUSTRALIA. Offshore Petroleum and Greenhouse Gas Storage (Environment) Amendment (Consultation and Transparency) Regulations 2019 (F2023L00998 predecessor, F2019L00370). Available at: <https://www.legislation.gov.au/Details/F2019L00370>. Accessed: Aug. 31, 2026. The public notice and comment process had already been in effect since 2019 and did not constitute a change introduced after the *Tipakalippa* case.
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- 204 OPGGS Act 2006, Sections 300, 307, 327, 333, 364, and 454.
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- 222 37. (1) No onshore operator shall accept and inject carbon dioxide streams into a storage site in onshore areas unless such carbon dioxide streams comply with the carbon dioxide stream acceptance criteria specified in section 28. Available at: <https://faolex.fao.org/docs/pdf/mal239148E.pdf>
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- 230 UNITED STATES OF AMERICA. Code of Federal Regulations, Title 40, §§ 144.35–144.37, 146.87–146.91. § 144.35(b)
- 231 UNITED STATES OF AMERICA. Code of Federal Regulations, Title 40, § 146.85
- 232 UNITED STATES OF AMERICA. Code of Federal Regulations, Title 40, § 146.93(a)–(c).
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- 235 NORTH DAKOTA. Century Code, Chapter 38-22, §§ 38-22-15 through 38-22-17. § 38-22-15 establishes the Carbon Dioxide Storage Facility Trust Fund; § 38-22-17
- 236 WYOMING. Senate File 0047, 2022, incorporated into W.S. 35-11-318 through 35-11-320. Available at: <https://wyoleg.gov/Legislation/2022/SF0047>. Accessed Sept. 7, 2026; WYOMING ENERGY AUTHORITY. Summary of Wyoming's CCS/CCUS Legal Regime & Opportunities for Geological Sequestration of Carbon Dioxide, June 8, 2022. Available at: <https://wyoleg.gov/InterimCommittee/2022/09-202206276-01ResponsetoJMEDCLetter-Murrell.pdf>. Accessed on: Sept. 7, 2026
- 237 UNITED STATES OF AMERICA. Code of Federal Regulations, Title 40, §§ 144.36–144.41, 146.82, and 146.90–146.94. Pursuant to § 144.38(b), automatic transfer does not apply to Class VI permits.
- 238 BRAZIL. Law No. 14,993, of October 8, 2024, arts. 26–29.
- 239 BRAZIL. Decree No. 13,095, dated August 12, 2026, Articles 7 and 8.
- 240 BRAZIL. Law No. 14,993, dated October 8, 2024, Art. 27; Decree No. 13,095, dated August 12, 2026, Art. 2.
- 241 BRAZIL. Decree No. 13,095, dated August 12, 2026, Articles 3(IV) and 4.
- 242 BRAZIL. Law No. 14,993, of October 8, 2024, Articles 26, § 4, and 28, § 1; Decree No. 13,095, of August 12, 2026, Article 7, § 3.
- 243 BRAZIL. Decree No. 13,095, dated August 12, 2026, Art. 7, § 4.
- 244 BRAZIL. Law No. 14,993, dated October 8, 2024, Art. 28, § 3; Decree No. 13,095, dated August 12, 2026, Arts. 3, I, and 8.
- 245 BRAZIL. Law No. 14,993, dated October 8, 2024, Art. 29.
- 246 BRAZIL. Decree No. 13,095, dated August 12, 2026, Art. 10.
- 247 BRAZIL. Decree No. 13,095, dated August 12, 2026, Art. 11, §§ 1, 2, 3, and 5.
- 248 BRAZIL. Decree No. 13,095, dated August 12, 2026, Art. 11, § 4.
- 249 LGLA, Art. 4: “The construction, installation, expansion, and operation of any activity or project that uses environmental resources, is an actual or potential source of pollution, or is capable, in any way, of causing environmental degradation are subject to prior environmental licensing by the licensing authority that is part of SISNAMA, without prejudice to any other applicable licenses, concessions, and authorizations.” Law No. 15,190/2025. Available at: www.planalto.gov.br/ccivil_03/_ato2023-2026/2025/lei/l15190.htm.
- 250 Federal Constitution of 1988, Art. 225, §1, IV; CONAMA Resolution No. 237/1997; Complementary Law No. 140/2011.
- 251 The most advanced project is the FSBioenergia project, which had not yet begun commercial operations as of September 1.
- 252 CONAMA Resolution No. 23/1994. Available at: www.ibama.gov.br/sophia/cnia/legislacao/MMA/RE0023-071294.PDF; MMA Ordinance No. 422/2011. Available at: www.ibama.gov.br/sophia/cnia/legislacao/MMA/PT0422-261011.PDF.
- 253 LGLA, Art. 3, XXV: “Environmental permit: an administrative act by which the permitting authority, taking into account the legal and regulatory provisions and technical standards applicable to the case, certifies the feasibility of the installation, expansion, and operation of an activity or project subject to environmental permitting and establishes the applicable environmental conditions.”

- 254 LGLA, Art. 24, main text and §1.
- 255 LGLA, Art. 3, XVIII: "Preliminary Environmental Impact Study (EIA): an environmental study of an activity or project that uses environmental resources and that actually or potentially causes significant environmental degradation, conducted prior to the analysis of its environmental feasibility"; XIX: "Environmental Impact Report (RIMA): a document that reflects the conclusions of the EIA, presented objectively and with information in language accessible to the general public, so that the advantages and disadvantages of the activity or project, as well as the environmental consequences of its implementation, can be understood."
- 256 MMA Ordinance No. 422/2011, Art. 3: The activity of conducting seismic surveys at sea and in land-sea transition zones is subject to obtaining a Seismic Survey License (LPS) from Ibama, an administrative act through which the activity is authorized and conditions, restrictions, and environmental control measures are established. Available at: www.ibama.gov.br/sophia/cnia/legislacao/MMA/PT0422-261011.PDF.
- 257 CONAMA Resolution No. 23/1994: The LPper authorizes well drilling to delineate the intended area of operation. Available at: www.ibama.gov.br/sophia/cnia/legislacao/MMA/RE0023-071294.PDF.
- 258 LGLA, Art. 5, §3.
- 259 LGLA, Art. 3, XX: "Basic Environmental Plan (PBA): a study submitted, during the Installation Permit (LI) phase, to the licensing authority in cases subject to the preparation of an EIA, which includes details of the programs, projects, and actions for the prevention, mitigation, control, monitoring, and compensation of negative environmental impacts resulting from the installation and operation of the activity or project."
- 260 LGLA, Art. 29, III.
- 261 Based on international benchmarking of CCS projects (Canada, Australia, and Norway, among others).
- 262 CONAMA Resolution No. 09/1987. Available at: www.ibama.gov.br/component/legislacao/?view=legislacao&legislacao=94201; MMA Ordinance No. 422/2011, cit.; Law No. 9,784/1999. Available at: www.planalto.gov.br/ccivil_03/leis/l9784.htm; CONAMA Resolution No. 237/1997, cit.
- 263 BRAZIL. Law No. 14,993, of October 8, 2024, arts. 26, § 2, 28, and 29; Decree No. 13,095, of August 12, 2026, arts. 7 through 11.
- 264 BRAZIL. Law No. 14,993, of October 8, 2024, Art. 26, § 5; Decree No. 13,095, of August 12, 2026, Arts. 5, 6, and 9.

