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Legal Protection for Land Rights Holders in The Sharing of Benefits from Porous Space for Carbon Storage in Indonesia

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ABSTRACT

Updates to the legal framework for the Economic Value of Carbon (NEK) through Presidential Regulation No. 110 of 2025, as well as regulations on Carbon Capture and Storage (CCS) in Presidential Regulation No. 14 of 2024 in conjunction with Minister of Energy and Mineral Resources Regulation No. 16 of 2024 have established mechanisms for carbon storage in pore spaces within Carbon Storage Permit Areas (WIPK). However, there is a legal gap regarding the certainty of civil protection and the equitable redistribution of economic benefits for surface landowners. Using a normative legal methodology through the statute approach and the conceptual approach, this study analyzes legal constructs based on Book II of the Civil Code and the Land Law (UUPA) to formulate a fair benefit-sharing scheme. The research findings indicate that current positive regulations still focus on the administrative relationship between the state and business entities, thereby creating an imbalance in bargaining power for landowners. Therefore, regulatory improvements are needed that integrate the principle of benefit sharing to ensure legal certainty and distributive justice in the implementation of NEK-CCS in Indonesia.

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INTRODUCTION

The evolving global climate change agenda has prompted Indonesia to take transformative steps by strengthening its national environmental and energy regulatory framework. As a concrete manifestation of its commitment to the Nationally Determined Contributions (NDCs), the Government issued Presidential Regulation No. 110 of 2025 on the Implementation of Carbon Economic Value Instruments and National Greenhouse Gas Emission Control. This policy is not only focused on environmental conservation but also paves the way for the creation of new economic instruments based on industrial decarbonization through both market-based and non-market-based mechanisms (Wilda Prihatiningtyas, 2023). In this context, the Economic Value of Carbon serves as the central pillar for a sustainable energy transition in Indonesia.

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Along with the implementation of the NEK, the development of Carbon Capture and Storage (CCS) technology has emerged as a strategic solution to reduce emissions in industrial sectors that are difficult to decarbonize directly. The government subsequently solidified its operational framework through Presidential Regulation No. 14 of 2024 on the Implementation of Carbon Capture and Storage Activities, as well as various subsidiary regulations from the Ministry of Energy and Mineral Resources governing the designation of Carbon Storage Permit Areas (WIPK). The procedures for capturing, transporting, and injecting carbon into specific geological formations now have an administrative legal framework that enables business entities to manage underground carbon storage (Darodjat, 2026). This marks the beginning of an era in which geological space is utilized as a highly valuable economic and environmental asset.

A fundamental legal issue arises when we examine the concept of pore space within the rock formations targeted for carbon injection. Pore space refers to the empty spaces within rock that can permanently store carbon dioxide; however, these spaces are often located underground on land subject to land rights held by specific legal entities, whether in the form of Freehold Title, Right to Use for Business Purposes, or Right of Use. To date, there is no clarity regarding who is entitled to economic benefits from the utilization of this pore space within the framework of the National Energy Policy (NEK) (Atlanta et al., 2022). This lack of clarity creates tension between the state's authority to manage subsurface natural resources and the private rights of land rights holders on the surface.

From the perspective of civil law and agrarian law, Indonesia adheres to the doctrine of separation between the surface of the land and the space beneath it. Book II of the Civil Code, concerning property and property rights, provides the foundational civil law framework, while the political dynamics of modern agrarian law indicate an expansion of state authority over agrarian resources, which directly impacts the legal standing of those holding surface land rights (Lubis et al., 2026). However, the use of subsurface space for energy and carbon storage creates new challenges in interpreting the vertical boundaries of land ownership (Sesung et al., 2025). There is a potential imbalance in bargaining power, whereby land rights holders are often viewed merely as affected parties, without being granted the role of stakeholders entitled to a share of the economic value generated by carbon.

The main issues in this study center on how to ensure legal certainty regarding the status of pore space and how to formulate a concept of redistributive justice for land rights holders under the WIPK scheme. It is crucial for the state not only to facilitate the needs of CCS investors but also to protect the civil rights of citizens whose geological space is utilized for the benefit of the national economy and corporations. Without a clear contractual legal framework, the utilization of pore space risks triggering protracted civil disputes that could actually hinder the achievement of the decarbonization targets themselves (Darodjat, 2026). Therefore, this study aims to unravel these complexities in order to propose a more equitable legal framework. Studies on the legal framework for the utilization of subsurface space and the regulation of carbon economic value have been discussed in several scientific publications.

First, a study by Atlanta, Anggono, & Setyawan (2022) examined the regulation of subsurface space within Indonesia's land law reform, asserting that the boundaries of vertical land tenure under the Basic Agrarian Law (UUPA) still require clarity regarding the demarcation between private rights and state tenure rights. Second, Wilda Prihatiningtyas (2023) analyzed carbon trading policies from the perspective of environmental justice; however, the study focused on carbon trading instruments in general without addressing the technical aspects of geological technology.Third, Larasati, Aditia, & Gunawan (2026) evaluate the regulations and governance of Carbon Capture and Storage (CCS) in carbon trading in Indonesia. This research focuses on the administrative aspects of permitting as well as investment mechanisms for business entities in the energy sector. Meanwhile, in the context of

international comparison, Duncan, Anderson, & Nicot (2009) emphasize that the determination of pore space ownership status in the United States designates the surface owner as the primary party entitled to receive lease compensation for the injection of emissions.

Unlike previous studies, which tended to treat the domains of general land law, CCS administrative governance policies, and public carbon trading instruments, the novelty of this study lies in the integration of civil law, agrarian law, and sectoral NEK-CCS regulations (Presidential Regulation No. 110 of 2025 and Presidential Regulation No. 14 of 2024). Specifically, this study formulates civil law protections as well as a contractual benefit-sharing model for surface land rights holders when the pore space beneath their land is utilized within a Carbon Storage Permit Area (WIPK).

The urgency of this research lies in the pressing need to establish a civil legal framework capable of reconciling the public interest in emissions control with the private rights of landowners. The legal interpretation of property rights over underground geological spaces utilized as pore space is not merely an administrative procedure, but an ethical and legal imperative to ensure justice for landowners. By refining regulations related to benefit sharing, it is hoped that legal certainty conducive to CCS investment will be created while also ensuring the well-being of communities directly affected by these policies (Devano, 2024). The research questions in this study are, first how are legal certainty and its enforcement for land rights holders regarding the use of pore space addressed in the designation of Carbon Storage Permit Areas (WIPK) within the framework of the Carbon Economic Value (NEK) program in Indonesia?. Second, How can the concept of redistributive justice regarding the Carbon Economic Value (NEK) be formulated and implemented for land rights holders whose geological formations are utilized as carbon storage pore space, when viewed from the perspectives of civil law, land rights holders, and business operators?

RESEARCH METHOD

This study employs a normative legal methodology that focuses on an in-depth analysis of relevant positive legal norms, legal doctrines, and principles of civil law. The approaches used in this study include a statutory approach, which involves a comprehensive review of Presidential Regulation No. 110 of 2025 on NEK, Presidential Regulation No. 14 of 2024 on CCS, and Regulation of the Minister of Energy and Mineral Resources No. 16 of 2024. The analysis also covers provisions in Book II of the Civil Code and the Land Law (UUPA) to understand the framework of property rights and land rights within the Indonesian legal system (Kristianto & Chariansyah, 2026). This step aims to identify synchronization and potential disharmony among regulations regarding the management of subsurface space. Meanwhile, the conceptual approach is used to refer to principles, doctrines, and the views of legal experts to construct a conceptual framework, analyze the fundamental nature of the laws under study, and examine legal gaps (Firdaus, 2024).

ANALYSIS AND DISCUSSION

Legal Framework for Pore Space and the Status of Land Rights Holders under the NEK Scheme within the WIPK

The legal construction of pore space as part of a geological formation beneath the Earth's surface requires clarity regarding its legal status in relation to surface land rights. From a traditional civil law perspective, there is a tendency to view land ownership as extending to unlimited depths; however, modern practice in Indonesia indicates a shift toward separating the legal regimes governing the surface and the subsurface for the public interest. A legal interpretation of property rights over geological spaces utilized as pore space within carbon

economic value schemes indicates that rock pore space is not merely a physical object but a functional space possessing high economic value (Adnan et al., 2026). Regulating the depth limits for the use of subsurface space and establishing rights to it require legal certainty regarding the relationships between the government, investors, and surface rights holders (Arbianzah, 2025). Therefore, legal certainty regarding the status of pore space is an absolute prerequisite before any further carbon transactions can take place.

An analysis of Book II of the Civil Code regarding property and property rights reveals that any use of the space attached to the underlying property must be based on a clear legal basis. Although the Land Law (UUPA) grants the state the authority to regulate subsurface space in the national interest, this does not mean that the private rights of landowners can simply be disregarded in the designation of Carbon Storage Permit Areas (WIPK) (Aziz et al., 2026). The provisions in Presidential Regulation No. 14/2024 do indeed grant business entities the authority to conduct carbon injection; however, procedures for aligning these activities with the land rights above remain minimal and are purely administrative in nature (Darodjat, 2026). This situation creates legal vulnerability for landowners whose civil rights are threatened by the dominance of state permitting processes.

The principle of legal certainty requires administrative order that not only ensures the smooth operation of CCS but also protects the civil rights of the public. The granting of exploration permits and carbon storage operation permits often precedes the conclusion of agreements with landowners whose land lies above the Target Injection Zone (ZTI). Under these circumstances, the status of landowners becomes uncertain because, de facto, the geological space beneath their land is controlled by the storage permit holders, while de jure, there has been no relinquishment of rights or provision of adequate compensation (Shinta Pangesti et al., 2026). The national land law framework has not yet clearly defined the limits of physical control over subsurface space, thereby potentially creating legal uncertainty and overlapping jurisdictions between sectoral permit holders and surface land rights holders (Prasetyo et al., 2026). This tension between the public permitting regime and private property rights indicates that the current CCS regulatory framework is not yet fully aligned with the principles of land rights protection in Indonesia.

Furthermore, property rights theory emphasizes that any restriction on an individual's rights must be based on law and accompanied by equivalent protections (Candra et al., 2021). The use of subsurface pore space for carbon storage over very long, or even permanent, periods substantially restricts the use of surface land for certain activities for reasons of safety and storage integrity. If legal certainty regarding the status of pore space is not immediately affirmed in higher-level legislation, the establishment of WIPK will continue to be viewed as a form of state intervention that disregards the private rights of citizens (Boediningsih, 2024). A redefinition of the vertical boundaries of land rights is urgently needed to avoid future agrarian conflicts.

Equitable Redistribution of Carbon Economic Value to Land Rights Holders

The implementation of Carbon Economic Value (NEK), as set out in Presidential Regulation No. 110 of 2025, treats emissions reductions as an economic asset that can be traded through carbon exchange mechanisms or carbon taxes. However, within the EEV-CCS framework, reinforced by Presidential Regulation No. 14 of 2024 in conjunction with Ministry of Energy and Mineral Resources Regulation No. 16 of 2024, surface land rights holders tend to be treated solely as administrative objects of policy, rather than as civil law subjects entitled to a share of these economic benefits. Based on the principle of redistributive justice, there is a demand for proportional benefit-sharing for those who contribute to providing carbon storage space (Raodah & Amalia, 2026). From the perspective of social and distributive justice, the

utilisation of land or natural resources for carbon economy instruments requires transparency, meaningful participation, and fair benefit-sharing mechanisms, so that the green transition does not morph into a new form of exploitation for communities (Latifah, 2025).

Global best practices emphasize that the integration of inclusive benefit-sharing schemes is key to ensuring the integrity of the carbon market and mitigating social and legal risks at the local level (F.F. Valentika & Bambang Eko Turisno, 2024). The utilization of underground pore space owned by citizens makes a tangible contribution to the production of high-value carbon credits; therefore, it is deeply unfair if all the benefits are enjoyed solely by the state and businesses.

From a civil law perspective, the concept of benefit sharing in natural resource management must be consistently applied in the context of NEK to ensure the sustainability of CCS projects. The compensation mechanisms currently in place under land regulations generally cover only physical damage to the land surface, whereas the economic value of environmental services, specifically carbon storage in geological formations, has not been adequately addressed (Atlanta et al., 2022). The redistribution of the economic value of carbon can be achieved through a payment scheme for ecosystem services, provided periodically to landowners throughout the duration of storage operations. Without a fair redistribution scheme, landowners will feel aggrieved, and this could potentially trigger civil lawsuits on the grounds of unlawful acts by the government. The potential for civil disputes arises when the substantial carbon transaction value from a CCS project does not provide direct economic benefits to the land-owning communities within the Target Injection Zone (TIZ).

In international practice in several U.S. states, ownership of pore space is explicitly recognized as part of the surface landowner's rights, such that any use of it requires a lease agreement that generates income for the landowner (Duncan et al., 2009). Indonesia needs to adopt a similar spirit of fairness by formulating a redistribution scheme that involves land rights holders as strategic stakeholders.

From the perspective of landowners, clarity regarding profit-sharing mechanisms or carbon-value-based compensation will create a more stable and inclusive investment climate. An analysis of the equitable distribution of benefits must also consider the long-term risks borne by landowners, such as the risk of leakage or a decline in property values in the injection area. The redistribution of NEK benefits serves not only as an economic reward but also as a form of social insurance and a guarantee of protection for citizens. Equity in the redistribution of the economic value of resources demands that the most vulnerable parties receive the strongest legal protection (Sesung et al., 2025). Therefore, the designation of Carbon Storage Permit Areas (WIPK) must be balanced with a legal obligation to involve communities as strategic stakeholders and to provide compensation to affected landowners.

From the perspective of business actors (investors), a clear legal framework for redistribution is a crucial tool for mitigating operational risks and social barriers on the ground. Based on Presidential Regulation No. 14 of 2024 and the operational framework of Ministry of Energy and Mineral Resources Regulation No. 16 of 2024, certainty in civil legal relationships through the acquisition of legitimate and equitable rights to use subsurface resources will protect business entities' investments from potential social blockades or legal disputes in the future. Therefore, aligning administrative regulations on investment with legal certainty in civil matters will create a stable, inclusive, and sustainable CCS investment climate for all parties (Larasati et al., 2026).

CONCLUSION

Regulations regarding the utilization of pore space within the framework of the Economic Value of Carbon (NEK) and carbon capture and storage (CCS) in Indonesia currently still

present significant legal uncertainty for land rights holders. Although administrative regulations such as Presidential Regulation No. 14/2024 have facilitated the designation of permit areas for investors, the civil rights of landowners over the geological space beneath their surface have not yet received adequate protection. This situation creates an imbalance in bargaining power that risks triggering agrarian and civil disputes in the future, given that the utilization of this subsurface space holds immense carbon economic value that has not yet been fairly redistributed. The concept of equitable redistribution of NEK benefits for land rights holders must be immediately formulated through contractual designs and regulations that guarantee benefit-sharing. This requires synchronization between civil law, agrarian law, and sectoral energy regulations to create transparent compensation and royalty mechanisms. Strengthening the civil law framework to recognize the strategic role of landowners in carbon storage ecosystems will not only ensure investment certainty but also meet the ethical and legal demands for the equitable and sustainable management of national natural resources.

AUTHORS' CONTRIBUTIONS

In this study, each author contributed to various aspects. AP identified the research problem while conducting a digital media review regarding landowners' rights to the economic value derived from the utilization of underground pore space, over which legal entities hold rights, and subsequently developed the conceptual framework for the study and drafted the initial research proposal. MA analyzed the alignment of laws and regulations regarding the economic value of carbon (NEK) and carbon capture and storage (CCS) and formulated the concept of benefit-sharing for land rights holders, which was subsequently incorporated into the paper. MN conducted a literature review, which served as a reference for developing the research arguments.

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