JURNAL LOCUS: Penelitian & Pengabdian
Volume 5 No. 9 September 2026
E-ISSN 2829-7334
DOI: 10.58344/locus.v5i9.6383

The Legal Framework for Using Carbon Credits as Collateral in Indonesia: Validity, Enforceability, and Perfection of Security Interests

Patrick Martin[1]*, Viyoneta Purnama[2]
Universitas Padjadjaran, Indonesia[1]
University California, Amerika Serikat[2]
Email: martinpatrick441@gmail.com[1]*

Keywords:
carbon credits, fiduciary security, legal certainty, regulatory reform, sustainable finance.

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Abstract

The development of carbon trading in Indonesia has transformed carbon credits from environmental policy instruments into emerging economic assets with potential applications in sustainable finance. This article examines the legal status and characteristics of carbon credits under Indonesian law, particularly their classification as intangible, transferable assets that may serve as objects of fiduciary security. Employing a normative juridical approach, this study analyzes the relevant provisions of Indonesian security law, particularly Law No. 42 of 1999 on Fiduciary Security, together with the carbon regulatory framework established under Presidential Regulation No. 110 of 2025 on the Administration of Carbon Economic Value Instruments and the Control of National Greenhouse Gas Emissions. The analysis demonstrates that carbon credits possess characteristics consistent with those of intangible, transferable assets and, in principle, may satisfy the legal requirements for fiduciary security because they are identifiable, transferable, and capable of being recorded through digital carbon registry mechanisms. Nevertheless, the absence of specific rules governing the use of carbon credits as collateral creates substantial legal uncertainty regarding their classification, valuation, registration, monitoring, and enforcement, which may undermine their bankability and acceptance by financial institutions. Accordingly, regulatory reform is required to establish a comprehensive framework governing the use of carbon credits as collateral, thereby strengthening creditor protection, facilitating sustainable financing, and supporting the development of Indonesia's carbon market and broader climate policy objectives.

INTRODUCTION

The development of carbon credits in Indonesia is inextricably linked to the dynamics of global climate change, deforestation pressures, and Indonesia's commitment to fulfilling its international climate obligations. According to data from the 2026 World Population Review, Indonesia ranks eighth among the world's largest carbon dioxide (CO_2) emitters, with total emissions reaching 812.2 megatonnes and accounting for approximately 2.49% of total global emissions (Indonesian Civil Code, n.d.). Meanwhile, monitoring results by the Ministry of Forestry of the Republic of Indonesia regarding the condition of forests across Indonesia's land area, as presented during a Joint Working Meeting with the People's Representative Council of Indonesia on January 19, 2026, showed that Indonesia's total forest area, comprising conservation forests, protected forests, and production forests, reaches approximately 119.67 million hectares, representing 62.5% of Indonesia's total land area (Law No. 42 of 1999 on Fiduciary Security, 1999).

With its substantial natural resources and ecological potential, Indonesia continues to contribute to global climate change mitigation efforts. Indonesia has committed to reducing carbon emissions by 29% through its own efforts and by 41% with international cooperation by 2030, in accordance with the Paris Agreement (BPMI Presidential Secretariat, 2021; Button, 2008; Caston et al., 2025; Hasbullah, 2002; International Finance Corporation, 2018; IQPlus, 2025). In line with this commitment, Indonesia has adopted the 2050 Long-Term Strategy for Low Carbon and Climate Resilience (Long-Term Strategy for Low Carbon and Climate Resilience 2050) and established a pathway toward achieving net-zero emissions by 2060 or earlier (Presidential Regulation No. 110 of 2025 on the Implementation of Carbon Economic Value Instruments and the Control of National Greenhouse Gas Emissions, 2025).

On October 10, 2025, the President of the Republic of Indonesia, Prabowo Subianto, issued Presidential Regulation No. 110 of 2025 on the Implementation of Carbon Economic Value Instruments and the Control of National Greenhouse Gas Emissions ("Presidential Regulation 110/2025"), which revoked and replaced Presidential Regulation No. 98 of 2021 on the Implementation of Carbon Economic Value Instruments for Achieving Nationally Determined Contribution Targets and the Control of Greenhouse Gas Emissions in National Development, thereby rendering the previous regulation no longer applicable (Financial Services Authority Regulation No. 14 of 2023 on Carbon Trading Through Carbon Exchanges, as Amended by Financial Services Authority Regulation No. 10 of 2026 on Amendments to Financial Services Authority Regulation No. 14 of 2023 on Carbon Trading Through Carbon Exchanges, 2023). This regulatory change reflects Indonesia's continuing commitment to addressing climate change issues, consistent with the statement delivered by former President Joko Widodo during the United Nations Climate Change Conference (COP26) on November 9, 2021 (Minister of Forestry Regulation No. 6 of 2026 on Procedures for Carbon Trading Through Greenhouse Gas Emission Offsets in the Forestry Sector, 2026).

This regulatory update also demonstrates Indonesia's commitment to its Nationally Determined Contribution ("NDC"), which is periodically updated to support the achievement of the objectives of the Paris Agreement (Afifah, 2024). Presidential Regulation 110/2025 introduces provisions designed to accommodate the development of the carbon trading market and align Indonesia's carbon governance framework with international standards (IFRS Foundation, 2026; International Finance Corporation, 2025; Kenton, 2026; Macaire & Naef, 2023; Ministry of Foreign Affairs of Denmark, 2025; Mishkin, 2007). Consequently, this regulation represents an important milestone in accelerating green investment, strengthening green economic growth, and maximizing Indonesia's contribution to national and global climate targets (Agreena News, 2024). The regulation introduces guidelines for reducing greenhouse gas ("GHG") emissions through the implementation of various policies and actions oriented toward sustainable development. In this context, the Economic Value of Carbon ("EVC"), defined as the value assigned to each unit of greenhouse gas emissions generated from human activities and economic activities (BATS Consulting, 2025), serves as one of the instruments for fulfilling the Indonesian Government's obligations in contributing to GHG emission reductions (Bank Mandiri, 2023; BNI Sekuritas, 2025; Indonesia Stock Exchange, 2023; Ministry of Forestry of the Republic of Indonesia, 2025, 2026).

In an effort to curb the rate of global warming, various countries continue to seek the most efficient economic instruments. Carbon trading has become a major focus in global climate discussions because this mechanism is considered crucial for providing direct economic

incentives to countries and companies that successfully reduce their greenhouse gas emissions. Presidential Regulation 110/2025 defines carbon trading as a market-based mechanism for reducing GHG emissions through the buying and selling of Carbon Units. A Carbon Unit represents the result of emission reductions and/or removals achieved through domestic certification (in this case, the Greenhouse Gas Emission Reduction Certificate or "SPE-GRK"), international certification, or GHG emission allowances expressed in metric tons of carbon dioxide equivalent ("tCO_2e"). Information regarding Carbon Units at the level of EVC instrument implementation is provided and managed through the Carbon Unit Registry System ("SRUK"), while data and information regarding climate change mitigation and adaptation actions and resources in Indonesia at the NDC level are provided and managed through the National Registry System for Climate Change Control ("SRN-PPI").

It should be noted that the Ministry of Environment of the Republic of Indonesia launched SRUK in July 2026 as a new registry mechanism that officially replaced the Carbon Unit record-keeping and technical management functions previously administered through SRN-PPI. As under previous regulations, the SPE-GRK remains the primary certification used in the implementation of EVC instruments, including carbon trading. However, under Presidential Regulation 110/2025, the process for obtaining SPE-GRK has been revised. Currently, Carbon Units must be registered through SRUK and verified by an independent verifier, with the verification results submitted to the Minister of Environment as the basis for the issuance of SPE-GRK.

As part of the implementation of Presidential Regulation 110/2025, the Indonesian Government issued Minister of Forestry Regulation No. 6 of 2026 on Procedures for Carbon Trading Through Greenhouse Gas Emission Offsets in the Forestry Sector ("MoF Regulation 6/2026"), which recognizes both national and international standards for Carbon Units, thereby creating new opportunities for investors. One of the key developments introduced by MoF Regulation 6/2026 is the official recognition of Carbon Units other than SPE-GRK, specifically non-SPE-GRK Carbon Units that are not issued under Indonesia's domestic certification system. Based on MoF Regulation 6/2026, Carbon Units may take the following forms:

1. SPE-GRK Carbon Units issued by the Minister responsible for government affairs in the field of environmental protection and management; or
2. Non-SPE-GRK Carbon Units based on international standards issued by non-SPE-GRK issuing institutions with the approval of the Minister.

Presidential Regulation 110/2025 stipulates that carbon trading may be conducted through domestic and/or international markets. Not only Indonesia, but countries globally are also beginning to expand the utilization of Carbon Credits beyond the mere buying and selling of Carbon Credits, including through the use of Carbon Units as collateral instruments. The practice of business entities using Carbon Units as security interests for financial institutions has also become increasingly recognized. In this regard, the International Finance Corporation ("IFC"), a member of the World Bank Group, has highlighted the economic value of Carbon Credits by enhancing their financial potential through the issuance of Green Bonds as debt instruments since October 2016. These Green Bonds, valued at US$152 million with a five-year tenor, provide investors with the option to receive compensation in the form of Carbon Credits (Verified Carbon Units) generated from deforestation prevention activities, cash, or a combination of both. Responding to this development, the People's Bank of China, in June

2018, expanded the range of assets eligible as collateral under its Medium-term Lending Facility to include Green Bonds.

The sustainability of carbon credit values is also crucial for maintaining economic stability and promoting reforestation efforts through the existence of carbon credits. Indonesia has integrated carbon trading through a carbon exchange regulated by:

1. Law No. 4 of 2023 on the Development and Strengthening of the Financial Sector, as amended by Law No. 4 of 2026 on Amendments to Law No. 4 of 2023 on the Development and Strengthening of the Financial Sector ("Law 4/2023"); and
2. Financial Services Authority Regulation No. 14 of 2023 on Carbon Trading Through Carbon Exchanges, as amended by Financial Services Authority Regulation No. 10 of 2026 on Amendments to Financial Services Authority Regulation No. 14 of 2023 on Carbon Trading Through Carbon Exchanges ("FSA Regulation 14/2023").

Indonesia's carbon exchange, known as IDXCarbon, was officially launched in September 2023 and has been connected with SRUK and SRN-PPI to facilitate the administration and transfer of Carbon Units.[1] IDXCarbon introduces Carbon Units as securities-like instruments, enabling the management and trading of Carbon Units as financial instruments that may be resold, including through derivative mechanisms.

Several banks in Indonesia, such as Bank Negara Indonesia through BNI Securities, have participated in purchasing 6,250 tCO_2e of Carbon Units in January 2025, after previously purchasing 40,000 tCO_2e of Carbon Units in 2023 to support the development of Indonesia's capital market. Similarly, Bank Mandiri directly purchased 5,000 tCO_2e of Carbon Credits generated from the Conversion of Single Cycle to Combined Cycle Power Plant project in West Java in February 2025, after previously purchasing 3,000 tCO_2e of Carbon Units through IDXCarbon in September 2023. These transactions provide evidence that Carbon Credits represent valuable assets capable of being traded. Many companies purchase Carbon Credits to obtain emission allowances or offset their greenhouse gas emissions, thereby reducing or compensating for the carbon emissions generated from their operational activities.

Presidential Regulation 110/2025 was also issued with the aim of encouraging investment and financing for green projects as part of Indonesia's efforts to adapt to and mitigate climate change in order to reduce GHG emissions. Although the nature of these activities varies across sectors, all such projects require significant capital and are often constrained by financing limitations. Private investors and lenders remain reluctant to finance these projects due to high business risks and the absence of adequate Carbon Unit collateral. This condition exists despite the fact that appropriate financing schemes and long-term benefits from Carbon Credits are essential for ensuring the effective implementation of projects and optimizing GHG emission reductions.

Furthermore, a key challenge in developing the carbon market is that business entities in Indonesia have not yet recognized the long-term economic value of sustainable Carbon Credits. This challenge is further compounded by the lack of price certainty for Carbon Credits and the absence of a comprehensive legal framework governing Carbon Credit implementation. Unlike other countries, such as the United States, which has begun recognizing the value and utility of Carbon Credits through the establishment of sustainable financing instruments, including performance-based Green Bonds, sustainability-linked loans, and pay-for-performance impact bonds. Although these instruments are not identical to carbon credit mechanisms, they can be

utilized to finance projects that generate environmental benefits, including GHG emission reductions.

In fact, considering that Carbon Credits are intangible assets with both economic and environmental value, as well as implications for community welfare, their characteristics create the possibility of using ownership of Carbon Credits as an asset that may be pledged as collateral to financial institutions or utilized as a payment instrument to enhance their long-term economic value.

Problem Statement

1. What is the legal status of Carbon Credits in terms of their classification as collateral objects under Indonesian law?
2. What are the challenges faced in Indonesia legal reform regarding the implementation Carbon Credits as collateral objects?

METHOD

This study employed a normative juridical research method to examine the legal framework governing the potential use of Carbon Credits as collateral under Indonesian law. The research focused on the legal status, validity, enforceability, and perfection of security interests over Carbon Credits, particularly within the framework of fiduciary security. The normative juridical approach was appropriate because the research primarily analyzed statutory provisions, legal principles, doctrines, and regulatory instruments relevant to Carbon Credits, property law, security interests, carbon trading, and sustainable finance.

The study applied two principal approaches, namely the statute approach and the conceptual approach. The statute approach was used to examine Indonesian laws and regulations governing Carbon Credits and fiduciary security, particularly Law No. 42 of 1999 on Fiduciary Security, Law No. 4 of 2023 on the Development and Strengthening of the Financial Sector, Presidential Regulation No. 110 of 2025 on the Implementation of Carbon Economic Value Instruments and the Control of National Greenhouse Gas Emissions, Financial Services Authority Regulation No. 14 of 2023 as amended by Financial Services Authority Regulation No. 10 of 2026, and Minister of Forestry Regulation No. 6 of 2026. These regulations were analyzed to determine whether Carbon Credits fulfilled the legal requirements of assets that could be owned, transferred, valued, registered, and encumbered with fiduciary security.

The conceptual approach was employed to analyze the legal nature of Carbon Credits as intangible and transferable assets. The analysis considered principles of property law, fiduciary security, asset identification, transferability, valuation, registration, and creditor protection. Particular attention was given to whether Carbon Credits could be classified as intangible movable assets under the Indonesian Civil Code and whether their digital and transferable characteristics were compatible with the requirements for fiduciary security under Law No. 42 of 1999.

The legal materials used in this study consisted of primary and secondary legal materials. Primary legal materials included statutes, government regulations, presidential regulations, ministerial regulations, and Financial Services Authority regulations governing fiduciary security, carbon trading, Carbon Units, and financial-sector activities. Secondary legal materials included scholarly books, journal articles, reports from international organizations, institutional publications, and studies concerning Carbon Credits, carbon markets, sustainable

finance, intangible assets, and security interests.

To enrich the analysis, this study also incorporated a limited comparative perspective by examining how Carbon Credits were legally characterized in selected foreign jurisdictions and international frameworks. Comparative materials concerning the United Kingdom, the United States, and European jurisdictions were used to identify alternative approaches to the classification of Carbon Credits as property rights, intangible assets, commodities, or financial instruments. This comparative analysis was not intended to provide a comprehensive comparative law study, but rather to identify regulatory practices that could inform future legal reform in Indonesia.

Legal materials were collected through documentary and literature research and subsequently analyzed using qualitative and prescriptive legal analysis. The analysis was conducted by interpreting and systematically correlating relevant legal provisions with the characteristics of Carbon Credits as digital, identifiable, transferable, and economically valuable assets. The study then evaluated existing legal gaps concerning the classification, valuation, registration, monitoring, and enforcement of Carbon Credits used as collateral.

The final stage of the analysis formulated regulatory recommendations for strengthening the Indonesian legal framework governing Carbon Credits as collateral. The recommendations focused on improving legal certainty regarding asset classification, valuation mechanisms, registration procedures, supervision, creditor protection, and enforcement of security interests, with the objective of enhancing the bankability of Carbon Credits and supporting sustainable financing in Indonesia.

RESULTS AND DISCUSSION

The Legal Status of Carbon Credits as Intangible Assets in the Indonesian Security Legal System

The facts stated in the Introduction section above indicate that Carbon Credits can be traded on the market, therefore Carbon Credits can be recognized as assets, specifically intangible assets that encompass non-physical assets but possess a value or price that provides economic benefits. Carbon Credits are considered intangible assets because they represent the company's right to emit a certain amount of carbon emissions or other greenhouse gases during its industrial operation, where one Carbon Unit is equivalent to a reduction of one tCO_2e emissions. This allows for the application of Carbon Credits in bank financial services as a factor in environmentally friendly financing projects.

Carbon Credits trading is conducted under Emission Reductions Payment Agreements ("**ERPA**"), which are legal agreements that allow one party to sell and transfer verified Carbon Credits to another party. There are at least four provisions that define Carbon Credits, namely:

1. Right to emit;
2. A specified substance;
3. A specific quantity; and
4. Over a defined period of time.

As an illustration, Government ABC sets an emission quota limit for company X Ltd. of 50 tCO_2e per year. However, during its business operations in 2026, X Ltd. actually emitted carbon emissions equivalent to 70 tCO_2e, resulting in a Carbon Credits deficit of 20 tCO_2e. In contrast, Y Ltd. with the same emission quota, which is 50 tCO_2e per year, emitted only 30 tCO_2e in 2026, resulting in a Carbon Credits surplus of 20 tCO_2e. To cover its deficit, X Ltd. is

required to purchase Carbon Credits equivalent to 20 tCO_2e from another company. Y Ltd., which has a surplus of 20 tCO_2e in Carbon Credits, can sell it to X Ltd. or can also store it for use in the next year in case Y Ltd. faces a Carbon Credits deficit in subsequent years. This carbon trading mechanism occurs when a company's carbon emissions exceed the established limit.

In addition to being traded, Carbon Credits have the potential to serve as collateral for securing financing. In financing transactions, Carbon Credits can enhance a project's creditworthiness, thereby helping ensure its financing viability. Carbon Credits can be used as collateral for loans because they provide a measurable way to assess and manage climate-related risks. However, the specific details regarding how Carbon Credits can be used as collateral will depend on the financing agreement and the relevant legal and regulatory framework. Given that Indonesia currently lacks regulations that specifically govern the requirements and procedures for Carbon Credits to be used as collateral, a comparative study with practices in other countries could be a strategic step toward addressing this issue.

In the United States, Carbon Credits have also been recognized as an intangible asset, which refers to assets that lack physical form, but possess economic value or benefits for a company or business. IAS 38, an international accounting standard for intangible assets, defines an intangible asset as identifiable non-monetary assets that lack physical substance. IAS 38 also establishes criteria for the recognition and measurement of intangible assets and requires the disclosure of information about these assets, so Carbon Credits can be recognized as assets under this framework with an approach if they provide economic benefits and costs can be measured, for example, if they can be resold or used internally.

The legal status of legally issued Carbon Credits varies widely across jurisdictions. The following is a comparison of the classification of Carbon Credits as intangible assets in several countries.

Table 1. Comparison of the Legal Classification of Carbon Credits as Intangible Assets in Several Countries

Country	Carbon Credits Categories
United Kingdom	Carbon Credits are most often considered private property rights or intangible assets. This recognition provides clarity regarding ownership, transfer, and legal enforcement.
United States of America	Carbon Credits may be recognized as property rights or assets in some states, but in others they may be treated as commodities subject to commodity markets regulations, which creates legal uncertainty.
Countries in Europe	Carbon Credits are classified as financial instruments. This classification places them under the financial market regulatory framework, which imposes strict requirements regarding the transparency, trading, and reporting.

Source: *Adapted from Public-Private Partnership Resource Center (2023), The Legal Nature of Carbon Credits, World Bank Library*

Although the implementation of Carbon Credits trading is subject to an international legal framework, the legal aspects of Carbon Credits can also be examined under Indonesian national law. From the perspective of the theory of the property rights, Carbon Credits can be categorized as a legal object because they possess the inherent characteristics of property, such as:

1. Principle of individuality
   Carbon Credits are a unit of measurement for a country's efforts and results in reducing emissions. Under the SPE-GRK, each unit has its own credit unit serial number and tradeable value or price.
2. Principle of public disclosure
   Information regarding Carbon Credits ownership is open for public, because it is transparently accessible to the public via the internet through a registration system, such as the Certified Emissions Reduction system.
3. Transferable
   Carbon Credits can be transferred or assigned between parties, either through a trading mechanism on a carbon exchange or through direct trading.

The Civil Code defines "goods" or "asset" as any object and right that can be the subject of property rights. Furthermore, the Civil Code also clearly distinguishes between types of asset into tangible and intangible asset, as well as movable and immovable asset. Carbon Credits can be categorized as intangible movable asset because they have no physical form and cannot be perceived by the five senses, but still provide material rights, such as Carbon Units arising from GHG emission quotas, SPE-GRK, and non-SPE-GRK, which can be traded through a trading mechanism on carbon exchanges. Similarly, Law 4/2023 recognizes Carbon Units as security, thereby implicitly indicates that Carbon Credits are an intangible and tradable financial instrument. The nature property rights of Carbon Credits are also reflected in their ability to be transferred or assigned between parties, whether through a carbon exchange or direct trading between parties.

Since Carbon Credits qualify as intangible and transferable goods, Carbon Credits may also serve as subject matter of a fiduciary security interest under Law No. 42 of 1999 on Fiduciary Security ("**Law 42/1999**"). This is because assets that may serve as the subject matter of a fiduciary security include anything that can be owned and transferred, whether tangible or intangible, registered or unregistered, movable or immovable, as long as they cannot be encumbered with a mortgage or lien. Furthermore, a fiduciary security interest may be granted over one or more units or types of property, including receivables, whether existing at the time the security interest is granted or acquired subsequently.

The rights to the collateral will remain in the possession of the fiduciary grantor as security for the repayment of certain debts, and will grant the fiduciary recipient a priority position over other creditors. The encumbrance of assets with fiduciary security interest must be formalized by a notarial deed in Indonesian language, which constitutes a fiduciary security deed. For comparison, in Indonesian collateral/security law practice, intangible assets such as certain financial instruments and receivables can be used as collateral. Furthermore, economic rights over intellectual property, such as copyrights, trademarks, patents, and etc., may be used as collateral under a fiduciary security interest following the enactment of Government Regulation No. 24 of 2022 on the Implementing Regulations of Law No. 24 of 2019 concerning the Creative Economy.

Carbon Credits may be used as collateral as long as they meet the material requirements and qualify as fiduciary security interest. In the process of transferring Carbon Credits to serve as fiduciary security interest, the valuation of the Carbon Credits becomes crucial. This valuation is necessary to determine the collateral value and the value of the assets serving as the

subject of the fiduciary security, as required by Article 6 letters d and e of Law 42/1999, which stipulates that the fiduciary security deed must contain these details. The valuation of Carbon Credits (in this case, SPE-GRK, which is a digital certificate) as collateral can be conducted by an independent appraiser or a party with expertise in the valuation of intangible assets, to ensure an objective and legally accountable economic value. The valuation of Carbon Credits may also be conducted objectively based on trading data from carbon exchanges and records maintained by SRUK.

Carbon Credits securitization is indeed more appropriate using a fiduciary security system mechanism, considering the characteristics of Carbon Credits ownership which is based on digital-based SPE-GRK registered in SRUK. In practice, the transfer of ownership of digital-based SPE-GRK requires administrative recording and changes to ownership data, which aligns with the fiduciary principle that allows the collateral object to remain in the control of the fiduciary grantor. Meanwhile, other security systems such as pledges, require the physical delivery of the asset to the pledgee, which is not applicable to digital-based intangible assets such as SPE-GRK, unless expressly agreed upon in the security agreement.

By establishing Carbon Credits as a tradable security that can be used internationally, this actually opens up opportunities for increased Carbon Credits sales. This is easily achievable, especially since IDXCarbon has opened opportunities for international buyers to conduct carbon transactions in Indonesia. The global trading of Carbon Credits, combined with the existence of Carbon Credits fiduciary security as a collateral instrument that can be used in Indonesia and abroad, creates a synergy that can boost Carbon Credits sales. The economic value of Carbon Credits has motivated many companies eager to participate in the growth of Carbon Credits market in Indonesia.

With the growing development of carbon trading and legal recognition of Carbon Unit as tradable and transferable assets, Carbon Credits has significant potential to be recognized as collateral objects in the future, particularly through fiduciary security mechanisms based on regulatory developments and the characteristics of property law in Indonesia.

Reforming Indonesia's Legal System to Ensure the Sustainability of Carbon Credits as Collateral

Carbon trading through the Carbon Credits mechanism has currently been implemented in several regions in Indonesia, where the potential for Carbon Credits is assessed by analyzing the value of Carbon Credits and the transaction value of Carbon Credits in a project. Indonesia is currently developing a Carbon Credits scheme in carbon trading because the establishment of Carbon Credits drives innovation for the industrial sector, like encouraging the creation of environmentally friendly machinery or compelling certain industries to conduct their business operations while still prioritizing the sustainability of natural ecosystems, particularly regarding carbon emission that can lead to increased Greenhouse Gas emissions, a primary cause of climate change. Companies that hold Carbon Units can used them as collateral to finance commercial projects related to the environment, given the potential of the loan scheme.

In general, the procedures and requirements for banking institutions to issue Carbon Credits are governed by regulations and mechanisms involving several stages and systems, including:

1. Banks are required to carry out activities that result in GHG emission reductions;
2. The resulting emission reductions must then be measured, reported, and verified (MRV);
3. The bank submits an application for the registration of Carbon Units to SRUK (formerly SRN-PPI); and
4. Banks submit Carbon Units listings for registration to a carbon exchange operator for trading.

Banks can act as business entities that reduce GHG emission through projects or activities that meet the emission reduction criteria. Carbon Units to be traded on a carbon exchange must first be registered with the SRUK starting in 2026, as well as with the carbon exchange operator. Considering that Carbon Credits are intangible assets, the Financial Services Authority is also obligated to supervise carbon trading through carbon exchange, with a scope of activities including:

1. Carbon exchange operators;
2. Supporting market infrastructure for carbon trading;
3. Users of carbon exchange services;
4. Transactions and settlement of Carbon Unit transactions;
5. Carbon trading governance;
6. Risk management;
7. Consumer protection; and
8. Parties, products, and/or activities related to carbon trading through carbon exchanges.

With the launch of IDXCarbon in 2023, several banking companies purchased Carbon Units in the initial trading of the carbon exchange, for example, PT Bank Central Asia Tbk., PT Bank DBS Indonesia, PT Bank Mandiri (Persero) Tbk., PT BNI Sekuritas, and PT BRI Danareksa Sekuritas. Although banking companies are not major carbon-emitting companies, they still purchased Carbon Units for the following factors:

1. Banks are interested in carrying out carbon offset because some banks are still involved in financing fossil fuels sector or other sectors that contribute to carbon emissions; and/or
2. Banking companies want to issue credit products with Carbon Credits.

These factors have also been taken into consideration by banks in relation to Environmental, Social, and Governance (ESG) criteria, enabling these banking institutions to be labeled as “green banks” committed to providing sustainable financing. This demonstrates that banking institutions view Carbon Units as valuable assets. Sustainable financing is also supported through various schemes, including Sustainability-Linked Loans and Green Loans aimed for sustainable projects. For example, Bank Mandiri has launched a Sustainable Green Bond Public Offering with a total funding target of IDR10 trillion, valid until 2025 to support the financing of environmentally friendly projects.

In addition, the IFC also focuses on helping the private sector address climate change through innovative investments and financing, where the World Bank Group having set a target to allocate 45% of its annual financing for climate-related initiatives by 2025, focusing on reducing emissions trajectories and strengthening adaptation and resilience in developing countries. Previously in 2010, IFC launched the Green Bond program to help create markets

and unlock investment for private-sector projects that support renewable energy, clean transportation, solar power, and energy efficiency.

Throughout 2016, the Financial Services Authority conducted an analysis of Green Bonds in Indonesia as the primary basis for green bond policy. Technical experts from international organizations such as the IFC also provided examples of international best practices and lessons learned from other countries, which ultimately led to the issuance of a Green Bond policy in 2017. Subsequently, the Indonesian Government issued US$1.25 billion in Green Bonds in 2018, earmarked for sustainable rubber plantations in Indonesia, as well as US$580 million to finance geothermal energy projects, among other initiatives.

However, the development of Green Bonds has not been immediately followed by the development of other green financial instruments, such as Carbon Credits, which face difficulties in being implemented as collateral. Although carbon trading has already in place, the status of Carbon Credits as a legal entity still raises legal uncertainty because it has not been explicitly defined in any statutory provisions. Furthermore, the intangible nature of Carbon Credits as Carbon Units creates challenges in tracking and preventing fraud. The following are some of the main reasons for the difficulty in implementing Carbon Credits as collateral:

1. Lack of Quality Standardization and Registration
   Presidential Regulation 110/2025 acknowledges that certified Carbon Units can be issued through either a domestic or international certification process based on national standards, the United Nations Framework Convention on Climate Change (UNFCC) standards, or other international standards recognized by the Indonesian Government, such as Verra Verified Carbon Units, the Gold Standard, and others, with the mandatory approval from the Minister. However, the absence of precise definitions and standards for measuring and assessing high-quality Carbon Credits makes it difficult for lenders to evaluate Carbon Credits. Additionally, Carbon Credits can be tracked across various registration systems, making it difficult to obtain a comprehensive description of the market.
2. Regulatory Uncertainty
   The legal status of Carbon Credits remains controversial, whether they are considered securities as stipulated in FSA Regulation 14/2023 or as commodities. This uncertainty makes it difficult to accurately classify them as collateral assets.
3. Price Risk and Yield Uncertainty
   Fluctuations in Carbon Credits prices due to legal uncertainty make it difficult to use as stable collateral. Uncertainty regarding project outcomes also undermines confidence in the value of Carbon Credits. According to IDXCarbon data, Carbon Credits prices on IDXCarbon have fluctuated, starting at an average price of IDR69,600/tCO_2e, rising to nearly IDR77,000/tCO_2e, and then falling to IDR58,000/tCO_2e by the end of 2024. The absence of a predetermined price standard means that fluctuations in Carbon Credits' value remain a cause for concern.

In economic theory, the valuation of Carbon Credits is best analyzed through the integration of Unit of Account Theory and Monetary Standard Theory.

1. Unit of Account Theory
   Carbon Credits are not created to be consumed as physical goods, but rather are created as an abstract unit of measurement, which is tCO_2e to offset environmental externalities. This theory unifies economic value for measuring economic worth. In business

accounting practices and sustainability reporting, companies use them as an internal measurement standard for calculating emission liabilities and determining the cost-efficiency of GHG emission offsets. However, because these abstract units have no intrinsic natural value, their valuation relies heavily on a legal framework based on the Monetary Standard Theory.

2. Monetary Standard Theory

   Carbon Credits have no intrinsic value without a legal framework, as their value depends on regulations, registry systems, climate policies, and standard mechanisms (such as those outlined in Article 6 of the Paris Agreement). Much like modern currencies whose value is maintained by central bank standards, the value of Carbon Credits is largely determined by standards (e.g., Verified Carbon Units or the Gold Standard) and carbon market regulations (e.g., Compliance Market vs. Voluntary Market). If the government lowers emission caps, the price of Carbon Credits tends to increase. In this regard, the government is obliged to establish emission cap policies, certification standards, verification mechanisms, and strict regulations regarding Carbon Credits to maintain price stability and the credibility of the carbon market. Therefore, the value of Carbon Credits is also heavily determined by the applicable regulations and standard systems.

Based on the authors' review of some regulations, the following are relevant regulations regarding Carbon Credits that need to be updated:

Table 2. Regulatory Framework Related to the Use of Carbon Credits as Collateral Objects in Indonesia

Field	Regulation	Explanation
Banking	FSA Regulation Number 28/POJK.04/2021 of 2021	This regulation governs the valuation and presentation of property valuation reports in the capital market. This regulation may serve as a reference for the valuation of assets related to Carbon Credits in the financial sector.
	FSA Regulation Number 35/POJK.04/2020 of 2020	This regulation governs the valuation and presentation of business valuation reports in the capital markets. This regulation may be relevant as a reference for business valuations, including the business potential of Carbon Credits.
Taxation	Law Number 7 of 2021	This regulation is indeed aimed at controlling GHG emissions and supporting Indonesia's NDC, but the regulated tax rates is only aimed at carbon trading, not for the Carbon Credits' security system.
Establishment of an Assessment Institution (auditor) for Carbon Credits	Minister of Finance Regulation Number 228/PMK.01/2019 of 2019	This regulation governs public assessors and allows for updates to also establish the procedures, requirements, and authority of public assessors so that they can serve as auditors for Carbon Credits.

Source: *Compiled from the regulations analyzed in the article.*

Carbon Credits bridge the gap between environmental responsibility and economic opportunity, encouraging businesses and individuals alike to invest in projects that regenerate ecosystems and support sustainable development. As the urgency to reduce GHG emissions, demand for Carbon Credits is expected to rise significantly, driving the expansion of the carbon markets worldwide. The fact that the United States of America has achieved the most substantial reduction in carbon dioxide equivalent emissions by 879 million metric tons over the past 15 years. Under the Clean Development Mechanism, emissions reduction projects in developing countries have generated Carbon Credits that industrialized countries use to meet part of their emissions reduction targets.

It is inevitable that the growth of renewable energy, as desired by countries around the world, including Indonesia, is closely linked to the growth of Carbon Credits. This is proven by Denmark, where 88% of its activities are already supported by renewable energy. Behind this achievement, turns out that Denmark has been trading Carbon Credits since 2001, even having its own system for conducting such trade through the Danish CO_2 Quota System. In line with this development, Denmark has become one of the countries that voluntarily imposes emission limits on companies and has implemented a carbon tax policy in the agricultural sector. This proves that every policy formulated by Denmark and their active compliance with every European Union regulation, served as the first step for Denmark to develop its Carbon Credits activities.

Therefore, the Indonesian government must strengthen regulations by creating a specific law on carbon security system to ensure that their implementation is clear and evaluable. Indonesia actually already has a legal framework for Carbon Credits through various regulations, such as Presidential Regulation 110/2025. However, legal reforms are still needed to strengthen implementation, expand coverage, ensure certainty regarding valuation or assessments, and address incomplete implementing regulations, particularly regarding the implementation of Carbon Credits as collateral.

In short, Carbon Credits are likely to become a form of business collateral in the future. However, there are additional issues that need to be examined, including the classification of Carbon Credits as an asset, valuation, the procedures for granting credit, asset supervision, and the collateral enforcement processes, including various minor details related to the legal framework governing Carbon Credits as well as comparisons with international laws to ensure better legal integrity.

CONCLUSION

Carbon Credits are tradable intangible assets with economic value, in which each unit represents one metric ton of carbon dioxide equivalent (tCO_2e) of verified emission reduction or removal. Carbon trading is generally conducted through an Emission Reduction Purchase Agreement (Emission Reduction Purchase Agreement or ERPA). In the context of sustainable finance, Carbon Credits may be used as collateral because they meet the criteria for fiduciary security under Law No. 42 of 1999 on Fiduciary Security, particularly because they can be owned, transferred, and assigned economic value. Therefore, accurate valuation of Carbon Credits is essential, whether through independent appraisal mechanisms or reliable market-based valuation standards. The use of Carbon Credits as fiduciary collateral is consistent with their characteristics as digital assets, where ownership and transaction records can be maintained without physical transfer. However, implementation in Indonesia still faces several

challenges, including legal uncertainty, difficulties in tracking ownership and transactions, and risks of value fluctuations arising from the absence of clear quality standards and comprehensive regulatory mechanisms.

Indonesia's current carbon regulatory framework has the potential to facilitate the use of Carbon Credits as collateral. However, its implementation requires supporting regulations that effectively operationalize the existing framework. Therefore, strengthening the legal basis remains necessary through the establishment of specific regulations governing the use of Carbon Credits as collateral. Overall, Carbon Credits have the potential to become collateral instruments in the future but still require greater legal certainty regarding their classification, valuation mechanisms, crediting processes, and supervision. Presidential Regulation 110/2025 requires the issuance of implementing regulations within one year from its enactment. Accordingly, further developments will determine how this framework is implemented in practice and how financial markets respond to the use of Carbon Credits as collateral.

FUNDING

The authors declare that no financial support was received for the conduct of this study and/or the publication of this article.

CONFLICT OF INTEREST

The authors declare that this study was conducted without any commercial or financial relationships that could be interpreted as a potential conflict of interest.

AUTHORS' CONTRIBUTIONS

Patrick Martin: research conceptualization, methodology design, experiment execution, data collection, data analysis, manuscript drafting, and manuscript revision. Viyoneta Purnama: research supervision, validation of research results, provision of scientific input, and manuscript review and revision. All authors have read and approved the final version of the manuscript.

STATEMENT ON THE USE OF GENERATIVE ARTIFICIAL INTELLIGENCE

The authors declare that generative artificial intelligence (AI) was used in the preparation of this manuscript to help improve linguistic clarity, correct grammar, and refine the writing structure. Generative AI was not used to generate, manipulate, or analyze research data. The entire content of the manuscript has been reviewed and verified by the author(s). The author(s) are fully responsible for the accuracy, integrity, and final content of the manuscript.

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