BioCarbon Standard

BIOCARBON GUIDELINES

Tokenization Guidelines

for transparent practices connecting digital markets.

Version 1.0

www.biocarbonstandard.com

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1 Introduction

As the global community intensifies its efforts to combat climate change, governments and companies around the world are setting increasingly ambitious emission reductions targets. Multiple market and regulatory developments are bringing growth to the carbon markets globally, from voluntary contributions to corporate sustainability regulations, through maturing emission trading systems (ETS), COP Article 6 negotiations, or hybrid markets such as CORSIA. In this context, climate programs in support of carbon avoidance or removal as well as biodiversity like those of BioCarbon Standard (BioCarbon) are playing an essential role by guaranteeing the effective and real impacts climate finance can make.

At the same time, involved stakeholders across all global carbon markets are demanding more robust digital tools to increase the transparency and quality of carbon credit instruments from both the supply and demand perspectives: ultimately, assuring that emission reductions are accurately accounted and tracked, but also that carbon credits are not double counted.

Numerous technologies are being deployed to create this assurance and increase efficiency such as digital tools and platforms, stakeholder portals, data exchange protocols (APIs), ticketing systems, remote sensing for improved Monitoring, Reporting and Verification (MRV, e.g., IoT, Satellite), artificial intelligence and Distributed Ledger Technologies (DLT) such as blockchains.

As described by the Bank for International Settlements[1], DLT refer to "*the protocols and supporting infrastructure that allow computers in different locations to propose and validate transactions and update records in a synchronized way across a network*".

"Due to their public, accessible and machine-readable format, blockchains can provide a transparent foundation necessary for a trustworthy and scalable VCM. When carbon registries are built on blockchain, market participants can view a transparent digital record of every credit across geographies and standards, allowing global price and supply coordination (…). Such transparency removes the risk for corporate buyers who want to ensure their net-zero budgets are going

[1] https://www.bis.org/publ/qtrpdf/r_qt1709y.htm

towards measurable, verifiable climate mitigation efforts". World Economic Forum, April 2023 White Paper „Blockchain for Scaling Climate Action"[2]

In a key use case and when properly implemented, blockchain helps ensure transparency and trust throughout the life cycle of issued carbon credits like the Certified Carbon Credits (VCC) issued by BioCarbon. A VCC can be represented in a digital form by a unique token, backed one-to-one by underlying credits, on a distributed, publicly accessible and permissionless blockchain. In this instance, ownership transfer details and activities of "tokenized" VCCs between known participants are able to be stored on the blockchain. As a result, transactions cannot be reverted, manipulated, or counted twice allowing for all records to be audited in real-time.

This groundbreaking blockchain approach holds great potential to enhance the efficiency and accessibility of carbon markets, paving the way for wider participation and accelerating progress towards a more sustainable future.

Blockchain technology and DLTs alone cannot solve all carbon market challenges by itself which is why implementing proper standards and frameworks are crucial for unlocking blockchain's potential. In that regard, BioCarbon acknowledges the potential risks associated with carbon tokenization practices without proper standards. Such risks can be linked to the VCC double accounting, loss of traceability, cyber security or regulatory uncertainty. To address these concerns, BioCarbon has established this initial Tokenization Guideline document outlining the allowed, conditional, and prohibited practices regarding the tokenization of Verified Carbon Credits (VCC) issued by our program.

2 BioCarbon Operations

BioCarbon is a certification and registration program that develops Carbon and Biodiversity Standards aligned with environmental and social sustainability actions.

It is globally recognized by ICROA[3], the leading industry Accreditation Programme committed to enhancing integrity in the voluntary carbon market in support of the Paris Agreement Goals (https://icroa.org).

[2] https://www3.weforum.org/docs/WEF_Blockchain_for_Scaling_Climate_Action_2023.pdf
[3] https://icroa.org

The Registry platform of BioCarbon is managed by Global CarbonTrace (GCT[4]) and enables to projects from different sectors (renewable energy projects, transport, waste management, and AFOLU[5]) that demonstrate contributions to climate change mitigation through, the issuance of Verified Carbon Credits (VCCs) for the global carbon market. BioCarbon is committed to prioritizing quality, integrity and reliability in the certification and registration of projects in the GHG and Biodiversity programs, as well as in the issuance of verified carbon credits, in accordance with best practices and principles.

For more information, visit https://biocarbonstandard.com.

2.1. BioCarbon and CAD Trust

BioCarbon is integrated with Climate Action Data (CAD), an initiative launched at the Asia Climate Summit in 2022 and developed under the World Bank's Climate Warehouse End-to-End Digital Ecosystem together with the government of Singapore and the International Emissions Trading Association (IETA). The CAD Trust open-source metadata system uses blockchain technology to create shared records of carbon market activity with the aim to avoid double counting, increase trust in carbon credit data and build confidence in carbon markets through improved transparency. It includes data from disparate registries, government-led carbon markets as well as the UNFCCC's Clean Development Mechanism.

2.2. Registry platform of BioCarbon

The registry platform on Global CarbonTrace is built on Hyperledger Fabric. This technology ensures the immutability and integrity of the data stored on the blockchain. Our gateway Stamping.io is a blockchain organization with nodes implemented in LACChain[6], a global alliance led by the Innovation Laboratory of the Inter-American Development Bank Group purposed for the development of blockchain infrastructure and ecosystem in Latin America and the Caribbean. LACChain has been listed as the architect in reference by the International Telecommunication Union, a specialized agency on information and communication technologies of the United Nations.

In the current blockchain integration in place with LACChain, transaction information on the registry is recorded and stored securely on the blockchain. In

[4] https://globalcarbontrace.io
[5] Agriculture, Forestry and Other Land Use
[6] https://www.lacchain.net/home?lang=en

this way, the BioCarbon provides authenticity, traceability, and transparency along the life cycle of VCCs from issuance to transfers between registry account holders, until retirement.

3 General scope

- Process for the authorization of Third-Party tokenization partners.
- Issuance and life cycle rules for authorized Third-Party VCC tokenization including allowed, conditional, and prohibited practices.

The scope of application of these Guidelines is primarily for the BioCarbon GHG program and could be extended to credits from the Biodiversity program in the future.

All the requirements detailed in this document's or applicable and need to be complied with by authorized Third-Parties, as it aligns with the certification and registration conditions established by BioCarbon and the best practices for VCC custody, traceability, and avoiding double counting, outlined in BCR Standard Operating Procedures and ADC tool.[7]

The in-situ tokenization of VCCs by BioCarbon directly from the registry are not in scope for this document and not a foreseen activity in the short term, although we may explore this opportunity in the future. The Tokenization of VCCs remains solely an activity from allowed Third-Parties integrating with BioCarbon.

3.1. Alignment with global initiatives

BioCarbon builds expertise in leveraging blockchain through partnerships and data integrations with LACChain, the CAD Trust meta registry (presented above) as well as digital carbon marketplaces which offer tokenized VCCs[8].

As the market continues to evolve and BioCarbon continues to learn from early implementations, BioCarbon will continue to update the Tokenization Guidelines moving forward. BioCarbon is aware of developments from international stakeholders and standards proposed by entities such as the World Bank or the

[7] https://biocarbonstandard.com/wp-content/uploads/BCR_avoiding-double-counting.pdf
[8] https://www.thallo.io/thallo-biocarbon-registry-launch-worlds-first-two-way-carbon-bridge/

InterWork Alliance[9] and will seek for global alignment in the aim to facilitate well-functioning and inter-operable carbon markets.

4 Carbon Tokenization: An Overview

This section presents general information and considerations about blockchain technologies, tokenization, and their applications in the carbon markets. It is meant as a simplified explainer and alignment on key terms and definitions relevant for the use of the Tokenization Guidelines.

4.1. General definition

Tokenization is a transformative process that leverages the power of blockchains to create digital tokens representing ownership or data linked to any asset, whether physical, financial, intangible, identity-based, or even environmental. It has gained significant momentum across various industries, including finance, real estate, and environmental sustainability.

> *„Tokenisation of assets involves the digital representation of real (physical) assets on distributed ledgers, or the issuance of traditional asset classes in tokenised form. "*
>
> Proposed definition of Tokenization by the OECD[10]

The etymological meaning of the word token is synonym to "sign" or "symbol".

4.2. Token Smart Contracts

The rules governing the creation and life cycle of tokens are written in code in "intelligent contracts" on the blockchain, called "Smart Contracts".

Smart Contracts can automatically execute, control, or document events and actions according to the terms of a contract or an agreement. They can interact with information stored on the blockchain, with users or with other smart

[9] https://gbbcouncil.org/interwork-alliance-resources/cet-protocol/

[10] https://web-archive.oecd.org/2020-01-17/542780-The-Tokenisation-of-Assets-and-Potential-Implications-for-Financial-Markets-HIGHLIGHTS.pdf

contracts. Smart Contracts can also be connected with traditional APIs or with computer programs broadcasting real-world data.

Pre-defined internal or external events can trigger the execution of diverse functions within the Token Smart Contract such as:

- Token minting: creating new tokens and bringing them into circulation.
- Token burning: permanently removing the token from the available supply.
- Token transfer: transferring the ownership of the token between from a sender (the source blockchain address) to the receiver (the destination address).
- Token locking: restricting the transferability of tokens for a determined period of time or until further triggers.
- Whitelisting: defining the list of blockchain addresses which are permitted to mint or transact tokens.

4.3. Types of tokens

There are different ways to classify tokens depending on their characteristics, technical standards, or regulatory considerations.

Security, utility, commodity tokens

Tokens can represent shares or securities (security tokens), the right to access services or participate in a community (utility tokens); commodities (currencies); uniquely identifiable assets (non-fungible tokens).

The classification of a token as a security or commodity has often been made, however it is a matter of law depending on the applicable jurisdiction where the token is issued or offered, which is still up for debate in many countries.

Green Crypto-Assets

If we look specifically at application of the tokenization in the carbon and overall environmental asset space, we see that tokens can represent different types of assets and ownership rights (sometimes combining several of the following):

- The **ownership of an environmental project** or asset - similar to the equity share of a company - for example, a fractional ownership of a natural capital asset such as land - which can possibly generate future streams of carbon credits to which a token owner can have discounted or full access

to. Ownership tokens are common for Real World Assets (RWAs) or Green Collectibles.

- A **unit of avoided or removed emissions** usually in the form of a unique carbon credit (1 ton of Co2e). It can also represent any other type of unit measurement: 1 kg, 10 MT, 1000 MT. Tokenized Renewable Energy Certificates use this same approach usually with units of 1KWh or 1MWh per token. A token could theoretically also represent different environmental assets such as a Biodiversity or Plastic Credit following a specific unit of measure.
- A "**governance token**", meaning a token giving access to governance and decision-making rights in a decentralized organization system. Here the token gives utility to community members who hold tokens to get certain rights, votes, and benefits (e.g., accessing exclusive services or voting for fund allocations).
- A **derivative** such as a Carbon Forward Credit or Carbon Future contract.
- A **crypto-currency** used as a means of exchange such as nature-based stablecoins.

For a taxonomy proposition, refer to a proposition by Ecofrontiers[11] of a Green Crypto Asset Mapping.

Tokenized assets versus native tokens

It is also important to note that Tokens can represent both pre-existing real asset and assets "native" to the blockchain.

In the first case, commodities, gold, real estate shares, physical art all pre-exist in the real-world and can be issued digitally through the minting of tokens representing these assets. The physical assets are usually kept in custody to ensure that the tokens are backed. The issued tokens exist only on the blockchain and their full life cycle can be traced transparently. In the case of tokenized VCCs, the "off-chain" credits (those in traditional format on our registry) are "locked", as it will be described further in this document.

In the second case, the asset is born by the issuance of native token directly in the blockchain, meaning that it is not pre-existing or living outside the blockchain.

4.4. Token Standards

It is important to understand the basic concepts of token standards because they rule how tokens can be issued by a smart contract, what data they can contain,

[11] https://mirror.xyz/ecofrontiers.eth/zkh2LoADInAgr7GLbXnsuUOEcwJKFE4GuUSYuYU22io

how it can be tied to one or a batch of underlying carbon credits, but also how to transfer, change or burn tokens.

In order to elaborate main differences, we use as example here the token standards introduced by the Ethereum blockchain ("Ethereum Request for Comment" or "ERC" standards). Beyond these, there are numerous existing token standards as well as upcoming ones across diverse blockchains proposing improvements and new use cases.

Figure 1: Types of Tokens

The earliest token standard found in blockchain platforms is a fungible token such as the ERC-20 token standard developed originally for smart contracts on the Ethereum blockchain. Tokens are identical, numerable, and interchangeable. It is the case for cryptocurrency tokens but also for other assets which leverage the fungibility attribute of tokens to bring market liquidity in efficient trading platforms.

On the other hand, there are Non-Fungible Tokens (NFTs), such as the ERC-721 tokens which have been used largely in the digital representation of art, IP, domain names among various use cases. NFTs are unique, they have their own IDs, custom metadata, and are not interchangeable. Similarly, carbon credits have unique serial identification numbers such as BioCarbon's VCCs. In principle, such NFTs require individual transactions per token.

Furthermore, hybrid versions such as Semi-Fungible Tokens (SFT) which have grown in interest in recent years due to their combined liquidity benefits of fungible tokens and unique attributes of NFTs. Respectively, the ERC-1155 standard has the functionality for bundling multiple tokens and transactions of different types into a single transaction. It supports batch transfers unlike ERC-721 which helps increase efficiency and reduce transaction costs.

The ERC Standard are used here as reference examples, there are other similar standards outside the Ethereum ecosystem.

We refer to the Glossary at the end of the document for definitions on key terms.

4.5. Tokenization Benefits

Tokenization inherits the key features of blockchains, offering:

- **Transparency**: All transactions involving the token are permanently recorded on the blockchain and accessible to anyone which provides unparalleled transparency.
- **Cryptographic Validation**: Each transaction is secured by cryptography, eliminating the need for centralized trust and ensuring data integrity.
- **Immutability**: Once recorded, data on the blockchain cannot be altered or deleted, guaranteeing the authenticity and historical integrity of the tokenized asset.
- **Liquidity:** Tokenization can improve liquidity, make financial transactions more convenient and help secure ownership rights.
- **Trustless infrastructure**: Participants can verify the validity of transactions and ownership without revealing sensitive information, upholding privacy and security.

By harnessing these features, tokenization can help unlock a new era of efficient, secure, and transparent asset ownership and exchange across diverse sectors, especially in the carbon markets.

In particular, carbon Tokenization can offer several specific benefits, such as attracting a broader range of participants, reducing transaction costs and intermediaries, and streamlining administrative processes. Moreover, digital carbon tokens are globally accessible, making it easier to transfer across borders, facilitating international cooperation in carbon markets, and promoting global interoperability of different carbon markets. Carbon or environmental credits in a specific registry can be offered seamlessly for trade and retirement to other marketplaces through data connections or “bridges”. Additionally, using an immutable and transparent registry can help to avoid issues of double counting or fake credits.

4.6. Use cases for Tokenization in the carbon market

There are various areas for blockchain applications and tokenization in the voluntary carbon markets, among which:

- **Digital Measurement, Reporting and Verification (MRV):** projects developers and registries can use blockchain technology to safely and transparently capture and store project-level data. In some emerging models, such data is collected or validated by Third-Parties through decentralized protocols and referred to as "decentralized MRV". For example, satellite data can be monitored by a specialized partner sending regular validation in the form of on-chain signatures and or data distribution through specialized programs called "Oracles"

- **Community empowerment:** local communities can be directly involved in the project and incentivized to perform local collection or verification activities. Such interactions can be governed by smart contract rules and embedded workflows including micro-payments to reward contributions, in a way that could not happen easily in the traditional carbon market. Projects in the "Regenerative Finance" (ReFi) movement are using such approaches to reinvent extractive economies and encourage regeneration through projects such as natural ecosystem preservation.

- **Carbon credit issuance and distribution**: two possibilities generally exist: issuing a token representing an existing, traditional carbon credit in a registry; or issuing the carbon credits themselves directly in a tokenized form in which case we refer to a "native" carbon credit token. Once a carbon credit is issued as a token with all its unique attributes on a blockchain, it is easier to trace its transactions along its life cycle until the final token "burning" for the retirement of the underlying carbon credit. Burning a token assures that unique tokens cannot be sold twice, because burning it on the blockchain implies that it is no longer transactable. Another benefit of issuing carbon credits as digital tokens is the enhanced accessibility, since tokens can be exchanged globally at all times and minimal costs. Organizing more open, organized markets thanks to the tokenization of carbon credits also helps price discovery and transparency for all participants.

- **Programmability of remuneration or offsetting activities**: tokenization also allows for the programmability of carbon credits. This

means tokenized credits can be imbued with programmatic functions using smart contracts. For example, royalty fees can be programmatically sent to different stakeholders in the carbon value chain, which can strengthen alignment among market participants and drive capital to maximize project impacts. Another area of programmability of carbon credits is the triggering of automatic retirement through online payment, promoted by API-driven offsetting solutions.

BioCarbon knowledge the benefits of achieving use of digital traceability from project data capture until final retirement using blockchain and the use of tokenization in the process. However, this needs to be approached with careful considerations of challenges and risks involved.

4.7. Carbon Tokenization risks

The previous section has presented different use cases and benefits for blockchain and tokenization in the carbon market. Over the past three years countless projects have emerged to develop solutions leveraging distributed ledger potential in the carbon markets. The European Carbon Offset Tokenization Association (ECOTA) has mapped more than 190 projects and organizations in this space[12].

BioCarbon highlights here risks and concerns from the perspective of a GHG program.

4.7.1. Carbon pooling

Pooling in the context of carbon tokens refers to the practice of aggregating multiple individual carbon tokens into a common pool or grouping.

The current implementations of tokenization of carbon in the market see different models in play from platforms offering tokenized carbon credits using single tokens (using NFTs or SFTs) or others proposing double-token models. In the later, NFTs representing a single project can be redeemed for fungible tokens which form "pools" of similar carbon project types. Market participants in the carbon credit tokenization space, including BioCarbon need to maintain a clear link between tokens and carbon credits to prevent double counting.

[12] https://home.ecota.io/working-group-ecosystem-analysis

4.7.2. New financial instruments

The creation of a new financial instrument has potential quality and legal risks, we are strongly encouraging the VCCs tokenization through Non-Fungible or Semi-Fungible Tokens. BioCarbon is aware of new technology innovations, especially with new token initiatives and models (Section 4.4). Alternative propositions will be considered by BioCarbon with the utmost attention to compliance with these guidelines' requirements.

4.7.3. Tokenization of retired credit

Another concern regarding carbon credits is the possibility of a Third-Party tokenizing a credit that has already been retired, making the token worthless in terms of its intrinsic value. This can result in the total loss of the asset's value as well as in the loss of community's trust, impacting similar projects. Furthermore, after carbon credits are tokenized, those tokens may change ownership multiple times. Without transparent and robust traceability of ownership data, this could lead to double use or double claim. It is essential to link each carbon token to the project data and track its journey through every transaction to ensure that it represents a unique carbon credit from its origin.

4.7.4. Lack of metadata

Tokens can have custom data including the details of the original asset, a URL link with information records and documents, or a serial ID. Tokens missing such information can carry risks of being misused and lack transparency.

To avoid the double-counting of VCCs that are issued by BioCarbon, the program has put in place strict measures, these can be found and are explained within the Avoiding Double Counting (ADC) tool. The provisions include assigning a unique serial identification (ID) to each VCC (Figure 1) already before tokenization which will remain attached to the credit during its entire life cycle even after tokenization and transactions.[13] In the tokenization process and similarly for non-tokenized VCCs in retirement processes, the Credit´s ID must never be altered; such a situation is against the BioCarbon Operation Procedures[14] in place for traceability and custody of VCC.

[13] Serial Identification of VCC, described in Standard Operation Procedures https://biocarbonstandard.com/wp-content/uploads/BCR_Standard-Operating-Procedures.pdf
[14] https://biocarbonstandard.com/wp-content/uploads/BCR_Standard-Operating-Procedures.pdf

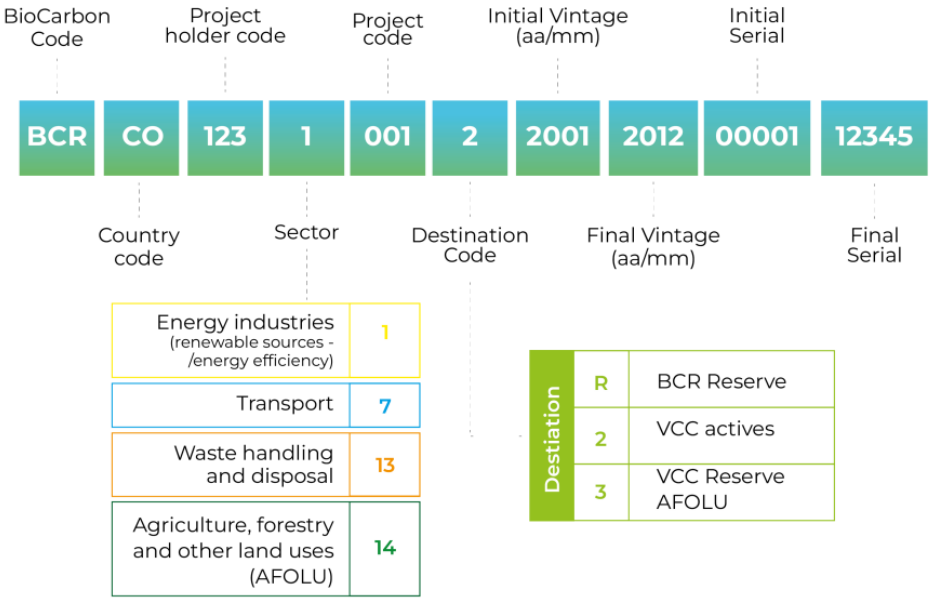

Figure 2. BioCarbon Serial Identification

4.7.5. Fractionalized token transactions

Tokenization allows the fractionalization of digital assets through the ownership of tokens or fractions of tokens by multiple holders, who then own a fraction of the asset. Similarly, carbon tokens can be divided or fractionalized into smaller units, with each unit representing a fraction of the underlying carbon credit. Such feature can have benefits to allow for transactional carbon offsetting. Example: an online consumer selects an option on an eCommerce website to spend 5% of the amount paid for purchase and retirement of a carbon credit. However, fractionalization can also make it more challenging to trace the retirement, beneficiary, and the exact amount of retired tokenized.

5 BioCarbon guidelines for VCC Tokenization by Third-Parties

As mentioned in previous sections, BioCarbon recognize that blockchain and tokenization can offer advanced transparency, traceability, and efficiency to the carbon market, but also acknowledge associated risks related to as VCC custody,

double-counting, and misuse, and focuses on mitigating them to maintain VCC integrity. BioCarbon reinforces measures to safeguard VCC integrity and supports global transparency efforts in the Carbon Market with outlined tokenization practices.

The following guidelines and procedure aim to establish the allowed, and prohibited practices regarding the tokenization of VCC issued by BioCarbon program to foster trust and transparency for all market participants.

5.1. Actors in the process

Ensuring a clear, common understanding, we subsequently will clearly define the roles and steps involved in the Third-Party tokenization process. We refer to the BioCarbon SOP documentation for general terms, user types and definitions which include i.a. the "GHG project developers", "Project Holders" or "Accounts holders", "Intended User", "Registry User", "Registration System and Platform", and "Retirement Statement".

Besides standard users, we identify key actors in relation to tokenization activities:

Tokenization Third-Party: an entity that "transforms" the issued VCCs into digital tokens tradable on blockchain platforms. They handle the technical aspects related to smart contracts, token minting and lifecycle, cybersecurity, ensuring secure and transparent representation of the underlying carbon credits.

Token Registry Service Provider: acts as the digital custodian of the VCC tokens, managing their issuance, transfer, and retirement on the blockchain network. They maintain a public record of transactions, guaranteeing the tokenized VCCs' authenticity and ownership.

Exchange/Marketplace: platform serving for the distribution of the tokens, where "buy and retire" transactions trading of the tokenized VCCs can be done. Importantly, the platform shoulders the responsibility of adhering to all relevant legal and regulatory requirements, including Know Your Customer (KYC), Customer Due Diligence (CDD), Anti-Money Laundering (AML), Counter Terrorism Financing (CTF), and tax regulations.

Holders and Beneficiaries: users on the Third-Party platform can buy, hold, sell, or retire their tokenized carbon credits. BioCarbon refers to the "Beneficiary" as the user retiring the credit for the purpose of offsetting emissions.

5.2. Core Principles for VCC Tokenization:

a) **UNIQUE IDENTIFIER:** to avoid the double-counting of VCCs that are issued by BioCarbon, a unique serial identification (ID) to each VCC is assigned in the original creation of these credits (before tokenization). This ID needs to remain attached to the credit during its entire life cycle after tokenization and transactions. It is a mandatory pre-requisite that all relevant unique identifiers allowing BioCarbon to identify the unique VCC are passed on to the tokens, visible in its metadata and maintained there until the burning of the token by Third-Parties.

b) **COMPLIANCE:** Third-Parties tokenizing VCCs within BioCarbon shall comply with all relevant applicable laws, regulations, and standards, including those governing financial asset regulation, carbon markets and blockchain technology in accordance with their legal and regulatory environment. As issuers of the tokenized instrument, Third-Parties have to ensure a correct classification of the token in their legal environment (e.g., as utility, commodity, security, crypto-asset, etc.) and comply will all subsequent obligations (e.g., whitepaper, prospectus, KYC, …).

c) **TRANSPARENCY**: Third-Parties are required to issue on-chain VCC tokens with all relevant attached attributes accessible to the relevant stakeholders. One VCC equals one Third-Party token, directly from the BioCarbon platform, which allows BioCarbon to lock the underlying VCC and confirm the retirement at the end of the life cycle.

5.3. Additional Principles for VCC Tokenization:

BioCarbon will review and authorize Third-Parties to tokenize VCC following the procedure described under 5.5. These Third-Parties must adhere to the Core Principles applicable BioCarbon tokens and in addition respect the following principles:

a) **INTENTION**: Prerequisite for the authorization of Third-Parties to tokenize VCC is that the VCC based token is (1) solely utilized to promote environmental sustainability and associated co-benefits, and (2) to support authentic emission offsetting.

b) **ENERGY CONSUMPTION**: earlier smart-contract platforms have use energy intensive blockchains using “Proof-of-Work” consensus protocols which require high amount of computing power and energy, a sustainability issue which have in large part been solved by many of the large-scale

blockchain platforms and protocols available today. The Third-Party is committed to have minimal environmental impact from the use of technology itself and is using such energy-efficient, low-carbon blockchain platforms. The platform chosen by the Third-Party will be considered as part of the authorization decision-making process.

c) **DATA INTEGRATION:** Third-Parties shall create an integration via API with BioCarbon platform and must follow the guidelines provided in the Tokenization procedure section and the Core Principles. This end-to-end technical integration is paramount to automatically pass-through all life cycle events affecting the token to the point of origination with the Third-Party, in order to avoid double counting.

d) **RETIREMENT PROCEDURE:** once a Third-Party is authorized by BioCarbon and integrated by API, it can process transactions and trigger retirement of VCCs from the registry of BioCarbon. This transaction needs to contain essential information such as the amount of VCCs, vintage, purpose of retirement, name of the beneficiary who owns the compensation right. Please refer to the SOP for the general VCC retirement procedure (Section 6. Retirement and Transferences).

e) **TRACEABILITY:** BioCarbon has established these guidelines to ensure that the origin and history of each carbon token generated from VCC shall be traceable, preventing Third-Party tokenization without a clear link to the VCC issued by BioCarbon platform.

f) **CHANGE NOTIFICATIONS**: the Third-Party will inform BioCarbon of all changes on important token distribution and retirement models, core changes in Smart Contracts or related protocol or change of blockchain platform used.

5.4. Safeguard Principles:

a) **NO UNAUTHORIZED THIRD-PARTIES**: BioCarbon strictly prohibits unauthorized Third-Parties (users of the BioCarbon platform) from tokenizing VCCs or another type of units, such as Biodiversity Credit (BDC) issued under the BioCarbon Programs. VCCs offered by non-authorized Third-Parties are not endorsed by BioCarbon and cannot be retired on the registry. Only authorized channels for tokenization can provide this service once they have established an API connection. The same would apply for further stakeholders or sub-contractors operating platforms integrated with

the Third-Parties - such actors need to be pre-authorized by BioCarbon in order to make sure they operate under respect of these guidelines.

b) **ZERO TOLERANCE**: BioCarbon prohibits any activity that could compromise the integrity of the carbon markets, e.g., through deceptive marketing schemes or fraudulent trading practices. BioCarbon therefore reserves the right to suspend or remove any Third-Party token to protect the reputation of its GHG Program and VCCs, if the Third-Party's behavior or the behavior of agents involved in the distribution of Third-Party tokens gives raise to the suspicion of manipulative or fraudulent behavior that could undermine BioCarbon's credibility. In such a case, the Third-Party will need to organize the burning and delisting of the tokenized VCCs concerned, and the underlying VCCs will be unlocked on BioCarbon's registry. Authorized Third-Parties shall tokenize VCCs with the unique purpose of supporting authentic emission offsets to a single and last beneficiary.

c) **NO UNAUTHORIZED DEVIATION FROM STANDARDS**: Any deviation from the Tokenization Guidelines requires prior approval from BioCarbon. Any division or fractionalization of any VCC token below the Ton unit is prohibited unless specifically authorized by BioCarbon. Such authorization has to be specifically provided by BioCarbon on a case-by-case basis, even if there is a previous agreement, Memorandum of Understanding (MOU) or contract between parties. It is not possible for a Third-Party to list VCCs on its website and proceed with tokenization of these VCCs after a purchase from user/beneficiaries. VCCs need to be locked and tokens issued one-to-one prior to purchase and retirements by users.

d) **NO ATTRIBUTE REMOVAL**: it is not allowed to remove the attributes or information tied to VCC tokens for any tokenization activities, such as token "pooling" or "wrapping" with similar or different environmental assets unless otherwise approved by BioCarbon. For now, **BioCarbon only allows tokenization through Non-Fungible or Semi-Fungible Tokens.** Fungible token models that do not allow the association of a specific carbon token with its environmental attributes such as Serial ID are prohibited.

e) **NO POOLING**: BioCarbon does not permit pooling actions involving Third-Party tokens based on VCCs.

f) **MONITORING AND REVIEW**: BioCarbon will monitor the proper application of Tokenization by Third-Parties. It will also oversee the provisions in place to ensure that these Third-Parties comply with the

guidelines and standard operating procedures. BioCarbon reserves the right to review all documentation and smart contracts related to third-party tokenization. In cases where the principles and requirements in these guidelines are not followed, BioCarbon can veto the tokenization.

g) **REPORTING OBLIGATION**: in case of suspicious activities, BioCarbon will request timely clarification to the Third-Party and take precautionary measures such as holding the tokenization authorization to protect BioCarbon and project developers from reputational harm.

h) **RIGHT TO REVOKE**: in case of misconduct and clear deviation from the Tokenization Guidelines, BioCarbon can exercise its right to remove the authorization from the Third-Party which will lead to the delisting of tokenized VCCs according to the procedure detailed in 5.5. and to timelines stipulated in the agreement with BioCarbon.

5.5. Tokenization procedure

For reference, this is the traditional workflow to issue VCC under the registry platform of BioCarbon, starting from the account creation and requests for project certification and registration:

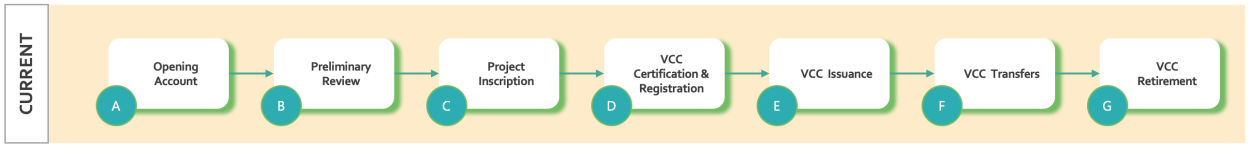

Figure 3. BioCarbon simplified general GHG project and VCC workflow

The tokenization process can be understood as an "add-on" building on top of the current general workflow (between steps F and G of the above flowchart).

The following flowchart and step-by-step explainer describe the end-to-end process for Third-Parties to engage with BioCarbon in tokenization activity.

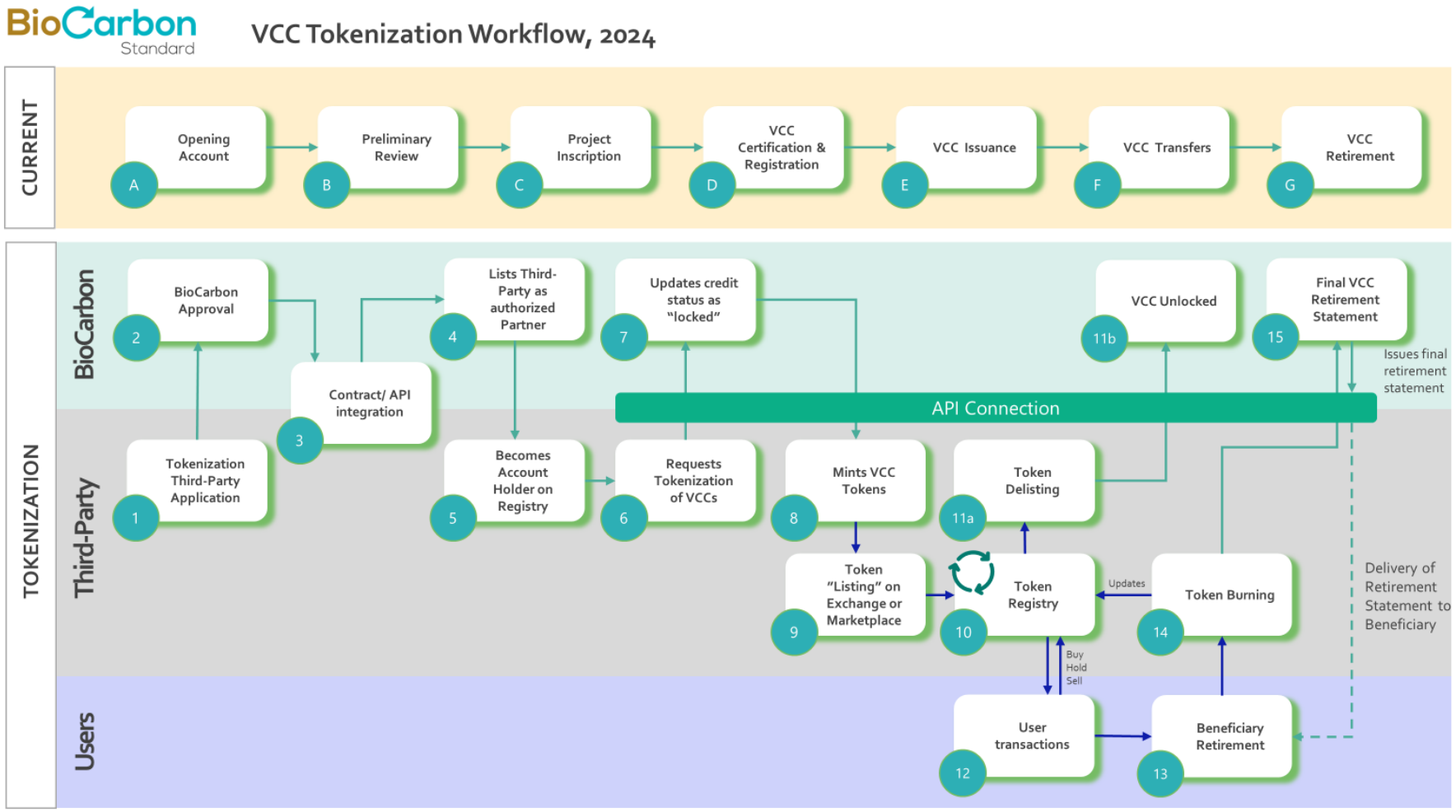

Figure 4. BioCarbon Tokenization workflow

1. **APPLICATION:** Send an official request via email to registry@biocarbonstandard.com to tokenize carbon credits issued by BioCarbon. The request must provide a **detailed explanation of the Company´s business model, tokenization procedure, and data model outlining how the Third-Party intends to use tokenized VCC and protect the integrity of the present guidelines**. The Third-Party clearly references the blockchain platform used, links to smart contracts and technical audit reports. Especially, the Third-Party needs to clearly explicit if the tokenization can happen across multiple blockchains and explain how associated risks of double counting are controlled.

2. DECISION: BioCarbon will review and assess the submission and potentially request additional information or documentation. A decision will be made by the internal management team of BioCarbon based on the alignment with procedures in place and requirements in these Tokenization Guidelines. The Third-Party will be informed of the decision by email whether it will be authorized or denied tokenizing VCCs.

3. CONTRACT & API INTEGRATION: If BioCarbon decides to proceed and authorize the tokenization, the Third-Party must agree to sign the Anticorruption-Bribery Policy and procedures as well as a partnership agreement. The integration to the registry via API can then commence, following the Data Model specification.

4. THIRD-PARTY LISTING: BioCarbon will list the authorized Third-Party as tokenization partners on its website. The logo of the Third-Party will be added to the marketplace alliance section. User of the registry of BioCarbon (account holders) will then be able to view and select the authorized Third-Party for the distribution of their VCCs.

5. ACCOUNT CREATION: If it was not the case yet, the Third-Party becomes Account Holder on the BioCarbon registry. This enables credits to be transferred or locked under its accounts or request retirements in the name of beneficiaries.

6. TOKENIZATION REQUEST: The Third-Party will be able to proceed with actual tokenization of VCCs. The Third-Party will use the API documentation to request the locking of specific VCCs, before issuing the same number of tokens representing these VCCs.

7. VCCs LOCKING: the requested VCCs will be transferred to the Account of the Third-Party on the registry where their status will be updated as “locked” by BioCarbon.

8. TOKENIZATION: at this point the actual tokenization may be initiated. The Third-Party will be able to mint the same number of tokens than VCCs locked, each being backed one-to-one. These tokens shall contain the serial ID of VCCs in their metadata, or have a unique link to such metadata stored, following the indications described in this document.

9. TOKEN LISTING: the Third-Party can now list the tokens for sell on its platform. The listed objects on the user interface need to make reference to the specific projects: title, visuals, descriptions, link to the project page with clearly visible mention that these are carbon credits from BioCarbon.

10. TOKEN REGISTRY: the Third-Party who takes custody of the tokens holds the responsibility of maintaining a transparent token registry accessible to the user, including the history of transactions and current token inventory, if possible, through dedicated interface for users not experienced with analyzing blockchain explorers and metadata.

11.a. TOKEN DELISTING: different reasons could lead to the delisting of tokenized VCCs. In such a case, the tokens should be burned, and the list of transactions and evidence should be sent to BioCarbon. Delisting is an essential function to fully realize the potential of two-way bridge mechanisms – the fact of not only being able to bring carbon credits "on-chain", but also get them from a tokenization version back to their original format in an "off-chain" registry.

11.b. VCCs UNLOCKED: in the case of delisting, the VCCs will be unlocked on the BioCarbon Registry.

12. USER TRANSACTIONS: buyers on the Third-Party platform can perform functions allowed specifically on that platform: "buy and retire" only or also buy-hold and sell transactions. Only entire units of carbon credits (CO2eq Ton) can be sold and retired (no fractionalization of tokens is permitted currently).

13. BENEFICIARY RETIREMENT: the end-user requesting retirement of the tokenized VCC is the "Beneficiary". The identity of this beneficiary, whether an individual or company will need to be verified by the Third-Party (as required in our SOP) and passed along to BioCarbon through the established API connection. The Third-Party shall inform BioCarbon specifically if the retirement is done for its own offsetting purposes (to offset emissions from its own organization) or for retirement of end users/beneficiaries. We refer to the SOP for the general retirement fundamental rules.

14. TOKEN BURNING: retiring of a tokenized VCCs requires the burning of this token by the Third-Party thanks to a smart contract function.

15. VCC RETIREMENT: the underlying VCC(s) credit to the burned token(s) will then be retired on the BioCarbon registry. This happens automatically in the API retirement call. A new retirement transaction record will be registered with the Account holder, the beneficiary's name and the serial numbers retired. BioCarbon will then issue a final retirement statement which will be stored in the account of the authorized Third-Party on the registry, as well as sent to him per email. We strongly recommend Third-Parties to provide the statement, ID and address of the official retirement transaction (on the registry of BioCarbon) to the beneficiary for highest transparency.

6 Glossary

Verified Carbon Credits: Measurable and tradable unit, accounted for a GHG project. When verified and listed in the registry systems of BioCarbon, it is called a Verified Carbon Credit VCC. It is equivalent to one metric ton of carbon dioxide equivalent (CO_2eq)

Blockchain: A decentralized and tamper-proof digital ledger technology that underpins the creation and management of environmental digital assets.

Smart Contracts: Self-executing contracts with the terms of the agreement between parties directly written into code on the blockchain, automating processes like the issuance and transfer of digital assets. Main Token Smart Contract functions are for the issuance (minting), transfer, retirement (burning), locking of token; or for the whitelisting of wallet addresses on the blockchain.

Decentralized Ledger Technology (DLT): A broader term that encompasses blockchain and other distributed ledger technologies used for recording transactions. Note that we often refer to "blockchain" in the document as simplification.

Environmental Digital Assets: Digital representations of environmental attributes, such as carbon credits or renewable energy certificates, are often tokenized on blockchain technology.

Token: The term Token is often used to describe a digital asset that lives on top of a distributed database that is automatically synchronized via a consensus mechanism. Such databases are often referred to as blockchains.

Tokenization: The process of converting physical or digital assets, like carbon credits, into digital tokens on a blockchain for easier trading and management and advanced transparency.

Native on-chain tokenization: the carbon credit created on-chain as a token by the registry, with all attached attributes publicly visible. One carbon credit equals one carbon token.

Interoperability: The ability of different blockchain networks or platforms to work together, allowing for the seamless transfer of environmental digital assets.

Immutable: The property of blockchain records that cannot be altered or deleted once they are added to the chain, ensuring the integrity and transparency of environmental digital asset records.

Custodian: An entity responsible for safeguarding and managing digital assets on behalf of their owners, ensuring security and compliance.

Environmental Attribute Registry: A digital platform or database that records and tracks the ownership and transactions of environmental digital assets like carbon credits.

Proof of Environmental Integrity: A verification process ensuring that environmental digital assets are backed by genuine, additional, and permanent removal or reduction of emissions.

Double Spending: The unauthorized or fraudulent use of digital assets, which can be prevented through blockchain's security features.

Carbon Neutrality: Achieving a balance between greenhouse gas emissions produced and emissions removed or offset, often through the purchase of carbon credits.

Environmental Marketplace: A platform or exchange where buyers and sellers can trade environmental digital assets, fostering liquidity in carbon and renewable energy markets.

Carbon Offset: A carbon credit or project that compensates for emissions elsewhere, helping individuals or organizations achieve carbon neutrality.

Non-fungible token (NFT): A token that represents ownership of a unique environmental asset, such as a digital art piece or a specific area of land for conservation.

Division or Fractionalization: These tokens can be divided into smaller units, with each unit representing a fraction of the underlying environmental asset. For example, one carbon credit can be tokenized into multiple tokens, each representing a percentage of that credit.

Fractional Ownership: Pooling can enable fractional ownership, where multiple individuals or entities collectively own a share of a pool of assets. For example, a large-scale renewable energy project might tokenize its RECs and allow multiple investors to buy fractional ownership in the pool of tokens representing those certificates.

Pooling of Carbon Tokens: Pooling in the context of carbon tokens refers to the practice of aggregating multiple individual carbon tokens into a common pool or grouping. This aggregation can serve various purposes, such as enhancing liquidity, facilitating fractional ownership, and simplifying the management of carbon assets. Carbon tokens within a pool may represent verified carbon credits or emissions reductions generated from certified environmental projects.

7 Resources

Pomeroy, Robin, "Carbon Offsets – How Do They Work, and Who Sets the Rules?", World Economic Forum Agenda, September 2nd, 2023: https://www.weforum.org/agenda/2022/09/carbon-offsets-radio-davos/

Tokenization of carbon credits - an explainer, December 2022 https://blog.toucan.earth/tokenization-of-carbon-credits-explained/

Spilker, G., & Nugent, N. (2022, December 1). Voluntary carbon market derivatives: Growth, innovation & usage. Borsa Istanbul Review; Elsevier BV. https://doi.org/10.1016/j.bir.2022.11.008

Recommendations for the Digital Voluntary and Regulated Carbon Markets, Briefing Paper, March 2023: https://www3.weforum.org/docs/Recommendations_for_the_Digital_Voluntary_and_Regulated_Carbon_Markets.pdf

Blockchain for Scaling Climate Action, White Paper, April 2023:

https://www3.weforum.org/docs/WEF_Blockchain_for_Scaling_Climate_Action_2023.pdf

InterWork Alliance Carbon Emission Token protocol, version for public comment, November 2023: https://gbbcouncil.org/interwork-alliance-resources/cet-protocol/