Flowcarbon™

Commodity Futures Trading Commission
1155 21st Street, NW
Washington, D.C., 20502

RE: Request for Information on Climate-Related Financial Risk

Dear CFTC Commissioners,

Flowcarbon appreciates the opportunity to respond to the Commodity Futures Trading Commission's ("CFTC") Request for Information ("RFI") on Climate-Related Financial Risks. We commend the CFTC for its leadership and are supportive of its goals to promote responsible innovation, ensure the financial integrity of all transactions subject to the Commodity Exchange Act, and avoid systemic risk.

Flowcarbon is a pioneering climate technology company that brings carbon credits onto the blockchain. Its mission is to make carbon credits accessible and transparent, enabling the efficient and early flow of capital to be invested directly into projects that combat climate change. To effectuate the tokenization of carbon credits in a manner which accomplishes our goals of enhancing and scaling the VCM as well as meeting the highest legal, reputational and regulatory standards, Flowcarbon has spent the past year working diligently with longtime Voluntary Carbon Market ("VCM") lawyers, regulatory compliance specialists, anti-money laundering ("AML") specialists, and blockchain legal experts. We have also collaborated closely through official processes and working groups with key VCM stakeholders including the International Emissions Trading Association ("IETA"), the main carbon crediting standards (Verra, Gold Standard and the American Carbon Registry), and institutions such as the World Economic Forum.

Flowcarbon believes that the innovations of blockchain and smart contracts — and, in particular, the creation of digital representations of carbon credits using blockchain technology (or, "tokenization") — can help accomplish the CFTC's core mission in this marketplace: facilitating risk management and price discovery of carbon offsets as well as detering disruptions to market integrity, ensuring the financial integrity of transactions, and promoting responsible innovation and fair competition.

In this submission, we intend to, (1) describe the challenges the VCM faces today, (2) share how distributed ledger technology can enhance the integrity of the spot market, leading to greater and more efficient risk mitigation techniques by market participants (Question 25), and (3) introduce the Commission to Flowcarbon's Protocol. Please note that Flowcarbon took part in IETA's response to this RFI and directs you to that submission for further information.

We are readily available for any follow-up questions, or to provide any additional information, and are happy to assist the CFTC in any additional way.

1. The Challenges with Today's Voluntary Carbon Market

The VCM has the potential to be a meaningful driver of decarbonization but is currently limited by highly inefficient market mechanisms that underpin the sale, purchase, and retirement of voluntary carbon credits. Flowcarbon has written extensively on this topic in the past, including in a May 9, 2022 response to the White House Office of Science & Technology Policy's RFI on the energy and climate implications of digital assets.[1] Should it be helpful to the CFTC to review this submission, we have attached that response as Appendix A. Reproduced below, with a slight modification, are the key inefficiencies identified:

- **Excessive transaction friction and cost:** Brokers and other trading intermediaries conduct the vast majority of trades in the VCM over the counter (OTC) and often charge fees up to 20%, greatly reducing economics for developers working to create new projects.
- **Limited price discovery:** With most trading volumes conducted through the OTC market in bilaterally negotiated transactions, price signals are hidden from most market participants. Emerging exchange-traded projects, such as Chicago Mercantile Exchange (CME) N-GEO and GEO contracts, provide incremental transparency, but most pricing/volume data remains hidden behind expensive subscriptions, and is, therefore, not easily accessible. This lack of transparency limits price discovery efforts and the ability of developers and buyers to ascertain accurate pricing of carbon offsets.
- **Slow and inefficient procurement process:** The use of standardized contracts in this market is still relatively limited for most buyers, and the buying process can often take weeks or months. Sourcing these credits requires carbon expertise, extensive due diligence, and legal resources. This creates significant barriers to entry for those who wish to purchase offsets.
- **Limited access for most:** To purchase and hold carbon credits, buyers need accounts with the main registries, which are extremely limited, and often prohibited for individuals. This lack of basic transaction infrastructure limits direct access to carbon credits for most market participants. In addition to the exclusivity of registry access, many participants also have difficulties onboarding to carbon exchanges due to high costs and onerous processes.
- **Over-reliance on specialist financing:** Due to the lack of price signals and data, the financing of carbon projects is limited to a few specialist funds with unique access to information and relationships. This greatly limits broad participation by institutional capital, severely limiting the suite of financing tools available to project developers.
- **Lack of liquid forward markets:** Forward financing markets for project development remain limited and/or nascent. This limitation restricts developers' ability to overcome early project development cost barriers, such as funding conceptual and feasibility studies, and hinders the implementation of high-impact climate mitigation projects.
- **Inconsistent measurement, reporting, and verification measures:** Currently, accounting capacities and consolidated functional and operational measurement,

[1]https://www.flowcarbon.com/knowcarbon/an-open-letter-to-the-office-of-science-technology-policy

reporting and verification ("MRV") systems are not sufficient and consistent with GHG inventories and meet robust accounting requirements.

2. How Distributed Ledger Technology leads to enhanced risk mitigation

Question 25: Are digital asset markets creating climate-related financial risk for CFTC registrants, registered entities, other derivatives market participants, or derivatives markets? Are there any aspects of climate-related financial risk related to digital assets that the Commission should address within its statutory authority? Do digital assets and/or distributed ledger technology offer climate-related financial risk mitigating benefits?

Before outlining the direct links between the CFTC's objectives and the benefits of blockchain, we want to underline the overarching theme of our comments. To enable a robust risk-transfer derivatives market to exist, a spot market with integrity is needed. Central to this is the development of sufficient liquidity, which according to the International Swaps and Derivatives Association ("ISDA") requires "ensuring the veracity of the underlying credits [and] enhancing fungibility of credits"[2].

Flowcarbon believes that a blockchain-powered protocol that creates digital assets which facilitate the buying, selling and retiring of carbon credits can play a material role in addressing these specific issues and helping the CFTC achieve its objectives:

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- **Facilitating Price Discovery.** Due to the opaque, over-the-counter nature of the vast majority of transactions, a single type of carbon credit can sell for vastly different prices to different buyers. This advantages extractive intermediaries and disadvantages project developers, local communities living near project sites–who often have revenue-sharing or other compensation tied to the net revenue obtained by project developers–and buyers looking to achieve environmental results and mitigate climate transition risk. Tokenization solves this because blockchain transactions are public and therefore inherently transparent, offering clear pricing data for different kinds of credits. It also allows access via transparent exchange infrastructure, removing the need for intermediaries. This enhanced price discovery leads to other material benefits as well, such as the development of a robust futures market (which leads to more accurate pricing of risk) and greater investor confidence in deploying capital in the VCM.

[2]ISDA has published several papers that provide detailed analysis of issues in carbon markets, including: (i) Legal Implications of Voluntary Carbon Credits ("VCCs") (December 2021), which investigates the legal treatment of VCCs and sets out recommended steps that can be taken to further develop legal certainty in VCCs at both a global and jurisdictional level; (ii) Role of Derivatives in Carbon Markets (September 2021), which describes how derivatives function in carbon markets – in particular, exchange-traded and over-the-counter carbon derivatives – and explains how carbon markets and carbon derivatives are used by firms to meet compliance objectives, achieve corporate social responsibility goals, and manage risk; and (iii) Voluntary Carbon Markets: Analysis of Regulatory Oversight in the US (June 2022), which discusses legal and compliance questions relating to the voluntary carbon market and how CFTC oversight is relevant to voluntary carbon markets. The particular section quoted is from Voluntary Carbon Markets: Analysis of Regulatory Oversight in the US (June 2022), on page 8.

- **Facilitating Risk Management.** The creation of a more robust market with clear price discovery and high integrity will help enable more robust and credible futures, swaps and derivatives markets that market participants can use to hedge risk.
- **Deterring Disruptions to Market Integrity.** Digital assets can have key metadata about the project that generated the underlying carbon credits directly embedded into them. The tamper-proof nature of blockchain as a ledger ensures that buyers of carbon credits have access to accurate project-level data. Purchasers can always be sure of what they are buying and more easily compare products. In addition, blockchain based trading systems can be monitored in real time, enabling efficient oversight of market integrity.
- **Ensuring Financial Integrity of Transactions.** All transactions on blockchains are final and settled within minutes, preventing potential double sales. Adding a clearinghouse component to VCM transactions through blockchain settlement adds an additional layer of protection. This also reduces counterparty risk because there is no waiting period in which parties can back out, and transactions can only occur if each party has the necessary capital readily available. It also removes the need for bilateral contracting between buyer and seller, in a market without standardized contracts.
- **Promoting Responsible Innovation and Fair Competition.** It is well accepted that, to achieve climate goals, there is an urgent need to facilitate the flow of considerable new capital to climate solutions. As described below, the composable, open source nature of blockchain technology and smart contracts, which enable carbon credits to be used as programmable “lego blocks” in an open development mechanism, is optimal for widespread innovation in service of creating a more robust, transparent, fair and efficient marketplace for all.
    - **Composability**. Web3 composability means that tokens become user-friendly open-source “lego blocks” that can be used (in accordance with the rules associated with them) by anyone to innovate and build on top of them. There are countless ways that carbon credits as a “lego block” can be used by innovative builders to galvanize new climate action across the value chain. One of the most powerful ways this can be implemented is automated retirements. It is possible for on-chain protocols to incorporate Flowcarbon’s infrastructure into their ecosystem so that carbon credit retirement is either a prerequisite for an action in that protocol or a byproduct of a transaction. Imagine a crypto exchange that automatically retires carbon credits when a swap occurs or a protocol that tracks emissions in a supply chain and offsets it automatically. Flowcarbon’s partnerships have already demonstrated some other use cases:
        - Using them in a sustainable Non-Fungible Token (“NFT”) platform to automatically offset NFT drops as they happen
        - Using them as part of a loyalty rewards program for a commerce platform
        - Using them in a crypto wallet to automatically offset a user’s wallet activity
    - **Clear, automatic link between credits and project information**. There are discussions in the VCM about the potential direct on-chain issuance of carbon credits. In that potential future state, validators, certification standards, and buyers would be able to quickly and transparently access key data underlying credit issuance and certification, bringing down costs and increasing speed to

market. It will also bring down ongoing monitoring costs for third party verification. But even as a more conservative first step, allowing for the tokenization of already-certified and issued credits allows token buyers to access, within a click or two, all relevant information associated with their token and the project underpinning it. To demonstrate this aspect, Flowcarbon has already announced a partnership with international project developer Allcot to pilot the development of a “blockchain-first” carbon project. This first-of-its-kind program will leverage blockchain technology to aggregate the data required for validation, verification and certification, and after credits are issued on-chain, will demonstrate how tokens can be linked to this data for maximum visibility into the underlying projects backing a token.

- **New use cases.** The indirect benefits of blockchain and tokenization may prove to be as powerful in the long run as the direct benefits. For example, increased transparency of the role that voluntary carbon credits play in the emissions reduction claims of corporations will bolster confidence in the VCM. On-chain retirement data could be readily available, allowing anyone to easily confirm that a corporation's claims match their stated efforts at reducing emissions. Tokenization can both directly and indirectly lead to significant enhanced ecosystem-wide benefits.

3. Introducing Flowcarbon’s Protocol to Tokenize Carbon Credits

Basic Architecture and Functionality:

Flowcarbon has created an open-source protocol (i.e. blockchain-based application) that enables the “tokenization” of carbon credits. The process is as follows: First, carbon credits are issued from projects that are validated, verified and registered by market-accepted standards. A project developer wishing to “tokenize” the carbon credits would then obtain from Flowcarbon our “Supply Partner Agreement,” created by carbon market legal experts, which outlines contractually the obligations of Flowcarbon to the project developer. After signing the agreement, the project developer transfers some number of carbon credits to a carbon registry account that serves as a “warehouse” account to hold the credits to be tokenized. For every carbon credit deposited into the warehouse account, Flowcarbon mints one “GCO2” token, meaning that each token represents one tonne of carbon reduced or removed. The token includes information regarding the project name, unique ID, vintage and batch serial number. Flowcarbon then delivers the GCO2 tokens back to the supply partner. Each carbon credit backing a GCO2 token remains in the warehouse entity’s registry account until one of two things happens:

1. Retirement: When a token holder wishes to retire a carbon credit and claim the associated offset. The token is permanently altered to a “retired” and unusable state, and a notification is sent to the Flowcarbon team to retire an underlying credit from the carbon credit warehouse account.

2. Redemption: When the token holder desires to take possession of a non-tokenized carbon credit. The token holder can deliver the token to Flowcarbon, which destroys it, and the corresponding carbon credit is transferred into the token-holder's registry account.

Token Bundling

A critical aspect of Flowcarbon's protocol is that certain credits with similar characteristics can be grouped together into more fungible "bundles," which can help drive liquidity and price discovery. The process is as follows: Flowcarbon sets certain criteria for a particular bundle, and programs those criteria into a "smart contract," which is a program stored on a blockchain that runs when predetermined conditions are met. They are used to automate the execution of an agreement so that all participants can be immediately certain of the outcome, without any intermediary's involvement or time loss. In this case, the conditions are met when a Supply Partner transfers to the bundle smart contract GCO2 tokens that meet the criteria for a particular bundle. Criteria can be broad or narrow, for example, all carbon credits from a particular standard issued in a certain year, or any carbon credit from a Forest Carbon project in 2022, and so forth. There is no limit on the number of GCO2s that can be deposited into a bundle or the number of bundles that can be created.

When the Supply Partner seeks to "bundle" her GCO2 tokens, she simply utilizes an easy-to-navigate Flowcarbon web interface which enables her to send her GCO2 tokens to the bundle smart contract. When the GCO2 tokens are received by the smart contract, it automatically sends back to the project developer the same number of tokens, but these are fungible "bundle tokens." The process can be visually represented as:

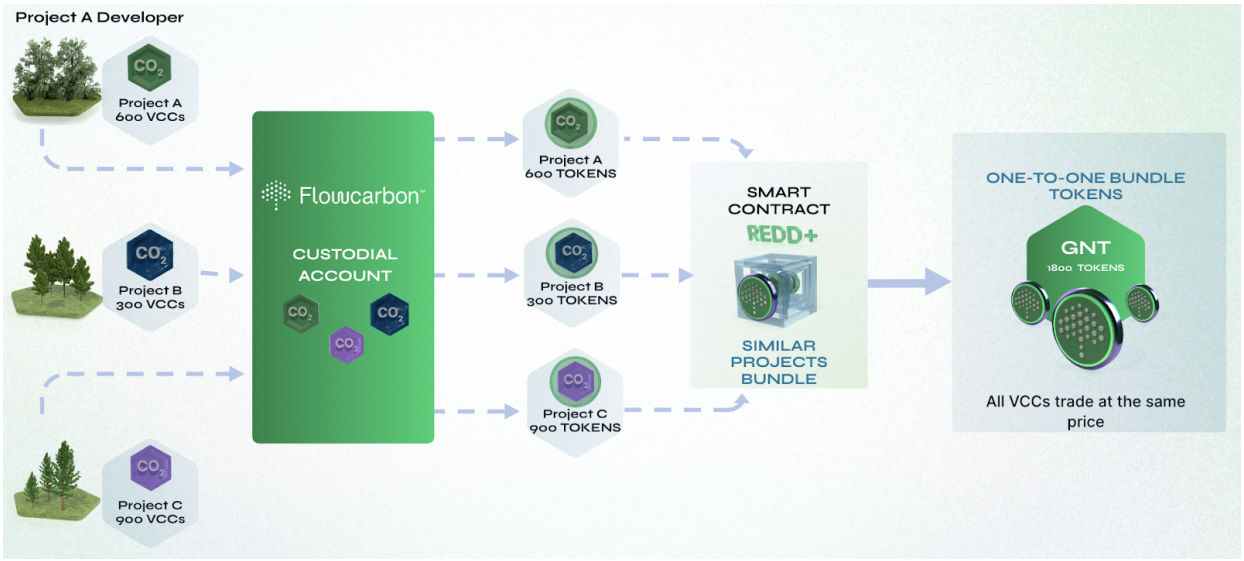

Exhibit A: Flowcarbon architecture overview

Each bundle token represents the right to claim any one of the GCO2 tokens held in that particular “bundle,” creating fungibility among those GCO2 tokens (and the carbon credits underlying them). At any point, a bundle token holder may “unbundle” her bundle tokens for an equivalent number of GCO2 tokens then present in the bundle, via the Flowcarbon web interface. These GCO2 tokens, as noted above, can then be redeemed for the relevant underlying carbon credits, which entitles the token holder to delivery of a carbon credit.

Additionally, via that interface, at any time, a bundle token holder can see information about which carbon credits are present in the bundle, along with all relevant project information.

Tracking Carbon Credits

Flowcarbon’s GCO2 tokens are traced back to the original project that issued the carbon credits through the token name, symbol, and data stored in the GCO2 token smart contract. Each GCO2 token that is created has its own smart contract and the GCO2 tokens are differentiated by standard, project ID and vintage.

Whereas tokens on the Ethereum network are named “Ether” and have the symbol “ETH”, a hypothetical GCO2 token could be one named “India Sundarbans Mangrove Restoration” issued by Verra (one of the major carbon registries) and have the symbol “VER1463-20”. This would indicate to the prospective purchaser of the GCO2 token that the carbon credit backing the token was issued in 2020 by the Verra Registry from Project 1463.

The serial number of each batch of carbon credits that are tokenized will be uploaded to the smart contract of the corresponding GCO2 token in the form of a hash. The hash is a unique set of characters generated from the serial number that is uniform in length regardless of the length of the serial number; each serial number can only have one hash. Third-party auditors will regularly compare the serial numbers of the carbon credits in Flowcarbon’s custodial registry account to the hashes that are contained in the smart contracts. These audits are the important final step in tracing GCO2 tokens to the underlying carbon credits. The audits confirm that the GCO2 tokens are representative of the actual carbon credits in the custodial account, that the number of GCO2 tokens are equal to the number of carbon credits, and that for any point in time since the last audit, these two numbers are equal, indicating that the order of events of retirements and transfers is correct.

All token owners will have access to Flowcarbon’s “Token Holder Web Interface” which is a web interface with a secure log in containing real-time information about a user’s own token balance, retired tonnes, and all project-level information about GCO2 tokens or bundle tokens owned by the user.

Retiring Carbon Credits - User Process

Exhibit B below is a screenshot of the interface a user encounters at login.

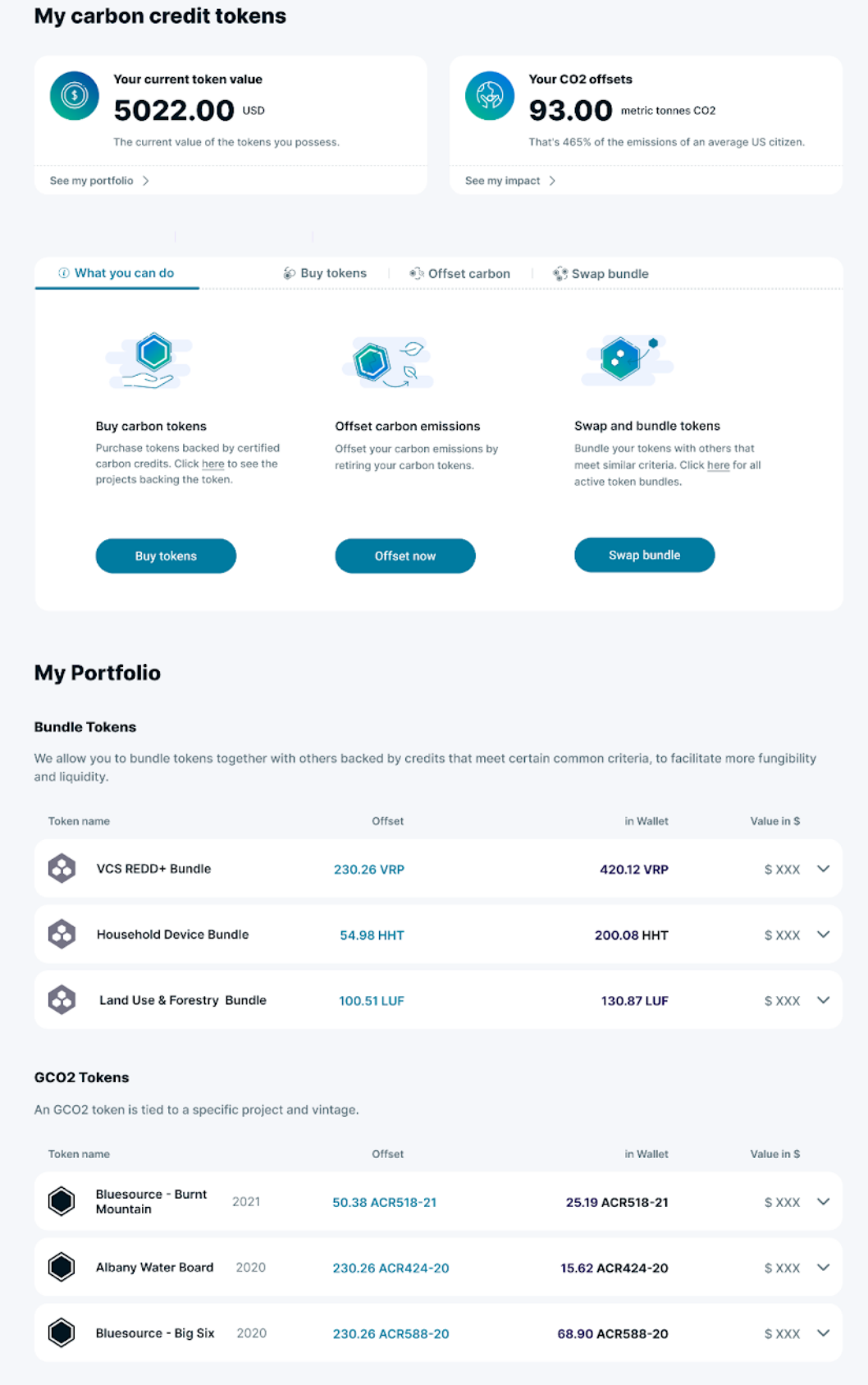

Exhibit B: Flowcarbon Decentralized Application (dApp) home screen upon login

The Flowcarbon protocol keeps track of two values per user:

1. The “token balance” is the value of the live bundle and GCO2 tokens a user has
2. The “retirement balance” is the number of carbon credit tokens that a user has retired

When a user retires a token, her token balance decreases by the amount specified and her retirement balance increases. Tokens that are retired by the user in this interface are immediately destroyed, or “burned”. Burning removes the token from existence permanently so that it cannot be sold or retired again. The retirement balance is strictly a number identifier unique to that account. It cannot be transferred, preventing any possibility of double use.

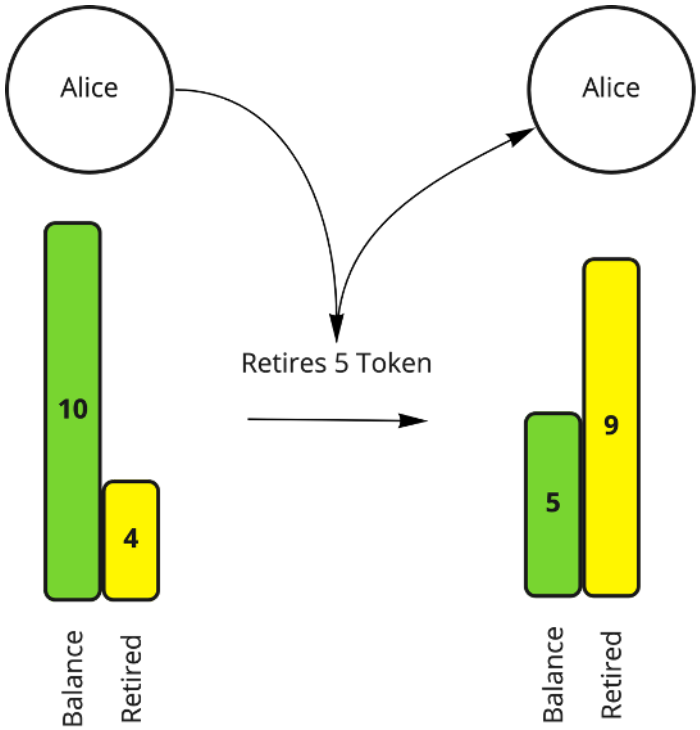

Exhibit C:
If Alice is retiring 5 tokens, then her balance decreases and her retirement increases.

The on-chain retirement then triggers a process to retire the underlying carbon credits in the registry (discussed further below).

GCO2 tokens and bundle tokens can be retired on-chain via the Token User Web Interface, an online interface available on Flowcarbon’s website, allowing the holder of the token to claim the environmental benefit.

For a GCO2 token retirement, the process is straightforward. The user connects her crypto wallet to the website and then selects the token she would like to retire and the amount of tonnes, i.e. number of tokens, to retire.

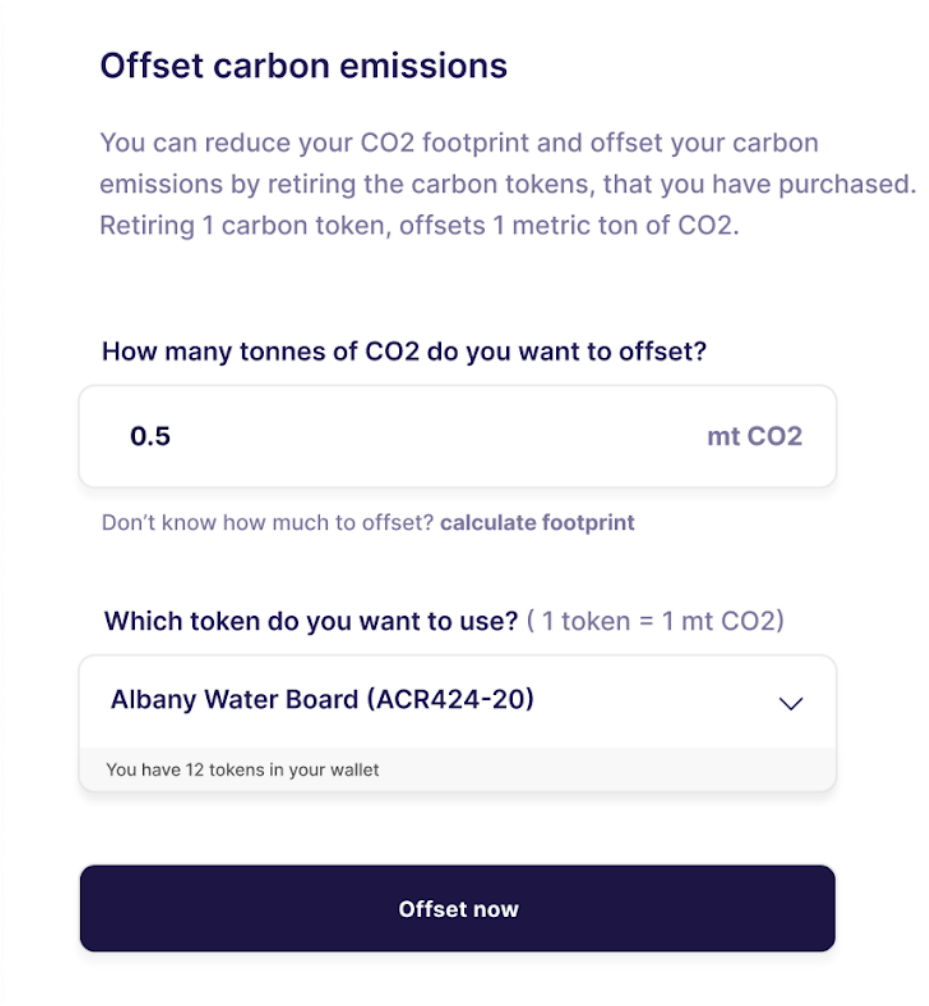

Exhibit D: Retirement of GCO2s

The process is slightly different for bundle tokens. The user has two options. First, she can choose to retire the bundle token, in which case an automated process occurs in which the GCO2 token with the oldest vintage then present in the bundle is automatically retired. Secondly, if she wants to choose the specific project from which the credit will be retired, she can select a specific GCO2 token present in the bundle from a drop down menu, and that GCO2 token's specific project will be retired. It is important to note that in both of these scenarios, the bundle token and the GCO2 token held within the bundle are immediately burned to prevent any double use. The only difference is whether the user takes the extra step of selecting a specific project in the bundle from which her retirement will happen.

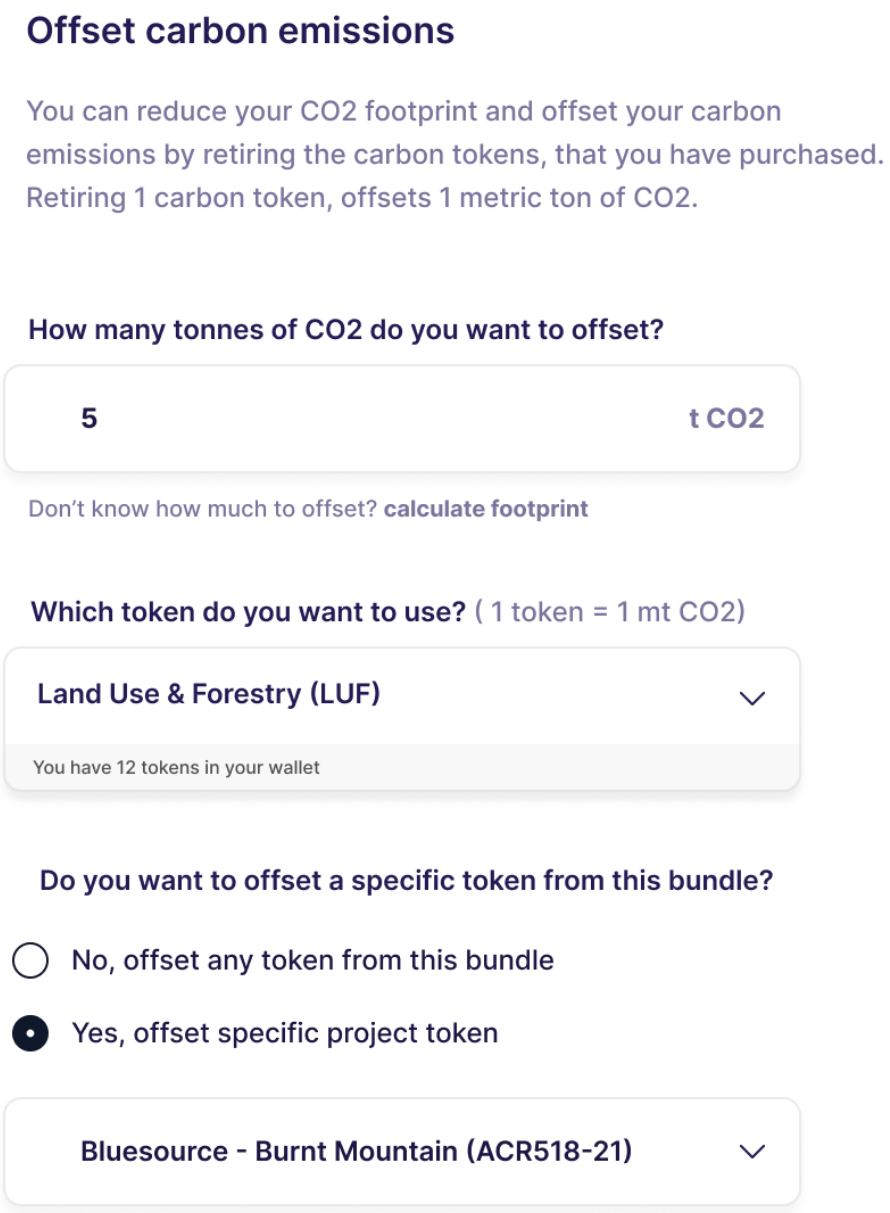

Exhibit E: Retirement of Bundle Token

Retiring Carbon Credits - Between Flowcarbon and Registry

When a user retires a carbon token on-chain, the number of tokens that were retired is stored in the protocol as a pending balance for that specific GCO2 token. A backend interface is connected to the protocol and used to manage the off-chain retirement process by the team managing the registry custodial account. Once per day, every day, the team reviews the backend interface to see which tokens have a pending balance and then retires an equivalent number of each corresponding carbon credit in the relevant registry. The retirement event identifier is then uploaded to the respective GCO2 token smart contract.

This links the unique retirement ID with the associated number of retired credits on the blockchain. This is a non-reversible and tamper-proof mechanism governed by audited smart contracts. It is programmatically guaranteed that a retirement ID cannot be reused and that a token can only be retired once. Flowcarbon (or a malicious actor gaining access to the system) cannot bypass this mechanism as it is part of the audited smart contracts itself. Since the retirement ID is stored on the blockchain with each retirement that happened, the process is transparent from the outside - the number of retired credits on the chain must match the number of retired credits in the registry.

Once the retirement has taken place in the registry, the pending balance for the GCO2 tokens is decreased and the tokens are marked as finally retired.

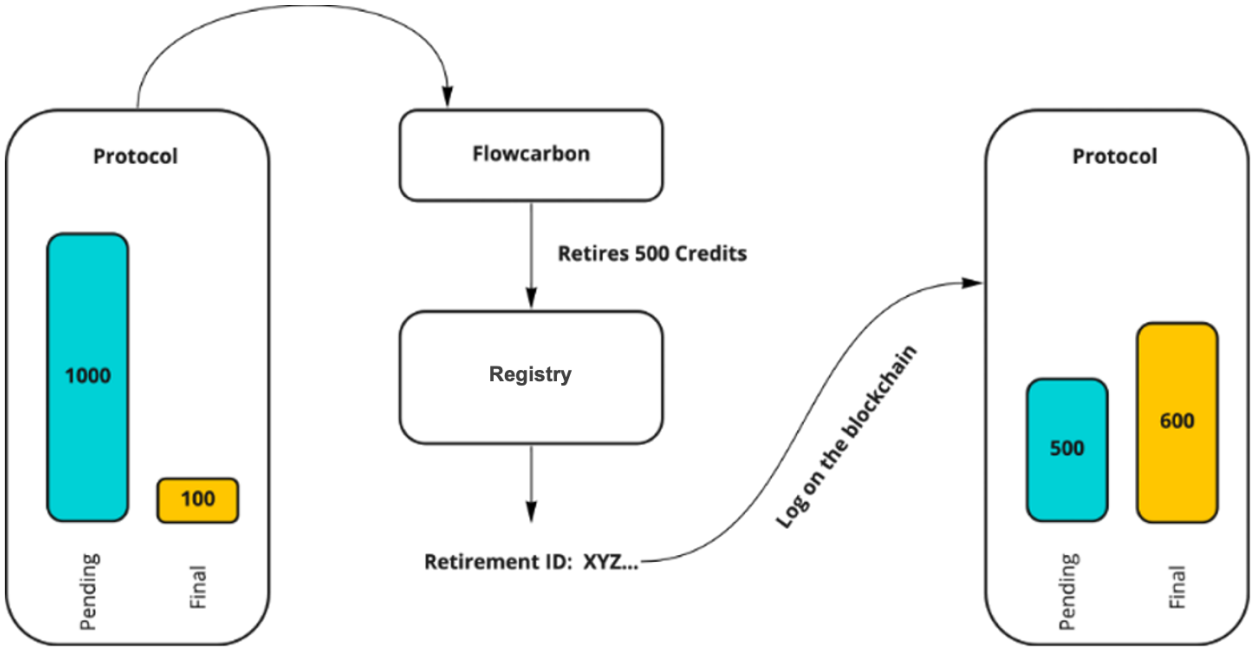

Exhibit F: Off-chain retirement process

Preventing Double Use

Flowcarbon's process for translating on-chain carbon token retirements to off-chain credit retirements prevents any possibility of double use.

In addition to accounting-firm audits and immediate burning of tokens, Flowcarbon's smart contracts have also undergone strict smart contract security audits by Quantstamp, the leading audit company in Web3. The audits entail architecture review, unit testing, functional testing, computer-aided verification, and rigorous manual review of the smart contract code The audits ensure that any smart contracts that contain GCO2 tokens (such as the smart contracts for Flowcarbon's bundle tokens) are secure and that the one-to-one representation of off-chain carbon credits to circulating carbon tokens is maintained.

Flowcarbon will make all of the accounting firm's audit reports available publicly and is also happy to provide the Commission with the security audit reports to the standards if helpful.

Environmental Sustainability

The GCO2 tokens issued by Flowcarbon would be ERC-20 compatible and issued on the Celo blockchain, a Layer 1 blockchain utilizing a proof-of-stake ("PoS") consensus mechanism. PoS mechanisms use greater than 99% less energy[3] than proof-of-work mechanisms and Celo is one of the lowest emitting blockchain networks[4]. Celo has committed to environmental integrity, and has purchased offsets that exceed its historical emissions. Flowcarbon's GCO2 tokens would also be transferable to other PoS blockchains.

Conclusion

Flowcarbon commends the CFTC for its leadership on the important issue of climate-related financial risk and solutions, and we support the agency's goals to promote responsible innovation, ensure the financial integrity of all transactions subject to the Commodity Exchange Act, and avoid systemic risk.

We are readily available for any follow-up questions, or to provide any additional information, and are happy to assist the CFTC in any additional way.

Best,

Dana Gibber

[3]https://www.bloomberg.com/news/articles/2022-09-13/what-s-ethereum-eth-merge-proof-of-stake-differs-from-bitcoin-btc)
[4]https://www.cryptowisser.com/crypto-carbon-footprint/

Appendix A

Celo, Flowcarbon & Climate Collective

Response to the Office of Science & Technology Policy, Request for Information on the Energy and Climate Implications of Digital Assets (87 FR 17105)

May 9, 2022

Dr. Alondra Nelson
Director
Office of the White House Science & Technology Policy (OSTP)
1650 Pennsylvania Avenue, NW
Washington, D.C. 20502

RE: Office of Science & Technology Policy, Request for Information on the Energy and Climate Implications of Digital Assets (87 FR 17105)

Dear Dr. Nelson:

Flowcarbon[1], the Climate Collective[2], and the Celo Foundation[3] welcome the opportunity to share our views with the White House Office of Science & Technology Policy ("OSTP") in response to its request for information ("RFI") on the energy and climate implications of digital assets.[4] We would also welcome the opportunity to meet with you and the OSTP staff to discuss these topics in more detail.

This response outlines the potential of distributed ledger technology to contribute to climate change mitigation by advancing the transparency and scale of the global voluntary carbon market

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[1] Flowcarbon is a pioneering climate technology company that brings carbon offsets onto the blockchain. Its mission is to make carbon markets accessible and transparent, enabling billions of dollars to be invested directly into projects that combat climate change. Flowcarbon is committed to driving real impact for people, biodiversity, and the planet.www.flowcarbon.com.

[2] The Climate Collective is a coalition of companies collaboratively building on the Celo blockchain at the intersection of Web3 and climate action. These companies include: Astral Protocol, Byterocket, Celo Foundation, cLabs, Curve Labs, Flowcarbon, Green World, Kolektivo, Kolektivo Labs, Loam, Moss, Plastiks, ReFi DAO, Regen Network, Toucan Protocol, and Wren. For more information about the Climate Collective, please visit: https://climatecollective.org/about.

[3] The Celo Foundation ("Foundation") is a nonstock corporation that serves developers on the use of the open-source Celo blockchain by providing grants, education and support. The Celo blockchain is a carbon-negative, layer-1 protocol with a rich ecosystem of global partners building innovative Web3 applications within the DeFi, ReFi, and NFT sectors in support of the Celo community's mission to create a more inclusive global financial system. Accessible to anyone with a mobile phone, the Celo ecosystem consists of a decentralized, proof-of-stake blockchain technology stack (the Celo Protocol), the CELO token, and several native stablecoins (cUSD, cEUR, and cREAL) that make it easy for anyone to use crypto like cash—every day. Launched on Earth Day in 2020, the open-source Celo network now supports 1000+ projects created by developers and creators located around the world. For more information, please visit: www.celo.org.

[4] White House Office of Science & Technology Policy, *Notice of Request for Information on the Energy and Climate Implications of Digital Assets,* 87 Fed. Reg. 17105 (March 25, 2022).

("VCM"). We address how certain structural limitations of the VCM can be overcome by leveraging blockchain infrastructure, thereby unlocking considerable growth and value for projects that protect and restore the Earth's natural ecosystems and carbon sinks. Carbon credits (and other related emissions reduction units or other units representing environmental attributes) issued and traded via immutable blockchain technology offer new economic opportunities by enabling the transfer of value to carbon reduction and removal projects, and other projects with environmental benefits, in a frictionless, transparent manner. We further comment on our approach to mitigate climate harm and reduce energy use associated with digital assets, and the opportunities to use tokenization for corporate carbon offsetting. Overall, tokenized carbon credits represent one of the most beneficial use cases for digital assets, and any regulatory approach taken regarding digital assets should be both nuanced and nimble enough to facilitate these benefits. Our main policy recommendations are to (1) differentiate between digital asset use cases and features, (2) support the development of clear accounting standards for VCM along with an explicit tax policy for corporations that allocate capital towards carbon offsets, and (3) clarify and/or create appropriate safe harbor provisions in any future regulatory action to ensure the continued use of digital assets in the VCM context.

I. The Voluntary Carbon Market: Opportunities & Challenges

Addressing climate change is one of the most pressing issues of our time. It is estimated that if policy mechanisms fail to preserve carbon sinks and biodiversity, at least USD $10 trillion of global GDP will be lost by 2050 due to climate change and biodiversity loss.

Recent reports by the Intergovernmental Panel on Climate Change and the World Economic Forum outlined that the Paris Agreement target—as well as U.N. Sustainable Development Goals—cannot be achieved without protecting and regenerating natural ecosystems. These nature-based solutions (NBS), such as forest conservation, reforestation, and the restoration of grasslands, peatlands, and mangroves, act as carbon sinks and carbon capture free of charge to humanity. Estimates suggest that NBS can provide around 30% of required mitigation activities to proceed on the "Below 2°C pathway" by 2050, with a minimal cost component of approximately $10-100/mt. However, based on UN estimates, to meet climate change targets we need to close a USD $4.1 trillion financing gap, requiring 3x investment in NBS over the next 10 years.

Carbon markets—especially the voluntary carbon market (VCM)—serve as tools to scale these cost-effective natural climate mitigation measures by providing a direct bridge between these projects and financial markets. The fundamental structure of the VCM is based on a mechanism whereby credits are issued to projects corresponding to the amount of carbon reduced or removed by the project and sold for carbon offsetting to corporate and individual buyers as a revenue stream for the project. Currently, around 50% of the total voluntary carbon market volume is represented by carbon credits originating from NBS.[5] A fundamental tenet of the VCM is "additionality," which means that projects financed via the VCM must prove that they would not be financially viable without the revenue stream created by the sale of carbon credits. In this way, the VCM is the primary financial construct creating economic incentives to preserve and restore Earth's natural carbon sinks, counteracting the considerable economic incentives for destroying

[5] Ecosystem Marketplace's State of the Voluntary Carbon Markets 2021 URL: https://www.forest-trends.org/publications/state-of-the-voluntary-carbon-markets-2021/

and degrading nature. Notably, projects in the VCM can also have a strong impact beyond the reduction of greenhouse gas emissions, especially on biodiversity, wildlife, and local communities.

The VCM has the potential to be a meaningful driver of decarbonization but is currently limited by highly inefficient market mechanisms for the sale and purchase of voluntary carbon credits. As more corporate commitments related to decarbonization lead to increasing demand for offsets, the VCM is seeing considerable growth. However, the Taskforce on Scaling Voluntary Carbon Markets (TSVCM), a private-sector initiative working to scale an effective and efficient VCM, estimated that to meaningfully support climate targets, the VCM needs to grow by more than 15 times by 2030.[6] Improving voluntary carbon market efficiency to accelerate investment requires transparent, scalable solutions, such as digital assets and blockchain technology, which can address many of the underlying challenges around transparency, integrity, efficiency, and scalability by reducing entry barriers, democratizing access, and enabling efficient and low-cost point-to-point transactions.

The Current VCM Market Has Significant Challenges

A multitude of stakeholders participates in the VCM, including private project and program developers, non-government organizations (NGOs), sovereign governments, private investors, and corporate buyers. The many stakeholders combined with the numerous certification methodologies and project types underlying the market give rise to many market inefficiencies.

Some key inefficiencies in the VCM are:

1. **Excessive transaction friction and cost:** Brokers and other trading intermediaries conduct the vast majority of trades in the VCM over the counter (OTC) and often charge fees up to 20%, greatly reducing economics for developers working to create new projects.
2. **Limited price discovery:** With most trading volumes conducted through the OTC market in bilaterally negotiated transactions, price signals are hidden from most market participants. Emerging exchange-traded products, such as Chicago Mercantile Exchange (CME) N-GEO and GEO contracts, provide incremental transparency, but most pricing/volume data remains hidden behind expensive subscriptions, and is, therefore, not easily accessible. This lack of transparency limits price discovery efforts and the ability of developers and buyers to ascertain accurate pricing of carbon offsets.
3. **Slow and inefficient procurement process:** The use of standardized contracts in this market is still relatively limited for most buyers, and the buying process can often take weeks or months. Sourcing these credits requires carbon expertise, extensive due diligence, and legal resources. This creates significant barriers to entry for those who wish to purchase offsets.
4. **Limited access for most:** To purchase and hold carbon credits, buyers need accounts with the main registries,[7] which are extremely limited. This lack of basic transaction infrastructure limits direct access to carbon credits for most market participants. In addition

[6] Taskforce on Scaling Voluntary Carbon Markets, Final Report, 2021 URL: https://www.iif.com/Portals/1/Files/TSVCM_Phase_2_Report.pdf

[7] American Carbon Registry (ACR), Climate Action Reserve (CAR), Verified Carbon Standard (Verra VCS), Gold Standard

to the exclusivity of registry access, many participants also have difficulties onboarding to carbon exchanges due to high costs and onerous processes.

5. **Over-reliance on specialist financing:** Due to the lack of price signals and data, the financing of carbon projects is limited to a few specialist funds with unique access to information and relationships. This greatly limits broad participation by institutional capital, severely limiting the suite of financing tools available to project developers
6. **Lack of liquid forward markets:** Forward financing markets for project development remain limited and/or nascent. This limitation restricts developers' ability to overcome early project development cost barriers, such as funding conceptual and feasibility studies, and hinders the implementation of high-impact climate mitigation projects.
7. **Inconsistent measurement, reporting, and verification measures:** Currently, accounting capacities and consolidated functional and operational measurement, reporting, and verification (MRV) systems are not sufficient and consistent with GHG inventories and meet robust accounting requirements.

II. Blockchain Technology Can Improve the VCM

Digitization of the VCM can greatly improve efficiency and utility for stakeholders, thereby aiding climate action and sustainable development. The World Bank has identified blockchain technology as an essential tool to support expanding and improving carbon market mechanisms[8]. Specifically, tokenized carbon credits on blockchain can advance market and environmental integrity, transparency and inclusiveness, cost efficiency, liquidity, and scalability. Using blockchain technology is an opportunity to rapidly scale the VCM by standardizing transactions, overcoming many of the underlying structural limitations in the VCM. Moreover, the digitization of carbon credits can unlock more private capital to expand the reach and impact of the VCM.

Blockchain as the Carbon Market Infrastructure Layer Can Solve Key Challenges: There is a remarkable overlap between existing structural limitations of the VCM, and the structural efficiencies facilitated by blockchain technology. Hence, blockchain technology can play a key role in boosting climate action by solving many of the underlying challenges of the VCM. Two especially useful features are smart contracts (self-executing processes), as they can facilitate emissions measurement, reporting, and verification (MRV), and tokenized trading of VCUs to streamline the fractured broker-driven OTC market

Tokenizing VCM credits to enable them to trade on crypto exchanges provides numerous benefits. Tokens that are backed by carbon offsets, built using smart contracts, and exchangeable across devices and other financial systems, can support the growth and environmental integrity of the VCM in the following ways, driving action on climate change that is not currently possible:

1. Blockchain can improve the low liquidity in the carbon market by reducing entry barriers: Instead of the lengthy and expensive process required to buy a carbon credit from a registry or via a broker, millions of people already using blockchain systems can participate more easily and quickly in purchasing VCM credits. This will facilitate robust growth in market segments that have experienced prohibitive barriers to entry, such as retail, and small and mid-market businesses, greatly expanding overall liquidity.

[8] Blockchain and Emerging Digital Technologies for Enhancing Post-2020 Climate Markets (2018), World Bank.

2. Blockchain can bypass the intermediary structure and enable efficient and low-cost transactions between suppliers and buyers via a peer-to-peer transaction model. By shifting the market away from a fractured, broker-driven model, the existing price opacity of the market is addressed, price discovery is enabled, and efficient pricing becomes possible.
3. Blockchain democratizes access to carbon credits. Blockchain technology allows for a decentralized, peer-to-peer network where no single entity can monopolize the market and exclude others from participating, resulting in improved accessibility. Tokenization reduces market friction as it democratizes market access, and intermediary fees are minimized or eliminated so that anyone can purchase live credits and retire them on-demand as offsets, without third-party interference.
4. Smart contracts can enhance transparency and integrate robust governance and accountability across an array of standards and programs required by government authorities and the investment community.
5. As blockchain is an open-source technology, it enables innovative applications to emerge rapidly, and more directly engages and empowers diverse stakeholders to participate. Blockchain technology can scale VCM through more compatibility among multiple applications.

The Energy Intensiveness of Blockchain is Limited: While advocating for blockchain as an essential technology to underpin the global VCM, it is necessary to mitigate its potential energy intensiveness. Since the emergence of the first blockchain, widely known as the Bitcoin blockchain, there has been substantial innovation towards that end. While the Bitcoin network and its Proof-of-Work (PoW) consensus mechanism tend to be inherently energy-intensive, the Proof-of-Stake (PoS) consensus mechanism used by many applications in the blockchain space does not require large consumption of energy. In PoW, network transactions are secured and validated by specially designed hardware (miners) competing to solve complex calculations. In PoS, on the other hand, transactions are validated, and the integrity of the network is secured by network participants staking collateral and running more standard servers to do similar calculations that require far less energy. The current trend indicates a move away from PoW towards the more environmentally-friendly PoS consensus mechanism. This is evidenced by looking at some of the most popular blockchains, including Ethereum (which is undergoing a shift from PoW to PoS,) Polygon, and Celo. By using a PoS consensus mechanism to authenticate the network, these chains have reduced the ratio of carbon avoided per carbon emitted to 100 million to one[9]. In addition, some blockchains, such as Celo, also purchase carbon offsets in the VCM to offset their emissions, which means there is effectively no negative climate impact of transactions.

III. Current Market Example—Flowcarbon's Tokenization of VCM Credits to Create a Liquid Transparent Spot Market

Flowcarbon's blockchain-based structural innovation in the VCM consists of enabling entities that own qualifying carbon credits, primarily project developers, to receive a tokenized representation of each credit unit they own, to then be sold freely via crypto exchanges. These tokenized VCM credits can also be bundled together with credits from other project developers if they have certain common characteristics (i.e. the type of project they came from and the year of issuance), creating

[9] Ethereum Foundation (2021) via https://blog.ethereum.org/2021/05/18/country-power-no-more/

grades of fungible carbon tokens that trade freely, thus bypassing the highly inefficient broker-driven OTC model. Flowcarbon's blockchain technology makes carbon markets more accessible and transparent while enabling further investments directly into projects that help scale VCM.

Tokenizing carbon credits can thus solve the underlying structural inefficiencies in the VCM, but a high level of integrity, transparency, and accountability is needed for digital innovation to improve the performance of carbon markets across the value chain. As one of the first companies undertaking the tokenization of carbon credits from the VCM, Flowcarbon has developed a set of tenets to ensure the environmental, structural, and financial integrity of carbon-backed tokens. Flowcarbon's tokenizing mechanism is closely aligned with the principles developed by the International Emissions Trading Association's (IETA) initial set of recommendations for the application of digital innovation to the carbon market.[10] According to IETA, tokens have the potential to reduce market friction, increase market access, reduce intermediary fees, and scale capital flows.

Flowcarbon's Core Tenets for the Tokenization of Voluntary Carbon Credits

In consultation with a wide range of stakeholders in the VCM, including IETA, Flowcarbon's tokenization process includes adherence to the following tenets, which are intended to optimize the structural, environmental and financial integrity of tokenized carbon credits from the VCM. By tokenizing carbon credits in accordance with these tenets, Flowcarbon is creating a functional, liquid, transparent, and accessible spot market for VCM credits:

1. **There is a one-to-one correspondence between tokens and underlying credits:** Each token is backed by a unique corresponding carbon credit, which must already be held in a dedicated, secure SPV at the time of token minting. Each time a new batch of carbon credits is tokenized, the same number of ERC-20-compatible tokens are created. Each token created represents a verified removal or reduction of one tonne of carbon dioxide equivalent from a specific project and year (known as the "vintage"), as represented by the underlying credit. A unique token will be created for each project and vintage of a project. This means that carbon credits of vintages 2017, 2018, and 2019 from one reforestation project will generate three unique tokens, one for each vintage.
2. **Underlying credits must be certified by credible standards:** The carbon credits backing tokens must be certified by market-accepted standards. Carbon credits used by Flowcarbon to issue digital tokens come from projects that are validated, verified, and registered under standards endorsed by the International Carbon Reduction and Offset Alliance (ICROA), government-approved carbon crediting schemes, or other market-validated crediting mechanisms.
3. **All underlying credits are live and unretired:** All credits underlying Flowcarbon tokens are as-yet-unretired. Inherently, a credit in the VCM represents the right to claim the achievement of a GHG emission reduction or removal in an amount of one ton of CO_2e, and the right to the benefit of an offsetting claim when a credit is "retired." Flowcarbon's tokens confer those same rights–and the full value they represent–on token holders. Tokens will only be minted for issued, ex-post verified carbon credits, never for canceled or retired credits, thereby ensuring that token holders benefit from the real-world value of the underlying credits.

[10] IETA Council Task Group on digital climate markets – Key findings and recommendations (2022) URL: https://carbon-pulse.com/153786/

4. **Tokens can be redeemed for underlying credits (the "two-way bridge"):** Any holder of a Flowcarbon token can redeem the token for an underlying carbon credit. This creates a "two-way bridge" that brings carbon credits onto blockchain in the form of tokens, and allows for them to be taken back off-chain via the redemption process in which a token holder can invalidate their token and take custody of an underlying carbon credit. This creates a stabilizing link between credits trading as tokens and those trading in traditional channels.
5. **Token holders can retire underlying credits on-demand:** As tokens represent issued carbon credits, claims relating to carbon neutrality, offsetting, and/or compensation of emissions will only be made after the token is retired. This occurs when the token holder elects to permanently change the state of the token to "retired" via a web interface maintained by Flowcarbon, which triggers a dedicated operations team to retire a carbon credit from the SPV at the issuing registry. No compensation claim may be made for simply holding, but not retiring, tokens. In the future, APIs may be developed in partnership with the carbon registries to automate this process.
6. **Robust processes ensure security and transparency:** Flowcarbon monitors the token creation process to minimize error and lower the technical burden of those looking to tokenize credits ("supply partners"). Supply partners are confirmed and diligent in accordance with existing industry standards. Supply partners deposit credits into a bankruptcy-remote special purpose vehicle (SPV), which is managed by a professional third party and structurally designed to maintain ironclad protection of the credits on behalf of token holders. The SPV is audited regularly by a recognized US accounting firm, with audit results posted on the blockchain.
7. **Similar credits may be bundled to facilitate liquidity and ease of purchasing:** Flowcarbon's token architecture includes the establishment of bundles, in which credits from different projects may be deposited, with a set of fungible tokens minted to represent participation in the bundle. The bundles track market segments. For example, any credits that qualify for the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) may be deposited into a corresponding smart contract representing that bundle and sold as fungible CORSIA-eligible tokens. This introduces a degree of market standardization where appropriate, thereby facilitating liquidity, price transparency, and reducing transaction costs.
8. **All Web3 operations are pursued in line with a commitment to sustainability**: Flowcarbon's technology is deployed in the most sustainable way possible, following principles based on inclusiveness, resiliency, and security, as well as by maintaining a low carbon footprint via a Proof of Stake (PoS) consensus mechanism and working with partners that are determined to achieve net-zero emissions. By tokenizing in accordance with these tenets, Flowcarbon is facilitating the most sustainable blockchain ecosystem approach.

By enabling carbon-backed tokens in accordance with these tenets, blockchain technology is a tool that can improve data management, liquidity, and inclusivity amongst all VCM participants. Digital assets can improve market access for project developers by affording a transparent and liquid off-ramp for credits as soon as they are issued. Digital assets can further expand the market through improved price transparency and market participation, improving access for buyers. Spot and futures markets have the potential to increase investments into climate action through higher and more reliable pricing, bringing liquidity to project developers and returns to investors. Through

blockchain integration in the VCM, a viable and more inclusive asset class is created, with predictable returns on investment and value protection for buyers and sellers.

IV. Beyond Tokenization: Further Benefits of Blockchain Technology in the Carbon Market Ecosystem

Tokenization of VCM credits in accordance with Flowcarbon's tenets will create a liquid, transparent spot market for credits, enabling further efficiencies and upstream synergies. In current carbon market dynamics, policymakers and off-takers are faced with countless pain points among all VCM participants, from disrupted information flow to limited interconnectivity and price opacity.

In addition to tokenizing carbon credits, blockchain technology is being used in several other innovative ways to enhance the overall functionality of the VCM:

1. **Blockchain-based Digital MRV:** The deployment of digital technologies in monitoring, reporting, and verification (MRV) can create efficiency, accuracy, and transparency in the VCM. The reduced transaction and administrative costs can enable project developers to develop more projects. Emerging technologies, such as the internet of things (IoT), artificial intelligence (AI), and new mobile and web applications can enhance MRV by automating data capture from a source (e.g., IoT sensors like smart meters) or remotely (e.g., remote sensing technologies, LIDAR, RADAR, or even drone capture), and from enhanced datasets (through AI or machine learning) for data verification to identify data errors or fraudulent behavior.
2. **Blockchain-based Meta-registries:** In the VCM, standards bodies and registries set the verification, validation, quantification, registration, and issuance criteria for carbon credits. They are often understaffed and use outdated, inefficient technology. Distributed ledger technology can improve data repositories such as the World Bank's Climate Warehouse, which is a blockchain-based platform intended to link all carbon crediting authorities and registries under one platform. Greater interoperability among the different kinds of carbon markets—VCM and the regulated markets—should be a long-term goal. Such innovations can provide much-needed carbon credit status and location transparency in a highly fragmented and dispersed market and help avoid double registration and double counting.
3. **Blockchain as a source of structured finance products for project developers:** The VCM is expected to grow exponentially over the next several years, with more than $1 billion worth of credits traded in 2021– already a three-fold increase over 2020. However, access to financing is still a key pain point as project proponents and developers face liquidity constraints and significant lags between receiving financing and credits issued. Buyers usually commit to credits through future purchase agreements (forward contracts) but payments are made upfront only partially and continue throughout the commitment period upon receiving the carbon offset units. Project proponents also sometimes give up project equity to receive financing. Blockchain technology can provide markets and investors with the infrastructure to fund new projects in a capital-efficient way by derisking forward carbon credits through structured finance products. This path to liquidity can provide clear and fair market prices to new carbon projects while making institutions more capital efficient. Flowcarbon, together with other blockchain partners, is facilitating the

ability for projects to leverage future issuances as collateral to borrow against more favorable rates than those offered in the traditional financial markets.

V. Policy Recommendations

In light of the positive climate impact facilitated by blockchain technology highlighted above, we make the following policy recommendations to OSTP in regard to the RFI:

1. **Federal Regulation of Digital Assets Should be Tailored to the Use Case of the Digital Asset:** Digital assets should not be regulated in a simplistic, one-size-fits-all manner, and regulation should consider the economic, social, and environmental benefits of diverse applications. In the specific case of the VCM or other climate blockchain solutions, the regulatory approach to carbon offsets as tokens has to be distinguished from *utility* or *financial tokens*. One of the major challenges to driving institutional capital into the VCM and encouraging wider adoption of the technology is to provide more regulatory certainty, in particular by ensuring that regulation is thoughtful, and supports new innovation in the climate arena.

2. **Encourage the Development of Clear Accounting Standards for Carbon Credits:** In order for the VCM to achieve its potential for positive environmental and climate impact, clear accounting standards for carbon credits must be established. Entities possessing carbon credits currently have no accounting guidance to follow. As a result, they use different accounting methods, hindering information transparency in the market.[11] The SEC and Public Company Accounting Oversight Board ("PCAOB") are currently developing climate-related disclosure rules that can support the further development and international harmonization of accounting standards for carbon credits. We encourage fulsome coordination and participation from the federal government in international efforts like the International Sustainability Standards Board, and private sector and civil society efforts like the Integrity Council for the Voluntary Carbon Market.

3. **Encourage Favorable Tax Treatment of Carbon Assets**: The Biden Administration should encourage the adoption of new tax policies to encourage companies to allocate capital towards carbon offsets on their balance sheet. If the price of carbon credits increases, companies should not have to pay the appreciation (gain) on the asset, even if the amount of carbon credits exceeds the offset for the current taxation period. If the price of carbon decreases, companies should be able to write off the loss. Adopting these policies will help to foster growth in the VCM, and to address climate change through market approaches.

4. **Harmonize Regulations on Digital Asset Use in VCM:** With limited guidance from accounting standard-setting bodies or financial regulators, the treatment and accounting of crypto-related economic activities have been challenging for many companies. Consequently, there is a lack of consensus as to how emissions reductions in the form of digital assets should be accounted for on the balance sheet and the income statement.

[11] Haller, T., Thoumi, G. - Financial Accounting for Carbon Offsets URL: https://www.ecosystemmarketplace.com/wp-content/uploads/archive/documents/Doc_65.pdf

Given that creating commodity derivatives in carbon markets through tokenized forward purchase agreements is a way to manage transition risks and hedge the market, regulatory certainty should be provided.

5. **Encourage Blockchain Use in Compliance Carbon Markets:** The convergence of compliance carbon markets with the VCM is likely to accelerate over the next several years, especially as negotiations implementing Article 6 of the Paris Agreement conclude. These markets already exist in Europe. The federal government can foster transparency and integrity between both markets by placing blockchain solutions on the same plane as traditional compliance carbon market solutions and encouraging wider adoption of tokenized carbon credits in existing regulatory frameworks at the local or regional level.

6. **Direct the U.S. Department of Energy to Consider Blockchain Solutions for Direct Air Capture & Carbon Management:** The recent Bipartisan Infrastructure Legislation[12] allocates more than $62 billion for the U.S. Department of Energy ("DOE") to deliver a more equitable clean energy future out of which approximately $6.5 billion will be allocated to new carbon management funding, largely for direct air capture and carbon dioxide storage. Direct air capture ("DAC") technology is set to generate a large number of carbon credits which require a data infrastructure link into the VCM. The Administration should direct the DOE to consider allocating federal grant funding to develop blockchain data infrastructure to manage the carbon credit generation in regional DAC hubs to foster a seamless data transmission of those credits into the VCM.

7. **Collaborate on Responsible Web3 Innovation at the State Level to Address Climate Change:** California recently became the first state in the nation to start creating a comprehensive and harmonized framework for responsible web3 technology while enhancing regulatory clarity for businesses and protecting consumers. Two of the seven priorities laid out in California's executive[13] order are: (1) creating a transparent and consistent business environment for companies operating in blockchain; and (2) exploring opportunities to deploy blockchain technologies to address public-serving and emerging needs. In the context of the climate change emergency, the latter is especially relevant, as blockchain can address the emerging need to scale a transparent VCM. California serves as a leading example of how the federal government can work together with California and other states to encourage technological advancements.

[12] *The Infrastructure Investment and Jobs Act*: Opportunities to Accelerate Deployment in Fossil Energy and Carbon Management Activities, Public Law 117-58 (2021).
[13] *Governor Newsom Signs Blockchain Executive Order to Spur Responsible Web3 Innovation, Grow Jobs, and Protect Consumers*, Press Release (May 4, 2022) *available at:* https://www.gov.ca.gov/2022/05/04/governor-newsom-signs-blockchain-executive-order-to-spur-responsible-web3-innovation-grow-jobs-and-protect-consumers/

Conclusion

Thank you for this opportunity to describe how digital assets can help reverse climate change and valuable tools in the broad sustainable development trajectory of the United States. We welcome the opportunity to meet with the OSTP team to discuss these issues in more detail in the coming weeks.

Sincerely,

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