Leon Krug and Walter Blocher

8 VCC tokenisation: Navigating legal frameworks and designing for regulatory compliance

Abstract: In this chapter, we will analyse the regulatory framework applicable to tokenised instances of VCCs. This necessitates a categorisation that can be used for VCC tokens and digital tokens in general. To this effect, digital tokens are to be examined as crypto-assets in blockchain environments. We will use the European Union's recently established Markets in Crypto-assets Regulation (MiCAR) as a legal basis, given its full applicability in the EU since 30 December 2024. MiCAR was drafted for the emerging market of crypto-assets, which is closely reminiscent of, but distinct from, the market of financial instruments. This is further substantiated by the observation of a close similarity between the legal nature of certain crypto-assets and financial instruments defined in the Markets in Financial Instruments Directives (MiFID and MiFID II).

We will assess the regulatory regime within the EU under which VCC tokens will fall, with a primary focus on MiCAR and MiFID II. In addition, given the increasing prevalence of VCCs and the likelihood of their regulation by legislators in the near future, we will also examine related legal acts that could influence their usage and determine the usefulness of their tokenisation. This chapter will encompass additional legislation to evaluate the European approach and demonstrate use cases where VCC tokens have been or are being used. Taking these use cases as examples, we identify the applicable regulation schemes and offer insights into the legal certainty for future scenarios.

The initial chapter will deal with the above-mentioned legal acts as well as relevant model law approaches (A.). The EU framework will be examined first (A. I.), followed by a comparison with other international policies that could be applicable to tokenised VCCs (A. II.). The subsequent examination will focus on key aspects of the relevant German law (A. III.) and insights from the UNIDROIT Working Groups for Digital Assets and Verified Carbon Credits (A. IV.). Finally, a selection of VCC tokens will be analysed in light of the applicable legal framework (B. and C.), and conclusions will be drawn (D.).

https://doi.org/10.1515/9783111706719-008

A Legal background

I Legal frameworks

1 MiFID and MiFID II

MiFID[1] and MiFID II[2] established the regulatory framework for financial instruments in the EU. Financial instruments are manifold, opaque, and of much importance for the financial well-being of consumers; they hereby need to be regulated by a precise framework of safety and transparency rules laid out by MiFID and further connected regulations.[3] Art. 4(15) MiFID II in connection with Annex I(C) of MiFID II defines financial instruments as any transferable securities, money-market instruments, units in collective investment undertakings, different kinds of derivatives and emission allowances recognised under the European Emissions Trading Directive[4] (EU ETSD). These instruments bear a great deal of financial responsibilities, thereby their issuers need to thoroughly inform their possible clients of any risks involved. The implications of the term 'financial instrument' are not easily defined, even though the categories are listed, leading to different implementations of MiFID II throughout the EU. Using Annex I(C) MiFID II, one can work out definitions of financial instruments.[5] Although MiFID II and MiCAR share some regulatory similarities, one must distinguish between them. Most of them do not involve VCCs or their tokens, with only a few describing similar financial instrument constructs—some of which will be discussed in the following. The specific market for crypto-assets has just arisen over the last few years and with it the need for regulation, resulting in MiCAR.

With the introduction of MiFID II, emission allowances in compliance with the EU ETSD are now being regulated. The reason for the amendment of the Directive into MiFID II was to increase the protection of investors in regard to the evolving fraud in the EU ETS, concerning the observed market abuse in the European carbon market, which was prohibited by making emission allowances fall under the Market Abuse Regulation (MAR) with their status as financial instruments.[6] As already established, the VCCs and VCC tokens cannot be used as an allowance to further emit carbon dioxide or equivalent gases (CO_2e) by any entity obliged under the EU ETSD.[7] Thus, they are not covered as emission allowances by the definitive list in Annex I(C)(11) MiFID II *per se*.

A VCC token could technically also be considered as a special derivative contract described in Annex I(C)(10) MiFID II.[8] These derivatives can relate to climatic variables, as it is often done by agricultural or energy-related undertakings to secure their upkeep in case of operations being obstructed by temperature, precipitation, drought, or other weather extremes.[9] VCC tokens are not necessarily reliant on any kind of variables. The only variability lies within their underlying VCC or, then again, in their underlying climate action and arises outside of the VCC tokens themselves. Their value should always stem from the agreed amount of emission reductions or removals stated (with possible additional values up to their purchasers). Financial derivatives as safeguards against risks related to climatic variables have to be evaluated differently due to their inherent variability and, thus, are regulated as financial instruments. VCCs and their tokens have no intentional variability and thereby should not be regarded as special derivative contracts according to Annex I(C)(10) MiFID II and to this effect not fall under MiFID II.

Even though MiFID II is drafted technologically neutral, we conclude that MiFID II is not decisive for the regulation of VCC tokens as these are not financial instruments.[10] Even in connection with the newly established Distributed Ledger Technology Pilot Regime (DLT Pilot Regime), which enables crypto-assets to qualify as financial instruments if their underlying asset is a financial instrument,[11] VCC tokens are not regulated by MiFID II.[12]

2 MiCAR

a) Classification of tokens

MiCAR is the newly enforced regime for crypto-assets in the EU. A crypto-asset as defined by Art. 3(1)(5) MiCAR is 'a digital representation of a value or of a right that is able to be transferred and stored electronically using distributed ledger technology or similar technology'. In the following, we will use the phrases tokens, digital assets, and crypto-assets interchangeably. Whilst this definition is open to many different interpretations, the main characteristic that classifies the token is the underlying 'value' and the stability established by it.[13] Similar to MiFID II, MiCAR differentiates between

crypto-assets that encompass an intrinsic monetary value, and those that do not necessarily do so. The different categories of tokens are electronic money tokens (EMTs), asset-referenced tokens (ARTs), or 'other crypto-assets', that is, any other token that does not fall under the first two categories. According to Art. 3(1)(7) MiCAR, EMTs are similar to electronic money and are mainly used for payments with their value purporting stability as they are coupled to an official currency. Tokens that are asset-referenced on the other hand are linked to real asset values like gold, rights, or official currencies and mixes thereof (Art. 3(1)(8)). The main category is other crypto-assets which encases all tokens that are not ARTs or EMTs, with a few further exemptions, as stated by Recital 18 MiCAR. Considering their standing in MiCAR, their importance is underlined by being mentioned in Title II.

For our analyses, we assume that VCCs or in certain cases, their underlying climate actions, are the value of the tokens. As these are not official currencies by any definition,[14] they are not to be classified as EMTs and therefore Title IV MiCAR does not apply.

As VCCs could be an asset referenced to by a token, their tokenised version could possibly be an ART. For this to hold, the underlying VCC needs to be a value, a right, an official currency, or a combination thereof while not already being an EMT. The main difference to EMTs is the number of underlying assets and their possibility of combination. While there can only be one type of currency coupled to an EMT, ARTs can have multiple and different underlying values. Following this, VCCs could technically be categorised as a value as mentioned by MiCAR, because of their monetary value or their usage. But as their prices differ over time and in dependence on the applicable legislation, with some countries allowing the usage of VCCs in their cap-and-trade or carbon tax systems whereas others do not, they lack similarities to other assets underlying ARTs. The aforementioned assets are financial in nature, as they need to be able to hold a *stable* monetary value, such as official currencies, tangible and certain intangible assets, rights, or other crypto-currencies.[15] With ART, MiCAR mainly describes so-called stablecoins,[16] because of which Title III MiCAR most likely does not apply to VCC tokens.

The final category of MiCAR comprises other crypto-assets than EMTs or ARTs.[17] These can be described as the MiCAR category to encompass all tokens that should be regulated but are not or not as financial in nature as the other two.[18] Among other things, this term encompasses the already established currency and utility tokens. Security tokens, which are often mentioned alongside the aforementioned tokens, should be considered as tokenised securities and thereby fall under the provisions of MiFID II.[19] While the term currency token covers crypto-currencies such as Bitcoin and Ether, utility tokens 'only provide access to goods or services supplied by the issuer' (Art. 3(1)(9) MiCAR). With these utility tokens, the holders can collect or use the goods or services as laid out in the smart contract or an actual contract with the issuer. As VCCs embody the possibility or right to claim that a certain amount of emissions has been reduced or removed by another entity when they are retired, VCC to-

kens should embody the possibility to claim these reductions or removals have happened when they are burned. VCCs and their tokenised counterparts thus serve as evidence for their holders in some way, respectively. Since the claims are connected to a VCC, the underlying tokens should only enable the holder to back up these claims and not serve to enforce them against other persons or entities.[20] This may come from statements made by themselves or obligations allowing them to use VCCs to some extent.[21] The issuer merely acts as some sort of intermediary in these cases. VCC tokens can be classified as utility tokens if they are designed to be retired (or burned) and not as an investment option.[22] Hybrid cases are conceivable, in which a determination would be more difficult,[23] but as there is only a niche secondary market (as it is even more niche than the regular VCM), financial speculation should not be the main reason to buy VCC tokens. This can be up for change in the future, but as utility tokens are other crypto-assets under MiCAR and are therefore covered by Title II, critical cases, considering these hybrid tokens, will lead to the same regulation.

Thus, even if not considering the VCC as a good or service with the VCC token providing access to the VCC according to the legal definition set out by Art. 3(1)(9) MiCAR, VCC tokens can still be considered as other crypto-assets as established in Title II MiCAR. With regard to the obligations for entities wanting to offer VCC tokens or admit them to trading, the difference between utility tokens and other crypto-assets is almost negligible and only matters for a limited number of exempt cases and will be explained in the following.

b) Exemptions

As stated before, financial instruments, tokenised or not, fall under the regulations of MiFID II.[24] The same applies for different objects of other European legal acts that are mentioned by Art. 2(4) MiCAR. This encompasses (structured) deposits (b), funds (c), securitisation positions (d)[25], non-life or life insurance products (e),[26] pension products (f, g, h, i),[27] and social security schemes (j).[28] As VCCs do not fall under any of these definitions, these legal exemptions can be disregarded in the following analysis.

In accordance with Art. 2(3) MiCAR, regulations of MiCAR do not apply to crypto-assets that are unique and thus not fungible with other crypto-assets (NFTs).[29] Conversely, tokens need to be fungible to be relevant for the scope of MiCAR. Fungibility can be understood as the tradability of tokens with other tokens of their kind. While the term 'fungible' seems to be elusive to some extent,[30] the idea behind this exemption becomes clear in Recital 10 MiCAR: Tokens that are truly unique or backed by a truly unique asset cannot be traded fungibly considering their worth is subjective to their purchasers—just like art.[31] But according to MiCAR, NFTs, labelled as such, are not always NFTs in a technical sense, as most of them can be serialised or fractured into fungible assets. Serialised NFTs are fungible inside of their series. Whereas fractionalised NFTs are fungible inside of their fractionalisation. MiCAR regulations thus care for actual fungibility and not only claims of non-fungibility according to Recitals

10 and 11. This exemption is especially interesting considering the use case of VCC tokens. As more and more purchasers of VCCs are interested in the location and specific actions of the project developer who reduces or removes emissions, a sense of non-fungibility can be attributed to them.[32] If this non-fungibility holds, the MiCAR regime does not apply to these cases. This is where some non-fungibility designations of VCCs and VCC tokens fail, as most of them can at least be serialised. A distinctive tree farm in a specific forest holds a wide array of trees and delivers co-benefits to certain areas, workers, and communities around them. As every tree is unique in the way it can sequester CO_2e, depending on its specific kind, growth, and location, there are possibilities to either serialise different tree groups into fungible tonnes of CO_2e or to fractionalise the whole output (or rather intake) of the tree farm into fungible units of CO_2e. Further recommendations for the exemption of NFTs according to Art. 2(3) MiCAR were made by the European Banking Authority (EBA) and the European Securities and Markets Authority (ESMA) in accordance with Art. 142(2)(d) MiCAR.[33]

With the differentiation of true non-fungibility and fungibility laid out by MiCAR, the markets in crypto-assets get new guidelines considering the NFT bubble a few years ago. At least some of these NFTs should fall under either serialised or fractionalised NFTs, becoming fungible through the lens of MiCAR. For VCC tokens, this has to be considered on a case-by-case basis.

c) Obligations for offerors of crypto-assets and persons seeking admission to trading regarding VCC tokens

As we stated, VCC tokens can be considered as other crypto-assets (or in a few cases as utility tokens) specified by MiCAR. Title II (Art. 5–15 MiCAR) is therefore crucial for the regulation of their issuance. To comply, there are several steps an entity (offeror or person seeking admission to trading) has to take to either be able to offer the crypto-asset or to admit the crypto-asset to trading. There are a few differences between these two options regarding VCC tokens, which we will be looking at in the following.

aa) Offering a VCC token

According to Art. 4 MiCAR, the offeror of a crypto-asset has obligations to fulfil before he is allowed to offer any kind of other crypto-asset. The term ‘offeror’ is defined as ‘a natural or legal person, or other undertaking, or the issuer, who offers crypto-assets to the public’ (Art. 3(1)(13) MiCAR), and is broader than the term ‘issuer’, which refers only to those who issue the crypto-assets (Art. 3(1)(10) MiCAR). Disclosure requirements thus need to be fulfilled by the offerors (in the secondary market) and not only by the issuers (in the primary market).[34] These obligations are largely identical to those the entity must fulfil if it wishes to have its crypto-assets admitted to trading. Firstly, it has to be a legal person by the standards of EU law (a) and needs to work out a so-called crypto-asset white paper, notify to the national competent authority (NCA), and publish it (b–d). Furthermore, he may draft marketing communications and publish them in

accordance with Art. 7 and 9 MiCAR (e, f). Lastly, he has to fulfil further obligations laid out in Art. 14 MiCAR, which deal with his commitment to transparency towards the potential purchasers and asset-holders. The white paper mentioned by MiCAR aims to mitigate the information asymmetries on the basis of the relationship between the entities obliged to publish it and possible holders. It is vastly different to any technical or other existing white paper before MiCAR came into force, which only explains the most basic information concerning the respective crypto-asset and is usually not standardised and therefore also misses mandatory contents.[35]

These obligations only come (partly) in effect for token offerings of a specific size and in accordance with their specific use case. If the crypto-asset is offered to less than 150 natural or legal persons per Member State (Art. 4(2)(a) MiCAR), the total consideration of the offer to the public does not exceed EUR 1,000,000 in respective currencies or crypto-currencies in the EU over the period of twelve months (b) or is only aimed at qualified investors as defined in Art. 3(30) MiCAR in connection with Annex II of MiFID II (c) no white paper has to be drafted and their marketing communications do not need to be published. This also has to be determined on a case-by-case basis for VCC tokens.[36]

The other exemption is connected to the specific use case of the crypto-asset in accordance with Art. 4(3)(a–d) MiCAR. If the offering of the asset is free ('airdrops'; a), the token acts as a reward for the maintenance of the DLT (b), the token is a utility token connected to a good that already exists or a service already in operation (c), or, if the holder has the right to exchange the token for goods and services only in a limited network of merchants contractually connected to the issuer (d), Title II MiCAR does not apply, as there is simply no consideration or investment character involved.[37] Classifying VCC tokens as utility tokens can lead to an exemption in connection with Art. 4(3)(c) MiCAR, in case the underlying VCC or climate action were to be considered a good or service already in existence or in operation—marking the special standing of utility tokens mentioned before. It is worth noting that none of the aforementioned exemptions are applicable, if the offerors or persons acting on their behalf communicate that they are seeking admission to trade these tokens in any way (Art. 4(4) MiCAR).

As VCC tokens are most likely purchased, only points (c) and (d) could be of relevance. As is sometimes the case, traditional and non-digital VCCs are connected to VCC tokens ('bridging')[38] on a blockchain (or via smart contracts). In this instance, the VCC token could be seen as the legal right to retire specific VCCs.[39] Confirming these VCCs as a good that already exists or a service that is in operation, their connected VCC token issuers would be exempted from the obligations of Title II. Considering the nature of VCCs, as not all of the reductions or removals have already completely taken place (e.g., tree farms can be destroyed—releasing all CO_2e back into the air), classification difficulties could arise as some of the 'goods' or 'services' exist, and some do not.[40] Alternatively, if VCCs are native on the blockchain, then the exemption would be more complicated to apply considering that the activities behind a VCC cannot easily be considered as a 'good existing' or a 'service in operation'.

If not exempted via point (c), both kinds of VCC tokens, bridged and native ones, could still be exempted according to point (d). As the underlying value of the VCC token stems from the possibility of claiming the existence of their CO_2e-reductions or -removals and not from claims against the offeror or the project developer (or other persons inside of a limited network), the usage of these assets is not necessarily limited to a specific network. Meanwhile, actions concerning the handling and eventually the burning of VCC tokens can only take place in the offeror's contractual network. The same holds true for the possibility of re-trading bridged VCC tokens into VCCs. Taking the limitation, the prerequisites for an exemption according to Art. 4(3)(d) MiCAR could still be present but would have to be evaluated case-by-case for specific VCC tokens. In this case, the question of exemption is determined by how the transaction and burning processes take place exactly (or how the specific smart contracts work). These processes could possibly stay inside or happen outside of the limited network of the offeror according to point (d). If certain emission systems allow for the use of VCCs and VCC tokens in a legal matter, the contractual network will no longer be limited to the offerors.

According to Art. 4(4) MiCAR, no exemptions are applicable if the offeror makes any communications regarding the admission of these crypto-assets to trading. As one of the main considerations for the tokenisation of VCCs is optimising the VCM's abilities to scale,[41] this should mostly be the case. Nevertheless, it is possible to structure VCC tokens in a way that exempts them from the regulatory scope of creating a white paper in the sense of MiCAR.

bb) Seeking admission to trading of VCC tokens

If a VCC token is to be traded, the entity must fulfil the obligations set out in Art. 5(1) (a–g) MiCAR, which are analogous to those in Art. 4(1)(a–g). There are no exemptions other than those laid down in Art. 5(4) MiCAR for crypto-assets that have already been admitted to trading on another trading platform within the EU (a) and for crypto-asset white papers that have been drawn up in accordance with Art. 6 (b) MiCAR. An offeror who desires their VCC tokens to be traded is therefore required to draft all the necessary documents.

d) Obligations of the offeror of crypto-assets

In the event that the offeror is obliged to fulfil the requirements of Title II MiCAR, it is necessary for him or them to draft and publish a crypto-asset white paper and to notify the NCA. A crypto-asset white paper shares several characteristics with a prospectus for securities.[42] Even though, the exact legal requirements differ in certain aspects, for example, white papers do not have to be authorised in accordance with Art. 20(1) of the Prospectus Regulation. Art. 6, 8, and 9 MiCAR, in conjunction with Annex I MiCAR, elucidate the information that must be included in the white paper. Moreover, the white paper serves as an official standardised information docu-

ment,[43] a function that was not necessarily inherent to such documents prior to MiCAR.[44]

The white paper must include a preliminary statement of missing approval by any competent authority within the EU (Art. 6(3) MiCAR), furthermore, a summary that cautions against its own summarising function (Art. 6(7)(a) MiCAR), an indication of this statement's value in comparison to the entire white paper (b), the absence of connections to financial instruments (c), and a differentiation between the white paper and a regular prospectus (d).

As a prerequisite, the white paper must contain all relevant information about the offeror and, if applicable, also information concerning the issuer of the crypto-asset and the operator of the trading platform in cases where the platform draws up the crypto-asset white paper (Art. 6(1)(a–c) MiCAR). Furthermore, the crypto-asset project, the offer or the admission to trading itself, and the crypto-asset with its rights and obligations attached have to be defined specifically (d–g).

Finally, the technology underlying the crypto-asset, the risks associated with it, and the potential adverse effects of the consensus mechanism used must be provided (h–j). All of the aforementioned points must be presented in a concise manner and shall not be misleading (Art. 6(2) MiCAR). The crypto-asset white paper must not contain any assertions about the future value of the crypto-asset (Art. 6(4) MiCAR).

It is imperative to establish clarity regarding the crypto-asset, which may lose its value (Art. 6(5)(a) MiCAR), transferability (b), liquidity (c), or exchangeability against goods (d) and that there is no compensation or guarantee system in place (e, f). The white paper should be structured in a coherent manner (Art. 6(8) MiCAR), written in an official language of the home Member State or in a language that is customary in the sphere of international finance (Art. 6(9) MiCAR), and presented in a machine-readable format (Art. 6(10) MiCAR). In this way, the white paper becomes a crucial source of information regarding the crypto-asset in question. ESMA has developed a proof of concept for white paper creation, delineating the essential components of such documents in a structured manner.[45]

This is consistent with the fundamental premise of how VCCs should be used in the EU: In the wake of numerous allegations of greenwashing, prospective purchasers of VCCs have expressed a keen interest in acquiring a clear understanding of the assets that they are purchasing.[46] Given that these are currently largely unregulated, it is important that at least their tokenised counterparts are holistically structured and regulated.

In the event of a misleading white paper, the offerors, individuals seeking admission to trading, or even operators of trading platforms may be held liable (Art. 15 MiCAR). Analogously to the prospectus regulation, their liability should be assumed with a crypto-asset holder of average (crypto-)understanding.[47] The liability is considered to be indefinite as it is not stated otherwise, as the vagueness of Art. 15(1) MiCAR in terms of its liability statutes necessitates referral to other sources for interpretation.[48]

The information presented in the white paper is required to be complete, fair, clear, and not misleading. Any infringement of these criteria may result in liability. This is a notable aspect of MiCAR, as it directly established a liability clause in EU regulatory law.[49]

In the event of the drafting of a white paper, the offeror, person seeking admission to trading, or operators of trading platforms for crypto-assets are required to notify the NCA of their home Member State in accordance with Art. 8 MiCAR. The notifying entities are required to state the reasons why the crypto-asset is not to be considered as an ART, EMT, or any other instrument mentioned in Art. 2(4) MiCAR.

The notification process for a white paper includes the provision of information pertaining to the entity's operational domains within the EU Member States, the date of publication of the white paper, and the commencement date for the offer. Following the completion of this step, the white paper has to be publicised on the entity's website prior to the offering as outlined in Art. 9 MiCAR.

This is particularly relevant in the case of VCC tokens, where offerors, those seeking admission to trading, and operators of trading platforms may wish to communicate the value, considering any co-benefits or competitive advantages over traditional and non-digital VCCs and other VCC tokens. In doing so, the relevant entities are required to comply with the regulations set out in MiCAR; failure to do so may result in far-reaching legal consequences as outlined in Art. 15 MiCAR. Marketing communications must also be duly notified and published in a manner consistent with the white paper. Any alterations to the crypto-asset must be considered in the context of the white paper and the marketing communications. Changed attributes can establish an obligation to modify and notify any differences in the relevant documents to the NCA (Art. 12 MiCAR).

Furthermore, Art. 13 MiCAR establishes a right of withdrawal for retail holders of crypto-assets against the offeror or a crypto-asset service provider (CASP) for a period of 14 days with regard to transactions involving crypto-assets. Retail holders are defined in Art. 3(1)(37) MiCAR as natural persons acting outside of their trade, business, craft, or profession—meaning only small purchasers. It should be noted that this does not apply to cases in which the crypto-asset has already been admitted to trading, due to the reasonable consideration of price fluctuations.[50]

Subsequent to this triad, offerors, persons seeking admission to trading, and operators of trading platforms are permitted to offer or admit their crypto-assets to trading in the entire EU, without further information obligations in accordance with Art. 11 MiCAR. However, these rights are accompanied by additional obligations connected to activities related to crypto-assets. These obligations encompass the requirement to always act honestly, fairly, and professionally (Art. 14(1)(a) MiCAR), not in a misleading manner (b), in the best interest of the holders (c), and according to security standards upheld by the EU (d).

e) Crypto-asset service providers

Following the summary of the rights and obligations of offerors and persons seeking admission to trading for VCC tokens, the focus will now be turned towards entities that may be interested in offering services regarding these crypto-assets. These CASPs are obligated to fulfil certain requirements in order to operate within these ecosystems (Title V MiCAR). The term CASP is defined in Art. 3(15) MiCAR as

> a legal person or other undertaking whose occupation or business is the provision of one or more crypto-asset services to clients on a professional basis, and that is allowed to provide crypto-asset services in accordance with Article 59 [MiCAR].

This is followed by an enumeration of the various types of crypto-asset services, set forth in Art. 3(16) MiCAR, with further details being laid down in the following paragraphs. Crypto-asset services are all services surrounding crypto-assets: The custody and administration of crypto-assets (a), the operation of a trading platform (b), the exchange of crypto-assets for funds (c) or other crypto-assets (d), the execution of orders on behalf of clients (e), the placement of orders (f), the reception and transmission of orders on behalf of clients (g), the provision of advice (h), portfolio management (i), and transfer services on behalf of clients (j). Any entity contemplating the provision of one or more of these services is obligated to obtain a requisite authorisation, as stipulated in Art. 59–65 MiCAR.

aa) Authorisation of crypto-asset service providers

In order to become authorised in accordance with Art. 59 MiCAR and start operating as a CASP, legal persons or other undertakings need to submit an application to the NCA in their home Member State. In accordance with Art. 62(2) MiCAR, such entities have to provide the NCA with their contact data (a), legal form (b), articles of association (c), a description of their governance arrangements (f), the members of their management body (g), stakeholders or members with direct or indirect qualifying holdings (h), and proofs of their good repute and (collective) knowledge, respectively, including the absence of any criminal records referring to financial crimes or penalties imposed under the applicable commercial law (Art. 62(3) MiCAR). Furthermore, they are required to present a programme of operations, setting out the specific crypto-asset services they intend to provide (d), along with substantiated evidence that they are capable of fulfilling the mandatory security requirements, including prudential safeguards, internal control mechanisms, technical documentation of information and communication technology (ICT) and security systems, and detailed descriptions of their client fund segregation procedures and complaints-handling mechanisms (e), (i), (j), (k), and (l). Finally, they are required to specify the Member State in which they intend to provide their services, and whether they plan to offer any of the specific services listed in Art. 3(1)(16) (m–r) MiCAR.

Subsequent to the submission of an application, the NCA is obliged to notify the applicant within five working days of its receipt. The assessment of the application's completeness is to be conducted within a time span of 25 working days, with the NCA having the possibility to request further information if need be (Art. 63(1) and (2) MiCAR). Following the verification of additional safeguards by the NCA (Art. 63(6) MiCAR), the NCA evaluates the application and communicates its determination of approval or rejection. The application is to be refused according to Art. 63(10)(a–d) MiCAR under any of the following circumstances: Entities having direct or indirect influence on the applying CASP do not fulfil or can be expected not to fulfil their requirements (a–c); or the CASP does not fulfil any further requirement enacted on them (d).

The application process to become a CASP can be streamlined for established financial institutions (Art. 60 MiCAR). This is due to the fact that these entities have already been approved under other EU regulations, resulting in a shorter list of information needing to be submitted to the NCA, as most of the influential entities in these institutions are already considered trustworthy.

The authorisation of CASPs may be withdrawn or partially withdrawn by the NCA if they have been inactive for a period of nine months (Art. 64(1)(c) MiCAR), have not made use of their authorisation for a period of twelve months (a), or have expressly renounced it (b). In addition, in the event of irregular acquisition of the authorisation (d) or breach of the safeguards laid out by MiCAR and/or other legislation (Art. 64(1)(e–g), (2)), the NCA may also withdraw the authorisation.

Once authorised, CASPs are permitted to provide their services in their home Member State or in any other Member State of the EU in accordance with Art. 65 MiCAR. The provision of these services entails the fulfilment of general and specific obligations, which are outlined in the following section.

bb) Obligations for all crypto-asset service providers

When operating, CASPs must generally act honestly, fairly, and professionally in the best interests of their clients. This includes transparency regarding information, marketing communications, risks, pricing policies, and the possible adverse environmental impact of consensus mechanisms (Art. 66 MiCAR) as well as prudential safeguards (Art. 67 MiCAR). The management body and directly or indirectly influential stakeholders or members must be of sufficiently good repute and have appropriate knowledge, skills, and experience. This has to be on an individual and collective basis. They must also be free of convictions for financial crimes, including money laundering and terrorist financing. It lies within the CASP's responsibility to ensure that these conditions are met and that compliance with other European legislation is maintained (Art. 68 MiCAR).

The NCA must be notified of any changes in the management body (Art. 68 MiCAR). In the event of insolvency, the crypto-assets themselves and, in the case of

'other crypto-assets', the ownership rights of clients must be safeguarded (Art. 70(1) and (2) MiCAR). This means that the crypto-assets are only allocable to the clients' and not to the CASPs' capital.[51] The resolution of client complaints and the management of conflicts of interest must be conducted in accordance with clearly defined policies and templates that are accessible to relevant stakeholders (Art. 71 and 72 MiCAR).

CASPs are allowed to outsource services and activities to third parties, provided that they remain responsible and comply with the provisions of MiCAR (Art. 73 MiCAR). This must be documented in a contractual agreement with the outsourcing partner in a cooperative relationship with the NCA (Art. 73(3) and (4) MiCAR).

To carry out specific crypto-asset services in connection with Art. 75–82 MiCAR, CASPs must comply with additional specific regulations. These crypto-asset services are tiered into three classes (Annex IV MiCAR) pertaining to the minimum capital requirements in Art. 67(1)(a) MiCAR. While the operation of a trading platform (Art. 76 MiCAR) requires an amount of EUR 150,000 (Class 3), the provision of custody and administration and the exchange of crypto-assets, either for funds or for other crypto-assets (Art. 75 and 77 MiCAR) require EUR 125,000 and every other crypto-asset service (Art. 78–82 MiCAR) requires EUR 50,000 as minimum capital. This is closely connected to an underlying risk assessment.[52] These specific crypto-asset services are briefly introduced in the following sections.

cc) Provision of custody and administration of crypto-assets on behalf of clients

Pursuant to Art. 75 MiCAR, the provision of custody and administration of crypto-assets on behalf of clients, constitutes a specific crypto-asset service. 'Custody and administration' are defined in Art. 3(17) MiCAR as 'the act of safekeeping or controlling [...] crypto-assets or the means of access to such crypto-assets, where applicable in the form of private cryptographic keys'. In order to provide these services, the CASP and its clients must reach an agreement on the main points listed in Art. 75(1)(a–g). The CASP must maintain a registry to keep track of all their clients' rights to crypto-assets and their movements and facilitate the exercise of their clients' rights (Art. 75(2) and (4)).

In order to ensure the security of their clients' crypto-assets, CASPs must implement custody policies, provide information regularly and upon request, and establish systems to return crypto-assets as soon as possible (Art. 72(3), (5) and (6) MiCAR). CASPs have to keep their clients' crypto-assets separate from their own (Art. 75 (7) MiCAR). In addition, clients must be informed and give their consent before the CASP uses other CASPs to ensure the continued protection of their assets (Art. 75(9) MiCAR). CASPs may be held liable to clients in the event of a loss of crypto-assets or the means of accessing those assets, if an incident is deemed to be attributable to them, establishing a possibility to claim these losses on the clients' side. (Art. 75(8) MiCAR).

Companies, as a target customer group for VCC tokens, will have an interest in not handling their tokens themselves due to the costs involved. Rather, it is more

likely that the custody and management of VCC tokens will become a widely used service, with CASP omnibus wallets and private keys linked to the company holding the tokens. Given the growing concern in the EU about the transparency of sustainability reporting and the drive to avoid any allegations of greenwashing, it is paramount that the VCC tokens remain accessible to the company at all times. The established liability will serve as a further safeguard for companies interested in VCC tokens.

dd) Operating a crypto-asset trading platform

Another example of a specific CASP is that of a crypto-asset trading platform operator. The act of operating a crypto-asset trading platform warrants a significant degree of responsibility for all customers engaged in trading activities on the platform. This crypto-asset service is similar to a multilateral trading facility (MTF) according to MiFID II and serves—in connection with the trading of crypto-assets (Art. 3(1)(19) and (20) MiCAR)—as a means to connect multiple sellers and buyers of crypto-assets.[53] The definition in Art. 3(1)(18) MiCAR is as follows:

> [T]he management of one or more multilateral systems that bring together or facilitate the bringing together of multiple third-party purchasing and selling interests in crypto-assets in the system and in accordance with its rules, in a way that results in a contract, either by exchanging crypto-assets for funds or by exchanging [...] for other crypto-assets.

Unlike in the case of Art. 75 MiCAR, CASPs do not have to engage in any contractual obligations with buyers according to Art. 76 MiCAR. Instead, Art. 76 MiCAR outlines the rules that CASPs must implement to ensure the fair and operational trading of crypto-assets in the language of their home Member State (Art. 76(1)(a–h) and (4) MiCAR). CASPs are also required to establish criteria for the exclusion of crypto-assets that may be used for illicit or fraudulent activities or that allow for the complete anonymisation of transactions (Art. 76(2) and (3) MiCAR). It should be noted that CASPs themselves are excluded from trading on their own platform, except in cases where they engage in matched principal trading (Art. 3(1)40 MiCAR in conjunction with Art. 4(1)(38) MiFID II). In such cases, they may act as the facilitator without financial benefit, provided that the clients have consented. Such matched principal trades have to be reported to the NCA (Art. 76(5) and (6) MiCAR). Transactions must be settled on the distributed ledger within 24 hours (Art. 76(12) MiCAR).

To ensure transparency, CASPs are required to make all bids and offers public on their website in a non-discriminatory manner. Furthermore, this must include the depth of trading interest and information on the price, volume, and time of transactions (Art. 76(9–11) MiCAR). Fee structures for transactions must be designed in a transparent, fair, and non-discriminatory manner so as to remove any incentive to place, modify, or cancel orders (Art. 76(13) MiCAR).

CASPs have to ensure that their systems are effective in terms of technical resilience and prevention of fraudulent behaviour, even under stress (Art. 76(7)(a–f)

MiCAR). They must be able to report to the NCA at any time, in particular in cases of market abuse, and keep records of all orders in crypto-assets for at least five years (Art. 76(8), (14), and (15) MiCAR). ESMA has established regulatory technical standards for the public display of the content of paragraphs (1), (9), and (10) and the presentation of the relevant data in paragraph (15) to the NCA on 3 July 2024 (Art. 75(16) MiCAR).[54]

Given that the majority of transactions in the VCM are currently conducted via over-the-counter (OTC) purchases facilitated by market participants, it is not implausible that new trading platforms for VCCs and especially for VCC tokens may emerge in the future. In light of the significant adverse selection problem arising from underlying information asymmetries,[55] which may be exacerbated by the additional layer of tokenisation, transparency obligations for trading platforms are particularly important. Establishing full transparency can be a first step to the prevention of market abuse.

With this long list of obligations to be met by CASPs and clients alike, operational and secure trading platforms can be established, which may help scale the (tokenised) VCM itself.

ee) Exchange of crypto-assets for funds or other crypto-assets

The exchange of crypto-assets for funds or other crypto-assets is defined in Art. 3(1) (19) and (20) MiCAR as 'the conclusion of purchase or sale contracts for crypto-assets with clients for funds [or "other crypto-assets"] using proprietary capital'. CASPs wishing to offer these services must adopt a non-discriminatory commercial policy with regard to the selection of their clients (Art. 77(1) MiCAR). The CASP shall publish a fixed price for the crypto-asset or the method for determining the price and any applicable limit set by the crypto-asset service provider on the amount to be exchanged (Art. 77(2) MiCAR). Orders shall be executed at the price displayed at the time of order (Art. 77(3) MiCAR) and information analogous to those of trading platforms in Art. 76(10) MiCAR (volume and prices of trades executed by the CASP) shall be publicly disclosed (Art. 77(4) MiCAR).

In conclusion, this obligation contributes to the development of new markets for VCC tokens and thus the whole VCM. Art. 77 MiCAR helps in establishing a fair exchange platform for VCC tokens to be traded for funds or other crypto-assets. In the future, trading unburned VCC tokens back into funds to use in other endeavours could be an important aspect of the VCM. Fair and level opportunities for all participants are the baseline for establishing and scaling the (secondary) market.

ff) Execution of orders for crypto-assets on behalf of clients

As defined in Art. 3(21) MiCAR, the execution of orders for crypto-assets on behalf of clients means 'the conclusion of agreements, on behalf of clients, to purchase or sell one or more crypto-assets or the subscription on behalf of clients for one or more crypto-assets, and includes the conclusion of contracts to sell crypto-assets at the moment of their offer to the public or admission to trading'. Similar to Art. 77 MiCAR,

this covers a service on behalf of clients that, in this case, facilitates purchases and sales in the field of crypto-assets. CASPs wishing to provide such services are required to act in the best interests of their clients. This includes considerations of price, cost, speed, likelihood of execution and settlement, size, nature, custody conditions, and any other aspects relevant to the execution of the order in crypto-assets, unless the client gives contrary instructions (Art. 78(1) MiCAR).

In order to achieve the objectives set out in paragraph (1), it is necessary to establish and implement effective execution arrangements. These arrangements must be designed to ensure that the objective is achieved in a prompt, fair, and expeditious manner and in a manner that abuse is prevented (Art. 78(2) MiCAR). CASPs must provide appropriate and clear information regarding paragraph (2) and any changes thereto (Art. 78(3) MiCAR). The execution policy must be made available to clients or the NCA on request (Art. 78(4) MiCAR) and its effectiveness must be monitored by the CASP in order to identify any possible shortcomings (Art. 78(6) MiCAR). Clients must be duly informed and subsequently give their consent, before orders may be executed off-exchange (Art. 78(5) MiCAR).

The aim of Art. 78 MiCAR is to facilitate a process in which companies can commit to buying or selling VCC tokens, while ensuring that CASPs act in their best interests. The obligations set out by Art. 78 MiCAR are particularly significant for companies lacking expertise in DLT, tokenisation, or crypto-assets, as they help foster confidence in the process of buying or selling VCC tokens. Thus, they do not need to employ experienced DLT traders themselves to participate in the VCC token market but can still expect to receive the exact kind and amount of VCC tokens (or money) that meets their objectives. Furthermore, the possibility of establishing a subscription-like service can be of use for enterprises offsetting emissions that cannot feasibly be reduced.

gg) Placing of crypto-assets

Placing a crypto-asset according to Art. 3(22) MiCAR means 'the marketing [...] of the crypto-asset to purchasers' on behalf of an offeror. Contrary to Art. 77 and 78 MiCAR, this crypto-asset service is enacted on the supplier side. In order to place crypto-assets, CASPs must first enter into an agreement with a prospective offeror or person seeking admission to trading. This agreement must cover several key aspects, including the type of placement, the amount of transaction fees, the expected timing, process, and price, and the targeted purchasers. In the absence of such an agreement, CASPs are prohibited from placing crypto-assets (Art. 79(1)(a–d) MiCAR).

In addition to the rules on conflicts for all categories of CASPs in Art. 72(1) MiCAR, CASPs intending to place crypto-assets must also address conflict issues in their rules (Art. 79(2)(a–c) MiCAR).

The placement of crypto-assets could become an important undertaking for project developers in the traditional VCM space, who lack proper knowledge of DLT and crypto-assets, but still want to place their tokenised VCCs. CASPs operating in this

space can facilitate the placement of these VCC tokens on behalf of project developers, further developing the digitalised ecosystem. It is crucial for project developers to work closely with CASPs at this stage, as they are possibly entering a completely new market with no best practices as a guideline other than the regulations of MiCAR.

hh) Reception and transmission of orders for crypto-assets on behalf of clients

Whenever a CASP acts on behalf of either side as an intermediary between the purchaser and the seller of crypto-assets, it offers the service of receiving and transmitting orders in accordance with Art. 3(23) MiCAR. Such orders can either occur as one-time purchases or in the form of a subscription model.

Pursuant to Art. 80 MiCAR, these specific CASPs must establish and implement procedures and arrangements to ensure the prompt and proper transmission of client orders (Art. 80(1) MiCAR). To ensure objectivity (Art. 80(2) MiCAR), they are prohibited from receiving any form of remuneration, discount, or non-monetary benefit when routing orders to specific trading platforms. They are also required to refrain from misusing any information relating to pending client orders and to take reasonable steps to prevent their employees from doing so (Art. 80(3) MiCAR).

This crypto-asset service is similar to the execution of orders for crypto-assets, but in this case, these executions are carried out by a third party.[56] The CASP can act as an intermediary, either on the side of the client interested in purchasing VCC tokens, or on the side of the client wishing to sell, in a specific market of other CASPs or with the execution carried out by other CASPs.

In particular, small companies or even individuals without sufficient knowledge or experience who wish to offset through the use of VCC tokens can benefit from these CASPs. The CASPs themselves are obliged to act fairly, without accepting any or following any incentives from the other party or trading platforms regarding their routing, and to support their clients in their endeavours.

ii) Providing advice on crypto-assets and providing portfolio management of crypto-assets

Both the provision of advice on crypto-assets and the management of crypto-asset portfolios on behalf of clients are regulated in Art. 81 MiCAR. While the provision of advice may be considered a secondary service, the active management of client portfolios represents a more principal service of CASPs.

The term ‘providing advice’ is defined as ‘offering, giving, or agreeing to give personalised recommendations to a client, either at the client’s request or on the initiative of the [CASP]’ (Art. 3(24) MiCAR). The management of portfolios ‘means managing portfolios in accordance with mandates given by clients on a discretionary client-by-client basis’ (Art. 3(25) MiCAR).

A so-called suitability assessment has to be a feature of both services (Art. 81(1) MiCAR), which bears a strong similarity to the suitability assessment enforced by

MiFID I for financial instruments.[57] CASPs must assess their clients' knowledge, experience, investment objectives, risk tolerance, and financial situation, including their ability to bear losses. They must also implement appropriate policies and procedures to inform their clients of the results of the suitability assessment (Art. 81(8) and (10) MiCAR). In addition, they are required to carry out assessments of their clients on a regular basis (Art. 81(12) MiCAR).

Where CASPs intend to provide advisory services, they are obliged to inform prospective clients in a timely manner of the extent to which their services are independent from third parties and the scope and depth of the advice to be provided (Art. 81(2) MiCAR). As a general rule, they have to inform their clients of all costs and charges associated with the advice they provide (Art. 81(4) MiCAR). If they claim to act independently, they must also draw from a sufficient range of crypto-assets available on the market, which must be adequately diverse and not provided by that same CASP, and may not accept or retain any fees from any third party or any person acting on behalf of a third party in relation to the provision of the service to clients (Art. 81(3)(a) and (b) MiCAR).

In addition to the suitability assessment mentioned above, CASPs managing portfolios on behalf of clients must ensure their independence by not accepting or retaining any fees, commissions, or other benefits from any entity related to the service (Art. 81(5) MiCAR). They must also provide their clients with regular updates on their portfolios at intervals of no more than three months, except if a client has access to the information through an online system (Art. 81(14) MiCAR).

Both of these categories of CASPs must warn their clients of the risks associated with changes in value, potential losses, and illiquidity of the crypto-asset (Art. 81(9)(a–e) MiCAR). In addition, they are prohibited from recommending crypto-assets or crypto-asset services to their clients and from commencing the provision of associated portfolio management until the suitability of the crypto-assets and/or services has been determined or decided against (Art. 81(11) MiCAR).

With regard to services related to VCC tokens, advice may be of particular value to companies that wish to acquire VCC tokens as part of their sustainability agenda without having sufficient knowledge.[58] In addition, portfolio management is a potential avenue for CASPs seeking to provide an integrated solution for the use of VCC tokens. In either case, CASPs need to obtain and review all relevant information regarding the suitability of various VCC tokens or services related to them in order to further their clients' objectives. By providing regular updates on their advice or portfolios, companies can use this information for their sustainability reporting, particularly if the CASPs already have expertise in the sustainable management of VCCs or VCC tokens.

jj) Placing transfer services for crypto-assets on behalf of clients

The final category of specific CASPs in Title V, Chapter 3 MiCAR refers to CASPs that facilitate transfer services on behalf of their clients. They are defined in Art. 3(26)

MiCAR as 'providing services of transfer, on behalf of a natural or legal person, of crypto-assets from one distributed ledger address or account to another'. In essence, they move crypto-assets to different blockchain addresses for their clients.[59]

In order to provide these services, an agreement must be concluded with the client, setting out the duties and responsibilities of the service provider (Art. 82(1)(a–d) MiCAR). Given the relatively simple nature of the service, the agreement referred to in paragraph (1) is the only requirement. According to paragraph (2), ESMA, in cooperation with EBA, was responsible for issuing additional guidelines on procedures, policies, and the delineation of client rights in the context of transfer services, which they have done on 17 December.[60]

Providing the management of transactions from a company's address is a very basic crypto-asset service that a CASP could offer and thus will most likely be coupled to further crypto-asset services. Companies will need to work out efficient and beneficial arrangements with these CASPs to keep the right VCC tokens in their 'possession', especially if they are already retired (if they are still tradable at this point) to keep them accountable in any voluntary or even compliance schemes.

f) Other European legislation on VCC tokens

As VCCs and VCC tokens can be used for the same purposes, it is possible to burn VCC tokens to claim that CO2e has been reduced or removed. This may be covered by some of the European legislation that has been enacted or is in the proposal stage. As the primary use case is the act of making environmental claims in relation to the production of goods or the provision of services, the EU has provided clear guidance on how to make reliable environmental claims. Directives such as the Corporate Sustainability Reporting Directive (CSRD)[61] and the Consumer Empowerment Directive (CED)[62] indicate that the EU intends to impose tighter restrictions on companies claiming to be 'climate neutral'.

The CSRD amended the Accounting Directive[63] to extend its scope to a wider range of companies. It also added the need for sustainability reporting by subjected companies on their impact on the environment and the impact of the environment on their business activities, respectively. It added Art. 19a and 29a Accounting Directive, mandating entities of public interest to report on their sustainability issues. With the support of a delegated regulation enacted through Art. 1(8) CSRD and its established European Sustainability Reporting Standard (ESRS),[64] the companies concerned are required to comply with a table of rules to draft their sustainability reporting. The reports need to be clearly defined in order to avoid any misrepresentation of information to (potential) stakeholders. The ESRS contains a set of rules defining the usage of CO_2e offsetting, which addresses VCCs and VCC tokens as forms of offsetting. Paragraph (61) of the ESRS E1 requires companies making public claims of CO_2e neutrality to explain how these claims are linked to emission reduction targets (a), whether and how the reliance on VCCs hinders their target to become net zero (b), and how they ensure the integrity of

the VCCs used (c). Companies will have to separate their emission reduction pathways from their use of VCCs to ensure compliance with their neutrality targets.

The CED is a competition law measure aimed to ensure fair competition through empowering consumers to hold companies liable for unlawful 'environmental claims' as defined in Art. 1(1)(b) CED. It amends the Unfair Commercial Practices Directive (UCPD)[65] to provide a legal definition of 'environmental claim' that is accessible to competition law. In the context of the ESRS, environmental claims relating to the inappropriate use of VCCs may result in significant penalties under competition law.

The definition of environmental claims will be further clarified by the Green Claims Directive (GCD),[66] which is currently in the proposal stage. In particular, Art. 3 (h) GCD will require companies to justify any explicit environmental claim in terms of the separation and clear definition of the offsetting and thus VCCs and VCC tokens used in such claims. Therefore, all VCCs used to achieve net-zero commitments must be fully documented and explained when used for marketing statements.

Another important piece of legislation is the Carbon Removal and Carbon Farming Regulation (CRCF),[67] which was adopted on 27 November 2024. Although the CRCF primarily focuses on one specific type of VCCs, removal credits, it nevertheless aims to establish a framework for the certification of high-integrity (removal) VCCs. The potential use of high-integrity removal credits in the EU ETS has also been considered and is addressed in Recital 4 CRCF. It is clear that a significant amount of documentation will be required to maintain the integrity of these removal credits.

Likewise, the potential utilisation of high-integrity VCCs in the European Carbon Border Adjustment Mechanism (EU CBAM) may only be possible with sufficient documentation.[68]

As we have briefly described, a short analysis of the various European legal acts relating to VCCs reveals a clear need for high-integrity and well-documented VCCs. In relation to VCC tokens, it is possible to create them in a way that prevents any subsequent changes to their inputs and to finalise transactions relating to them—this includes creation, trading, and burning. As long as there are VCCs that comply with these regulations to some extent, tokenisation can help in maintaining their integrity while increasing their availability by scaling tradability, improving transparency, and ensuring immutability to a certain extent. For anything happening before the creation of the VCC token, other processes ensuring the quality of the underlying VCC or climate action have to be in place. Tokenisation can help in some aspects, but it is not a comprehensive solution for all problems of the VCM.

II Comparison of non-European regulatory approaches with the European regulatory framework

In view of the extensive nature of the provisions of MiCAR, it is important to consider other legal frameworks that may also be applicable to VCC tokens.

1 Regulation of VCC tokens in the USA

In the USA, the financial regulatory system is divided between two main institutions: The Securities Exchange Commission (SEC) and the Commodity Futures Trading Commission (CFTC). The SEC oversees securities, while the CFTC is responsible for commodities and their derivatives. As VCC tokens, and crypto-assets in general, are not explicitly defined as one or the other, the institutions are in a competitive relationship over the regulatory scope.

The SEC works with the definition of a security, which is defined in 15 U.S. Code § 77b. As this definition originates from sources long before DLT and blockchains, it does not mention any type of digital assets. The definition covers several different types of securities and various catch-all phrases, such as investment contracts, transferable shares or 'certificates of interest of participation in a profit-sharing agreement'.[69] Because of the list of definitions being quite broad, the SEC uses a concept derived from the 1946 case SEC v. W. J. Howey Co.[70] to define what falls under the term 'investment contract'. The SEC applies this so-called Howey test to determine whether various unregulated items fall within its jurisdiction and thus whether their offerors must be registered and authorised to offer them.

For an item to fall under the SEC's regulatory oversight, there must be an investment of money (1.) in a common enterprise (2.) with an expectation of profits (3.), primarily derived from the efforts of others (4.). All four prongs of this test must be satisfied for an item to qualify as an investment contract and thus as a security. As the definition, and in particular the Howey test, was created without DLT, blockchains, crypto-assets, or VCC tokens in mind, the SEC has drafted a non-binding framework on how to assess digital assets in light of the Howey test.[71] This leads to a dynamic and legally uncertain situation around crypto-assets, as the framework contains a non-exhaustive list of more than 60 factors that influence the determination of whether a digital asset is a security or not, which needs to be considered on a case-by-case basis.[72]

If items are not securities, they may be commodities and fall under the purview of the CFTC. Art. 1a Commodity Exchange Act (CEA) defines commodities as a list of specific 'goods and articles [...] and all services, rights and interests [...] in which contracts for future delivery are presently or in the future dealt in'. As this is again a broad definition that does not mention crypto-assets or VCC tokens, the CFTC will need to further define its scope. In previous cases, the CFTC has stated that virtual currencies such as Bitcoin fall under its oversight.[73]

As they are primarily focused on regulating derivatives, the existence of a commodity in an OTC market does not empower the CFTC to regulate crypto-assets in the form of crypto-currencies, but it does enable the regulation of their derivatives.[74] Since VCC tokens are closely related to their underlying VCCs, a different assessment must be made. In the eyes of the CFTC, traditional, non-digital VCCs can be declared as 'environmental commodities'.[75] VCCs and their tokenised versions that are traded

in a manner analogous to crypto-currencies, futures, or derivative financial instruments thus may also be considered commodities.[76]

Given the considerable diversity of VCC tokens (and crypto-assets in general), there cannot be a single clear definition under the dual regulatory regime of the SEC and the CTFC. While VCC tokens can be designed to fit either definition, it remains uncertain whether these definitions will align with specific use cases of VCC tokens. Ultimately, as crypto-assets, VCC tokens may be securities, commodities, both, or nothing at all, leading to tremendous legal uncertainty.[77]

There are several ongoing attempts to regulate crypto-assets in the USA, but these have yet to be voted on and passed into law. Amongst these attempts are the Digital Commodities Act of 2022,[78] the Lummis-Gillibrand Responsible Financial Innovation Act of 2023,[79] and the Financial Innovation and Technology for the 21st Century Act, also of 2023.[80] These laws aim to define crypto-assets as commodities, giving the CFTC the ability to regulate them. This would lead to further restraints on the SEC, which seems to have overstretched its regulatory activities (as seen in the *SEC v Ripple Labs, Inc.* case in 2023).[81] A full assessment can only be made once legislation is in place.[82]

The federal structure of the USA may preclude the possibility of comprehensive regulation of voluntary carbon offsets. Some states have enacted minor regulations that allow the use of locally sourced VCM to exceed the emissions cap established by a cap-and-trade system, such as the Regional Greenhouse Gas Initiative or the Western Climate Initiative. As in the EU, the VCM is mainly voluntary.

In its Joint Policy Statements on the VCM, published in May 2024, the US Government outlined the importance of maintaining the integrity of the VCM.[83] The use of blockchain technology in conjunction with VCC tokens may facilitate the implementation of several mentioned principles, including accurately reflecting climate actions (Principle 5 Joint Policy Statement), reducing transaction costs (Principle 7 Joint Policy Statement), and may help to facilitate obligations set forth by the CFTC and/or the SEC. Considering this possibility, it is evident that the USA is not confident of the exact classification of VCC tokens.

The future of both regimes may be up for major changes, not least due to plans by the second Trump administration.

2 Regulation of VCC tokens in the United Kingdom

In the UK, the Financial Conduct Authority (FCA) is the regulatory authority responsible for overseeing financial matters. In this role, the FCA regulates all activities listed in the Financial Services and Markets Act 2000 (FSMA 2000). Due to the absence of an initial definition of crypto-assets under FSMA 2000, the FCA has developed a series of guidelines and statements on the implementation of such assets.

The FCA's final guidance on crypto-assets in 2019 stated that only certain tokens would need to be regulated under FSMA 2000.[84] In particular, these were e-money tokens and security tokens, while exchange tokens (crypto-currencies) and utility tokens would not require regulation.

As this has evolved and given that the UK's regulatory approach is primarily focused on activities rather than the underlying assets themselves, HM Treasury, the UK's economic and financial affairs ministry, has undertaken further consultations. According to these consultations, regulatory law shall apply to all types of tokens if they are or can be used in regulated activities in accordance with the FSMA 2000.[85]

The activities covered by Section 22 FSMA 2000 are primarily specified investment transactions. The newly amended Section 22(4) FSMA 2000 includes crypto-assets as a possible part of these activities. Crypto-assets are legally defined as 'any cryptographically secured digital representation of value or contractual rights' that can be transferred, stored, or traded electronically (a), and use technology that supports the recording and storage of data, such as DLT (b). These FSMA 2000-specified investments are further refined by an enumeration in the FSMA 2000 (Regulated Activities) Order 2001 (RAO).

In its final guidance, the FCA provides further clarification on whether crypto-assets could be considered specified investments. Structured rights or entitlements similar to those of financial instruments, tradability on exchanges, payment flows, or a directly stated investment-like character may indicate characteristics of specified investments. More precise definitions are not applicable due to the complexity of crypto-assets.[86] As these regulated activities are generally prohibited under Art. 19 FSMA 2000, companies wishing to offer crypto-assets used for any of these activities under Section 22 FSMA 2000 must obtain authorisation from the FCA or be otherwise exempted from the general prohibition.

To provide further protection for consumers investing in crypto-assets, the FCA has issued a series of guidance papers on the promotion of crypto-assets, resulting in amendments to the Financial Promotion Order 2005 (FPO), which regulates the promotion of financial products and services, to include crypto-assets. These guidelines also address the issue of unregulated crypto-assets, which are still considered high-risk investments.[87]

Under paragraph 26F of Schedule 1 FPO, which sets out the FPO's regulated activities, crypto-assets are deemed to be regulated if they are fungible (1)(a) and transferable (b). Furthermore, they are not qualified if they are a controlled investment (2)(a), electronic money (b), fiat currency (c), fiat currency issued in digital form (d), or a crypto-asset that can only be transferred or sold by way of redemption with the issuer and can only be used in a limited way to obtain the underlying goods and services from the issuer or a limited network connected to the issuer (e). The last exception is similar to that of Art. 4(3) MiCAR.

As the FCA states in its policy paper, there is no need for a different classification of token types (e.g. utility tokens), as the compliance costs of the FPO do not differ

significantly between them.[88] Those involved in the promotion of crypto-assets have a duty to ensure that the information provided is fair, clear, and not misleading. It is noteworthy that there is no obligation to publish a white paper as in the EU. Rather, the UK is seeking to encourage all crypto-asset issuers to promote their services in a consumer-friendly manner.

Detailed information on how to act in accordance with the FPO is provided in the form of non-handbooks or guidance documents.[89] With a new Discussion Paper dating from December 2024, the FCA aims to further develop a holistic market abuse regime for crypto-assets (MARC) and a crypto-asset admissions and disclosures regime (A&D).[90]

In regard to VCCs, the UK is considering the potential inclusion of specific VCCs in the UK ETS to incentivise the development of carbon removal technologies in line with its 2050 net-zero emissions target.[91] First, with the Law Commission's Final Report on Digital Assets[92] and, since 11 September 2024, with a new Bill,[93] VCCs and their digitalised forms can be considered as personal property, not falling into the two categories established by English common law (things in possession and things in action), but into a third category.

Similar to the other mentioned approaches, VCC tokens will need to be assessed on a case-by-case basis as to whether they can be characterised as a security-like investment falling under the FSMA 2000 and the FPO, as only a qualifying crypto-asset falling under the FPO or as an unqualified crypto-asset under Section 26F(3) of Schedule 1 to the FPO. As their initial design is not yet subject to a best practice, they can be created in a way that suits any of the three options above. The proposed regimes regarding crypto-assets (MARC and A&D) will help in clarifying any uncertainties and structure the framework for crypto-assets holistically in the future.

3 Comparison of the different regulatory approaches

The three different approaches have one thing in common: they distinguish security (-like) tokens from non-security-like tokens. Although all three approaches treat security tokens as securities due to their inherent financial implications, they differ in the employed classification systems. The USA uses a dynamic framework centred on the Howey test, which allows for considerable leeway in the interpretation of legislation to classify different crypto-assets as securities. If the Howey test is satisfied, the SEC assumes the role of a determinative authority with far-reaching obligations. If one of the prongs of the Howey test is not applicable, the crypto-asset is likely to be considered a commodity under the jurisdiction of the CFTC and CEA. Presumably, the majority of VCC tokens should be subject to commodity regulation, which still includes anti-money laundering and anti-terrorist financing provisions.

In the case of the UK, the FCA is responsible for determining which activities fall as specified investments within the scope of FSMA 2000. These specified investments

centred on tokens fall under the general prohibition of section 19 FSMA 2000. As most VCC tokens are unlikely to have the characteristics of these investments, they will not fall under the regulatory framework of FSMA 2000. However, as they could be classified as crypto assets under the remit of the FPO, they could still fall under its financial promotion regime. With an enactment of the MARC and A&D regime, most crypto-assets—also VCC tokens—will need to comply with a holistic framework.

The FPO does not apply a stringent classification of tokens, so the majority of VCC tokens (unless exempted in a manner comparable to MiCAR) will have to comply with the advertising obligations. In general, the UK's approach is focused on consumer protection in this regard, similar to that of MiCAR. This can be attributed to the UK's ongoing internalisation of European law, even after Brexit. In particular, this concerns MiFID II and the Prospectus Regulation, which also served as the basis for MiCAR.

The EU classifies more tokens than just security tokens and non-security tokens. MiCAR currently distinguishes between four groups of tokens: Tokenised securities (MiFID II), ARTs (Title III MiCAR), EMTs (Title IV MiCAR), and other crypto-assets (Title II MiCAR). In the context of VCC tokens, as reasoned in the beginning, it is particularly important to consider them as other crypto-assets defined in Title II MiCAR, which serves as the main category of the regulation. With the addition of obligations for CASPs, this approach attempts to regulate the entire crypto-asset ecosystem in the most holistic manner. In general, the EU aims to provide a comprehensive framework for all matters related to crypto-assets and is the first jurisdiction to do so. Whether this will facilitate a sustainable growth of the crypto-asset space or hinder innovation can only be answered in the future.

A further common feature of the various regulatory frameworks is the lack of direct regulation of VCCs (and thus VCC tokens). The lack of regulation governing the creation of these tokens allows for a greater degree of flexibility in their design, thereby allowing to avoid the more stringent obligations typically associated with securities. It is therefore crucial to ensure that potential purchasers are adequately informed, even in cases where the VCC tokens in question are not classified as securities. Furthermore, it is possible to disregard white paper requirements entirely, as demonstrated by non-investment utility tokens that provide access to pre-existing unregulated VCCs that are not traded.

If the predictions for the VCM prove to be accurate, it is likely that the demand for VCCs and VCC tokens will increase in line with the approach of net-zero targets, stimulating the growth of a secondary market. With a real and well-functioning secondary market, connecting holders with other holders or potential holders may make VCCs, and thus VCC tokens, increasingly more akin to securities due to financial incentives like speculation. It is reasonable to assume that frameworks allowing for dynamic interpretation, particularly the Howey test in the USA, may ultimately lead to quicker results in regard to delineating investment-like VCC tokens and others.

III Relevant German law

Following our analyses of the European regulatory framework and comparisons with alternative approaches, we would like to address a rather specific case of the transposition of European law into national law in the German context. As MiCAR is drafted as a European regulation, it is generally applicable in all EU Member States according to Art. 288 of the Treaty on the Functioning of the European Union (TFEU). To this end, Germany—like every Member State—must enact new legislation and amend existing legislation in line with MiCAR. In the specific case of Germany, this was done through the enactment of the Financial Markets Digitalisation Act (*Finanzmarktdigitalisierungsgesetz*; FinmadiG), which established the new Crypto Markets Supervision Act (*Kryptomärkteaufsichtsgesetz*, KMAG) and amended the main financial supervisory laws (most notably the *Kreditwesengesetz*; KWG). The KMAG has since been enacted on 27 December 2024.

The KMAG regulates all aspects of the authorisation of the NCA. In the case of Germany, this is the domain of the Federal Financial Supervisory Authority (*Bundesanstalt für Finanzdienstleistungsaufsicht*, BaFin). With the KMAG, the German legislator attempted to make the same clear distinction between financial instruments and crypto-assets as the European legislator.[94] However, the KMAG overlooks important points regarding other crypto-assets as defined by MiCAR. Art. 2(4) KMAG lists all institutions under the regulatory framework as offerors or persons seeking admission to trading for ARTs (1.) and EMTs (2.) or as CASPs (3.). Surprisingly, Title II MiCAR seems to also have been overlooked—deliberately or not. This could lead to the initiation of infringement proceedings by the European Commission.[95] As VCC tokens are likely to fall into the category of other crypto-assets, this omission does not contribute to clarifying the regulatory framework for VCC tokens in German law.

Until the amendment was enacted, crypto-assets were categorised as financial instruments and regulated by Section 1 (1a) sentence 4 KWG as

> digital representations of a value, which is not emitted or guaranteed by any central bank or public authority and which does not have the legal status of currency or money, but is accepted by natural or legal persons as a means of exchange or payment by agreement or custom or for investment purposes and which can be transferred, stored and traded electronically.

In addition, the German legislator excluded e-money and certain digitised monetary values such as vouchers or cash cards (Section 1 (1a) sentence 5 KWG). As cryptocurrencies are electronically tradable and accepted by natural or legal persons but are not issued or guaranteed by any of the institutions mentioned, they could have been considered as financial instruments similar to MiFID II.[96] Utility tokens could not be fully categorised as financial instruments, as the German legislator considered them to be a simple way of redeeming certain goods and services from the issuer, thus not making them financial instruments in the German regulatory framework and keeping them unregulated.[97] Other crypto-assets established by MiCAR could have been encased by this definition.

With the FinmadiG amendment to the KWG, the term crypto-asset has been changed to 'cryptographic instruments' (*Kryptographische Instrumente*). For the new definitions of crypto-assets, the KWG will refer to the definitions of MiCAR. The 'new' cryptographic instruments (as they keep the old definition) should apparently act as a catch-all element for crypto-assets that do not fall under the main MiCAR category of other crypto assets, nor under the ART or EMT categories, and which are not financial instruments under MiFID II. At present, this does not seem convincing, as there does not appear to be any applicable cases for cryptographic instruments.[98] Exemptions from crypto-assets such as Art. 2(3) MiCAR (NFTs) or Art. 4(3) MiCAR (crypto-assets not subject to Title II MiCAR) are also not added by the amended KWG.[99] Only utility tokens similar to Art. 4(3)(c) MiCAR, which represent the definition of a redeemable voucher for goods and services that already exist or are in operation, are explicitly excluded from the scope of the amended KWG by Section 1 (11) sentence 5.[100]

A possible scope of cryptographic instruments could be exactly the other crypto-assets exempted by MiCAR. These would be airdrops, crypto-assets issued for the maintenance of a blockchain or crypto-assets that can only be traded in a limited network of the provider (Art. 4(3)(a), (b), and (d) MiCAR). Even if the material scope allows this approach, the legislation around the cryptographic instruments could be incompatible with EU legislation, making any further consideration at this point more or less negligible.[101]

The German approach appears to be an incomplete transposition of MiCAR into German regulatory law, with some errors or omissions regarding the regulation of other crypto-assets in Title II MiCAR. As mentioned before, Title II is the main scope of VCC tokens, as they are not EMTs or ARTs. The exemptions in MiCAR appear to be only partially mirrored in the German KWG, with the result that the newly created definition of cryptographic instruments is not suitable for VCC tokens (or any other crypto-asset). The thought of pre-emptively encompassing crypto-assets not covered by MiCAR (real NFTs or VCC tokens created as voucher-like utility tokens) led the German legislator to create an empty shell of a definition. The main difficulty lies in the fact that VCCs themselves are not regulated in German law. If they were, there would be no need to regulate tokens for existing VCCs. With all of the regulations mentioned above, the VCC tokens in Germany exist in a regulatory vacuum until Title II MiCAR is transposed accordingly.

IV UNIDROIT Principles

The International Institute for the Unification of Private Law (UNIDROIT) is an independent intergovernmental organisation dedicated to the unification and modernisation of Private International Law. Its 65 member states represent a wide variety of legal, economic, and political systems. UNIDROIT strives to standardise various as-

pects of legislation throughout the world by advocating and creating model private law instruments.

The UNIDROIT instruments that are most relevant in this context are the Principles on Digital Assets and Private Law (DAPL),[102] and the Draft Principles on the Legal Nature of Verified Carbon Credits along with related works. While UNIDROIT focuses on private law aspects, some of its definitions and approaches may be helpful in the area of regulatory law, which we will explore further.

1 UNIDROIT Principles on Digital Assets and Private Law

The DAPL, published by UNIDROIT in 2023, are designed to be technologically neutral and to reflect the transitional nature of the evolving digital assets landscape. The Working Group behind these Principles met between November 2020 and May 2023. The Principles are intended to serve as best practice guidelines for digital-asset legislation. They are issued with accompanying commentary to assist with their interpretation. Explicitly, they do not cover regulatory approaches (Comment 1.1. DAPL). 'Digital assets' are defined in Principle 2 DAPL and can be targets of proprietary rights. In general, the definition of 'digital assets' as laid out in Principle 2 should encompass VCC tokens as well.[103]

Furthermore, Principle 4 aims at defining a 'linked asset'. This is also a digital asset that can be subject to proprietary rights according to Principle 3(1) DAPL. It is questionable if VCCs created as (utility) tokens linked to traditional and non-digital VCCs can be defined as 'linked assets'. Linked assets, according to Principle 4, are digital assets that are 'linked to another asset'. These 'other assets' may be tangible, intangible, or even digital assets. The existence, requirements, and legal effect of the established link are to be determined by 'other law'.[104] Commentary 4.2. DAPL mentions enabling transactions of the other asset in concordance with the digital asset as one of the main reasons for linkage, which is one of the aims for tokenising VCCs as well.[105] While the reasons for the existence of such a link and its legal effect come from other law, the existence of the link is a question of fact (Commentary 4.4.–4.6). As will be seen in the use cases later on, most bridged VCC tokens are connected to specific VCCs via digital identifications. Thus, VCC tokens created as utility tokens enabling access in accordance with Art. 3(1)(9) MiCAR can be considered as linked assets according to Principle 4 DAPL. Linking digital assets to a VCC in this case would lead to the governance of private law concerns through the scope of the laws regulating a VCC. As VCCs are largely unregulated, Principle 4 DAPL would be difficult to apply. Other laws as defined in Principle 2(4) DAPL, in the form of the aforementioned EU legislation on VCCs, could change this in the future.

For now, this means that (utility) tokens may be subject to proprietary rights, just as the Principles would establish for native VCC tokens. Differences in regulatory law between utility tokens acting as redeemable vouchers and other crypto-assets are not

recognised in the Principles.[106] The laws governing the link between digital assets and other assets (tangible, intangible, or digital) are to be determined by national legislation. This leads back to regulatory laws, or rather the, lack thereof, as VCCs themselves are not regulated and VCC tokens only have the chance to be regulated under crypto-asset regulations.

As stated before, the DAPL do not offer explicit information on regulatory aspects, but show further evidence for the need to treat certain VCC tokens as utility tokens due to the aspect of linking.

2 Draft UNIDROIT Principles on the Legal Nature of Verified Carbon Credits

Similar to the Working Group on Digital Assets and Private Law, the Working Group on the Legal Nature of Verified Carbon Credits[107] aims to summarise best practices for the treatment of these credits under private law in the form of Principles. The Working Group met in October 2023, April and September 2024, January and April 2025 with further meetings planned for September 2025 and thereafter. Finalisation is planned for the first half of 2026.

The term 'Verified Carbon Credits' stems from discussions between the first and the second meeting, as the legal nature of these credits will be determined before they are used voluntarily (VCCs) or in compliance markets (e.g., emission allowances).[108] Since the Working Group has yet to meet, no Principles have been finalised, but the group has produced a draft set of initial Principles (VCC Draft Principles).

In this draft, the definitions in Principle 2 immediately establish that VCCs should be treated as intangible assets (Commentary 2.2 VCC Draft Principles). In conjunction with the Principles on Digital Assets and Private Law, VCCs can form the basis of a linked digital asset, confirming the notion that certain VCC tokens are linked assets or even utility tokens.

UNIDROIT states in Principle 2(1)(c) and (d) VCC Draft Principles that uniqueness is a mandatory attribute for the creation of VCCs, as they require a 'unique identifier' in a registry. This is reminiscent of the idea of VCC tokens being NFTs, as all linked VCCs would need to have a unique serial number. As noted before, the simple description of being unique does not satisfy the requirement of being an NFT under MiCAR, which would lead to minor discrepancies between the VCC Draft Principles and MiCAR when it comes to VCC tokens. It is questionable if the mere hash value of tokens on a blockchain would meet the requirements of Principle 2(1)(c) and (d) VCC Draft Principles, as this should not suffice for the requirements of non-fungibility of MiCAR (as most tokens would then be NFTs).

Both Principles will be of relevance in relation to VCC tokens. While further work on the legal nature of Verified Carbon Credits will help to determine the applicable private law in respect to their underlying digital asset transactions, the Principles on Digital Assets and Private Law will aid in the private law aspects of the tokens them-

selves. Furthermore, the thought of including tokenisation as part of their Principles will help to enlighten this analysis.[109] It remains unknown whether, and to what extent, legislators will take inspiration from these Principles.

B Case studies

To gain a practical overview of VCC tokens and the legal requirements to be observed when dealing with them, a number of use cases can be examined that use tokenised VCCs to a certain extent. The objective of this examination is to evaluate the category of tokens created and whether or not they are subject to the regulatory framework outlined above.

We selected these use cases because they offer a comprehensive representation of VCC tokens, while also exemplifying distinct differences between them. In the subsequent discussion, the impact of these variations on the applicable legal framework will be addressed.

I Toucan

The Toucan Protocol Association (Toucan)[110] is a Swiss technology firm specialising in the creation of blockchain-based solutions for the scaling of the VCM by bridging in terms of efficiency, integrity, and speed. The initial instance of bridging by Toucan concerned VCCs from the two largest registry systems, 'Verra'[111] and 'Gold Standard'.[112] In order to avoid double-counting, the respective VCC was retired first and then a token connected to the retired VCC was created on the blockchain to make it tradable again (minting). However, in 2022, both Verra and Gold Standard prohibited the tokenisation of (retired) VCCs. Currently, both parties are seeking to independently advance these systems themselves.[113] To further support the scaling of the VCM in the meantime, Toucan has undertaken new efforts with other registries. Together with Puro.earth,[114] they claim to have created the first liquid market for biochar[115] credits (CHAR).

The creation of CHARs occurs through a two-way bridging system whereby different eligible projects by Puro.earth are tokenised. The projects get VCCs credited by removing CO_2e through the establishment and maintenance of biochar projects. The Toucan Carbon Bridge is utilised for tokenisation, and following this process, VCC tokens (TCO2) are minted on the underlying blockchain. As TCO2 tokens are all related to their vintage and their underlying projects, they are non-fungible (in a broad sense, not necessarily according to MiCAR) and get pooled together with comparable tokens. Through the means of pooling, fungible units of CHAR can be drawn out of the pool.

In a partnership with 'Neutral',[116] an exchange for environmental assets, Toucan introduced a 'Pool Health Fee' to ensure that projects within the pool do not monopo-

lise and project diversity can be maintained. CHARs are labelled as 'vouchers that provide access to the underlying asset'[117] and are minted on the Ethereum-based Celo blockchain. These tokens can be traded via Uniswap, a decentralised exchange based on the Ethereum blockchain. To retire the VCCs, holders of CHARs must redeem their tokens for specific TCO2 tokens inside the pool via the Toucan interface. These TCO2 tokens, which are managed by holders, can be burnt, thereby retiring the underlying VCCs in the Puro.earth registry.

II Nori

Nori Inc. was a Seattle-based company operating within the domain of traditional carbon removal since 2017. In 2019, the company unveiled the 'Nori Removal Tonne', subsequently rebranded as the 'Nori Regenerative Tonne' (NRT). The NRT was a digital asset designed to indicate carbon removal for a minimum of 10 years, primarily facilitated through carbon farming practices in the USA.[118] These digital assets were issued on the Ethereum blockchain within the Nori application. In contradistinction to Toucan's CHARs, NRTs were required to be retired immediately following their purchase, thereby signalling the retirement of their underlying removals. The primary rationale for utilising an application on the Ethereum blockchain was to circumvent the occurrence of double-counting of retired units.[119]

Initially, there was a proposal to introduce an additional crypto-asset, the NORI token, with the objective of creating a tradable commodity for the purpose of trading carbon and establishing a carbon pricing mechanism.[120] Farmers seeking to adopt sustainable practices in accordance with Nori's standards in collaboration with external entities would have received NRTs, which could be traded on the Nori marketplace to companies and individuals seeking to offset their CO2e emissions over a period of at least ten years (as these farmers had committed to maintaining these practices for a minimum of ten years). Upon purchase, the NRTs would have been retired immediately and should not have been tradable to circumvent any aspirations of double-counting tonnes of CO2e. The NORI token could have been traded further instead.[121]

Subsequently, in 2023, Nori introduced an additional sustainable investment option: The 'Nori Net Zero Tonne'. As outlined in an informational white paper (not in the sense of MiCAR), this product is designed to integrate fast-cycling CO2e removals (as previously described) with carbon removals that can be stored for up to 1000 years, as these long-lasting removal options become increasingly available in the future. It is noteworthy that this product does not incorporate any blockchain-based technologies other than the incorporated NRT. Consequently, these 'Net Zero Tonnes' would not have raised any additional concerns with regard to crypto-assets regulation.

Nori Inc. closed down in 2024, as the new CEO, Matt Trudeau, labelled the 'challenges of a stagnant Voluntary Carbon Market and tough funding environment' as too demanding for Nori. This was communicated through *LinkedIn* by Nori co-founder Alexsandra Guerra.[122]

III Crypto Carbon Company (C3)

Crypto Carbon Company (C3) is a decentralised platform that created a bridging system for VCCs similar to Toucan's for the registries of Verra and Gold Standard (2022). In conjunction with Verra's and Gold Standard's disapproval of tokenisation of their VCCs, C3 announced plans to expand their standards to include American Carbon Registry (ACR),[123] Climate Action Reserve (CAR),[124] and Plan Vivo.[125]

The C3 bridge is created as a permissionless protocol, meaning it is open for everyone to create VCC tokens, but to do so, they need to retire their VCCs in the first place. To avoid double-counting, each minted NFT receives a unique hash that corresponds to the metadata of the retired VCC. These, again, get fractionalised into ERC-20 tokens, becoming fungible. These tokens are then aggregated into one of C3's carbon pools, categorised by their VCC's underlying methodology, either in the 'Universal Basic Offset Pool' (UBO Pool) or in the 'Nature-Based Offset Pool' (NBO Pool). A further pool, the 'Afforestation and Restoration-based Offsets' (ARBO Pool), is scheduled for launch in the future, according to C3.

It is noteworthy that UBO or NBO tokens that exit the bridge are fully fungible and can be further traded by their holders. An important difference between C3's and Toucan's bridge for CHAR is that, in the case of C3, VCCs need to be retired before they can be submitted to the bridge. This is reminiscent of Toucan's first attempt at a carbon bridge.[126]

A further token, the C3 token, is utilised for governance, fees, and growth incentives, with further utility implementations planned in the future. These can be obtained through bridging, staking, and providing liquidity. As these C3 tokens do not directly relate to VCCs, except for being obtained through specific actions related to VCC tokens, they fall outside the scope of our analysis.

IV Coorest

Coorest OÜ, a company founded in Estonia in 2021, claims to have created the 'first certified standard for blockchain-based CO_2 compensation powered by smart contracts and satellite data'—the Coorest Carbon Standard (CCS). Projects eligible under the CCS are able to generate '$CCO2 tokens' ($CCO2) or 'NFTrees' according to their additional activities that sequester CO_2e. These tokens can be traded in a decentralised application on the Polygon blockchain, which is monitored by Coorest.[127]

There are two different kinds of NFTrees that can be purchased from Coorest. As the name suggests, these tokens are NFTs connected to specific trees. The underlying trees may be fruit-bearing or not. Upon planting of the actual trees, the connected NFTrees commence the minting of $CCO2, equivalent to the calculated amount of CO_2e sequestered by the respective tree in accordance with the standards and methodologies established by Coorest. Fruit-bearing trees possess an additional function in that the holder receives a proportionate compensation for the fruits of the trees linked to their NFTrees. However, these remunerations are not part of the present analysis due to them being unrelated to VCC tokens.[128]

The $CCO2 earned from NFTrees can be held, transferred, or burned by their holders, with each crypto-asset representing one kilogram of CO2e sequestered by real-world trees. Claims of carbon neutrality through compensation can only be substantiated through their on-chain burning. Subsequent to the burning of $CCO2, an NFT in accordance with the ERC-721 standard is minted and transferred to the wallet of the entity that performed the burn. The burning process serves as a proof of carbon compensation, resulting in the creation of a certificate (Proof of Carbon Compensation; PoCC) that contains data pertaining to the reason for compensation, the amount, the date, and the name of the entity responsible for the burning given by the holder burning the $CCO2.

In contrast to the aforementioned three on-chain tokens, which are related to traditional and non-digital VCCs, Coorest offers several on-chain tokens that do not share this characteristic. Instead, they function through a process of bridging real-world trees, facilitating the creation of native VCC tokens. It is noteworthy that all of the aforementioned tokens issued by Coorest can be regarded as VCC tokens, as they each represent a distinct phase in the lifecycle of a VCC.[129]

C Placing the use cases within the context of the relevant legislation

I CHAR

As Toucan has articulated, CHARs are voucher-like tokens and thus can act as utility tokens according to MiCAR. CHARs have to be linked to project-related TCO2 and these again have to be linked to certain VCCs.

The exemption of both the TCO2 tokens and their underlying VCCs from Title II MiCAR can be granted under Art. 4(3)(c) MiCAR, provided that the TCO2 tokens and their underlying VCCs are regarded as ‘goods and services that exist or are in operation’. The definition of a VCC is pivotal in determining this status. If the TCO2 token is classified as a good or service that exists or is in operation, CHARs could be exempted from Title II MiCAR. Consequently, this would exempt Toucan from drafting and notifying a crypto-

asset white paper. Negating any characteristics of this exemption from MiCAR would lead to the categorisation of CHARs as other tokens subjected to Title II MiCAR.

The question remains, however, whether the dynamic nature of the TCO2 pool, which undergoes changes with each deposit, affects the existence or operational status of the underlying assets or services of CHARs. If this can be negated or affirmed, it would be crucial to determine whether CHARs and TCO2 tokens would be obliged to comply with Title II MiCAR. It can be deduced that if the TCO2 inventory is altered, the value of the TCO2 tokens and, consequently, the value of specific CHARs will fluctuate. This fluctuation would suggest that the underlying goods or services of the CHAR cannot be defined as existing or operational, and a white paper would be required. This is further dependent on the functioning of the 'Pool Health Fee', which regulates the inventory of the pool. In any case, further elaboration of the fee is necessary, which in turn highlights the need for additional information from the purchaser.

In addition to their resemblance to vouchers, these tokens could be exempted by Art. 4(3)(d) MiCAR, on the basis that the burning process (the original destiny of these tokens) can only be performed within the limited network of Toucan in conjunction with the Puro.earth registry, another merchant in Toucan's contractual network. It cannot be performed elsewhere, for example, through the use of different services or applications on other blockchains, or even outside of the technical layer. This again can lead to the exemption from Title II MiCAR.

Art. 4(4) MiCAR can act as an exemption from the exemptions when the offeror communicates any thoughts of admitting their tokens into trading, consequently making CHARs subject to Title II once again. Toucan's promotion of CHARs as 'the first liquid market for biochar credits'[130] and their availability for trading on Uniswap, a prominent decentralised exchange, appears to endorse Art. 4(4) MiCAR, thereby rendering Title II MiCAR applicable again. In order to be compliant with it, Toucan must fulfil the requirements set out in Art. 4 and 5 MiCAR, namely the creation, notification, and publication of a white paper (and marketing communications) in accordance with Art. 6–9, 12, and 15 MiCAR. Furthermore, Toucan is obliged to fulfil all other obligations stipulated in Title II and Title V MiCAR regarding the crypto-asset services they are offering.

Non-fungibility of TCO2 according to MiCAR should not be a cause for concern, as these tokens can be readily pooled and made fungible, not falling within the narrow scope of non-fungibility of MiCAR.

In accordance with US security law, CHARs are expected to fail the Howey test, as they are not acquired with the primary objective of profit (third prong). However, this dynamic may shift as the market gains traction, the value of CHARs and their underlying VCCs increases over time, and their supply does not meet demand. The precise outcome of the Howey test by the SEC is unclear. Nonetheless, there is a possibility that the market's future growth may categorise the purchase of CHAR as an investment contract.

The remaining prongs of the test are expected to hold, given the necessity of purchasing CHARs (first prong) and the subsequent pooling of funds into a common enterprise to remunerate project developers (second prong), with any profit incentive derived from the performance of others (fourth prong). However, given the Howey test's dynamic and ambiguous nature, resulting in a wide margin for interpretation, it remains challenging to make a conclusive statement.

Given the capacity of CHARs to be traded similarly to other crypto-assets that fall under the remit of commodity laws, it is conceivable that they could be regarded as commodities. In the event that CHARs were considered securities, Toucan would be required to register with the SEC and comply with their regulatory jurisdiction. However, this would not be necessary if CHARs were only classified as commodities due to the absence of regulatory oversight over spot markets for commodities by the CFTC.[131] This would again change if the CFTC were to conclude CHAR to be a derivative of a VCC (a commodity).

In the UK, the conditions for the applicability of security regulations are more narrowly defined. Therefore, CHARs should not fall under the FSMA 2000, as they are not used in a specified investment according to Part III of the RAO. This can only be derived from an investment character akin to one described in the list, which is up for interpretation to some extent. However, this should not be the case with CHARs. Nevertheless, it is conceivable that they could be classified as qualifying crypto-assets under the FPO, which would necessitate Toucan's adherence to promotional laws due to their fungibility and tradability.

Section 26F(2)(e) of Schedule 1 to the FPO functions analogously to the exemption of specific utility tokens traded within a restricted network of the issuer as set out in MiCAR. This suggests the potential for promotions of CHARs to be exempt from the promotional guidelines stipulated by the FPO. The latter would apply, for example, if CHARs were to be exclusively available for sale and use within the issuer's network. Even if they could only be redeemed and utilised within the Toucan interface, they could still be traded outside of the offeror's network. Consequently, the exemption would not apply, and Toucan would be obliged to adhere to promotional laws when advertising their CHARs in the UK.

II Nori Regenerative Tonne and NORI

As NRTs demonstrated a considerable similarity to CHARs, albeit with an alternative focus on other VCCs, the majority of the observations previously made can also be applied in this context. The primary distinction is that the tokens became untradeable following their acquisition. The exemption (from the exemptions) set out in Art. 4(4) MiCAR would not apply in such a case, as the NRTs in question were not designed for further trading, and the offeror did not make any statements indicating their intention to seek admission to trading them (simply because they are no longer

tradeable). The plausibility of considering NRTs as utility tokens exempt from Title II MiCAR is considerably higher than that of CHARs. Negating their nature as utility tokens leads to NRTs being considered as an other crypto-asset subject to Title II MiCAR.

The existence of a market is questionable, as the NRTs were distributed to the project developers (or farmers in this case), which can be defined as the primary market. The farmers could simply retire their crypto-assets for themselves, if they wanted to. The secondary market would then be constituted by transactions between purchasers and NRT-holders.[132] It is possible that the primary market would already fall within Art. 4(4) MiCAR.

In the context of MiCAR, the concept of non-fungibility is not applicable, as the diverse tokenised activities, in accordance with Nori's standards and methodologies, can be integrated within the framework of NRTs, thereby resulting in fungibility.

Again—considering the limits of the exemptions of Art. 4(3) MiCAR—NRTs could have been utility tokens exempted from Title II MiCAR or other crypto-assets subject to Title II MiCAR. In both cases, Nori would act as a CASP, thus being subject to Title V MiCAR.

The Howey test, which posits an expectation of profit, would have likely failed in this case, as the NRTs were not tradable and thus no profit could be attained. In their primary market, these tokens were not purchased but traded for CO_2e-sequestration actions. This is not a direct purchase, but rather a trade, and yet it could still have been considered as an 'investment of money' as defined by the Howey test.[133] Further prongs of the Howey test are difficult to assess, as Nori Inc. ceased their services and there is a lack of information on how project developers sold their NRTs to individuals. According to US law, NRTs could have also been classified as a commodity since tradability is not explicitly stipulated as a prerequisite by the CEA.

The absence of any indication that the NRTs constituted a specified investment prevented them from falling within the purview of the FSMA 2000. As they were crypto-assets, it is possible that they could have fallen under the scope of the FPO; however, as previously mentioned, they lacked the essential characteristic of tradability. According to 26F(1)(a) to Schedule 1 FPO, they would not have qualified as crypto-assets needing promotional regulation, thus the promotional laws of the UK would not have been applicable to NRTs.

The intention of Nori founder Paul Gambill was to establish a carbon trading system, and therefore it is evident that the NORI tokens should have been created as a means of making NRTs tradable.[134] This would result in an analysis analogous to that of CHAR tokens. It is stated that one NORI token would have been equivalent to one unit of the NRT pool. This would have resulted in the tokens being considered tradable and fungible. The evaluation according to UK legislation would have been comparable to that of CHAR.

III UBO and NBO tokens

It is evident that UBO and NBO tokens are fundamentally similar in nature. Both of these concepts rely on a traditional and non-digital VCC and the retirement is a prerequisite for tokenisation. The distinguishing factor between these tokens is the underlying methodologies employed. This analysis will adopt a similar approach for both of these crypto-assets.

The fundamental distinction between these VCC tokens and the other use cases lies in the prerequisite for the creation of a UBO/NBO token, which necessitates the retirement of the underlying VCC. In the aforementioned cases, the VCC is retired with the token (either linked or blockchain-native). This modification to the narrative is marginal, yet it contributes to the delineation of an existing good or service in operation underlying these tokens.

As previously mentioned, the linkage between a traditional VCC and its tokenised counterpart is flexible; the retirement of the former on the traditional registry helps the link to become more static, thus underpinning the definition of utility tokens. Again, negating this leads to the conclusion that a UBO/NBO token is an other crypto-asset according to MiCAR. However, it should be noted that, given the intention of UBO/NBO tokens to be traded further, any exemption does not apply according to Art. 4(4) MiCAR. The fungibility of these VCC tokens is facilitated by their reasonable pooling, which aligns with the principles outlined in MiCAR. It is therefore reasonable to conclude that UBO and NBO tokens should both fall under the regulatory scope Title II MiCAR and C3 tokens under the regulatory scope of Title V MiCAR regarding their offered services.

In the context of the two VCC tokens, the Howey test is expected to be unsuccessful on two grounds: The expectation of profit and the reliance on the work of others. Even if the profit-seeking characteristic could be confirmed, the profit should not be reliant on the work of others, as their underlying VCCs are already retired. The value of these tokens is no longer dependent on the actions of the underlying VCCs (e.g., the maintenance of tree farms or the prevention of reversals) or on the integrity of the registry. Consequently, it can be deduced that these tokens would likely fail the Howey test. However, if the maintenance of the utilised blockchain is considered a prerequisite for this prong to be met, the Howey test itself could be deemed satisfactory, thereby classifying UBO and NBO tokens as securities. Furthermore, they could be regarded as commodities, akin to other crypto-assets.

Given the unlikelihood of being designated as an investment, comparable to other analysed crypto-assets, and the additional point of their value-creating underlying VCC being retired upon their creation, UBO and NBO tokens should not be subject to the FSMA 2000. As tradable and fungible crypto-assets, they are subject to regulation by promotional laws according to the FPO.

IV $CCO2, NFTrees and PoCC

The three crypto-assets established by Coorest are all distinctly different, as are the conclusions that can be drawn from them. This analysis will primarily focus on the $CCO2 token, which is most analogous to the other tokens analysed, while the NFTrees allow for interesting insights. While these tokens differ in the amount of CO_2e underlying them (one kilogram compared to one tonne), their main use case should not deviate too much.

Given the direct link between $CCO2 and the performance of NFTrees, it can be deduced that the latter is an underlying good or service in operation in a broader sense. The distinguishing factor is that the tree, within the context of its lifecycle, is still in a growth phase, meaning that the service is not yet complete. Conversely, the sequestered CO_2e can be considered the underlying asset of the NFTree. This complicates the application of MiCAR's definition of the 'goods existing or service in operation'. In this case, the service can either be in operation as the NFTree sequesters CO_2e, or the sequestered CO_2e can already exist as a good.[135] The exemption of Title II MiCAR is contingent upon the linked asset. This is debatable in this instance. However, given the communication of $CCO2 tokens as tradable outside of their infrastructure, the exemptions of Art. 4(3)(d) MiCAR should not apply. Consequently, the $CCO2 falls within the scope of MiCAR, either as another crypto-asset or a non-exempted utility token.

In terms of the relevant legislation in the USA and the UK, it is anticipated that the results will be analogous to those observed in the analysis of other tokens. Indeed, $CCO2 should not be regarded as an investment contract but most likely as a commodity in the USA. Furthermore, it is subject to promotional laws according to the FPO in the UK. The primary distinction between these tokens and the others discussed lies in the quantity of sequestered CO_2e, with the $CCO2 seemingly focusing on more exact offsetting.

A more intriguing analysis is that of NFTrees, which are designed to be linked to real trees at a 1:1 scale (disregarding the 10% of extra trees planted by Coorest) and are observable via satellite. This suggests that they should also be considered as non-fungible according to MiCAR, a notion further reinforced by the fact that the only fungible aspect (their output, or rather intake) is a separate token—the $CCO2. As fungibility is a necessary characteristic for the MiCAR definition, NFTrees should not be obliged to comply with MiCAR.

As the Howey test allows for a broad definition of securities, NFTrees could fall under the regulatory law for securities in the USA. Since NFTrees can be purchased using fiat or crypto-currencies, the first prong should be satisfied. The NFTrees can only fulfil their objective of generating $CCO2 if the underlying trees are maintained and cared for. This is primarily achieved through the efforts of individuals employed by or working with Coorest, who receive compensation for their services rendered in the form of the proceeds from NFTree sales. This provides a basis for a common en-

terprise (second prong). The expectation of profits (third prong), which has hitherto been unsuccessful for most other tokens, can be present in this case. The generated $CCO2 may be monetised through sale, potentially incentivising initial purchases of NFTrees. This phenomenon is further accentuated in the context of fruit-bearing NFTrees, whose produce can be sold for profit. This resemblance is reminiscent of the original Howey case, wherein the Howey Co. engaged in investments in citrus grove development. Coorest themselves have stated that these fruit-bearing trees recoup their purchase price in profits in about five years.[136] Furthermore, these profits primarily rely on others (fourth prong), as Coorest must meticulously oversee, nurture, and maintain their trees to ensure the generation of these returns.

The Howey test, as subjective as it may be, can be fulfilled for NFTrees. This would classify them as securities within the US regulatory system. The method of sale, which is analogous to an ICO, further reinforces this. As ICOs are frequently regarded as security offerings, their security-like character is accentuated, although further trading can mitigate this for some crypto-assets.[137] Consequently, Coorest would be required to register and obtain approval in the USA to sell their NFTrees under the oversight of the SEC.

By contrast, the regulatory framework in the UK is comparatively less extensive, resulting in NFTrees not being classified as specified investments. They are not subject to the FSMA 2000, and due to their non-fungible nature, the promotional laws do not apply to them.

As Proofs of Carbon Compensations (PoCCs) are the certificates of burned $CCO2, they could also be considered as VCC tokens. PoCCs are the crypto-assets that enable individuals and companies to claim and display their offsetting activities, and they encase means to ensure that $CCO2 cannot be double-counted and used more than once. The fungibility of PoCCs is obstructed by the specific information exhibited and hashed into the tokens. As they possess no inherent value other than a certificate that a specific entity has offset a certain amount of CO2e at a certain time, their fungibility is missing. This should hold for MiCAR's standard of non-fungibility. Thus, MiCAR should not be applicable to PoCCs according to Art. 2(3) MiCAR.

The Howey test should once again fail on the grounds that the PoCCs are not purchasable. Indeed, they can only be created by burning amounts of $CCO2. Thus, the first prong, namely the fulfilment of the requirement, should not be met. This assertion can be discussed further, as the burning of $CCO2 for the PoCC to be created can also be regarded as an investment of money in a broader sense. If the PoCCs' creation by the underlying blockchain can be regarded as constituting a common enterprise, the expectation of attaining profit cannot be satisfied. PoCCs should not be declared as securities, even with their restricted fungibility, but they could still be considered commodities.

PoCCs are not used in specified investments, so any expectations of them being regulated should not be met. Due to their missing fungibility, they are also not required to comply with promotional laws in the UK.

D Conclusion and outlook

At least the EU regulatory framework, as outlined by MiCAR, appears to explicitly encompass all VCC tokens that have been examined by us. Discrepancies in terms of fungibility, token classification, and use cases do not allow for a general circumvention of the regulatory scope of MiCAR. While it is still possible to create VCC tokens in a manner that avoids MiCAR's regulatory scope at least partially, doing so would alter their use cases to such an extent that a regulatory framework would no longer be necessary. MiCAR's exemption from its exemptions has far-reaching implications for all tradeable crypto-assets, a category that should encompass nearly all VCC tokens on the market. The absence of a clear definition of what constitutes a traditional and non-digital VCC means that their tokenised versions can be classified as either other crypto-assets or, in some cases, utility tokens. The final categorisation relies on the nature of the underlying VCC—either as a good, a service, a right, a claim, or merely as evidence for the expenditure of money for climate action taken by another party. Furthermore, all services offered by the legal persons in these use cases fall under one or more of the crypto-asset services regulated by Title V MiCAR.

The regulatory frameworks of the USA and the UK that do not directly regulate VCC tokens, but rather employ a dynamic analysis of the underlying action, seem to leverage regulatory uncertainty. A less stringent regulatory framework may facilitate the scaling of the VCM—regulatory uncertainty definitely will not. EU Member States, such as Germany, are obligated to implement MiCAR by modifying national regulatory frameworks, notably laws concerning financial instruments, which have the potential to over-regulate the creation of tokens. For instance, the implementation of KMAG in Germany appears to underestimate the significance of the main classification of other crypto-assets in a manner that is not consistent with MiCAR.

Legislation pertaining to the VCM and VCCs around the world has emphasised the importance of having a compatible regulatory framework on a global scale. Many of these attempts require clear and transparent documentation of any kind of offsetting. MiCAR can help by requiring standardised and fair white papers for VCC tokens and binding CASPs to enact fair measures. Furthermore, MiCAR and its improvement of regulatory stability can offer a paradigm for a comprehensive regulation of crypto-assets in general and VCC tokens in particular. Regulatory certainty will facilitate the evolution of the VCM, a process that will be further advanced by policymakers and participants developing blockchain-based approaches to VCCs. A potential outcome of such developments could be the creation of best practices, which may then be evaluated by more dynamic approaches. This is further underlined by the regulatory changes in progress, such as the bills introduced in the USA and the MARC and A&D regimes in the UK. These changes will help to make the regulatory frameworks in both countries more reliable.

The pursuit of technological solutions to existing problems, in addition to the fulfilment of net-zero goals and climate ambitions, which are imperative in combating climate

change, is hindered by regulatory uncertainties. The classification of existing VCC tokens within existing frameworks demonstrates the efficacy of MiCAR in combating such uncertainties by providing an encompassing category of other crypto-assets in Title II. Subsequent steps will include the acceleration of participants' involvement in and acceptance of blockchain-based technologies, thereby fostering their participation in the market expansion. The transfer of 'good' VCCs can be facilitated with fewer intermediaries than is the case with conventional VCCs, due to the main features of decentralisation through tokenisation. Ensuring the quality of underlying VCCs is a separate issue that must be addressed at its roots. As long as there are at least some VCCs that can be regarded as high quality, it would be a valid step in the positive development of the VCM to ensure their quality and mitigate the risk of double-counting through the use of tokenisation.

Notes

1 Directive 2004/39/EC of the European Parliament and of the Council of 21 April 2004 on markets in financial instruments amending Council Directives 85/611/EEC and 93/6/EEC and Directive 2000/12/EC of the European Parliament and of the Council and repealing Council Directive 93/22/EEC.
2 Directive 2014/65/EU of the European Parliament and of the Council of 15 May 2014 on markets in financial instruments and amending Directive 2002/92/EC and Directive 2011/61/EU (recast).
3 MiFID II is closely connected to the Regulation (EU) 2017/1129 of the European Parliament and of the Council of 14 June 2017 on the prospectus to be published when securities are offered to the public or admitted to trading on a regulated market, and repealing Directive 2003/71/EC (Prospectus Regulation) and the Regulation (EU) No 596/2014 of the European Parliament and of the Council of 16 April 2014 on market abuse (market abuse regulation) and repealing Directive 2003/7/EC of the European Parliament and of the Council and Commission Directives 2003/124/EC, 2003/125/EC and 2004/72/EC (Market Abuse Regulation).
4 Directive (EU) 2023/959 of the European Parliament and of the Council of 10 May 2023 amending Directive 2003/87/EC establishing a system for greenhouse gas emission allowance trading within the Union and Decision (EU) 2015/1814 concerning the establishment and operation of a market stability reserve for the Union greenhouse gas emission trading system.
5 Susanne Kalss and Fabian Aubrunner in Susanne Kalss, Christoph Krönke and Oliver Völkel (eds), *Crypto-Assets* (C. H. Beck 2024), Art. 4 MiFID II para 31–32.
6 European Commission, 'Ensuring the integrity of the European carbon market' (2020) https://climate.ec.europa.eu/eu-action/eu-emissions-trading-system-eu-ets/ensuring-integrity-european-carbon-market_en accessed 31 January 2025.
7 Cf Carsten Mueller and Leah Kling, 'Tokenising the Voluntary Carbon Credit Market: Harnessing Opportunities for Sustainable Development' in this book.
8 Dimitrios Linardatos, 'Finanzinstrumente im Digitalzeitalter – Teil II -' [2024], WM Zeitschrift für Wirtschafts- und Bankrecht 1685, 1689.
9 For more definitions of derivatives in MiFID II, cf Susanne Kalss and Fabian Aubrunner, in Susanne Kalss, Christoph Krönke and Oliver Völkel (eds), *Crypto-Assets* (C. H. Beck 2024), Art. 4 MiFID II para 28.
10 Cf Thorsten Voß, 'Non-fungible Token auf CO_2-Zertifikate – Eine kapitalmarkt- und aufsichtsrechtliche Einordnung' [2022], BKR 620; Dimitrios Linardatos, 'Finanzinstrumente im Digitalzeitalter – Teil

I -' [2024], WM, 1633; Linardatos, 'Finanzinstrumente im Digitalzeitalter – Teil II -' [2024], WM Zeitschrift für Wirtschafts- und Bankrecht 1685, 1689; Susanne Kalss and Fabian Aubrunner, in Susanne Kalss, Christoph Krönke and Oliver Völkel (eds), *Crypto-Assets* (C. H.Beck 2024), Art. 4 MiFID II para 38–42.

11 Susanne Kalss and Fabian Aubrunner, in Susanne Kalss, Christoph Krönke and Oliver Völkel (eds), *Crypto-Assets* (C. H. Beck 2024), Vor MiFID II para 22.

12 See also Sebastian Böhning and Dominik Skauradszun, 'VCC Tokens' Civil Law – Ownership, Transfer and Liability under Union and German Law' in this book.

13 Oliver Völkel in Susanne Kalss, Christoph Krönke and Oliver Völkel (eds), *Crypto-Assets* (C. H. Beck 2024), Art. 3 MiCAR para 23–24.

14 Especially considering Art. 3(8) MiCAR, see Matthias Lehmann in Susanne Kalss, Christoph Krönke and Oliver Völkel (eds), *Crypto-Assets* (C. H. Beck 2024), Art. 3 MiCAR para 65.

15 Oliver Völkel in Susanne Kalss, Christoph Krönke and Oliver Völkel (eds), *Crypto-Assets* (C. H. Beck 2024), Art. 3 MiCAR para 41–44.

16 Philipp Maume, 'Die Verordnung über Märkte für Kryptowerte (MiCAR) – Zentrale Definitionen sowie Rechte und Pflichten beim öffentlichen Angebot von Kryptowerten' [2022], RDi 461, 464.

17 These are not legally defined but mentioned under Title II MiCAR.

18 Christopher Rennig in Susanne Kalss, Christoph Krönke and Oliver Völkel (eds), *Crypto-Assets* (C. H. Beck 2024), Art. 4 MiCAR para 2.

19 Philipp Maume and Alireza Siadat, 'Struktur, Definitionen und Anwendungsfälle der Kryptoregulierung' [2023], NJW Neue Juristische Wochenschrift 1168; Susanne Kalss and Fabian Aubrunner in Susanne Kalss, Christoph Krönke and Oliver Völkel (eds), *Crypto-Assets* (C. H. Beck 2024), Art. 4 MiFID II para 34.

20 Principle 2 No 1 of the draft UNIDROIT Principles on the Legal Nature of Verified Carbon Credits; UNIDROIT Working Group on the Legal Nature of Voluntary Carbon Credits, Summary Report of the Second Session, Study LXXXVI – W.G.2 – Doc. 3 rev. (June 2024), 23 https://www.unidroit.org/wp-content/uploads/2024/07/Study-LXXXVI-W.G.2-Doc.-3-rev.-Summary-Report.pdf accessed 31 January 2025; for further discussion about claims established by VCCs and VCC tokens, see Sebastian Böhning and Dominik Skauradszun, 'VCC Tokens' Civil Law – Ownership, Transfer and Liability under Union and German Law' in this book.

21 E.g., Singapore allows to offset up to 5% of taxable emissions with high-quality international carbon credits, see National Climate Change Secretariat Singapore, 'Carbon Tax' (2023) https://www.nccs.gov.sg/singapores-climate-action/mitigation-efforts/carbontax/ accessed 31 January 2025.

22 Oliver Völkel in Susanne Kalss, Christoph Krönke and Oliver Völkel (eds), *Crypto-Assets* (C. H. Beck 2024), Art. 3 MiCAR para 75.

23 Oliver Völkel in Susanne Kalss, Christoph Krönke and Oliver Völkel (eds), *Crypto-Assets* (C. H. Beck 2024), Art. 3 MiCAR para 74.

24 European Securities and Markets Authority, 'Final Report – Guidelines on the conditions and criteria for the qualification of crypto-assets as financial instruments' (2024).

25 In accordance with Art. 2(1) of Regulation (EU) 2017/2402 of the European Parliament and of the Council of 12 December 2017 laying down a general framework for securitisation and creating a specific framework for simple, transparent and standardised securitisation, and amending Directives 2009/65/EC, 2009/138/EC and 2011/61/EU and Regulations (EC) No 1060/2009 and (EU) No 648/2012.

26 Annexes I and II to Directive 2009/138/EC of the European Parliament and of the Council of 25 November 2009 on the taking-up and pursuit of the business of Insurance and Reinsurance (Solvency II) (recast).

27 In accordance with Directive (EU) 2016/2341 of the European Parliament and of the Council of 14 December 2016 on the activities and supervision of institutions for occupational retirement provision (IORPs) (recast), Directive 2009/138/EC (Solvency II Directive) or Art. 2(2) of Regulation (EU) 2019/1238

of the European Parliament and of the Council of 20 June 2019 on a pan-European Personal Pension Product (PEPP).

28 In accordance with Regulation (EC) No 883/2004 of the European Parliament and of the Council of 29 April 2004 on the coordination of social security systems and Regulation (EC) No 987/2009 of the European Parliament and of the Council of 16 September 2009 laying down the procedure for implementing Regulation (EC) 833/2004 on the coordination of social security systems.

29 Further regulation concerning 'real' NFTs can still follow as the EU still sees their importance, according to Georg Lorenz, 'MiCAR – Markets in Crypto-Assets Regulation' [2024], ZIP Zeitschrift für Wirtschaftsrecht 58, 66.

30 Philipp Maume, 'Die Verordnung über Märkte für Kryptowerte (MiCAR) – Zentrale Definitionen sowie Rechte und Pflichten beim öffentlichen Angebot von Kryptowerten' [2022], RDi 461, 465; Philipp Maume, 'The Regulation on Markets in Crypto-Assets (MiCAR): Landmark Codification, or First Step of Many, or Both?' [2023], ECFR European Company and Financial Law Review 243, 259.

31 Cf Ben-Benedict Hruby in Susanne Kalss, Christoph Krönke and Oliver Völkel (eds), *Crypto-Assets* (C. H. Beck 2024), Art. 2 MiCAR para 36–39.

32 Jiehong Lou, Nathan Hultman, Anand Patwardhan and Yueming Qiu, 'Integrating sustainability into climate finance by quantifying the co-benefits and market impact of carbon projects', (2022) communications earth & environment 3:137 https://www.nature.com/commsenv accessed 31 January 2025; Jiehong Lou, Nathan Hultman, Anand Patwardhan and Irving Mintzer, 'Corporate motivations and co-benefit valuation in private climate finance investments through voluntary carbon markets' (2023) npj Climate Action 2:32 https://www.nature.com/npjclimataction/ accessed 31 January 2025; Groom and Venmans, 'The social value of offsets' [2023], Nature 768; Leho Tedersoo and others, 'Towards a co-crediting system for carbon and biodiversity' [2024], PPP Plants People Planet 6, 18.

33 European Securities and Markets Authority, 'Final Report – Guidelines on the conditions and criteria for the qualification of crypto-assets as financial instruments' (2024) Guideline 8.

34 Philipp Maume, 'Die Verordnung über Märkte für Kryptowerte (MiCAR) – Zentrale Definitionen sowie Rechte und Pflichten beim öffentlichen Angebot von Kryptowerten' [2022], RDi 461, 465.

35 Alireza Siadat, 'Markets in Crypto Assets Regulation – erster Einblick mit Schwerpunktsetzung auf Finanzinstrumente' [2021], RdF Recht der Finanzinstrumente 12, 17.

36 For more details regarding Art. 4(2) MiCAR see Christopher Rennig in Susanne Kalss, Christoph Krönke and Oliver Völkel (eds), *Crypto-Assets* (C. H. Beck 2024), Art. 4 MiCAR para 15–25.

37 Philipp Maume, 'The Regulation on Markets in Crypto-Assets (MiCAR): Landmark Codification, or First Step of Many, or Both?' [2023], ECFR 243, 263.

38 For more details regarding the bridging of VCCs see Carsten Mueller and Leah Kling, 'Tokenising the Voluntary Carbon Credit Market: Harnessing Opportunities for Sustainable Development' in this book.

39 Alireza Siadat, 'Regulierte Finanzinstrumente mit Schwerpunktsetzung auf NFT' [2023], RdF 4, 9; for a more critical view, see Sebastian Böhning and Dominik Skauradszun, 'VCC Tokens' Civil Law – Ownership, Transfer and Liability under Union and German Law' in this book.

40 Philipp Maume, 'Die Verordnung über Märkte für Kryptowerte (MiCAR) – Zentrale Definitionen sowie Rechte und Pflichten beim öffentlichen Angebot von Kryptowerten' [2022], RDi 461, 464.

41 For more considerations regarding tradability, see Georg von Wangenheim and Leon Krug, 'VCCs Tokenisation and the EU CBAM: Some Microeconomics of VCCs' in this book.

42 According to the Prospectus Regulation.

43 Christopher Rennig in Susanne Kalss, Christoph Krönke and Oliver Völkel (eds), *Crypto-Assets* (C. H. Beck 2024), Art. 6 MiCAR para 3.

44 Petra Buck-Heeb, 'Whitepaper-Haftung nach MiCAR' [2023], BKR Zeitschrift für Bank und Kapitalmarktrecht 689, 690.

45 European Securities and Markets Authority, 'MiCA white papers PoC' (2024), https://www.esma.europa.eu/document/mica-white-papers-poc accessed 31 January 2025.
46 For counterintuitive incentives to buy VCCs and VCC tokens, see Georg von Wangenheim and Leon Krug, 'VCCs, Tokenisation and the EU CBAM: Some Microeconomics of VCCs' in this book.
47 Christopher Rennig in Susanne Kalss, Christoph Krönke and Oliver Völkel (eds), *Crypto-Assets* (C. H. Beck 2024), Art. 15 MiCAR para 13.
48 Petra Buck-Heeb, 'Whitepaper-Haftung nach MiCAR' (2023), BKR 689, 695.
49 Philipp Maume, 'The Regulation on Markets in Crypto-Assets (MiCAR): Landmark Codification, or First Step of Many, or Both?' (2023), ECFR 243, 264; Christopher Rennig in Susanne Kalss, Christoph Krönke and Oliver Völkel (eds), *Crypto-Assets* (C. H. Beck 2024), Art. 15 MiCAR para 7.
50 Philipp Maume, 'Die Verordnung über Märkte für Kryptowerte (MiCAR) – Zentrale Definitionen sowie Rechte und Pflichten beim öffentlichen Angebot von Kryptowerten' (2022), RDi 461, 468.
51 Dominik Skauradszun, Selina Schweizer and Jeremias Kümpel, 'Das Kryptoverwahrgeschäft und der insolvenzrechtliche Rang der Kunden – Aussonderung oder Insolvenzquote' (2022), ZIP 2101, 2113.
52 Renate Prinz, Annabelle Rau and Oliver Völkel in Susanne Kalss, Christoph Krönke and Oliver Völkel (eds), *Crypto-Assets* (C. H. Beck 2024), Vor Art. 75 ff. MiCAR para. 3.
53 Oliver Völkel in Susanne Kalss, Christoph Krönke and Oliver Völkel (eds), *Crypto-Assets* (C. H. Beck 2024), Art. 3 MiCAR para 128–132.
54 European Securities and Markets Authority, 'Final Report – Draft Technical Standards specifying certain requirements of the Markets in Crypto Assets Regulation (MiCA) – second package' (2024).
55 For a more detailed discussion of the information asymmetry problems, see Georg von Wangenheim and Leon Krug, 'VCCs, Tokenisation and the EU CBAM: Some Microeconomics of VCCs' in this book.
56 Oliver Völkel in Susanne Kalss, Christoph Krönke and Oliver Völkel (eds), *Crypto-Assets* (C. H. Beck 2024), Art. 80 MiCAR para 4.
57 Philipp Ley in Susanne Kalss, Christoph Krönke and Oliver Völkel (eds), *Crypto-Assets* (C. H. Beck 2024), Art. 81 MiCAR para 2–3.
58 Philipp Ley in Susanne Kalss, Christoph Krönke and Oliver Völkel (eds), *Crypto-Assets* (C. H. Beck 2024), Art. 81 MiCAR para 5.
59 Oliver Völkel in Susanne Kalss, Christoph Krönke and Oliver Völkel (eds), *Crypto-Assets* (C. H. Beck 2024), Art. 82 MiCAR para 4.
60 European Securities and Markets Authority, 'Final Report – Guidelines specifying certain requirements of the Markets in Crypto Assets Regulation (MiCA) on investor protection – third package' (2024).
61 Directive (EU) 2022/2464 of the European Parliament and of the Council of 14 December 2022 amending Regulation (EU) No 537/2014, Directive 2004/109/EC, Directive 2006/43/EC and Directive 2013/34/EU, as regards corporate sustainability reporting.
62 Directive (EU) 2024/825 of the European Parliament and of the Council of 28 February 2024 amending Directives 2005/29/EC and 2011/83/EU as regards empowering consumers for the green transition through better protection against unfair practices and through better information.
63 Directive 2013/34/EU of the European Parliament and of the Council of 26 June 2013 on the annual financial statements, consolidated financial statements and related reports of certain types of undertakings, amending Directive 2006/43/EC of the European Parliament and of the Council and repealing Council Directives 78/660/EEC and 83/349/EEC (Accounting Directive).
64 Commission Delegated Regulation (EU) 2023/2772 of 31 July 2023 supplementing Directive 2013/34/EU of the European Parliament and of the Council as regards sustainability reporting standards.
65 Directive 2005/29/EC of the European Parliament and of the Council of 11 May 2005 concerning unfair business-to-consumer commercial practices in the internal market and amending Council Direc-

tive 84/450/EEC, Directives 97/7/EC, 98/27/EC and 2002/65/EC of the European Parliament and of the Council and Regulation (EC) No 2006/2004 of the European Parliament and of the Council.

66 Proposal for a Directive of the European Parliament and of the Council on substantiation and communication of explicit environmental claims (Green Claims Directive), COM(2023) 166 final (22.3.2023).

67 Regulation (EU) 2024/3012 of the European Parliament and of the Council of 27 November 2024 establishing a Union certification framework for permanent carbon removals, carbon farming and carbon storage in products.

68 For the evaluation on using VCCs for the EU CBAM, see Georg von Wangenheim and Leon Krug, 'VCCs, Tokenisation and the EU CBAM: Some Microeconomics of VCCs' in this book.

69 Program on International Financial Systems, 'A Review of Cryptoasset Market Structure and Regulation in the United States' (2023).

70 *SEC v Howey Co.* [1946] 328 U.S. 293, https://supreme.justia.com/cases/federal/us/328/293/ accessed 31 January 2025.

71 Cf U.S. Securities and Exchange Commission, 'Framework for 'Investment Contract' Analysis of Digital Assets' (2024), https://www.sec.gov/about/divisions-offices/division-corporation-finance/framework-investment-contract-analysis-digital-assets accessed 31 January 2025.

72 Program on International Financial Systems, 'A Review of Cryptoasset Market Structure and Regulation in the United States' (2023).

73 *CFTC v Coinflip Inc., d/b/a Derivabit, and Francisco Rioardan* [2015] CFTC Docket No 15–29; Commodity Futures Trading Commission, 'Digital Assets' (2024), https://www.cftc.gov/digitalassets/index.htm accessed 31 January 2025.

74 Program on International Financial Systems, 'A Review of Cryptoasset Market Structure and Regulation in the United States' (2023).

75 *CFTC v CQC Impact Investors LLC* [2024], CFTC Docket No 24–37; Congressional Research Service, 'Voluntary Carbon Credit Markets and the Commodity Futures Trading Commission' (2024), https://crsreports.congress.gov/product/pdf/R/R48095 accessed 31 January 2025.

76 Federal Register, 'Commission Guidance Regarding the Listing of Voluntary Carbon Credit Derivative Contracts' (2024), https://www.federalregister.gov/documents/2024/10/15/2024-23105/commission-guidance-regarding-the-listing-of-voluntary-carbon-credit-derivative-contracts accessed 31 January 2025.

77 Program on International Financial Systems, 'A Review of Cryptoasset Market Structure and Regulation in the United States' (2023); Program on International Financial Systems, 'Implementing an Effective Cryptoasset Regulatory Framework in the United States' (2024).

78 Digital Commodities Consumer Protection Act of 2022.

79 Luummis-Gillibrand Responsible Financial Innovation Act of 2023.

80 Financial Innovation and Technology for the 21st Century Act of 2023.

81 *SEC v Ripple Labs, Inc., Bradley Garlinghouse, and Christian A. Larsen* [2024] 20 Civ. 10832 (AT).

82 Program on International Financial Systems, 'Implementing an Effective Cryptoasset Regulatory Framework in the United States' (2024).

83 US Government, 'Voluntary Carbon Markets Joint Policy Statement and Principles' (2024).

84 Financial Conduct Authority, 'Guidance on Cryptoassets – Feedback and Final Guidance to CP 19/3' (2019).

85 HM Treasury, 'Future financial services regulatory regime for cryptoassets – Consultation and call for evidence' (2023); HM Treasury, 'Future financial services regulatory framework for cryptoassets – Response to the consultation and call for evidence' (2023).

86 Financial Conduct Authority, 'Financial promotion rules for cryptoassets – Policy Statement PS23/6' (2023).

87 Financial Conduct Authority, 'Financial promotion rules for cryptoassets – Policy Statement PS23/6' (2023).

88 Financial Conduct Authority, 'Financial promotion rules for cryptoassets – Policy Statement PS23/6' (2023).
89 Financial Conduct Authority, 'Finalised non-handbook guidance on Cryptoasset Financial Promotions – FG23/3' (2023).
90 Financial Conduct Authority, 'Regulating cryptoassets: Admissions & Disclosures and Market Abuse Regime for Cryptoassets – Discussion Paper DP 24/4' (2024).
91 UK Government, Welsh Government, Scottish Government and Department of Agriculture, Environment and Rural Affairs for Northern Ireland, 'Integrating Greenhouse Gas Removals in the UK Emissions Trading Scheme – A joint consultation of the UK Government, the Scottish Government, the Welsh Government and the Department of Agriculture, Environment and Rural Affairs for Northern Ireland' (2024).
92 Law Commission, 'Digital assets: Final report' (2023).
93 Property (Digital Assets, etc.) Bill [HL] (HL Bill 31—EN).
94 Dimitrios Linardatos, 'Finanzinstrumente im Digitalzeitalter – Teil II -' [2024], WM 1685, 1686; Florian Möslein and Christopher Rennig, 'Das Finanzmarktdigitalisierungsgesetz (FinmadiG) im europäischen Kontext (2024), RDi 145, 147.
95 Dimitrios Linardatos, 'Finanzinstrumente im Digitalzeitalter – Teil II -' [2024], WM 1685, 1686.
96 Philipp Maume '§ 12 Finanzdienstleistungsaufsicht' in Maume and Maute (eds), Rechtshandbuch Kryptowerte (1st edn, C. H. Beck 2024), para 7–8; Dimitrios Linardatos, 'Finanzinstrumente im Digitalzeitalter – Teil II -' [2024], WM 1685, 1686; Matthias Terlau, '§ 36 DLT-basiertes Geld im Währungs-, Aufsichts-, Geldwäsche-, Wertpapierrecht' in Florian Möslein and Sebastian Omlor (eds), FinTech-Handbuch (2nd edn C. H. Beck 2024), para 168.
97 Philipp Maume '§ 12 Finanzdienstleistungsaufsicht' in Philipp Maume and Lena Maute (eds), Rechtshandbuch Kryptowerte (1st edn, C. H. Beck 2024), para 26–27; Matthias Terlau, '§ 36 DLT-basiertes Geld im Währungs-, Aufsichts-, Geldwäsche-, Wertpapierrecht' in Florian Möslein and Sebastian Omlor (eds), FinTech-Handbuch (2nd edn C. H. Beck 2024), para 168.
98 Dimitrios Linardatos, 'Finanzinstrumente im Digitalzeitalter – Teil II -' [2024], WM 1685, 1687–1691.
99 Dimitrios Linardatos, 'Finanzinstrumente im Digitalzeitalter – Teil II -' [2024], WM 1685, 1691.
100 BT-Drucksache 20/10280 (2024), 164.
101 Dimitrios Linardatos, 'Finanzinstrumente im Digitalzeitalter – Teil II – '[2024], WM 1685, 1691.
102 UNIDROIT, 'Principles on Digital Assets and Private Law' https://www.unidroit.org/work-in-progress/digital-assets-and-private-law/ accessed 31 January 2025.
103 For a more defined evaluation of Principle 2 DAPL, see Dominik Skauradszun and Sebastian Böhning, 'Applicable Law in the Supply Chains of VCC Tokens' in this book.
104 According to Principle 2(4) DAPL, 'other law' refers to the existing law of the states looking to apply the Principles.
105 Tokenisation can help trading VCCs in some ways, see Georg von Wangenheim and Leon Krug 'VCCs, Tokenisation and the EU CBAM: Some Microeconomics of VCCs' in this book.
106 E.g., in German law, see BT-Drucksache 20/10280 (2024), 164.
107 UNIDROIT, 'Draft Principles on the Legal Nature of Verified Carbon Credits' (2025) https://www.unidroit.org/work-in-progress/verified-carbon-credits/ accessed 31 January 2025.
108 UNIDROIT, 'Summary Report of the second session' (2024), 4.
109 This was to be discussed at the meeting in April 2025; UNIDROIT, 'Issues Paper' (2025), 52.
110 Toucan Protocol Association https://toucan.earth/ accessed 31 January 2025.
111 Verra https://verra.org/ accessed 31 January 2025.
112 Gold Standard https://www.goldstandard.org/ accessed 31 January 2025.
113 Gold Standard, 'Conditions for consenting to tokenisation of Gold Standard-issued credits' (2022) https://www.goldstandard.org/consultations/conditions-for-consenting-to-tokenisation-of-gold-stan

dard-issued-credits accessed 31 January 2025; Verra, 'Verra Addresses Crypto Instruments and Tokens' (2022) https://verra.org/verra-addresses-crypto-instruments-and-tokens/ accessed 31 January 2025.

114 Puro.earth https://puro.earth/ accessed 31 January 2025.

115 Biochar refers to the act of capturing CO_2e in biomass through pyrolysis; for an in-depth article on biochar's properties, see Hamed Sanei and others, 'Assessing biochar's permanence: An inertinite benchmark' (2024), International Journal of Coal Geology 104409.

116 Neutral https://www.neutralx.com/ accessed 31 January 2025.

117 Sander DiAngelis, 'The world's first liquid market for biochar' (*Toucan*, 2024) https://blog.toucan.earth/onchain-climate-action-char/ accessed 31 January 2025.

118 Nori's websites are no longer accessible, cf Haje Kamps, 'Immune to irony, Nori puts a carbon market on the blockchain' (*TechCrunch*, 2022) https://techcrunch.com/2022/02/24/nori-series-a-carbon-blockchain/ accessed 31 January 2025.

119 Haje Kamps, 'Immune to irony, Nori puts a carbon market on the blockchain' (*TechCrunch*, 2022) https://techcrunch.com/2022/02/24/nori-series-a-carbon-blockchain/ accessed 31 January 2025.

120 Paul Gambill, 'How to save the planet and make climate change 'just go away' using blockchain and cryptocurrency' (*Medium*, 2020) https://medium.com/nori-carbon-removal/how-to-save-the-planet-and-make-climate-change-just-go-away-using-blockchain-and-cryptocurrency-f6e33917089d accessed 31 January 2025.

121 Paul Gambill, 'How to save the planet and make climate change 'just go away' using blockchain and cryptocurrency' (*Medium*, 2020) https://medium.com/nori-carbon-removal/how-to-save-the-planet-and-make-climate-change-just-go-away-using-blockchain-and-cryptocurrency-f6e33917089d accessed 31 January 2025.

122 Cf Lisa Stiffler, 'Nori, a Seattle-based carbon removal marketplace that raised $17M, shuts down after 7 years' (*Geekwire*, 2024) https://www.geekwire.com/2024/nori-a-seattle-based-carbon-removal-marketplace-that-raised-17m-shuts-down-after-7-years/ accessed 31 January 2025.

123 American Carbon Registry https://acrcarbon.org/ accessed 31 January 2025.

124 Climate Action Reserve https://www.climateactionreserve.org/ accessed 31 January 2025.

125 Plan Vivo Foundation https://www.planvivo.org/ accessed 31 January 2025.

126 C3.app, 'C3 Documentation' https://docs.c3.app/ accessed 31 January 2025.

127 Coorest, 'Coorest Carbon Standard' (2022) https://coorest.io/carbon-standard/ accessed 31 January 2025.

128 Coorest, 'Coorest Whitepaper 3.0' (2023) https://coorest.gitbook.io/coorest-whitepaper-3.0 accessed 31 January 2025.

129 For more details on the Lifecycle of VCCs, see Jonathan Lautenschlager, Marike Reinelt, Vincent Schaaf and Nils Urbach, 'From Project Design to Retirement: The Role of Blockchain along the Voluntary Carbon Credit Lifecycle' and Valeriya Arnold, Vincent Schaaf, Nils Urbach and Jonathan Lautenschlager, 'Designing a framework for a blockchain-based Carbon Credit Lifecycle' in this book.

130 Toucan, 'The first liquid market for biochar credits' (2024) https://toucan.earth/char/ accessed 31 January 2025.

131 Program on International Financial Systems, 'Implementing an Effective Cryptoasset Regulatory Framework in the United States' (2024).

132 Cf UNIDROIT, 'Summary Report of the first session' (2023), 5.

133 U.S. Securities and Exchange Commission, 'Framework for 'Investment Contract' Analysis of Digital Assets' (2024), https://www.sec.gov/about/divisions-offices/division-corporation-finance/framework-investment-contract-analysis-digital-assets accessed 31 January 2025.

134 Paul Gambill, 'How to save the planet and make climate change 'just go away' using blockchain and cryptocurrency' (*Medium*, 2020) https://medium.com/nori-carbon-removal/how-to-save-the-planet-and-make-climate-change-just-go-away-using-blockchain-and-cryptocurrency-f6e33917089d accessed 31 January 2025.

135 Coorest, 'FAQ' https://coorest.io/about/faq/ accessed 31 January 2025.
136 Coorest, 'Coorest NFTree' (2023) https://coorest.gitbook.io/coorest-whitepaper-3.0/coorest-nftree accessed 31 January 2025.
137 Program on International Financial Systems, 'A Review of Cryptoasset Market Structure and Regulation in the United States' (2023).