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Tokenized carbon credits: how blockchain is revolutionizing carbon markets

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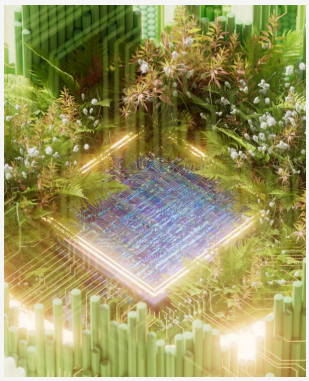

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Companies and financial institutions around the globe have offered, or have announced their intention to offer, tokenized real-world assets to complement a variety of services and products. As we noted in our February 2024 article, efforts to reduce carbon emissions have led to innovative financial instruments, including carbon credits (also known as carbon offsets), which are utilized as a tool for incentivizing organizations to lower their carbon footprint.

This article explores the intersection of these two developments: the tokenization of carbon credits. We deconstruct the concept of carbon credits (also known as carbon offsets), explain the process of tokenization and discuss the benefits, challenges and applicable Canadian regulations to the tokenization of carbon credits.

Understanding asset tokenization

Asset tokenization involves converting ownership rights of an asset into a digital token on a blockchain. These tokens, representing specific asset values, can be traded or transferred digitally without intermediaries. Tokenization applies to various assets, including real estate, art, commodities and financial instruments. Blockchain technology supports this process by providing a secure, decentralized ledger that records transactions immutably. Smart contracts, which are self-executing contracts written into code, automate these transactions when predefined conditions are met. This reduces the need for intermediaries, lowers transaction costs and speeds up settlement processes. Tokens are typically offered to buyers through online platforms or mobile apps, further streamlining transactions.

It is essential to recognize that tokenizing an asset, including carbon credits, does not modify the asset's fundamental characteristics. This highlights the need for a comprehensive legal and regulatory assessment that is tailored to the specific attributes of the carbon credit itself and the way it is traded. (Please see the section on "Canadian regulatory considerations" below for an overview of the Canadian laws and regulations that currently apply.)

Carbon credits

In Canada, two types of markets facilitate carbon credit trading: compliance markets and voluntary markets. In Canada's compliance markets, large emitters are under legal obligations to reduce carbon emissions or to use carbon credits established under such

regulatory frameworks to meet those obligations. In compliance markets, one carbon credit represents one tonne of covered emissions, which is measured in carbon dioxide equivalents. Carbon emissions in this type of market are regulated in each province under the federal framework, a provincial framework or a hybrid federal-provincial regime.

The federal industrial compliance market framework, provided through the *Greenhouse Gas Pollution Pricing Act* (GGPPA), regulates carbon emissions from large industrial emitters through minimum carbon pricing standards. This framework applies in provinces and territories that do not meet the GGPPA's pricing and output-based emission benchmarks. Provinces can meet the federal pricing and emissions targets through a provincial carbon pricing system, where an output-based emissions limit is imposed on regulated emitting facilities. Alternatively, they can meet facility-specific fixed targets through a cap-and-trade system in which "allowances" of a certain quantity of emissions are allocated to regulated emitting facilities.

Voluntary markets serve as a non-regulatory means of directing financial resources to projects that deliver independently verified emissions reductions or other environmental benefits. This type of market operates independently of, and can be complementary to, compliance markets. Voluntary offset project developers are issued carbon credits from a private standards body that acts as a certifying and auditing agency. The voluntary carbon credit can then be bought by a carbon credit buyer. Similar to the compliance market, one voluntary carbon credit typically represents one tonne of covered emissions. Emitters participate in voluntary markets to meet internal carbon emissions reduction goals; achieve environmental, social, and governance (ESG) targets; fulfill customer contracts; address climate concerns; or offset emissions to comply with green bonds and sustainability-linked debt agreements.

Growth of the carbon credit market

The carbon credit market has experienced significant growth due to increasing regulatory pressure and corporate commitments to sustainability. The global voluntary carbon credit market size was estimated at US$2.97 billion in 2023. Canada's market has seen significant growth, driven by increasing corporate and individual demand for carbon offsetting. According to Grand View Research, the Canadian market is expected to grow at the fastest compound annual growth rate (CAGR) of 34.9%.

Notwithstanding its impressive growth both globally and in Canada, many challenges continue to impede the widespread adoption of carbon markets. Notably, there have been issues with the verification of carbon emission reductions; independent auditors may struggle with complex, inconsistent standards and unreliable data, especially in remote areas. The risk of fraud and double counting emissions reductions further complicates the system. These issues highlight the need for improved standardization, transparency and verification processes in the market. Tokenization presents a practical solution to address these concerns, mainly due to the transparency and immutable nature of blockchain technology.

Tokenizing carbon credits

Carbon credits may be tokenized in a variety of different manners, depending on various considerations, including the level of decentralization desired, interoperability with existing systems, ease of use and accessibility, and regulatory considerations, among others. The following is an example of the steps involved when carbon credits are "bridged" from a traditional registry onto a blockchain resulting in the issuance of corresponding tokens:

1. **Locking in custodial account**: Carbon credits and the unique information they contain

can be transferred by credit holders from established registries like Verra or Gold Standard to a custodial account controlled by a bridging platform, which is a system or service that connects traditional carbon credit registries with blockchain networks. (Examples of bridging platforms include Toucan Protocol and Flowcarbon.) This account acts as a secure vault, ensuring that the original credits remain intact, are verified for authenticity and cannot be double counted.

2. **Minting tokens**: Once the credits are secured in the custodial account, the platform mints corresponding tokens onto a blockchain. Many projects use the Ethereum blockchain for its smart contract capabilities and widespread adoption, though other blockchains are also considered. Common token standards include ERC-20 for fungible tokens and ERC-721 for non-fungible tokens. These tokens represent the carbon credits on-chain, on a 1:1 basis (one token = one carbon credit). When tokens are minted, they may include metadata that links them back to the original credits in the registry. This metadata typically contains information such as the project type, vintage and unique identifier from the original registry.
3. **Token functionality**: The minted tokens can then be traded on various blockchain platforms, potentially fractioned into smaller units or retired (used to offset emissions). When tokens are retired to claim offsets, the corresponding credits in the registry are also retired, preventing double counting. Smart contracts automate processes like token minting, retiring credits and updating registries.

The process of tokenization aims to create an efficient, transparent system for trading carbon credits on a blockchain while preserving the credibility of the underlying environmental benefits. Ensuring tokenized credits maintain a connection to the original registry (e.g., Verra or Gold Standard) and comply with the specific rules and guidelines set by the registry is essential. Specific implementations can vary between platforms and registries, with some offering two-way bridging (i.e., where tokenized credits can be "de-tokenized" and returned to the original registry if needed) and others managing the entire process internally, thereby restricting a user's ability to move credits themselves between a blockchain and a registry.

Examples of tokenized carbon credit platforms

ACX

AirCarbon Exchange (ACX) is an example of a regulated carbon exchange and clearinghouse which uses blockchain technology to streamline carbon credit transactions.

In November 2022, ACX became the first entity to be licensed by the Financial Services Regulatory Authority (FSRA) under the Abu Dhabi Global Market (ADGM) regulatory framework for carbon credits. The regulatory licenses granted by the FSRA in ADGM permit ACX to provide its market for tokenized carbon credits globally (including in Canada), as well as to facilitate settlement and to act as custodian for participant assets.

ACX leverages blockchain to create a digital record of carbon credits on their platform. This allows for real-time viewing, management and valuation of assets, as well as secure and efficient trading and settlement of transactions. The blockchain infrastructure enables ACX to provide a transparent and immutable record of carbon credit ownership and transactions, reducing the risk of double counting and enhancing trust in the voluntary carbon market. Additionally, ACX's use of blockchain technology supports their unique custody model,

allowing market participants to securely hold and transact carbon credits and renewable energy certificates linked to leading carbon registries.

Toucan Protocol

Toucan is one of the leading platforms for tokenizing carbon credits. They provide infrastructure for tokenizing carbon credits as "Base Carbon Tonnes (BCT)" and "Nature Carbon Tonnes (NCT)". These tokenized credits can then be traded within Toucan's ecosystem and on major crypto trading platforms.

Toucan demonstrates both the potential opportunity and challenges of tokenizing carbon credits. Within six months of its October 2021 launch, over 20 million tonnes of carbon credits were tokenized using Toucan's infrastructure, showcasing significant market interest. However, Toucan also faced criticism when many low-quality, dormant credits were tokenized, leading to temporary bans on tokenization by some registries. This highlighted the need for careful quality control and collaboration with traditional carbon market stakeholders.

DeepMarkit

DeepMarkit, a publicly traded Canadian company, has developed a proprietary web-based platform called MintCarbon.io that facilitates the tokenization of carbon credits. The platform allows carbon credits to be minted into unique, resaleable non-fungible tokens (NFTs) powered by the Ethereum blockchain.

The tokenization process on MintCarbon.io enables the creation of tradeable digital assets representing carbon credits, which can then be bought and sold on the platform. DeepMarkit's MintCarbon.io platform demonstrates a practical application of tokenization in the carbon credit market, potentially opening up new opportunities for market participants to engage in transparent, secure and efficient transactions.

Benefits of tokenizing carbon credits

There are several benefits of tokenizing carbon credits:

1. **Enhanced transparency and traceability**: Tokenization on a blockchain provides an immutable, transparent record of carbon credit ownership and transactions. This reduces the risk of fraud and double-counting, and ensures the integrity of the carbon credit market.
2. **Increased liquidity and accessibility**: Tokenized carbon credits can be easily traded on digital platforms, increasing liquidity in the market. Tokenization lowers barriers to entry, allowing individuals and smaller organizations to participate in the carbon credit market.
3. **Improved efficiency and cost reduction**: Blockchain streamlines the issuance, trading and retirement of carbon credits, reducing administrative costs and time. Smart contracts can automate transactions and enforce the terms of carbon credit transactions.

Specific benefits for financial institutions

Financial institutions may enjoy unique benefits from tokenizing carbon credits. Tokenization could lead to the creation of new financial products such as green bonds and tokenized securities. It could enable banks to build secure marketplaces for trading carbon credits, fostering trust by ensuring the quality and legitimacy of carbon projects. Tokenization enhances liquidity and transparency through improved price discovery mechanisms, while

also helping banks meet their ESG commitments. Additionally, banks can innovate and help their clients meet their ESG commitments with hybrid products, diversify client portfolios and create a network effect by collaborating with other entities in the ESG space.

Challenges

As mentioned above, the Toucan Protocol encountered some difficulty in 2022 when concerns about the integrity and quality of its tokens emerged. In May 2022, Verra, a leading carbon offset registry, prohibited the practice of creating tokens based on retired credits and proposed exploring the "immobilization" of credits to enable tokenization while maintaining transparency and traceability. This directly impacted Toucan Protocol, which had "bridged" around 22 million Verra-issued credits onto the blockchain by retiring them in exchange for tradeable tokens.

Verra launched a public consultation on its proposed approach in August 2022, seeking input on issues like anti-fraud measures, know-your-customer (KYC) checks and potential fee structures. However, as of this writing, Verra has yet to announce the implementation of a specific framework for tokenizing live credits.

Other than concerns around the quality and integrity of tokens, some have highlighted the absence of consistent standards and terminology across different carbon credit systems and blockchain platforms that might lead to confusion and hinder interoperability.

While blockchain technology is often touted for its transparency, some market participants worry that the level of detail provided in token transactions may not match the granularity required for proper market analysis and integrity. However, this could resolve itself in time as the tokenized carbon credit industry matures. It will be critical that carbon credits maintain a strong link to the underlying environmental benefits they represent and that robust verification and retirement processes are implemented to prevent double counting and to maintain the credibility of the market.

Canadian regulatory considerations

The tokenization of carbon credits in Canada operates within a complex regulatory landscape that is still evolving. As of early 2025, there is no specific federal or provincial legislation directly addressing the tokenization of carbon credits. However, several key regulatory aspects are relevant:

1. **Federal offset system**: The Canadian Greenhouse Gas Offset Credit System, established under the *Greenhouse Gas Pollution Pricing Act*, provides a framework for generating and trading carbon credits. While this system does not explicitly address tokenization, it forms the foundation for the carbon credit market in Canada.
2. **Provincial jurisdiction**: Some provinces, such as Alberta, British Columbia and Québec, have their own offset systems. Any tokenization efforts must consider these provincial regulations and ensure compliance with both federal and provincial requirements.
3. **Securities regulations**: Depending on how tokenized carbon credits are structured and traded, they may fall under securities regulations. The Canadian Securities Administrators (CSA) have not issued specific guidance on tokenized carbon credits, but existing securities laws could apply if these tokens are considered investment contracts or derivatives.
4. **Anti-money laundering (AML)/counter-terrorist financing legislation:** Platforms that facilitate the trading of tokenized carbon credits may be "dealing in virtual currency" for

the purposes of federal and provincial AML legislation and therefore may fall under the definition of money services businesses. Money services businesses are required to register with FINTRAC and possibly Revenu Québec and must comply with know-your-customer rules along with various reporting and record-keeping obligations.

5. **Verification and integrity**: Any tokenization system would need to align with the verification and integrity requirements set out in the Canadian Greenhouse Gas Offset Credit System Regulations, ensuring that each token accurately represents a verified carbon credit.
6. **Interoperability**: Consideration must be given to how tokenized credits would interact with the existing federal and provincial carbon pricing systems and registries.
7. **Environmental claims**: The Competition Bureau's guidelines on environmental claims would apply to any marketing or representations made about tokenized carbon credits.

As the tokenization of carbon credits is a relatively new concept in Canada, regulators are likely to scrutinize such initiatives closely. Companies looking to implement carbon credit tokenization should engage early with relevant regulatory bodies and consider seeking legal advice to navigate this complex and evolving regulatory landscape.

Conclusion

While there are challenges to navigate, the potential for carbon markets to contribute to Canada's climate objectives is significant. Tokenization of carbon credits may be a solution to some of these challenges due to greater transparency, liquidity and efficiency. The success of the markets for tokenized carbon credits will hinge on thoughtful design, robust implementation and ongoing adaptation to emerging trends, regulations and technologies.