BNC.
bravenewcoin.com

JAN
2020

TECHEMY
CAPITAL

TECHEMY
ADVISORY

CARBON CREDIT TRADING:

The compelling case for market tokenization

TECHEMY GROUP PROPRIETARY RESEARCH 2020

Executive Summary

To most people, the workings of the international carbon credits system remains a complete mystery. High profile international accords such as the Kyoto Protocol and the Paris Climate Agreement have garnered considerable media attention, but most investors have no idea how to engage in carbon credit markets - or indeed, if the schemes are still operating given the United States intention to formally withdraw from the Paris Agreement in 2020.

Climate challenges are becoming an input to "value-at-risk" and a major constraint on future growth, as demonstrated by the catastrophic Australian wildfires. Finding solutions is no longer limited to the domain of governments but now a wider stakeholder effort with investors and corporations becoming more involved. The World Economic Forum's annual *Global Risks Report 2020* highlights for the first time in the survey's 10-year outlook the top five global risks in terms of likelihood are all environmental.

- Extreme weather events with major damage to property, infrastructure and loss of human life
- Failure of climate-change mitigation and adaptation by governments and businesses.
- Human-made environmental damage and disasters, including environmental crime, such as oil spills, and radioactive contamination.
- Major biodiversity loss and ecosystem collapse (terrestrial or marine) with irreversible consequences for the environment, resulting in severely depleted resources for humankind as well as industries.
- Major natural disasters such as earthquakes, tsunamis, volcanic eruptions, and geomagnetic storms.

This research report investigates the current state of carbon credits trading schemes. It finds that dozens of schemes are currently operating internationally but that the monetization of carbon trading and government policies relating to it vary widely from jurisdiction to jurisdiction. The territorial nature of the current marketplace thus makes attracting liquidity difficult and is a major challenge to the establishment of global carbon markets.

The report then highlights 'Article 6' of the Paris Agreement and its intent to ease the way for international carbon trading - before proposing the concept of 'tokenizing' carbon markets using security tokens - and how this could assist Article 6 initiatives by opening up markets, attracting liquidity from a broader investor base and standardizing pricing.

BNC Research prepares business leaders, policymakers and investors for the major changes occurring in our legacy systems so they can adapt to the new digital economy. This proprietary research is aimed at policymakers and business leaders, for a consultation on our services contact us here.

© Brave New Coin 2020. BNCRR210120

Contents

© Brave New Coin 2020. BNCRR210120

Carbon Credits Overview

Carbon trading began in response to the Kyoto Protocol, signed by 180 countries in 1997, which initially called for 37 industrialized countries to reduce their greenhouse gas emissions. The Paris Climate Agreement adopted in December 2015 and ratified by 187 countries evolved out of the Kyoto Protocol with the goal of developing and industrialized countries limiting global warming to well below 2°C and pursuing efforts to limit it to 1.5°C.

Carbon trading is a market-based system designed to control carbon dioxide (CO2) emissions by providing economic incentives for achieving emissions reductions. Owners of trees that absorb carbon produce carbon credits that can be sold to producers of carbon. The producers of carbon utilize the carbon credits to offset their carbon production.

The problem: Fragmented and mispriced markets

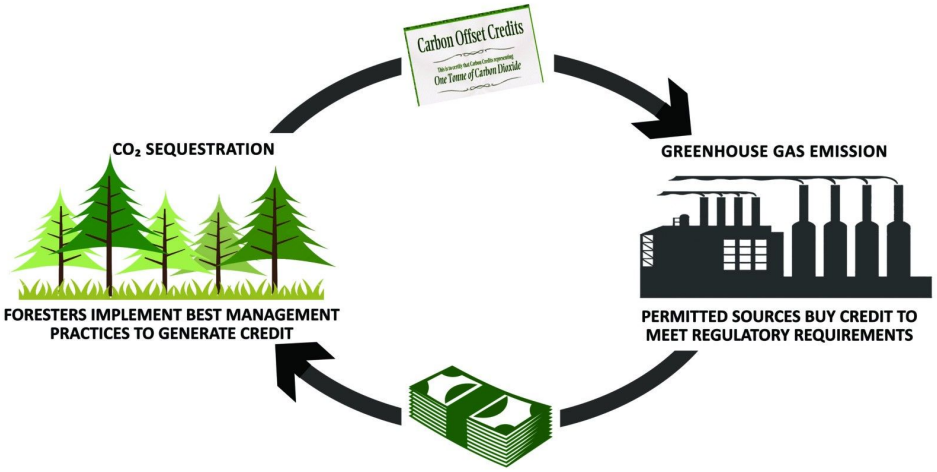
The size of the carbon market is estimated at US$82 billion per annum according to the World Bank. There are currently 51 carbon pricing initiatives around the world, consisting of 25 emissions trading schemes and 26 carbon taxes. These initiatives cover 20 percent of all global greenhouse gas emissions, or 11 gigatonnes of carbon dioxide.

The schemes have been put in place across 71 jurisdictions, 45 of which are on the national level as governments increasingly see the economic benefits of curbing emissions. The World Bank estimates that receipts from carbon pricing now amount to $33 billion. The European Union also took steps to fix its dysfunctional trading scheme by increasing the price from 5 euros per tonne of CO2 equivalent to 13 euros ($7 to $16).

However, analysts from the World Bank point out that this remains below the accepted range of $40-$80 per tonne needed to reach the goals of the Paris Climate Agreement.

There are various types of projects that produce carbon credits including forestry, renewable energy, manufacturing, transport, agriculture, wastewater treatment, and methane capture initiatives that reduce emissions. This paper will focus on carbon credits produced by forests and their tokenization. Carbon market stakeholders include producers of credits (forestry companies, forestry trusts, and public government owned conservation land) and buyers of credits (companies, organizations, speculators, and individuals who want to offset their emissions).

© Brave New Coin 2020. BNCRR210120



Source: Clemson University Public Service and Agriculture

Types of Carbon Markets

Mandatory Carbon Market

Mandatory schemes, also known as cap-and-trade, issue a set number of emissions allowances each year. Businesses whose emissions exceed a defined threshold are required to obtain an allowance, or credit, for each tonne of carbon dioxide equivalent that they emit annually. These allowances can be auctioned to the highest bidder as well as traded on secondary markets, creating a carbon price. Businesses who subsequently reduce their emissions sell their excess carbon credits to other participants whose emissions have increased, thereby commoditizing carbon and creating a market.

Mandatory carbon markets generally only accept their own carbon credits, but some schemes also accept carbon offsets from the voluntary market in place of a proportion of the credits if they comply with strict regulatory rules. Regulated carbon markets include the EU, US markets (Western Climate Initiative and Regional Greenhouse Gas Initiative), New Zealand, China, and South Korea.

A similar but slightly different policy tool that governments can also employ to cut emissions is a carbon tax. A carbon tax directly establishes a price on greenhouse gas emissions with companies charged a dollar amount for every ton of emissions they produce. The main advantage of a carbon tax when compared to cap-and-trade is that it provides for more stable carbon prices. It also provides stronger incentives to reduce emissions because a carbon tax penalizes all carbon emissions while cap-and-trade only penalizes emissions beyond a threshold.

© Brave New Coin 2020. BNCRR210120

Voluntary Carbon Offset Market

The other type of carbon market relies on the creation of carbon offsets, which can be bought by any business, organization or individual to offset their own greenhouse gas emissions on a voluntary basis.

The most common buyers in the voluntary carbon market are organizations that have implemented carbon reduction plans to minimize emissions from their business activities as far as possible. To achieve zero emissions or corporate social responsibility (CSR) targets, they choose to buy carbon offsets. Lyft, the ride-sharing company, recently announced that it is buying carbon offsets to make every ride in a Lyft vehicle "carbon neutral." Lyft anticipates buying enough offsets for over 1 million metric tonnes of carbon emissions in the first year of the program.

Other large companies that voluntarily buy carbon offsets as a part of their carbon emissions reduction strategies include General Motors, Delta Airlines, and Expedia. Royal Dutch Shell is launching a $300m forestry programme, including investing in large forests in the Netherlands and Spain. Shell considers these projects to be both a way to meet climate targets as well as a business opportunity selling the carbon credits produced by the forests.

The sellers in the voluntary carbon market are project developers who design and implement real-world carbon reduction projects in accordance with the requirements of one of the voluntary standard bodies. Each tonne of CO2 emissions sequestered can be sold as a carbon offset, compensating for a tonne of CO2 emitted elsewhere. Because the voluntary market is global and lacks liquidity, many project developers sell offsets through a retailer or broker, who takes responsibility for promoting the offsets and finding buyers.

© Brave New Coin 2020. BNCRR210120

Economics of Carbon Credits

There are many components to the cost of producing carbon credits and each situation will be slightly unique depending on circumstances. Below are descriptions of the major cost and revenue input components.

Cost of Production of Credits

Land acquisition: Land costs will vary based on location. For example, land in developing countries and remote areas that are more difficult to travel to will have more expensive certification costs.

Trees: If the forest is not already established on the land, tree planting costs vary depending on what types of trees are planted and what labor costs are in the region, but typically tree seedling and labor costs can be expected to be a minimum of $1500 per hectare.

Insurance on the land: Insurance is necessary to safeguard against any adverse events that cause damages to the property such as fires.

Certification: There are certification costs in order for the carbon credits to be officially approved under the mandatory and voluntary markets. The most popular certifications in the voluntary market include the Clean Development Mechanism ("CDM") and the Gold Standard. The cost of certification is typically $5000 in certification fees plus .15 per certified credit.

Expected Income from Credits

Carbon Ratio: The environmental impact of a project on carbon levels is known as the carbon ratio. The type of trees on the land will impact how many credits are produced because different trees absorb different amounts of carbon from the atmosphere. As an example, the New Zealand ETS outlines the tonnes of carbon dioxide that are absorbed by different tree types at various ages per hectare.

Deforestation: Cutting forests down has a negative impact on the number of credits allocated to the land because not only does carbon absorption cease, but the carbon stored in the trees is released into the atmosphere as CO2 if the wood is burned or left to rot after the deforestation process.

© Brave New Coin 2020. BNCRR210120

Table 2: Carbon stock per hectare for Douglas-fir, exotic softwoods, exotic hardwoods and indigenous forest (expressed as tonnes of carbon dioxide per hectare)

Age (yrs)	Douglas-fir	Exotic softwoods	Exotic hardwoods	Indigenous forest
0	0	0	0	0
1	0.1	0.2	0.1	0.6
2	0.1	1	3	1.2
3	0.4	3	13	2.5
4	1	12	34	4.6
5	2	26	63	7.8
6	4	45	98	12.1
7	7	63	137	17.5
8	20	77	176	24.0
9	33	87	214	31.6
10	50	95	251	40.2
11	69	106	286	49.8

Source: Carbon Look-up Tables for Forestry in the Emissions Trading Scheme, New Zealand Ministry for Primary Industries

Price of Carbon Credits: There are different pricing mechanisms in the mandatory and voluntary markets.

Prices in the mandatory markets are largely controlled by government policies and regulations. The government policies control the supply and demand of the market through multiple levers including adjusting the number of circulating credits, raising the mandatory emissions reductions targets, and adjusting carbon emission tax amounts.

Prices in the voluntary markets are controlled mainly by market forces of supply and demand. As the private sector increases its commitments to emissions reductions in addition to those reductions that are mandatory, the price of credits increases. Companies are initiating voluntary reduction goals in order to have more cost-effective energy usage, pre-empt government regulations, and enhance their corporate social responsibility. Carbon credits certified by well-recognized standards are more expensive.

© Brave New Coin 2020. BNCRR210120

Trends and Future Outlook

The current state of the mandatory carbon markets is that they are fragmented at the country level, so each country's scheme prices carbon differently under different rules and regulations. As part of the 2015 Paris Climate Agreement, there is an annual Conference of the Parties, which is the top decision-making body for climate negotiations working at an international level.

Linking carbon markets internationally can help further drive down the cost of achieving emission reduction targets, helping to stimulate the needed investments for clean energy transitions. There is speculation that a global carbon market would enable the frictionless trading of carbon emissions between the various mandatory markets, and create standards for having the voluntary market credits accepted by the mandatory markets.

Article 6 of the Paris Agreement will pave the way for a new form of international interaction among carbon markets. Article 6 builds on the market approaches of the Kyoto Protocol, the Paris Agreement's predecessor. It intends to support countries in enhancing the ambitions of their stated climate actions, which collectively contribute to the overarching goal of the Paris Agreement to keep the rise in global average temperatures to below 2 degrees celsius. There has not yet been a formal outcome on Article 6 and there are still issues to work through such as agreeing on an accounting system to avoid double counting.

Article 6 introduces two mechanisms for international trading of carbon credits. Article 6.2 sets out the principles for voluntary co-operative approaches. One country can transfer "internationally transferred mitigation outcomes" (ITMOs) to another country, which can then use them towards its own target.

These transfers will apply transparent accounting rules to avoid double counting and to ensure environmental integrity. The transfers can take place using various mechanisms, such as bilateral cooperation programmes between countries or national or regional emission trading schemes. Article 6.4 establishes a mechanism to contribute to the reduction of greenhouse gas emissions under the oversight of a central UN governance body. Public and private entities can participate in this mechanism.

We propose a number of models that could ameliorate some of the accessibility and pricing issues for investors and policymakers in the legacy carbon credit system through digitization.

© Brave New Coin 2020. BNCRR210120

The Solution: Tokenization of Carbon Credits

What is Tokenization?

With the advent of blockchain technology came the opportunity to digitally represent real world assets as tokens. Tokenization of assets refers to the process of issuing a blockchain token, also known as a security token, that digitally represents a tradable asset. The initial creation of the security tokens is referred to as a security token offering (STO). This is not limited to traditional financial asset classes like stocks and bonds, as security tokens can be expanded to all assets. They can represent ownership of a piece of real estate, an investment fund, concert tickets, cars, precious metals, carbon credits, and much more. Once the tokens are issued via the blockchain to token holders, they are tradable on secondary market exchanges.

Advantages of Tokenization

Carbon credits currently trade on regional exchanges and often require minimum purchase amounts. With tokenization, there is opportunity for increased liquidity and increased access for retail investors by making carbon credit tokens openly traded on global exchanges. Carbon credits are no longer accessible only to large investors who can afford to buy up large pieces of forestry land. Now retail investors can buy a fraction of a forest and be entitled to a proportional amount of carbon credits associated with their portion of land.

The tokenization of carbon credits is aligned with the global linking of the currently fragmented carbon markets. Tokenization facilitates the cross-border movement of carbon credits and the interoperability of blockchain protocols will enable tokens produced in different countries to be easily exchanged.

Issuing tokenized carbon credits on distributed ledger technology also solves many of the problems in today's carbon markets of fraudulent credits being allocated to projects that don't exist. Carbon credits issued on a blockchain have a transparent and verified source of origin. Blockchain connected to IoT sensors will enable an accurate linking between the environmental impact of projects and the carbon credits allocated to those projects based on measurements in carbon reductions.

© Brave New Coin 2020. BNCRR210120

Potential Challenges of Tokenization

There are a few potential drawbacks to tokenizing in the current blockchain ecosystem. The user interface to interact with ERC-20 tokens is not yet advanced and it currently provides a poor user experience. There is some baseline education that is needed when interacting with tokens. For example, when tokens are sent to the wrong blockchain address, they are not recoverable since blockchain transactions are irreversible.

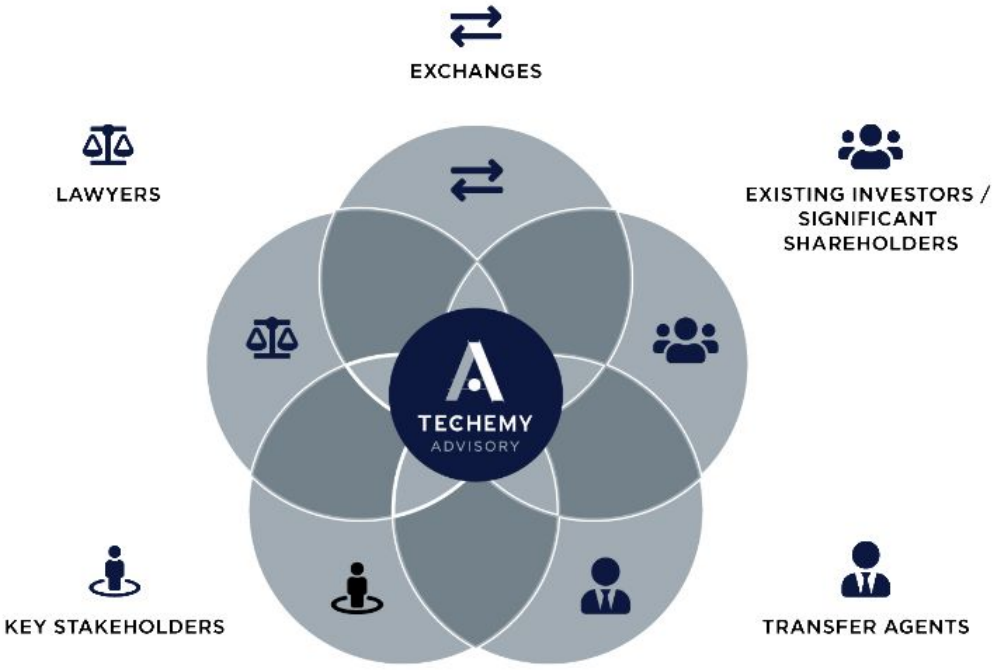
Tokens can also lead to increased volatility in the market which is not good for businesses who have carbon obligations to pay or for forest owners attempting to forecast cash flows. This should be minimized when there is sufficient liquidity in the market. As the ecosystem matures and the infrastructure and interfaces are developed, many of these challenges should be resolved.

These are just some of the services that Techemy Advisory helps enterprise clients with who are transitioning to the new digital economy.

© Brave New Coin 2020. BNCRR210120

Token Issuance Structuring

Outlined below are a few of the potential structuring framework options for tokenizing a forest's carbon credits. Optimal issuance structure is largely dependent on country laws and regulations. There are various commercial and tax trade offs to consider in structuring the fund and the tokens. Tax treatment is dependent on the way the tokens and the fund are structured. Other considerations include ensuring that the tokens will be suitable for listing on a security token exchange, seeking binding rulings from regulators on tax treatment and status as a security, and implementing tax registrations.

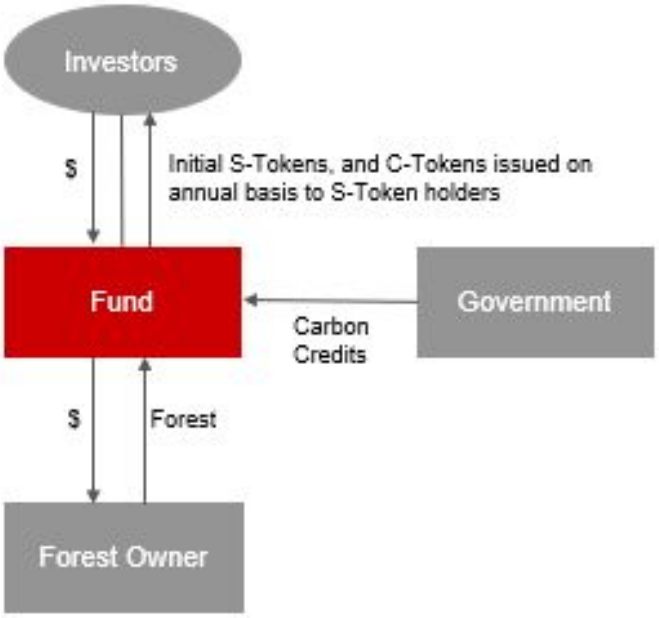


© Brave New Coin 2020. BNCRR210120

Two Token Structure

Looking at a specific jurisdiction, Techemy Advisory believes a fund structure is likely the best option for tokenizing the carbon credits of a New Zealand forest when taking into consideration New Zealand's laws and regulations. The establishment process would go something like this. A fund is set up that invests in forestry assets that generate carbon credits. Funding is raised by issuing Security Tokens (S-Tokens) to investors, and with the proceeds the fund buys carbon credits.

As the fund earns carbon credits, it is intended that the fund will distribute Carbon Tokens (C-Tokens) to S-Token holders (i.e. S-Token holders will have a right to receive C-Tokens and C-Token holders will have a right to receive carbon credits). The C-Tokens are intended to represent a tradeable interest in carbon credits, and it is intended that the C-Tokens will be listed on a security token exchange.



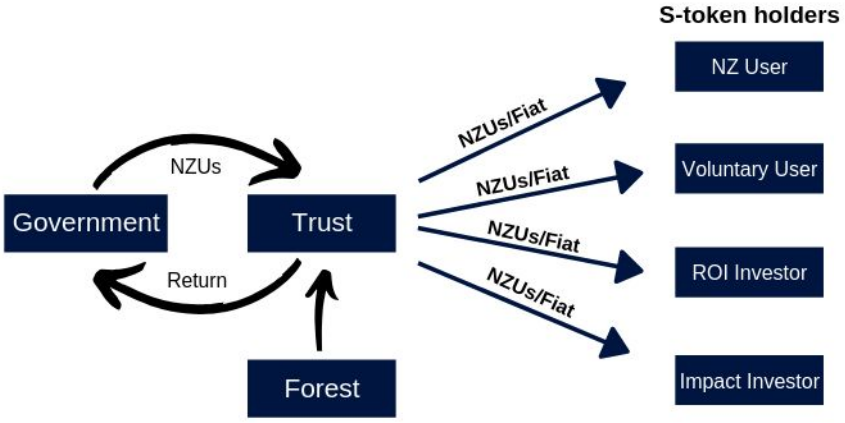
Source: MinterEllisonRuddWatts, Tokenized Carbon Credit Fund Structuring Options and Considerations

© Brave New Coin 2020. BNCRR210120

Single Token Structure

A single token structure is very similar to the two token structure with a trust fund established that invests in forestry assets that generate carbon credits. The fund issues Security Tokens (S-Tokens) to investors, and with the proceeds, the fund buys carbon credits.

As the fund earns carbon credits, the fund distributes carbon credits or the equivalent in fiat to S-Token holders. This method involves the challenge of moving and transferring carbon credits between the trust fund and S-token holders.



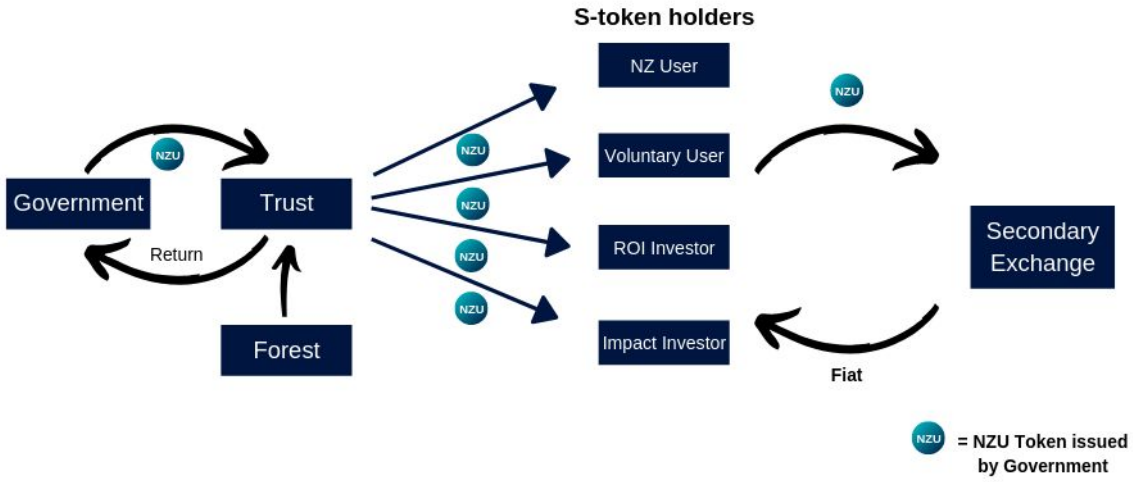
Example of Single Token Model with New Zealand government issued carbon credits (NZUs)

© Brave New Coin 2020. BNCRR210120

Tokenization of Carbon Credit System at Government Level

Governments can use blockchain to issue tokenized carbon credits and improve the efficiency of their back-end processes. This structure takes it a step further and tokenizes the entire system with the government issuing tokenized carbon credits on the blockchain to the trust fund. The fund then issues the tokenized carbon credits to S-token holders.

By tokenizing the carbon credit at the government level, it removes the need for the C-token. The tokenized carbon credits would be tradable on a secondary exchange. Governments can program the tokenized credits to be as freely tradeable or restricted as necessary through the use of smart contracts.



Example showing potential structure of tokenization of New Zealand Carbon Credit (NZU) at Government Level

© Brave New Coin 2020. BNCRR210120

Conclusion

Carbon credits as an investment vehicle will only grow in popularity as global standards continue to emerge that bring together the mandatory markets under a global framework and link the voluntary markets to the mandatory market. Carbon emission mitigation is also becoming an imperative business strategy for all medium-to-large organizations and trading credits could be one way to better hedge against future costs.

The parallel emergence of blockchain technology and tokenization will provide the necessary tooling to implement this global framework by providing further transparency and global liquidity to the carbon markets. There are many factors that impact the expected costs and income from producing carbon credits, and these factors vary greatly depending on the project and location.

While there is no one-size-fits-all approach for issuance structure and it is largely dependent on country laws and regulations, we hope that this document has been helpful in outlining some of the main considerations that need to be made when tokenizing carbon credits.

© Brave New Coin 2020. BNCRR210120

Author Bio

Stephen Lane

Stephen Lane is an analyst at Techemy Advisory where he advises clients in capital raising, digital asset deal structuring, blockchain solution review and token issuance. Stephen has previously held positions at both Yahoo and Citigroup in New York. He graduated magna cum laude from Cornell University with a Bachelor of Science in Applied Economics and Management.

Techemy Advisory offers end to end deal structuring, including blockchain solution review, tokenomics assessment and guidance on coin mechanics. Techemy Advisory is a sister company to BNC.

About BNC

Do you want to participate in the future of finance?

Since 2014, BNC has been building price discovery for the future of digital assets and currencies with IOSCO-aligned indices and trusted third-party global spot prices. To navigate this burgeoning new asset class, traders and investors require a guide through token classifications, definitions and sectors and the BNC Taxonomy is the most comprehensive institutional grade information available.

Brave New Coin offers a professional suite of applications, trusted crypto indices, a 24/7 staffed newsfeed, 250+ Exchange API integrations, a full token taxonomy, five years of historical data, and digital asset analysis.

Join BNC Pro today or contact us to integrate our trusted data into your platform or app.

Liquid Indices Program

Trusted USD prices for Bitcoin, Ethereum and Ripple.

More info

Global Crypto Asset Spot Rates

Global volume-weighted spot pricing for any digital asset across 240+ exchanges worldwide.

More info

XchangeFeed

Every exchange with a single connection. Near real-time price & volume data from over 240 exchanges.

More info

General Taxonomy for Cryptographic Assets

The 'gold standard' resource for digital asset classification.

More info

© Brave New Coin 2020. BNCRR210120