C4Coin: The Carbon-Negative Blockchain

A Rewards Engine for Verifiable Environmentalist Behavior

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All facts stated are cited in the full-length white paper.

1. Introduction

C_4Coin is building a carbon-negative public-permissioned blockchain. We will achieve this goal by providing the first viable economic incentive to voluntarily retire carbon credits.

Carbon credits, equivalent to one metric ton of carbon or equivalent offset, are a widely accepted mechanism for financially incentivizing conservation efforts. Carbon markets exist around the world, allowing these credits to be traded. Two types of carbon markets exist: compliance markets and the voluntary market.

In compliance markets, a government mandates that polluters purchase carbon credits for any emissions produced above a certain threshold. As of 2017, compliance markets have hosted $52 billion in worldwide trading. Unfortunately, compliance markets are not standardized between jurisdictions, and it is nearly impossible for compliance market actors to trade across borders.

The voluntary market covers all emissions not captured by compliance markets. Individuals and businesses looking to offset their carbon footprint can purchase voluntary offsets. While roughly 85% of global emissions fall into this category, the space is massively underdeveloped, with only $200 million in yearly trading.

Underdevelopment in the voluntary market is largely due to the lack of a viable financial incentive to purchase and retire voluntary credits. This problem also creates an oversupply issue in the market, with some carbon credit producers holding millions of unsellable credits.

The C_4Coin network will create this missing incentive through a two-token blockchain model. First, CO2KNs will be equivalent to one carbon credit. Second, C_4Coins will function as traditional crypto-assets, usable as fuel for distributed applications (dApps). A Proof-of-Burn consensus mechanism will link the creation of C_4Coins to the staking and burning of CO2KNs.

Representing carbon credits as CO2KNs will have several benefits. The ability to retire CO2KNs to earn C_4Coins will give them added value compared to traditional credits. Hosting these credits on a blockchain will streamline the process of issuing, trading, and retiring credits, nearly eliminating transaction fees.

Our network will feature a virtual machine similar to Ethereum's, allowing developers to create dApps and fuel them with C_4Coins. Because carbon credits must be retired to earn C_4Coins, the network (and any dApps using it) will lead to emissions reductions. This innovation improves on existing blockchain technologies, which are inherently wasteful.

By creating a carbon-negative blockchain economy, C_4Coin will provide a tangible incentive for environmentalism. In the absence of unified government efforts, we aim to mobilize individuals, businesses, and communities to fight climate change.

2. Problems

The C_4Coin network is designed to address three major problems.

First and most importantly, climate change represents a global ecological crisis. Sadly, millions of Americans including the current presidential administration remain skeptical, adding to the challenge of organizing climate-conservation action.

Fighting to halt or reverse climate change is expensive. Even businesses that accept the reality of the problem have no incentive to change their usual practices if they could lose profit and fall behind their competitors. Unless this profitability gap can be bridged, businesses will continue to ignore environmental concerns out of necessity.

Secondly, carbon markets face significant political and economic hurdles to widespread adoption. Compliance markets around the world are not interoperable due to differing regulations. Policies designed to fight climate change can also appear stifling to the economy, making it difficult for politicians to publicly support these policies. For these policies to be politically viable, a financial incentive must exist to protect the environment.

Finally, Proof-of-Work consensus is highly wasteful. The Bitcoin network is projected to use more electricity per year than the nation of Denmark by 2020. This figure does not account for the resources consumed purchasing and transporting the required computer chips.

An environmentally conscious project cannot reasonably be built on such a wasteful network. It is essential for any carbon token solution to present a green consensus mechanism.

3. Network Design

C_4Coin's innovative Proof-of-Burn consensus mechanism addresses the problems mentioned above at an infrastructural level.

A distributed carbon registry will streamline the carbon trading process from issuance to retirement. Immutable blockchain records of a credit's entire history will enable interoperability between different carbon standards. In other words, jurisdictions can easily whitelist any CO2KNS they want to recognize under their carbon standard. Because CO2KNs entered into consensus must be burned, C_4Coin resolves the voluntary carbon market's biggest failure by incentivizing the retirement of voluntary credits.

The C_4Coin solution is market-driven and does not rely on new ecological science. Our solution depends on the following facts:

- Rewarding environmentally-conscious behavior will help keep green businesses profitable, and
- Incentivizing the retirement of carbon credits will help curb global warming.

All CO2KNs will be generated from off-chain data.

Trusted, legally-bound partners offsetting emissions will push data into dedicated 'Oracle' smart contracts. Generation methodology specifications will be implemented as another set of smart contracts, accessing the Oracle data.

If these smart contracts determine that the baseline and additionality criteria of the offsets are valid, tokens will be generated and sent to user wallets. To ensure that users do not submit fraudulent data to the network to receive more tokens, C_4Coin will enter into legal agreements with partner companies. These agreements will be hashed and uploaded to the chain, visible to all network users.

CO2KNs will be implemented using an EIP20 token interface, with one token corresponding to one carbon credit. Tokens will contain a hash of metadata indicating the offset generator's public key and the generation methodology used to create the tokens. This metadata will allow users to identify which tokens qualify for retirement under various carbon standards. Tracking token metadata ensures that the value of tokens with existing certifications will be protected.

C_4Coin's consensus mechanism will be based on the Tendermint Practical Byzantine Fault Tolerance (PBFT) Protocol. Our Proof-of-Burn uses a two-token model.

Tendermint is a formally verified PBFT Proof-of-Stake protocol well-suited for use on a blockchain network. It was designed to be modular, allowing us to adapt it into a public-permissioned Proof-of-Burn system. Validators on the chain will be nodes hosted by C_4Coin, trusted partners, and some public participants.

In traditional Proof-of-Stake consensus, a user's stake and rewards are denominated in the same tokens. Nodes are rewarded for staking tokens without acting maliciously. Rewards are distributed based on each node's relative stake, a function of its absolute stake over the total network state for any given voting round.

In C_4Coin's consensus, CO2KNs are staked and burned for rewards of a different token, C_4Coin. To participate in consensus and receive rewards, a user will send CO2KNs to a validator's bond smart contract. This contract will reward the user proportional to their stake after each block proposal, until the user's entire stake is depleted.

A user's stake will decay (be burned) over the duration of their staking period. See white paper §4.3 for an in-depth explanation.

Our monetary policy is currently being developed. At this time, our working assumption is that the C_4Coin network's monetary policy will be based on Ethereum Classic. Community feedback will be essential as we develop this policy further.

The C_4Coin token is the utility token used to run our network.

C_4Coin is a disinflationary crypto-asset, meaning it reduces to a near-zero inflation rate within two decades. Annual block rewards (the base amount of C_4Coins received for successfully proposing a block) will decrease by 10% per era (roughly 2.4 years). Each era will consist of 5,000,000 epochs.

Since C_4Coins will be required to run dApps on the network's virtual machine, this demand for C_4Coins will help prioritize the network's computations.

4. Conclusion

C4Coin is an innovative project with the potential to combat climate change globally.

Current carbon markets are not adequately addressing environmental degradation. C4Coin takes the carbon market framework and expands on it by increasing the number of people who can create, trade, and be rewarded for retiring offsets.

Incentivizing individuals, businesses, and communities to clean up the atmosphere represents the most realistic opportunity to protect the earth.

5. Contact Information

For any questions about the C4Coin project, please contact:

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Our full-length white paper can be found at:
https://github.com/C4Coin/whitepaper/blob/master/c4coin-wp-v11.pdf