ECO.DAO

- A peer-to-peer electronic self-sovereign carbon offset solution -

1. Introduction

Climate change is one of the most pressing issues of our time and is a complex and multifaceted issue that has far-reaching impacts on our planet [1].

The burning of fossil fuels, deforestation, and other human activities are releasing large amounts of greenhouse gases into the atmosphere, causing global temperatures to rise and leading to a wide range of negative effects, including rising sea levels, more frequent and severe extreme weather events, and changes in precipitation patterns [2]. The Intergovernmental Panel on Climate Change (IPCC) in its fourth Assessment Report, stated that it is extremely likely that human activities, particularly the burning of fossil fuels, are the dominant cause of observed warming since the mid-20th century [3].

The impacts of climate change are already being felt around the world, with many regions experiencing more severe droughts, floods, heatwaves and storms. These impacts have significant economic and social costs, and threaten the well-being of both people and ecosystems [4]. The United Nations Framework Convention on Climate Change (UNFCCC) in the Paris Agreement, aims to limit global warming to well below 2 degrees Celsius above pre-industrial levels, and to pursue efforts to limit the temperature increase to 1.5 degrees Celsius [5].

While there are many potential solutions to climate change, one of the most effective ways to reduce carbon emissions is to increase the number of carbon-negative projects, such as reforestation and afforestation efforts [6]. Trees and other vegetation absorb carbon dioxide from the atmosphere and store it in their biomass, making them a powerful tool for reducing the amount of carbon in the atmosphere [7].

However, despite their potential, many reforestation and afforestation projects are not currently protected or incentivized enough to ensure their long-term success [8]. This is because, many of these projects are small-scale, often lack of proper legal protection, and are subject to land-use changes, illegal logging and other forms of land degradation. Moreover, the traditional carbon offset market is fragmented and opaque, making it difficult for individuals and organizations to purchase offsets from a wide range of projects and ensure that their offset purchases are genuine and effective in reducing carbon emissions [9]. The need for effective solutions to reduce carbon emissions and offset the effects of climate change is clear.

One promising approach is the use of decentralized blockchain-based carbon offset solutions, which can provide a transparent and efficient way for individuals and organizations to offset their carbon emissions. By using blockchain technology to track and verify carbon offset transactions, a high level of transparency and accountability can be ensured, so that the offsets purchased are genuine, verifiable, and effective in incentivizing and financing carbon-negative projects [10].

In this paper we go a step further and develop a fully fledged Decentralized Autonomous Organization (DAO) for managing and enabling an integrated carbon offset market. We argue that the DAO approach is the only suitable method to integrate strong incentives and a steadfast governance for securing the market infrastructure for carbon-offset trading.

2. Meet the DAO

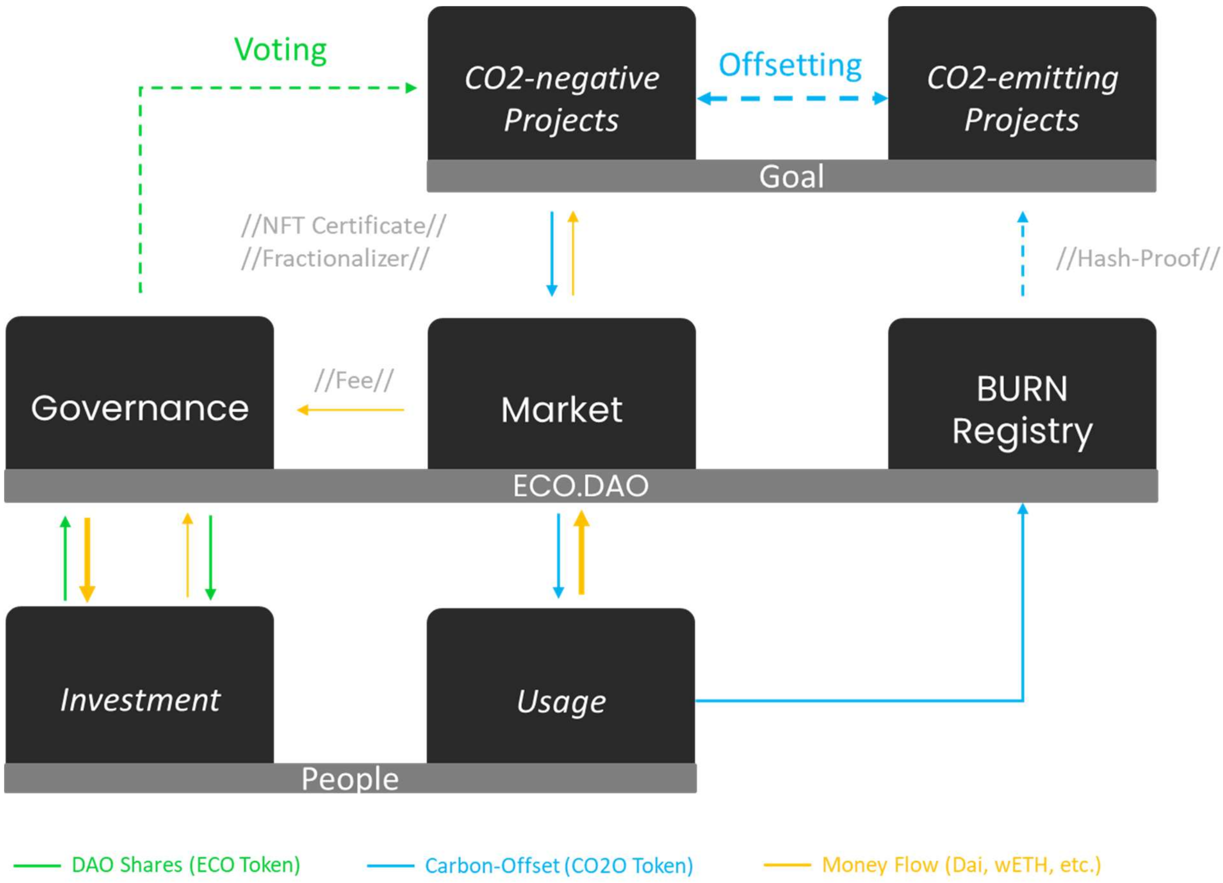

Figure 1: Overview of the ECO.DAO

Figure 1 illustrates the different components, token flows, and functionalities of our solution approach. These are implemented in a set of smart contracts. As this set of smart contracts has the ability to govern itself via algorithmic rule, it is commonly referred to as a DAO. We dub this specific instantiation the "ECO.DAO".

//The heart of the ECO.DAO is its market//

This is not suprising because it's primary functionality is to ensure that carbon offset trading can be performed seemlessly in a secure and verifiable manner. Carbon offset tokens are therefore represented as fungible ERC-1155 tokens, which we term CO2O tokens. CO2O tokens can be traded on the market for other tokens and crpytocurrencies. The market itself is implemented as an automated market maker, which determines the token exchange rate based on the popular constant function formular. This ensures fair pricing according to the balance of demand and supply, while disintermediating and thus cutting out third-party costs.

//Market functionality is only half the job//

Users won't use the market if they don't have incentives to buy these tokens. The DAO therefore needs a purpose model (a business model that aims at making as less profit as possible, but enough to achieve its goal).

//The goal of the DAO is to facilitate matching between CO2-neutral projects and C02-emitting projects//

It is important that the creation of CO2O tokens is heavily regulated and follows the ratio of 1:1 between new CO2O tokens and acutal amounts of physically bounded CO2. Ensuring this in a decentralized manner is very difficult and can be reduced to the oracle problem.

There exist some work-arounds for this problem in research and practice. The most common being:

1) Re-introducing a third party [11]
2) Using a decentralized oracle network [12]
3) Using cryptographic proofs [13]

The work-arounds are ordered 1-3 according to the degree of centralization this approach takes (1: high; 2: medium; 3: low).

It is problematic from a security standpoint to re-introduce a thrid party because it needs to be trusted not to forge any coins and represents a single point of failure that could bring the whole DAO down in a single attack [11].

Using a decentralized oracle network (DON) is arguably more decentralized, however, trust is still needed for the single oracles in this network. More importantly, these networks usually take fees for their services, thus, would lower the efficiency of our approach when implemented [11, 12].

Lastly, cryptographic proofs are the most decentralized method out of these approaches. Yet, these proofs require a pre-existing infrastructure such as smart meters and are usually characterized by a large computational overhead (at least for the prover) [13, 14].

A DON seems to offer the greates potential. However, it would be nice to eliminate the service fee, so that the only caveat remaining is the relatively small amount of trust in the honesty of the individual oracles. Yet, it is exactly that fee that incentivices the oracles to act honestly.

We must recognize that incentivation is more or less impossible to avoid for our approach. However, the incentive can be strengthened significantly when replacing the external DON with an internal governance structure. The trick is to align incentives and connect the value of a governance token to the overall performance of the DAO [15, 16].

In the ECO.DAO, we therefore connect a governance token, called ECO, to the performance of the DAO by offering ECO holders to get a reward which is payed for by a small fee that is extracted when user buy CO2O tokens. Meaning, the CO2O buyers need to pay a small fee on top, to ensure that the security of their infrastructure is ensured by the ECO.DAO governance.

//The better the performance of the DAO, the higher the reward for ECO holders//

As governance of the DAO, ECO holders can vote with their ECO amount on proposals by carbon-negative Projects that popose a new CO2O mint order.

These holders will therefore make sure that only well justified orders go through. After all, if the market is flooded with worthless CO2O tokens, users wont use the ECO.DAO for their offsets and the ECO token declines in value.

Reconsidering Figure 1, there is one last thing to elaborate on: How is CO2 offsetted?

//CO2 is offsetted by burning the CO2O token in the BURN Registry, which will log the burn events of users and emitt a cryptographic proof of offsett//

3. Why … ECO.DAO?

As protecting our planet and preventing climate change from happening becomes more important second by second, it is crucial that we find new and innovative ways to offset carbon emissions.

Traditional solutions for offsetting carbon emissions, such as carbon credits, have proven to be obstructed by their disadvantages. These include lack of transparency in the offsetting process, difficulty in verifying the effectiveness of carbon credits, and the potential for double counting of emissions reductions.

These problems call for a blockchain-based solution. However, just implementing an offsetting token is not enough. The token needs a properly designed ecosystem arround it that secures and governs the infrastructure.

ECO.DAO leverages exactly this sourrounding ecosystem and thus empowers the offset significantly. Offsetting can be proven via the Proof-of-Offset and Governance ensures security of the underlying ecosystem.

As carbon offsetting has become increasingly important for governments worldwide, much needed change is inbound (e.g., requiring companies to go carbon zero). ECO.DAO offers the infrastructure to make this change effortless for individuals as well as businesses. We look forward to working with our ECO investors and CO2O customers to make this vision a reality and make a real difference in the fight against climate change.

4. See you soon

This concludes the elaborations on our approach. However, we are not quite done yet.

As you read this paper, you may have had some questions that were not included in the text due to the need to keep it concise. However, we are very interested in hearing your feedback and answering your questions. May it be that you have some valuable ideas for improvements or have found a bug in our code (the code is here).

//Please, let us know!//

We are always looking for talent that is interested in **changing the world one block at a time**. We look forward to your response!

Until then…Best wishes and see you soon!

Your ECO.DAO

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