CO$_2$IN: A system of positive incentives to achieve the immediate implementation of the Paris Agreement.

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Abstract. A system of positive economic incentives purely based on cryptocurrencies will allow the international community to raise the financial flows agreed in the Paris Agreement. These flows will serve to stimulate green initiatives around the world for compliance and immediate implementation of the agreement, and thus avoiding an attempt to achieve it by other means, which could be harmful to the economies of the signatory countries such as new taxes, regulations and sanctions. We propose a solution based on the creation of a blockchain whose main characteristics are the impossibility of splitting it, the control of the source code and the exclusive access to the network by those who carry out the mining process with zero emission energy by the global community.

Keywords: carbon, blockchain, mining, zero emission energy, smart contract, peer-to-peer, distributed system, e-governance.

1. Introduction

The deadline for applicability of the Paris Agreement [1] is getting closer and closer and the UN does not have a technological tool that allows international auditing of CO_2 emissions. At the same time, thousands and thousands of green initiatives such as CO_2 capture and zero emission energy coexist with environmentally irresponsible industries. While the vast majority of green initiatives do not obtain economic benefits that help them to be massified or optimize development, the vast majority of environmentally irresponsible industries do not have positive economic incentives for them to be efficient or intelligent about their CO_2 emissions.

What is needed is to use the advantages and positive incentives of market systems, powered by decentralized technologies such as the blockchain [2], and that the blockchain is generated with zero emission energies. By doing this, a green blockchain is possible by definition.

2. Green Blockchain

It is a well known fact that the blockchain as described in its original whitepaper entails the need for a proof of work that demands a huge energy expenditure.

If we take, for example, the Bitcoin blockchain, we will see that it currently consumes 28 TWh per year [3], which places it at the consumption level of the Slovak Republic, while a single transaction currently involves the use of as much energy as an average household during one week [4]. Replacing the proof of works of the blockchain is something that several industry benchmarks have been working on. But this is not the right approach, since in any case the peer network proposed will continue consuming energy, and when it inevitably scales, it would probably use energy that involves carbon emissions (unless it is restricted in some way).

What is needed is a proof of veracity, where the nodes of the peer network who do the mining work of the blockchain use exclusively zero emission energy.

These proofs of veracity consist of different options, all of which are valid and complementary to each other:

1. Government certificates issued and properly registered in the blockchain by the member states of the UN and signatories of the Paris Agreement.
2. Certificates from non-governmental organizations duly registered with the competent agencies of the member states of the UN and signatories of the Paris agreement.
3. Energy distribution grids, public or private, duly registered with the competent agencies of the member states of the UN and signatories of the Paris agreement.
4. Units of generation of energy of emission zero of CO_2 that have a sensor that certifies the cleaning of the energy.
5. Pools of mining of private cryptocurrencies and audited by the competent agencies of the member states of the UN and signatories of the Paris agreement.

This last point has already been carried out by initiatives [5] such as NastyMining, HydroMiner, SolarCoin, HARVEST, etc. In the case of the first mentioned, it is accessed by buying a seat in the club, while the last one existed only to finance a climate investigation. All of them proving that a system of positive incentives like the one we propose is technically possible, and environmentally necessary.

3. Compensation Distribution System

As in all peer networks using the blockchain, the incentive to provide disk space, electricity and computing power is a compensation of a predefined amount of new coins and transaction fees variables set at the time of the generation of the genesis block.

In a majority percentage, the new coins are retained by the miner who discovers the new block. The minority percentage will go to the multi-signature control addresses of the source code established in the genesis block. These addresses automatically distribute, through the use of smarts contracts, the majority percentage of the new coins received from the miners. The minority percentage will remain in

the hands of the controlling multisig addresses of the source code established in the genesis block of the blockchain as a reserve of value and subject to the decisions of the blockchain controllers.

The distributed majority percentage will be sent in a 1:1 ratio regarding the amount of CO_2 captured to those who carry out green initiatives such as the Nationally Appropriate Mitigation Actions (NAMA) of the UN [6]. The distribution is carried out such as the distribution of dividends. Here is how it would look like in smart contract format [7]:

```
struct Account {
  uint balance;
  uint lastDividends;
}
mapping(address=>Account) accounts;
uint totalSupply;
uint totalDividends;
function dividendsOwing(address account) internal returns(uint) {
  var newDividends = totalDividends - accounts[account].lastDividends;
  return (accounts[account].balance * newDividends) / totalSupply;
}
modifier updateAccount(address account) {
  var owing = dividendsOwing(account);
  if(owing > 0) {
    accounts[account].balance += owing;
    accounts[account].lastDividends = totalDividends;
  }
  _;
}
function disburse(uint amount) {
  totalDividends += amount;
  deduct(msg.sender, amount);
}
```

4. Incentive System for Green Initiatives

The minority percentage received by the controlling multisignature addresses of the source code will be sent to green initiatives automatically as we saw in the previous point.

These initiatives, such as those included in the NAMA list of the UN mentioned above, or project initiatives related to climate and the use of blockchains, such as Climate Coin [8] and Earth Token [9], they will all benefit from this percentage of new coins and transaction fees.

These green initiatives, regardless of their nature and industry, are verified in relation with their impact of capture of CO_2, their zero emission of carbon or their carbon emission reduction, by using proof of

veracity solutions. To do this, there are two solutions compatible with the use of a blockchain. The proof of veracity is carried out in two complementary phases, in a first stage by an artificial intelligence and in a second stage by humans.

In the first stage, artificial intelligence and the blockchain can be seen as the yin and yang of digital asset management [10]. While the first one helps us to value, understand, recognize and decide; the second one helps us to verify, execute and record. While machine learning methods that are part of artificial intelligence help us find opportunities and improve decision-making, smart contracts and blockchain technologies can automate the verification of the transactional parts of the process. Artificial intelligence and blockchain technology are, in this sense, complementary and synergistic. Initiatives such as those of ACM [11] are taking this synergy to new levels of complexity.

In the second stage, human beings verify one-by-one the proofs of veracity approved by the artificial intelligence in the first stage, similar to the statistical models of initiatives such as reCAPTCHA. They will give a veracity well adjusted to the reality of what have been sent to be validated by the network. Unlike the mentioned initiative, the time used by the human beings involved in this stage will be compensated with fractions of the new coins saved as a value reserve. It is only until this moment when both proofs of veracity have been carried out that the contract releases the funds.

5. Genesis Block

We have already discussed the genesis block of the proposed chain, but not in detail. As the proposal is a solution used by state agencies, the anarchy in the governance of the source code is neither admissible or compatible with the controlling nature of the State. While most of the ecosystem around blockchain technology supports the free market anarchy that gives rise to and supports cryptocurrencies since its origin, we understand the imperative need to build a bridge between the decentralized solutions and the control of the Paris Agreement signatories.

An open source solution, of decentralized use but of controlled implementation, is possible if we add to the traditional model of the blockchain, tested for almost a decade already, some variables not taken into account before.

What is needed is to include as many multisignature addresses in the genesis block as there are signatory states. In order to respect the political representativeness of the countries involved, the private keys of the nation states that signed the Paris Agreement that are included in the genesis block must be multisignature m-of-n [12]. Each key will be delivered exclusively for their protection to each of the politicals branches that compose the National State. In the case of Argentina, for example, it would be a multisignature 3-of-3, one for the Executive Branch, one for the Judicial Branch and one for the Legislative Branch, although the power to decide on modifications will depend exclusively on the latter.

The functions of these multisignature addresses consist to execute the smart contracts that are part of the incentive system explained in the previous point.

Finally, there will also be a special address, which will receive new coins from all addresses in the same

block and will be responsible, depending on its status, for authorizing or not the modification of the verification amount described below.

6. Checksum of the source code and impossibility of splitting the blockchain.

Another variable incorporated in the genesis block is a checksum of the software with which the genesis block was generated. This checksum is combined (from the first block) to the nonce of the mined block, blocking the possibility that the software used to participate in the network is altered. In this way the network is free from nodes that want to participate in it without having proof of veracity of carbon-free energy. Another important advantage is that it avoids the possibility of a 51% attack like in the Bitcoin blockchain or a 33% attack as in other DTLs such as IOTA [14].
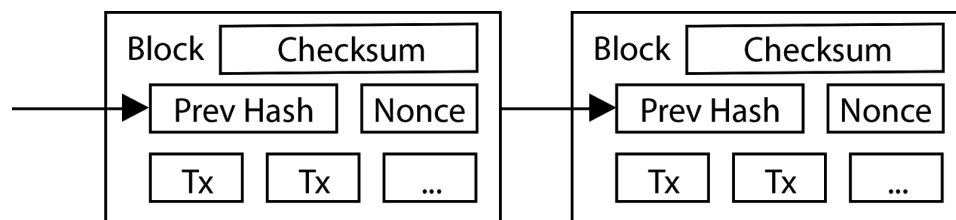
Consequently with these advantages, the impossibility of an unforkable blockchain gives the framework of control necessary so that a proposal such as the one we make will be considered by such a large and complex organization as the UN.

7. Governance and Consensus

The problems of anarchy in governance and community consensus such as those suffered in the development of the Bitcoin blockchain are not a problem for the proposed blockchain and their technical characteristics. In this way, the governance of the development of the source code is ensured by the supranational body that carries out the initiative.

All modifications, fixes and new features are incorporated into the source code once there is full consensus to do so, once this consensus has been reached, the nation states carry out in their entirety and from their private keys make a transaction to the special address registered in the genesis block. If this condition is given, immediately from the next block the checksum will be different and valid for the network, having validity until the next transaction to the special address.

Since international transparency is not a minor issue, it is necessary to emphasize that the audit of carbon markets would be guaranteed per se with a proposal such as ours.

8. Interoperability of the Green Blockchain

The proposed blockchain is based on the RSK blockchain [15], whose unique characteristics also allows providing smart contracts to the Bitcoin blockchain and to give interoperability to the blockchain proposed with the robust ecosystem of solutions related to climate change [16], generated not only in the Bitcoin blockchain but also in the Ethereum [17] one.

9. Coins supply

The maximum issuance of new coins will be limited by a number defined in the genesis block and that will represent 1:1 the amount of $GtCO_2$ needed to capture during the 21st century to avoid exceeding the breaking point where global warming is irreversible.

This number is subject to debate even within the UN, so it can not be defined in the proposal until and as long as this supranational organization dictates it. The best and the worst scenario can be taken into account as minimum and maximum possible and then averaging the number. This, like other software variables, may be modified over time, provided there is consensus through the mechanisms described above.

Each new coin can be divided up to a millionth part, in order to compensate up to the level of one gram of CO_2 captured.

10. Conclusion

We have proposed a system of economic incentives purely based on cryptocurrencies that avoids harmful measures such as new taxes, regulations and sanctions for the economies of the countries that signed the Paris Agreement.

We started by describing the need for a new type of blockchain that contains certain characteristics that are unavoidable for the adoption of a decentralized technology controlled by state agencies, thus canceling natural anarchic governance in blockchain technologies.

To solve this, we have proposed a series of proofs of veracity for:

1. Mining with clean energy:
    a. Explained in #2 "Green Blockchain".
2. Tracking of CO_2 emissions:
    a. Explained in #3 "Compensation Distribution System".
3. Green initiatives that capture CO_2:
    a. Explained in #4 "Incentive System for Green Initiatives".

Along with a series of modifications to the more traditional blockchain model from the inclusion of

variables in the genesis block to the inclusion of a checksum in the mining process. The blockchain technology has been put to the test for almost a decade. All the tools necessary to carry out our proposal have already been created or have been described for their creation in this white paper. The call to action is imperative on the actual climate situation.

All that is needed is to make a pragmatic executive decision and to carry out what is described here.

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