Carbon Coin

Martha Han, Hylann Ma, Henry Su

Currently in Canada, carbon emissions are self-reported by companies through data entry into an online system, and audits are conducted periodically to verify the reports.[1] The lack of transparency in self-reporting brings to question the accountability of the audit process.

The protocol outlined below is subject to the following assumptions: auditors are trained to report carbon emissions accurately, and auditors have no incentive to misreport.

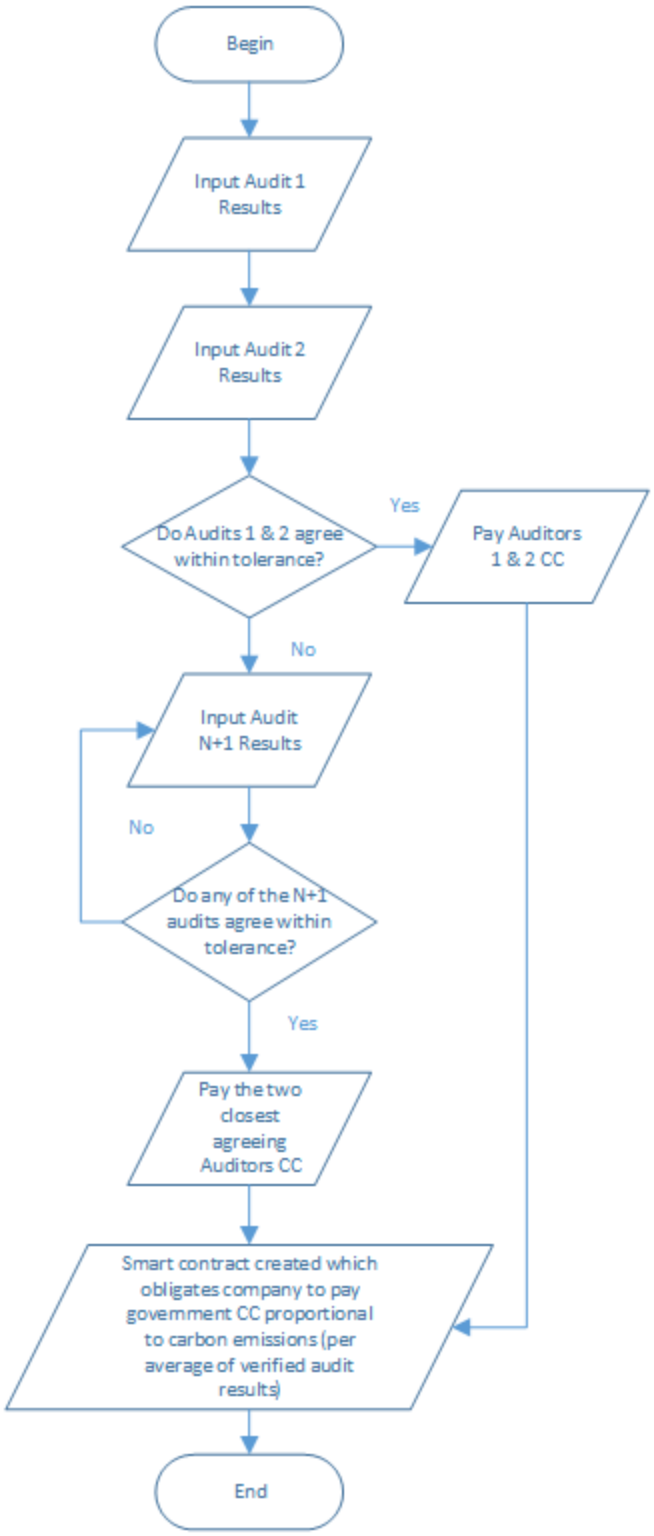
Suppose we are auditing the carbon emissions of companies in 2018. Throughout 2018, companies will upload their carbon-auditable records to IPFS, a decentralized file storage system in which file access is restricted to specific users. On January 1, 2019, the government grants all companies blockchain tokens called 'Carbon Coins' (CC), proportional to their obligated emissions targets (e.g. a company with an emissions obligation of 200,000 tonnes of CO2 will receive 200,000 CC). Each company is required to house a full node of the CC blockchain.

Each company must hire two professional carbon auditors. The two auditors are granted exclusive access to the carbon-auditable records on IPFS (achieved through asymmetric encryption). The two auditors will independently assess the company's 2018 carbon offsets. A 'verification smart contract' is used to verify whether the results of the two audits agree within a predetermined tolerance. If they agree, the audits are verified and the smart contract issues a CC reward to both auditors. A 'payment smart contract' that obligates the company to pay the government CC proportional to their 2018 emissions (average of the audit results) is created. The smart contract will trigger on December 31, 2019. If the audit results do not agree within tolerance, the audits are not verified. Note that the auditor is paid traditionally by the company regardless of outcome.

All companies without a verified audit must be audited by an additional auditor. This auditor must have a track-record of verified audits. The 'verification smart contract' will assess whether the new audit results agree with the results of any preceding audits on the same company within tolerance. If there is agreement, the two closest agreeing audits are verified and a CC reward is issued to both successful auditors. The 'payment smart contract' is triggered. These steps iterate until all companies have verified audits. In latter rounds, auditors are paid traditionally by the government regardless of outcome.

Like Ethereum, all nodes store the state of each smart contract and all CC transactions. From the 'payment smart contracts', companies will know whether they have a surplus or deficit of CC. Companies and auditors can buy and sell CC on an exchange at market value. If on December 31, 2019, a company is unable to obtain sufficient CC, they will be forced to fulfil their contract by buying CC from the government at a fixed price.

[1] https://www.canada.ca/en/environment-climate-change/services/climate-change/greenhouse-gas-emissions/facility-reporting/reporting.html



The protocol will use a private ledger between participating companies to limit the amount of computational power necessary. Initially, the blockchain will be permission based as carbon auditing only applies to companies.

In the short term, blockchain will streamline CC transactions. Smart contracts will enable the government to define the rules and penalties around the agreement and automatically enforce those obligations. Trading of CC between companies in a marketplace will also be powered by blockchain, the decentralization of the ledger increases safety for all parties and minimizes human biases and errors.

In the long run, the protocol could extend to different industries and be applied on a global scale. The volume and diversity of companies involved could decrease the trust between individual companies. Because blockchain requires a consensus truth agreed among its participants, issues of trust between the parties involved will be eliminated.

This protocol is a feasible method to stimulate technological advancement in carbon recapture. Implementing blockchain technology will reduce manual processing involved in audits, collection, and processing of payments; these costs savings can be used to fund any additional audits that the government will be responsible for. This protocol will also help diversify the economy, providing opportunities for businesses that specialize in carbon reduction to sell their services or technologies to major polluters. From the perspective of companies, use of third party auditors will replace the overhead of having an in-house auditing team year-round with an annual contracting fee.

While auditing with blockchain technology is available on the market through initiatives like AuditChain, this proposal incorporates a series of unique ideas to improve carbon audits. Two distinctive features of the protocol include the pairing of blockchain with IPFS for decentralized data storage, and the cap-and-trade imposed on industries through issuance of CC.

The pairing of carbon auditing blockchain with IPFS (existing peer-to-peer data storage and sharing protocol) ensures data quality control. Like the hosting of ledgers on multiple nodes, when copies of the audit required data is stored throughout the network, it significantly increases the difficulty to manipulate, thus improving security and transparency.

Cap-and-trade is an existing type of government mandate for reducing emissions. An upper limit is set but companies that cut emissions faster can sell or bank the excess in allowance. Through this protocol, carbon credits issued by government are replaced with decentralized CCs that can be traded on an open market, assigning tangible value. Initial implementation must be achieved with government support, but the use of blockchain to record transactions allows the potential for self-governance.

The proposed protocol addresses the lack of accountability in current day self-reporting, by ensuring audits are conducted routinely and redundantly, and auditable data is distributed with decentralized file storage. By tokenizing tradable carbon emissions through a blockchain, we encourage society to assign tangible value to environmental protection. Only then, can we fully appreciate the impact of carbon emissions and limit our exertion on the environment. If proof of concept is achieved, this protocol could be extended to small enterprises and individuals, who could trade personal carbon credits. Hence, we envision a world in which individuals take responsibility for environmental stewardship, and government involvement can be phased away.