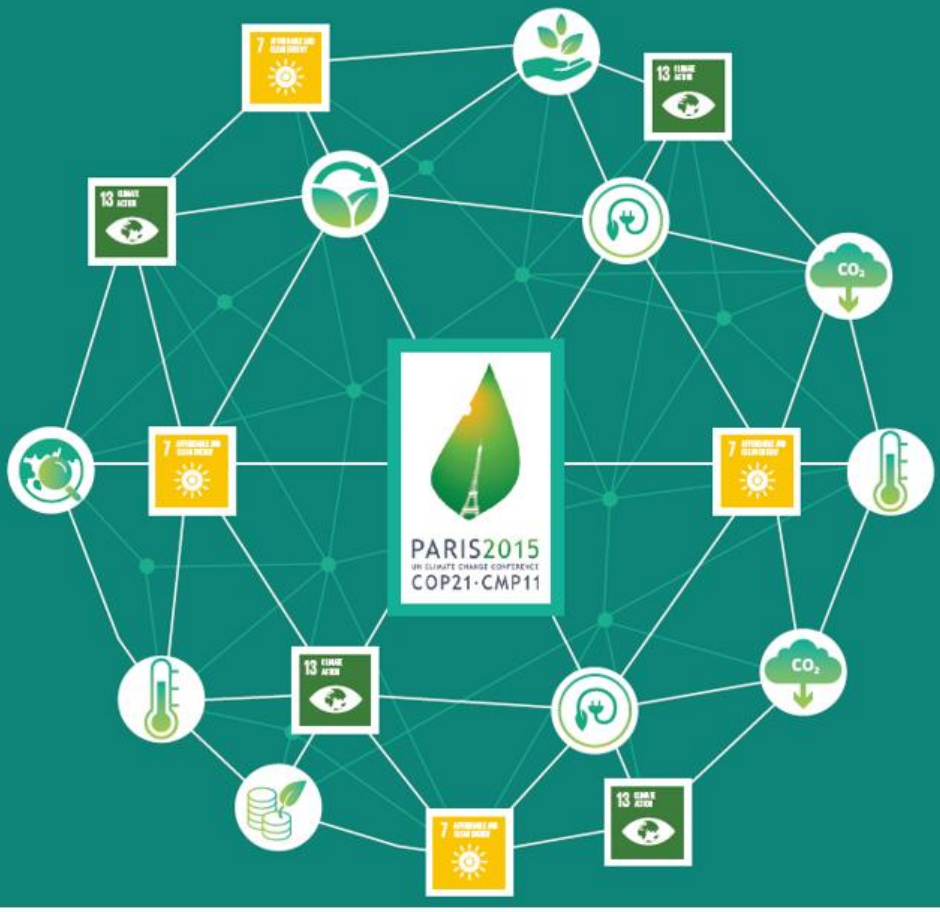
CARBON MARKET CHALLENGES AND BLOCKCHAIN SOLUTIONS

Policy Brief



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UNEP DTU Partnership

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The Paris Agreement defines a bottom-up approach to reduce greenhouse gas emissions and keep the global average temperature below 2°C. Article 6 introduces the idea of creating a new cost-efficient carbon market mechanism that enables cooperation between Parties.
Under Article 6.2, international mitigation outcomes (ITMOs) are generated and can be bilaterally transferred. The participating Parties are responsible for the issuance of ITMOs. In comparison to Article 6.4 – which is mainly centralized under the CMA and a supervisory body -, Article 6.2 embodies the bottom-up and decentralization approach of the Paris Agreement.
Stakeholders of Article 6.2 are the UNFCCC secretariat, the participating Parties, and the Technical Experts (Article 13.11). The Technical Experts shall review the reports and mitigation activities.

Challenges encountered in the Kyoto Protocol mechanisms ranged from low transparency in mitigation activities, insufficient documentation, over extremely high administrative costs and slow processes, to double counting and issuance. These challenges compromised the environmental integrity of actions, resulted in poor unit quality, and caused information asymmetry amongst the actors.

In the context of the above listed challenges, blockchain can enhance the Article 6.2 market mechanism by providing the following solutions.

Carbon Market Challenges	Blockchain Solutions
Environmental Integrity	The establishment of an immutable and distributed tracking system makes it possibly to identify early on ineffective mitigations.
Transparency and Information Asymmetry	Blockchain can establish actor access to necessary information so that each Party can verify the origin and implementation of a mitigation activity.
Double Counting	By using blockchain, the usage of each ITMO token can be traced. The consensus protocol makes sure that a token cannot be applied in several areas at the same time, e.g. NDC target and transference to another country.
Administrative Costs	Through the usage of smart contracts, certain tasks, e.g. the issuance of ITMOs and first verification of submitted data, can be automated. The process can be streamlined.
Unit Quality	Each ITMO token could store information about the original project, bringing traceable quality to each token.

Blockchain is a distributed peer-to-peer network upon which transactions are submitted, validated, and stored. Upon a blockchain tokens, which represent an asset (e.g. Bitcoin), are transferred.
Each member of the network has a full copy of all transactions. This creates transparency inside the network. Furthermore, the transactions are stored in blocks which are interlinked to create an immutable record. Consensus protocols enforce the on-chain government rules and ensure the faultlessness of token transferals.

Blockchain offers a number of possible architectures that are determined by different design choices, like for example governance or data visibility. There are three different types of blockchain architectures.

	Permissioned	Permissionless
Private	Only with predefined users and validators Examples: Corda & Hyperledger Fabric	
Public	Open access to platform but restricted consensus protocol access Examples: Stellar & Lisk	No restrictions to join the platform and participate in the consensus protocol Examples: Bitcoin & Ethereum

Blockchains are complex and differ in designs. This results in several misconceptions:

Misconception	Explanation
Blockchains consume a lot of energy	Only Proof of Work (e.g. Bitcoin) consumes high amount of energy. For the Carbon Market Mechanism, other (permissioned) consensus protocols without a high energy demand, e.g. Proof of Stake, would be possible.
Blockchains cannot handle enough transactions	It is true that some blockchain cannot handle more than 10 transactions/second. Under the Paris Agreement, around 40 transactions/second are imaginable. This transaction volume is easily manageable by a permissioned blockchain design.
All data is publicly available	With the type of blockchain and usage of other features as off-chain, the external visibility of data is reduced. However, isn't a transparent system, what the Paris Agreement thrives for?

Research Results

The research results conclude that the blockchain technology can provide an alternative to the existing carbon market infrastructures. The technology enables a new distributed governance system, where each Party has ownership of the generated data. Based on our analysis, which encompassed technological considerations like scalability and transaction volumes, as well as soft factors like privacy and security concerns, we recommend a permissioned consensus protocol where all Parties participate in the validation of information. In terms of system access, a public system would provide full transparency of all transactions and open access to Parties in- and outside of the Paris Agreement. For more control over the system and the participants, a private design choice is suitable.

Further information, please visit:
Webinar – Blockchain for Climate.
The webinar discusses potential blockchain designs and trade-offs to address carbon market barriers and enhance efficiency and transparency.

System Recommendations

In addition to storing data in a transparent and immutable way, blockchain allows for the creation of tokens. Internationally transferred mitigation outcomes (ITMOs) can be represented as a transferable token, which contains all relevant data, like e.g. the origin of data, timestamps, used methodology, project developers, and verifiers. This information prevents double spending and creates the required transparency of transactions. To provide privacy for sensitive data in a transparent system, private chains can be created. Parties can store and aggregate sensitive data on these private chains. Each private chain is synchronized with the main chain to maintain the current status and guarantee transparency, visibility, and traceability.

Policy Recommendations

At present, the existing infrastructures of the conventional market mechanisms are more proven, but by not considering this evolving technology, there is the risk of designing a new system for a post-2020 mechanism that is already outdated at the time of its inception. We recommend a proactive approach to create a technological infrastructure in which all Parties have the same rights and responsibilities to support climate mitigation activities.

- Conduct workshop and seminars to educate and raise awareness amongst all relevant stakeholder groups;
- Consult the Parties to co-create the governance and system design for full ownership in a bottom-up approach;
- Develop pilot projects to test the technology and refine it for this specific use case.