



Task Force 4
Refuelling Growth: Clean Energy
and Green Transitions



CARBON CREDIT ISSUANCE, VERIFICATION, TRACKING, AND STANDARDISATION THROUGH VARIOUS MEANS

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Abstract






The carbon credits market faces various challenges that hinder its effectiveness in mitigating climate change and reducing greenhouse gas (GHG) emissions. These challenges include ensuring the integrity of carbon credits, lack of standardisation, verification and monitoring complexities, price volatility, limited representation of project types, and insufficient market demand. By leveraging decentralised identifiers (DIDs), verifiable credentials (VCs), and distributed ledger technology (DLT), aligned with World Wide Web Consortium (W3C) standards, policymakers can enhance the effectiveness and


credibility of carbon credit systems, promoting integrity, transparency, and inclusivity in the market. The G20 can play a significant role in advancing carbon market policies by fostering collaboration, promoting harmonisation and standardisation, supporting capacity building, and encouraging private sector engagement. It can also work to strengthen data privacy and security, advocate policy alignment, strengthen monitoring and compliance, and promote inclusivity and equity in market participation. Implementing these recommendations can achieve sustainable emission reductions and deal with climate change challenges globally.



The Challenge



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The problem with the carbon credits market is rooted in the global challenge of mitigating climate change and reducing greenhouse gas (GHG) emissions. The larger policy goal is to transition to a low-carbon economy and limit global warming to well below 2 °Celsius above pre-industrial levels as outlined in the Paris Agreement.

The carbon credits market, while intending to facilitate emission reductions and support sustainable projects, faces several barriers that hinder its effectiveness in achieving the broader policy goal.

Additionality and integrity. One challenge is ensuring the integrity and credibility of carbon credits. ‘Additionality’ refers to the requirement that emission reductions or removals claimed by a project would not have occurred without the financial incentive provided by carbon credits. Ensuring that projects are truly additional and generate real emissions reductions is essential for the market’s environmental effectiveness.


Lack of harmonised standards. There is a lack of harmonisation and consistency among different carbon

credit standards and methodologies. This creates complexities and confusion for market participants, as each standard may have varying requirements, leading to difficulties in comparing and verifying the environmental integrity of carbon credits.

Verification and monitoring challenges. Adequate verification and monitoring of emission reductions can be complex, especially for projects that involve land-use changes, or forestry, or avoided deforestation. Establishing robust and transparent monitoring mechanisms is crucial to avoid double counting, accurately quantify emission reductions, and maintain the environmental integrity of the market.

Price volatility and uncertainty. Carbon credit prices can be volatile and fluctuate due to market factors, policy changes, or shifts in demand and supply. This volatility can reduce market confidence and hinder long-term investments in emission reduction projects.

Lack of standardisation in project types: The current carbon credits market is often skewed towards specific project types, such as those



of renewable energy, which can overshadow other vital sectors for emission reductions. Projects therefore require broader representation and opportunities in areas like energy efficiency, sustainable agriculture, and waste management.


Limited market demand. The voluntariness of the carbon credits market means that demand for credits is not as strong as it could be. Many organisations and individuals are not actively engaging in voluntary offsetting, and the overall market demand for carbon credits may not be commensurate with the scale of emission reductions required to deal with climate change adequately.

The larger policy goal towards which the carbon credits market is a barrier is achieving significant and sustainable GHG emission reductions globally. The market must deal with the challenges mentioned above to ensure that carbon credits play a more effective role in incentivising emission reductions, fostering sustainable development, and facilitating the transition to a low-carbon economy.

Distributed ledger technology (DLT): Ensuring transparency in carbon credit issuance, tracking, and reporting

The increasing concentration of GHG in the atmosphere is causing global warming, which has severe implications for the planet. Governments and organisations worldwide are taking measures to reduce their carbon footprint and mitigate their impact on the environment. Carbon credits are one way to incentivise organisations to reduce their carbon emissions. However, the carbon credit market has faced challenges in ensuring transparency, which has led to fraud and mismanagement. DLT can provide a solution to these challenges by ensuring transparency in carbon credit issuance, tracking, and reporting.

Transparency in carbon credit issuance. Carbon credits are issued to organisations that reduce their carbon emissions below a certain level. However, the current system of carbon credit issuance lacks transparency, which has led to fraud and mismanagement. DLT can



provide a solution to this challenge by facilitating transparent and immutable tracking of carbon credits. With DLT, each carbon credit can be assigned a unique digital identity that can be tracked throughout its lifecycle. This will ensure that carbon credits are issued only to organisations that have actually reduced their carbon emissions.


Transparency in carbon credit tracking. The current system of carbon credit tracking is also prone to fraud and mismanagement. Carbon credits are often traded multiple times, making it difficult to track their ownership and usage. DLT can provide a solution to this challenge by enabling transparent and immutable tracking of carbon credits. With DLT, each transaction involving carbon credits can be recorded on a distributed ledger that is accessible to all participants in the network. This will ensure that the ownership and usage of carbon credits are transparent and verifiable.

Transparency in carbon credit reporting. Transparency is critical in carbon credit reporting. Organisations that issue carbon credits must report the carbon emissions they have

reduced to ensure that the credits are legitimate. However, the current system of carbon credit reporting lacks transparency, which has led to fraud and mismanagement. As enunciated earlier, DLT can provide a solution to this challenge. This will ensure that carbon credit issuers report their emission reductions accurately and transparently.

Decentralised identifiers (DIDs) and verifiable credentials (VCs): Empowering carbon credit policy with W3C standards

As the world grapples with climate change, innovative technologies are emerging to streamline sustainable practices. DIDs and VCs, backed by W3C standards, are in focus recently for their potential to revolutionise various sectors, including carbon credit markets. This Policy Brief aims to elucidate the concepts of DIDs and VCs, their alignment with W3C standards, and their role in facilitating transparent and secure transactions for carbon credits. By leveraging these technologies and adhering to W3C standards, policymakers can enhance the integrity, efficiency, and accessibility of carbon credit systems,



ultimately fostering sustainability and accountability.

Decentralised identifiers (DIDs).

DIDs provide a framework for creating and managing globally unique identifiers for digital entities, such as individuals, organisations, or things. Unlike traditional centralised systems where identification relies on a central authority, DIDs are self-sovereign, enabling individuals to control and manage their digital identities. DIDs utilise blockchain or distributed ledger technologies to ensure the integrity, immutability, and privacy of the identifiers.


For carbon credits, DIDs aligned with W3C standards offer several benefits. First, they provide a secure and tamper-resistant means of representing and tracking carbon credits throughout their lifecycle. Each carbon credit can be associated with a unique DID, facilitating traceability and accountability. Moreover, the adherence to W3C standards ensures compatibility and interoperability between different systems and platforms, allowing seamless exchange and verification of carbon credits across various market participants and

jurisdictions. By advantageously using W3C-compliant DIDs, policymakers can ensure the integrity of carbon credit issuance, trading, and retirement practices while minimising the risk of fraud, double-spending, or identity theft.

Verifiable credentials (VCs).

VCs are digital representations of attestations or claims about a specific entity's characteristics, qualifications, or achievements. The W3C standards for VCs ensure common data models, cryptographic security, and interoperability. VCs are issued by trusted parties and can be cryptographically signed to ensure authenticity and integrity. VCs enable individuals to assert specific attributes or qualifications without revealing unnecessary personal information, thereby enhancing privacy and control.

For carbon credits, W3C-compliant VCs play a pivotal role in enabling efficient and trustworthy transactions. VCs can be utilised to represent various elements of a carbon credit, such as its emission reduction methodology, verification status, and ownership. By adhering to W3C standards, market participants can ensure



compatibility and seamless integration of VCs, facilitating secure and reliable exchange of information on carbon credits. W3C-compliant VCs also enable selective disclosure, allowing individuals or organisations to provide specific credentials without divulging unnecessary personal or confidential data. This feature enhances privacy and mitigates concerns of data protection.


Integration of DIDs and VCs with W3C standards for carbon credit policy. The integration of DIDs and VCs with W3C standards presents a powerful combination for enhancing carbon credit policies. On the one hand, by leveraging W3C-compliant DIDs, carbon credits can be uniquely identified, tracked, and authenticated, ensuring the integrity of the overall system. On the other, W3C-compliant VCs enable the efficient exchange, verification, and selective disclosure of relevant information, fostering transparency and privacy. This integration empowers policymakers to establish robust and trustworthy carbon credit markets, facilitating accurate accounting, monitoring, and incentivisation of emission reduction efforts. Furthermore, adherence to W3C standards simplifies compliance,

promotes interoperability, reduces administrative burdens, and fosters international cooperation in carbon markets.

Role of the state in carbon market reforms: Government intervention, private sector initiatives, and regulatory management

The state has a crucial role to play in the carbon market reforms, considering the involvement of governments, the private sector, and regulators. There is a need for government intervention, the potential contributions of the private sector, and the role of regulators in managing carbon markets. The aim is to achieve an optimal balance of responsibilities to foster effective and sustainable carbon market frameworks.

Role of governments in carbon market reforms. Governments play a crucial role in carbon market reforms as they deal with climate change as a public good. Governments are responsible for establishing regulatory frameworks that provide a clear legal basis for carbon markets, setting emission reduction targets, and implementing policies, such as that for carbon pricing. Additionally,




governments can support the development of infrastructure, ensure compliance with environmental standards, and encourage investment in low-carbon technologies. Moreover, the integration of DIDs and VCs can enhance the government's role by enabling secure and transparent management of carbon credits and facilitating the issuance and verification of emission reduction credentials.

Potential contributions of the private sector. Though governments play a significant role, the private sector too, has a vital role to play in carbon market reforms. The private sector can contribute by driving innovation, investing in emission reduction projects, and responding to market signals. Market-based mechanisms, such as emissions trading, provide the private sector with economic incentives to reduce emissions efficiently. The private sector's expertise and agility can lead to the development of innovative solutions and the promotion of market liquidity. Furthermore, the integration of DIDs and VCs can empower the private sector by facilitating secure and efficient transaction management, verifying emission reduction claims, and aiding market participation.

Regulatory management of carbon markets. Effective regulatory management is essential for ensuring the integrity and efficiency of carbon markets. Regulators play a critical role in overseeing market operations, preventing market manipulation, enforcing compliance, and maintaining market transparency. They establish rules and standards, monitor trading activities, and safeguard against fraudulent practices. Regulators ensure that market participants adhere to emission reduction targets, meet reporting requirements, and follow verification procedures. Additionally, regulators can facilitate the adoption of DIDs and VCs by providing guidance on their implementation, ensuring data privacy, and promoting interoperability among market participants.

Differentiating carbon market reforms and emissions trading schemes. Carbon market reforms encompass broader policy measures aimed at creating functional and efficient markets for trading carbon credits. These reforms may include the establishment of emissions trading schemes, but they extend beyond them. On the one hand, emissions trading schemes specifically refer to market-



based mechanisms where emission allowances or permits are allocated and traded among participants to achieve emission reduction targets. Carbon market reforms, on the other hand, encompass wider market mechanisms, including offset programmes, renewable energy certificates, and voluntary

markets. The integration of DIDs and VCs can enhance the efficiency and transparency of both carbon market reforms and emissions trading schemes by providing secure, tamper-resistant, and verifiable records of emission reductions.



The G20's Role



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Considering that carbon markets may have limited application across the globe, and that many G20 nations prefer utilising existing global markets rather than developing their own, the G20 has a crucial role to play in fostering international cooperation, promoting the use of global carbon markets, and ensuring policy alignment to achieve collective emission reduction goals.

Fostering international cooperation.


The G20 serves as a platform for fostering international cooperation on climate change, including the establishment and development of carbon markets. By convening leaders from both advanced and emerging economies, the G20 can facilitate dialogue, knowledge sharing, and collaboration on carbon market policies and practices. This cooperation eases the exchange of experiences, best practices, and technical expertise, fostering the growth and effectiveness of carbon markets globally. The G20 can also encourage capacity building and financial support for developing countries to participate in carbon markets, promoting global inclusivity and equity.

Promoting the use of global carbon markets.:

The G20 can play a significant role in promoting the use of existing global carbon markets, given that not all G20 nations may have the capacity or interest to develop their own. The G20 can facilitate discussions on harmonising standards, methodologies, and accounting practices to enhance the compatibility and interconnectivity of different market systems. By encouraging the use of global carbon markets, the G20 can provide its member nations with access to ample emission reduction opportunities, including project-based mechanisms, offset programmes, and international trading platforms. This approach allows G20 nations leverage existing market infrastructure and liquidity, fostering cost-effectiveness and efficiency in achieving emission reduction targets.

Ensuring policy alignment.

To effectively utilise global carbon markets, policy alignment among G20 nations is crucial. The G20 can facilitate policy coordination and harmonisation, aiming to establish a consistent and predictable regulatory environment for carbon markets. This coordination may involve aligning emission reduction targets, carbon pricing mechanisms,




reporting standards, and transparency requirements. By ensuring policy alignment, the G20 can mitigate market fragmentation, reduce regulatory barriers, and enhance market liquidity. This alignment can also provide market participants with the certainty and stability to invest in emission reduction projects and facilitate cross-border trading.

Leveraging DLT, DIDs, and VCs.

For carbon markets, the integration of DLT, DIDs, and VCs can deal with key challenges, such as transparency, traceability, and integrity. DLT ensures transparency in carbon credit issuance, tracking, and reporting. DIDs provide


unique and decentralised identifiers for entities participating in carbon markets, ensuring secure and tamper-resistant record-keeping. VCs authenticate the emission reduction claims and facilitate efficient and reliable trading of carbon credits. The G20 can play a role in promoting the adoption of DLT, DIDs, and VCs by facilitating discussions on their standardisation, interoperability, and privacy enhancements. By advantageously using these technologies, the G20 can enhance the trust and increase the efficiency of global carbon markets, promoting widespread adoption and participation.



Recommendations to the G20



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Foster collaboration and knowledge sharing.

The G20 should actively encourage collaboration and knowledge sharing among member nations and international organisations. Facilitate regular forums, workshops, and platforms where countries can exchange experiences, best practices, and lessons learned in implementing carbon markets. This collaborative approach can enhance the understanding of effective market design, policy instruments, and regulatory frameworks.

Promote harmonisation and standardisation.

Encourage the harmonisation of standards, methodologies, and accounting practices across global carbon markets. By establishing common guidelines and frameworks, the G20 can facilitate interoperability and seamless integration of different market systems. Standardisation efforts should also consider the integration of DLT, DIDs, and VCs, ensuring compatibility and consistency in the adoption of these technologies.

Support capacity building and technical assistance.

Provide financial and technical support to developing countries to enhance their capacity in implementing carbon markets. This support can include training programmes, capacity-building initiatives, and financial assistance for the establishment of market infrastructure. Additionally, assist developing nations in advantageously using DLT, DIDs, and VCs by providing guidance, resources, and expertise to overcome technical and implementation challenges.

Encourage private sector engagement.

Facilitate private sector engagement in carbon markets by creating favourable investment environments and incentives. Collaborate with the private sector to develop innovative financial instruments, such as green bonds and climate investment funds, to attract private capital for emission reduction projects. Encourage the use of DLT, DIDs, and VCs by promoting their benefits, providing guidance on their integration, and fostering public–private partnerships to drive technological advancements.



Strengthen data privacy and security.

Deal with concerns on data privacy and security when utilising DLT, DIDs, and VCs in carbon markets. Collaborate with relevant stakeholders, including privacy experts and technology providers, to develop robust privacy-enhancing mechanisms and frameworks. Establish guidelines and regulations to ensure the responsible handling of data and protect the confidentiality and integrity of sensitive information within carbon market transactions.

Advocate for policy alignment.


Promote policy alignment among G20 nations to create a level playing field and avoid market distortions. Encourage countries to implement carbon pricing mechanisms, emission reduction targets, and regulatory frameworks that are consistent and complementary. This alignment will support the effective functioning of global carbon markets and facilitate the cross-border utilisation of carbon credits.

Strengthen monitoring and compliance.

Support the development of robust monitoring, reporting, and verification (MRV) systems to ensure the accuracy and integrity of emission reduction claims. Encourage the use of advanced technologies, including satellite-based monitoring and blockchain-enabled verification, to enhance transparency and accountability in carbon markets. Collaborate with international organisations to establish common MRV standards and facilitate information sharing among market participants.

Promote inclusivity and equity.

Ensure that the benefits and opportunities of carbon markets are accessible to all countries, including developing nations. Focus on promoting inclusivity and equity in market participation, allowing developing countries to benefit from emission reduction projects and international trading mechanisms. Support capacity building to enhance the readiness and capabilities of developing countries to effectively engage in carbon markets.



By implementing these recommendations, the G20 can play a pivotal role in advancing the development and utilisation of carbon markets while harnessing the potential of DLT,

DIDs, and VCs. These actions will contribute to global efforts in achieving sustainable emission reductions and deal with climate change challenges on a broader scale.

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Bibliography

Cheikosman, Evîn, Josh Knauer, and Lauren Serota. Recommendations for the Digital Voluntary and Regulated Carbon Markets. *World Economic Forum* (March 2023). <https://www.weforum.org/whitepapers/recommendations-for-the-digital-voluntary-and-regulated-carbon-markets>.

Donofrio, Stephen, Patrick Maguire, Kim Myers, Christopher Daley, and Katherine Lin. Ecosystem Marketplace's State of the Voluntary Carbon Markets 2021. *Ecosystem Marketplace* (2021). <https://www.ecosystemmarketplace.com/publications/state-of-the-voluntary-carbon-markets-2021/>.

Porsborg-Smith, Anders, Jesper Nielsen, Bayo Owolabi, and Carl Clayton. "The Voluntary Carbon Market Is Thriving." *Boston Consulting Group* (January 2023). <https://www.bcg.com/publications/2023/why-the-voluntary-carbon-market-is-thriving>.

Sporny, Manu, Dave Longley et al. Decentralized Identifiers (DIDs) v1.0. *W3C* (2022). <https://www.w3.org/TR/did-core/>.

Sporny, Manu, Dave Longley, and David Chadwick. Verifiable Credentials Data Model v1.1. *W3C* (2022). <https://www.w3.org/TR/vc-data-model/>.



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