Digital MRV can spur growth in voluntary carbon credit market

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Executive Summary

To limit global warming to +1.5°C, the voluntary carbon credit (VCC) market has to grow. Digital measurement, reporting and verification processes can play a key role in both scaling up the market and ensuring VCC quality.

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CO2 reduction through voluntary carbon credits

Carbon trading[1], whereby CO2 emission[2] allowances are bought and sold, is garnering renewed attention as an important means of limiting global warming to a maximum of 1.5°C above the earth's preindustrial average temperature. By creating economic incentives[3], carbon trading aims to fund activities that can reduce CO2 emissions more effectively, thereby accelerating decarbonization. Carbon trading schemes can be broadly classified based on whether they are (1) publicly or privately operated and (2) compulsory or voluntary.

In the lower right quadrant of the table below are privately operated[4] voluntary carbon credit (VCC) schemes through which companies and other CO2 emitters voluntarily purchase credits to offset their own CO2 emissions. The credits they purchase are supplied by third-party projects that reduce CO2 emissions[5] through such means as displacing fossil fuel consumption with renewable (e.g., solar, wind, hydro, biomass) energy or naturally sequestering atmospheric CO2 through, e.g., reforestation.

Because VCC schemes are not compulsory, they have yet to be widely adopted. To cap global warming at +1.5°C, the VCC market's CO2 trading volume reportedly must grow 15-fold between 2019 and 2030[6]. In 2021, it grew nearly 50%, from 230Mt to 350Mt[7].

Prominent carbon trading schemes

	Compulsory	Voluntary
Publicly run	• EU Emissions Trading System (EU-ETS) • Cap-and-Trade California • Tokyo Carbon Emissions Reduction Program	• Saitama Prefecture Target-Setting Emissions Trading Program • J-Credit
Privately run	• Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA)	• Verified Carbon Standard (VCS) • Gold Standard

Voluntary Carbon Credits (VCCs)

Source: NRI

NOTE

1) As used herein, "carbon trading" encompasses both emissions trading and carbon credit trading.

2) Other greenhouse gas (e.g., methane, N2O) emissions also are traded but they are normally priced on a CO2-equivalent basis. We accordingly refer herein to all tradable greenhouse gases as CO2.

3) The incentives assume companies place priority on reducing their own emissions.

4) Privately operated schemes include Verified Carbon Standard (VCS) and Gold Standard, respectively developed and operated by Verra (an NPO) and the World Wildlife Fund, the latter in collaboration with several NGOs.

5) Strictly speaking, a project's decarbonization effect can be measured in various ways, including the extent to which emissions were reduced or averted relative to what they would be in the absence of the project and the extent to which atmospheric greenhouse gases were absorbed or otherwise removed from atmosphere.

6) According to the *Taskforce on Scaling Voluntary Carbon Markets Phase I Report.*

7) The 230Mt and 350Mt are NRI estimates based on the World Bank's *State and Trends of Carbon Pricing 2022.*

The key to VCC market growth is VCC quality. Quality encompasses multiple dimensions, including measurability, permanency and additionality. In other words, reductions in emissions should be able to be measured accurately, CO2 removed from the atmosphere should not subsequently find its way back into the atmosphere and funding raised through the VCC market should drive additional reductions in CO2 emissions. A measurement, reporting and verification (MRV) process is crucial to ensure VCC quality.

Significance of MRV digitalization

The biggest impediment to expanding VCCs' supply while ensuring their quality is that MRV processes are mostly manual. They are consequently prone to human errors that result in faulty data[8], including mis-verification, transposition and spreadsheet entry errors. Additionally, human involvement poses a risk of intentional overstatement of emission reductions.

8) According to a 2021 survey by Boston Consulting Group, 86% of companies and other parties' CO2 emissions estimates are manually entered into spreadsheets. Additionally, an estimated 30-40% of the measurements are erroneous.

MRV processes entail operating costs also. The costs of on-site manual measurement are borne by the project operator. When verification is done manually, it is often performed infrequently (e.g., annually). Infrequent verification means projects take longer to monetize through carbon credit sales, potentially resulting in financial hardships for their operators. If a project is not sufficiently profitable, it would not be able to generate enough additionality to scale up.

One solution that addresses such challenges and would expand VCCs' supply without sacrificing quality is digital MRV. Digital MRV aims to reduce costs and improve information credibility by using digital data from sources such as sensors, IoT-connected devices and satellite photographs to automatically measure emission reductions remotely and report and verify the measurements in real time.

One leading-edge example of digital MRV is a Chilean project that captures methane gas emitted by a landfill and uses it as renewable energy[9]. Its digital MRV system was developed by IOTA Foundation and ClimateCHECK. The system records biogas volumes captured from the landfill at 10 minute intervals. By measuring the concentration of methane[10] in the biogas, it is able to automatically track emission reductions in real time. The measurement data are securely recorded on Tangle, a distributed ledger designed specifically for IoT environments. Tangle is linked to a reporting system that forwards the data to a certification body in a manner that ensures data integrity, facilitating certification of

9) See *Open Collaboration on Next Generation Digital Solutions for Measurement, Reporting and Verification (MRV)*.

10) As a greenhouse gas, methane is some 25 times more potent than CO2.

the measurements. Tangle is also vastly more energy-efficient than conventional blockchains, enabling even large-scale digital MRV systems to minimize their carbon footprint[11].

VCC use as potential demand growth driver

VCC use cases involving other products, services and entities will likely emerge going forward. One example of such a use case is carbon-neutral funds[12] offered to institutional investors overseas. These funds measure their investees' CO2 emissions and offset them by purchasing an equivalent amount of VCCs[13]. Embedding VCCs in financial products might lead to growth in demand from parties other than today's VCC buyers. Additionally, if an investment fund were to buy VCCs that later became tainted by greenwashing allegations, for example, it may incur reputational damage itself. Quality therefore could become a more important consideration in VCC sourcing decisions.

Another example is Singapore's decision to allow businesses to offset up to 5% of their taxable CO2 emissions with VCCs once its recently increased carbon tax takes effect in 2024. The policy is intended to spur development of a Singaporean carbon market by generating domestic demand for VCCs. To inspire confidence in its tax code and ensure the quality of the VCCs used to offset carbon tax liabilities, Singapore will accept only VCCs certified by Verra or Gold Standard, both of which are major players in the space. Such examples bode promisingly for (1) VCC market growth through diversification of demand and (2) higher prioritization of VCC quality. Digital MRV has a key role to play in meeting such demand growth by increasing the supply of high-quality VCCs.

Japan's VCC market is currently still small but use of globally standardized VCCs embedded in various services or financial products may grow even in Japan. On the supply side, Japanese technologies could be applied to digital MRV to provide a stable supply of high-quality VCCs to overseas markets. We hope VCC market participants leverage digital MRV and other such innovations to expedite the market's growth.

11) Because Tangle does not require blocks to be mined, transactions can be recorded in essentially real-time. Additionally, Tangle consumes at least 99.9999999999999997% less electricity per transaction than the Bitcoin blockchain.

12) Specific carbon-neutral funds include VIA AM's VIA Smart-Equity Europe Fund in France and Alliance Bernstein Australia's AB Managed Volatility Equities–Green.

13) VCC acquisition costs are often split 50:50 between the fund manager and investors or deducted from the fund's NAV and therefore indirectly borne by the investors.

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