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Seeking scale:

The role of physical commodity markets in delivering carbon removals

Hannah Hauman and Malihah Shah

Introduction

In the most recent Intergovernmental Panel on Climate Change report[1], carbon removals are identified as a necessary and unavoidable tool to remedy the likely overshoot past annual emissions levels required to meet the goals of the Paris Agreement. The shortfall in country commitments[2] and the many challenges of the energy transition mean that the additional contribution required from carbon removals is material, in both 1.5°C and 2°C scenarios. Notably, the most conservative estimate in the Bloomberg New Energy Finance Gray Scenario requires 21.5 billion tonnes of carbon removals between 2023 and 2050.[3]

While there has been significant growth in carbon finance to date, and in the voluntary carbon market in particular, projects have primarily focused on 'avoided emissions' instead of the development of negative emissions in the form of carbon removals. This is not because of a lack of demand: over 70 countries and 1,200 companies have committed to net zero by 2050[4], encompassing 80 percent or more of global emissions at time of writing. Many of these countries and companies are committed to the Science Based Targets initiative, which requires carbon removals for offsetting residual emissions. While these are long-term targets, immediate demand needs are just as critical in terms of achieving progress towards net zero. Notably, Microsoft has cited a supply shortage of appropriate solutions in relation to their 2021 Request for Proposals[5] on carbon removals.

Therefore, the constraint remains supply, a predicament seemingly unique to carbon removals, with all carbon avoidance sectors having experienced an increase in supply in response to growing demand.

Carbon removals, as an electronic certificate recorded in a registry ledger, are often oversimplified in terms of their ease of production. However, behind these virtual tonnes are very real physical assets with complex operations and risks, not dissimilar to those faced in the traditional physical commodities sector. While a tonne of carbon removals from a forestry or carbon capture, storage and utilisation (CCUS) project will never be loaded onto a ship, project investors are still required to manage delivery, timing, policy, credit and customer risk against the backdrop of a rapidly changing regulatory landscape. This is not necessarily unique to carbon removals compared to other classes of carbon credits, however as removals require a higher cost of implementation with an outcome of lower volumes and extended delays to production, this risk is amplified and projects are often foregone altogether.

While a number of corporates have been recognised as pioneers in direct carbon removals investment, the scale required by voluntary net zero demand and Intergovernmental Panel on Climate Change scenarios[6] requires enhanced market architecture in the form of participants as much as frameworks. Just as an exchange facilitates transactions for clearing risk, supply chain experts and commodity risk managers are uniquely suited to managing the inherent physical risks underlying the carbon removals market and to delivering solutions at scale.

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1 IPCC (2022) *Climate Change 2022: Impacts, Adaptation, and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change.* Cambridge. Cambridge University Press.

2 UNFCCC Secretariat (2021) *Nationally determined contributions under the Paris Agreement. Revised note by the secretariat.* Available at: https://unfccc.int/sites/default/files/resource/cma2021_08r01_E.pdf

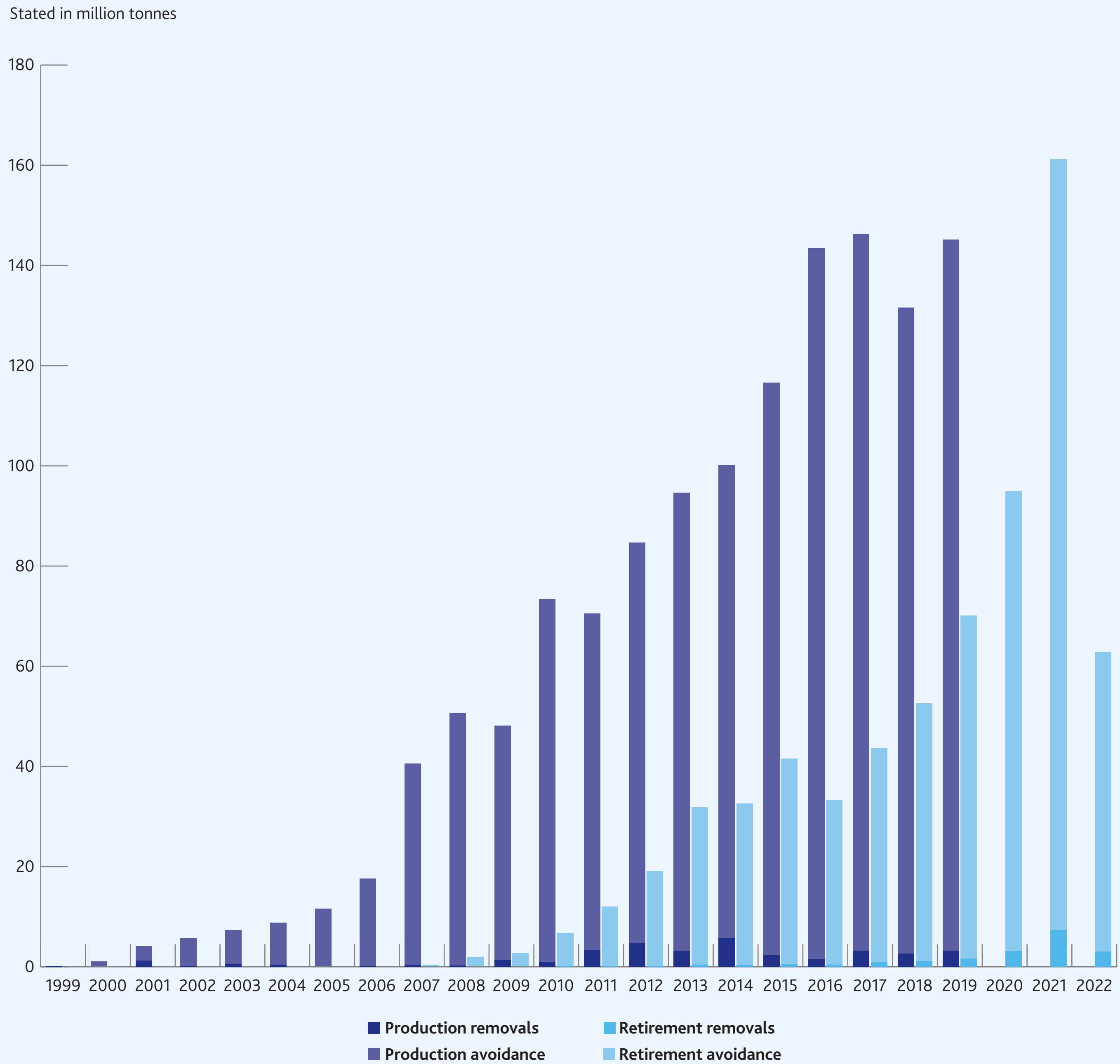
3 Henbest, S. Kimmel, M. Callens, J. Vasdev, A. Berryman, I. Danial, J. Brandily, T. Vickers, B (2021) *New Energy Outlook 2021.* Available at: https://about.bnef.com/new-energy-outlook/

4 United Nations (2022) *For a livable climate: Net-zero commitments must be backed by credible action* Available at: https://www.un.org/en/climatechange/net-zero-coalition

5 Microsoft (2022) *Microsoft carbon removal: An update with lessons learned in our second year.* Available at: https://query.prod.cms.rt.microsoft.com/cms/api/am/binary/RE4QO0D

6 IPCC (2021) *Climate Change 2021 The Physical Science Basis Working Group I Contribution to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change: Summary for Policymakers.* Available at: https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_FrontMatter.pdf

1 Annual growth in voluntary carbon credit retirements and production



Source: Data from Verified Carbon Standard[7], Gold Standard[8,9], Climate Action Reserve[10,11], American Carbon Registry[12,13] as of 6 June 2022.

7 Verified Carbon Standard (2022) VCUs. Available at: *https://registry.verra.org/app/search/VCS/VCUs*

8 Gold Standard (2022) Impact Registry: Retirements. Available at: *https://registry.goldstandard.org/credit-blocks?q=&page=1*

9 Gold Standard (2022) Impact Registry: Issuances. Available at: *https://registry.goldstandard.org/credit-blocks/issuances?q=&page=1*

10 Climate Action Reserve (2022) Project Offset Credits Issued. Available at: *https://thereserve2.apx.com/myModule/rpt/myrpt.asp?r=112*

11 Climate Action Reserve (2022) Retired Offset Credits. Available at: *https://thereserve2.apx.com/myModule/rpt/myrpt.asp?r=206*

12 American Carbon Registry (2022) Project Credits Issued. Available at: *https://acr2.apx.com/myModule/rpt/myrpt.asp?r=112*

13 American Carbon Registry (2022) Project Retired Credits. Available at: *https://acr2.apx.com/myModule/rpt/myrpt.asp?r=206*

Removals taxonomy and associated challenges

Even with a wide range of carbon removals options available within the categories of nature-based and technology-based project solutions, all removals share a heightened barrier to entry compared with avoidance and reduction equivalents because of the lead time from final investment decision to production, ongoing operational challenges and policy risk. However, this presents differently based on the project subcategory.

Nature-based removals contain the widest variety of subcategories, including traditional forestry-based afforestation/reforestation (AR), regenerative agricultural practices (soil carbon), mangrove restoration (blue carbon) and biochar. The concept of carbon sequestered via biomass means that the constraint of time is a given, with projects taking two to four years to deliver the first tonnes and only reaching full-scale production after seven to 10 years. The final growth rates, however, depend on the specific geography, land eligibility and species type, which means that even forestry-based removals production curves can have extraordinary variability in terms of assessing and guaranteeing volume. Soil carbon, while more accurate in terms of delivery timescales, has the distinct challenge of measurement, reporting and verification when it comes to managing landscapes at scale. This is especially difficult given that sequestration rates may only become truly quantifiable following a project's first monitoring period, potentially years after the activity has begun.

Afforestation and restoration with native species is as beneficial for restoring biodiversity as they are for carbon sequestration. Still, from a silvicultural perspective, they have far slower growth rates than exotic (non-native) equivalents and face greater physical risks outside their natural environment. On the other hand, while exotics demonstrate strong rates of growth, there can be risks associated with ensuring the ideal clone selection and the accurate assessment of land eligibility to make sure a project is truly operating on degraded lands that otherwise would not be viable for carbon.

The final variable for nature-based removals, whether natives or exotics, is that developers have to choose between the inclusion of a harvesting component or to seek pure carbon sequestration. Harvesting practices, while producing far fewer carbon removals under the long-term-average methodology, can provide meaningful revenue and diversification of community engagement for the project, arguably ensuring their long-term sustainability and permanence. Restoration through non-harvest exotics or native species, on the other hand, receive top marks for environmental additionality but have far greater risks as stand-alone carbon investments.

Technological removals, while not reliant on seasonal constraints in the same way as nature-based equivalents, experience their own lead-time and production risks on the front end as a result of the human constraints of permitting, engineering studies and final technical viability testing. Once operational, these projects largely forego variability in production figures as they sequester carbon in a linear, predictable fashion. However, as policy evolves, they face a unique risk in the regulatory treatment of their engineering process under the lens of policy, namely the tightening of requirements on energy consumption. The key input for technology-based removals, such as direct air capture and carbon capture, storage and utilisation processes, is power. Therefore, the absence of renewable power supply can change carbon sequestration rates drastically. Leading technologies achieve only 20 percent of the capture rate if reliant on grid-sourced power and legislators are taking an increasingly rigorous stance on additionality when it comes to renewable power use for green projects. We see this in advancing legislation on hydrogen in the European Union, which requires renewable-power-generating installations to be built alongside electrolysers to ensure that projects are not cannibalising existing resources.

Finally, while each type of carbon removal activity faces unique challenges surrounding surety on sequestration rates and timing, common to all projects is the overarching policy risk relating to the UNFCCC Article 6 implementation. There have been an increasing number of instances that highlight how nationalisation risk and changing domestic policy can have an impact on project participants, such as the recent freeze of voluntary carbon issuances for export in Indonesia or the announcement in China that forestry projects in the province of Fujian will only be allowed under domestic schemes. There is also the uncertainty relating to project policy-driven validity, such as in the case of the REDD+ moratorium on all new projects in Papua New Guinea or the ban on methane flaring in Russia, which rendered upstream emission reduction projects obsolete as a result of a lack of additionality.

Physical commodity players as an integral part of market architecture

The categories and associated risks can be dizzying for even the most experienced agronomists and technologists, let alone for corporates otherwise occupied with decarbonising their core industrial businesses. This has resulted in an admirable but relatively limited movement of capital into removals as a result of the aforementioned risks tied to ownership and operation of physical carbon assets. Therefore, traditional physical commodity players bring a unique skillset in managing physical asset risk and connecting markets, enabling solutions at scale by managing three key risk parameters and enablers: delivery, specification and financial tools.

Delivery

At the heart of any traded commodity market is the natural mismatch between global producers and global consumers with regard to requirements relating to timing and quantity. Producers naturally want immediate cash for goods produced, while consumers avoid payment until delivery is required. At the same time, producers seek to avoid any quantity or timing guarantees because of inherent variability and propensity for delays in production processes, while consumers seek security of supply in terms of both quantity and timing. Carbon removal supply chains are no different. Just as an automotive manufacturer is reliant on deliveries from nickel mines, the corporate managing its net-zero commitment is reliant on the carbon removal project to deliver the exact tonnes transacted, at the price agreed and at the timing required. The absorption of delivery risk relating to quantity shortfall and potential for delays occurs every day in the physical commodity world, with supply chain managers providing producers with the flexibility they require while providing consumers with the surety they need.

Additionally, as supply chain managers are focused on meeting a broad view of general market demand as opposed to individual corporate requirements, quality and scale explored are never limited by quantity. Every project development requires a high fixed amount of costs and time related to technical and policy vetting, legal structuring and financial arrangement costs. This translates to size and scale acting as a positive for supply chain managers at the same time that it is a limiting factor for individual corporates with constraints around project diversification, capex or quantity.

Specification

Just as there are specific requirements with regard to quantity and timing, individual corporates seek specific quality baskets, often with priorities for type, registry and geography. While the concept of product specification is not unique to any physical commodity market, it is a natural limitation for individual actors investing for their own consumption to scale for the full suite of carbon removals, each with its own role to play in mitigation and adaption services.

Terrestrial afforestation/reforestation projects to date have served as the largest supplier of carbon removals, offering corporates the opportunity to contribute to bolstering forestry stocks that help to protect biodiversity and shield against the loss of carbon contained in the biomass. However, for organisations with direct exposure to agricultural supply chains, it may be important to interweave carbon removals with the production of cacao, coffee, bananas or cotton, giving rise to agroforestry and soil carbon projects. Similarly, the maritime industry in particular has gravitated towards the category of blue carbon removals or projects that focus on restoration of mangroves to rebuild marine ecosystems. Others have a keen interest in driving carbon finance to communities nearest to their operations, meaning the main qualifier could actually be the project location itself.

While a tonne may equal a tonne in carbon accounting, the social and biodiversity aims that often accompany net-zero targets create a range of carbon removals specifications that require a broad-based markets approach to deliver at scale and to ultimately connect global producers and consumers in what is anything but a one-size-fits-all landscape.

Financial tools

While physical assets and delivery risk serve as tremendous barriers to entry and scale in their own right, the largest barriers of all are concentrated in what could be characterised as financial tools: finance, credit and price risk management.

To date, while strong commitments have emerged from individual corporate end users, investments are often limited by capex constraints, especially in carbon removals that have a high upfront cost hurdle for implementation and a long delay to delivery. The physical commodity landscape is inherently tied to the traditional banking community for project finance, but also significantly in terms of the use of working capital as goods move from origin to transformation, storage and end-user stages. Leveraging these relationships and this expertise to increasingly frame carbon removals as a bankable commodity class is a critical requirement to move markets forward and deliver sequestration at scale, allowing for broad-based cooperation across the private sector to unlock sidelined financing into carbon removal asset development.

Credit and counterparty risk management is another critical component for markets to function efficiently. This is largely taken for granted in the major commodity markets, but a mismatch in working capital and the provision of credit is often as critical to scaling markets as any other aspect. Credit requirements exist on both the producer and consumer fronts, with individual corporates often lacking the technical expertise to assess a project for prepayment eligibility and producers requiring credit guarantees from buyers. Given that carbon removal offtakes generally average a minimum of 10 years, transactions are naturally very long term in nature, even compared to traditional commodities, which average one year in duration. This only increases the importance of this capacity within the market.

Finally, price risk management looms as the final hurdle in scaling carbon removals, especially because of their relatively high implementation cost and long lead times to production and payback periods, and with the backdrop of a rapidly changing regulatory landscape. While the derivatives market is swiftly advancing to create a robust underlying market architecture to improve transparency, liquidity and ability to hedge, such as the CME Group CBL Nature-Based Global Emissions Offsets (N-GEO) futures contract and the Intercontinental Exchange Nature-Based Solutions carbon credit futures contract, it is reflective of voluntary avoidance credits only.

A carbon removals derivatives market is likely to develop in the future, but at present the market finds itself stuck in a circular loop, whereby a derivatives market requires liquidity and therefore high volumes to launch, and equally the removals sector looks for hedging mechanisms to invest in new projects. Until the market crosses the threshold of critical mass to create a positive feedback loop in this respect, market participants need to be prepared to underwrite price risk, making physical commodity traders with experience in managing price risk an important lever in introducing solutions at scale and ultimately underpinning liquidity for wider market architecture to be further developed in the name of carbon removals.

Conclusion

Developing market infrastructure to enable meaningful scale and climate impact goes far beyond traditional facilitators such as registries, regulators and exchanges, and extends to market participants. While the most important of these is the demand signal from net-zero ambitions, there is an equal challenge on the supply side of the equation that requires expertise in operational risks associated with physical assets, in understanding policy and country risk, credit and counterparty risk, and in price risk management.

To date, the strong growth in the development of carbon assets has been encouraging. However, it has thus far left one of the most critical climate mitigation levers, carbon removals, out of the equation due to the far greater burden of cost and risk linked to this solution compared with carbon avoidance equivalents. Reframing this landscape requires an increased level of commitment from traditional commodity participants that are uniquely equipped to manage physical, legislative and financial risks, such as supply chain managers, banks and the insurance community, to adapt best practices from some of the most sophisticated markets in the world for use in what urgently needs to become one of the largest.

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TRAFIGURA

Trafigura Pte. Ltd.

10 Collyer Quay #29-00
Ocean Financial Centre
Singapore 049315

Tel : +(65) 6319 2960
Fax : +(65) 6734 9448

www.trafigura.com

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