Harnessing the power of voluntary carbon markets

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Macro Foresight

Contents

Executive summary

Carbon is now a mainstream topic in boardroom agendas. Leaders worldwide have set ambitious emission-reduction targets, responding to pressures from investors, customers, governments and a tightening regulatory landscape. But climate economics are complex, and although the imperative for climate action is clear, the cost of inaction is uncertain, and many of the pathways to decarbonize are often still incipient.

What is evident is that, as solutions for decarbonization evolve, carbon markets will play a critical role to balance a net zero system. Managing carbon exposure will be a key consideration for all corporations during capital allocation decisions, in the development of new business ideas and models, and for managing corporate risk or meeting evolving customer needs.

Voluntary carbon markets (VCMs) are growing fast, and as they become a critical tool to achieve net zero, an ecosystem of new participants, products, regulations and standards is forming. As such, companies across all industries need to develop a basic understanding of VCMs, what they may mean for them, what role they need to play, and what capabilities they require.

Are those capabilities the same for every industry? Are they more critical for certain industries? Are there industries that are more exposed to risks than others? Will my industry have business opportunities in these markets?

These are only a few questions that executives across all industries must start finding answers for as the race to decarbonize accelerates. The specific characteristics of VCMs present a set of new challenges but also opportunities that executives must understand to manage efficiently their pathway to a net zero world.

Note: Readers experienced in the carbon markets, both regulated and voluntary, might be familiar with the concepts in sections 1 and 2 and are invited to focus their reading on section 3.

Carbon taking the main stage

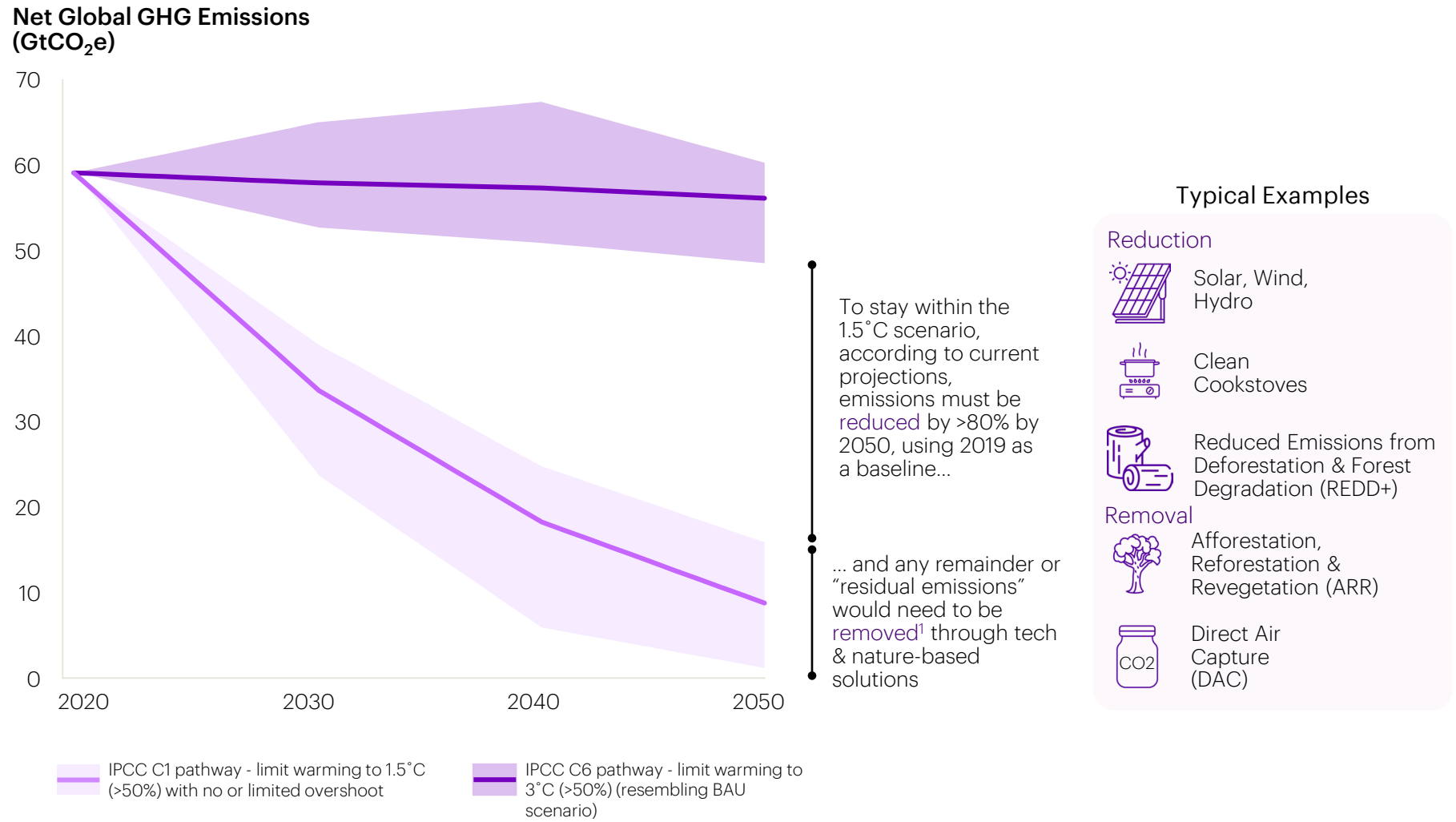
Carbon is now a mainstream topic in boardroom agendas. Leaders worldwide have set ambitious emission-reduction targets, responding to pressures from investors, customers, governments and a tightening regulatory landscape.

According to our recent analysis, countries representing 91% of global GDP have pledged to reduce their greenhouse gas emissions to net zero by 2050. On the corporate side, 34% of the Accenture Global 2000 companies, which consists of the world's largest public and private companies by revenue, have publicly stated net zero targets, and that share is increasing rapidly.

In most decarbonization scenarios, reaching net zero emissions by 2050 would still require a significant volume of emissions to be permanently removed from the atmosphere annually, to the order of some 10 $GtCO_2e$ / year.

Figure 1

Reaching net zero is dependent upon both reductions and removals of CO_2e



Sources:
Intergovernmental Panel on Climate Change, 2023, AR6 Synthesis Report: Climate Change 2023
Note:
(1) IPCC estimates 5-16 GtCO2e of removals needed until 2050 to stay within the 1.5˚C scenario, 10 $GtCO_2e$ has been assumed in the subsequent analysis

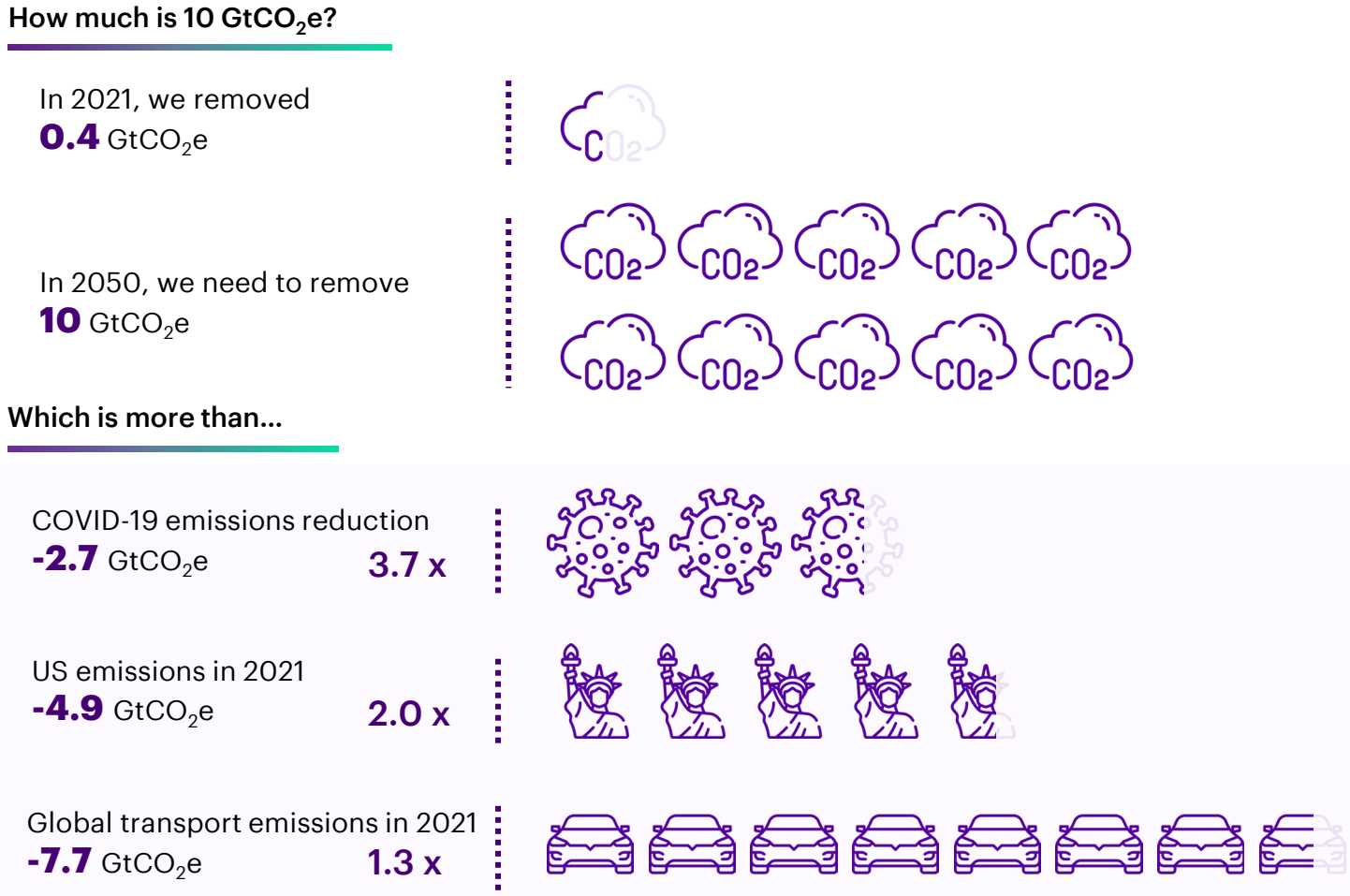
Achieving net zero will require significant investment in carbon removal solutions. For example, nature-based solutions such as reforestation or soil carbon capture, and technology-based solutions, including direct air capture (DAC).

The drive to curb climate change is gathering pace and corporates are defining their pathways to net zero. However, it is clear that they must go beyond decarbonizing their operations and products, meaning that indirect removals through carbon markets must also be part of their toolkit.

Removing 10 $GtCO_2e$ annually from the atmosphere will be incredibly challenging. To put things into context, removing this amount of emissions would be the same as removing the United States' entire CO_2e generated emissions for 2021 twice over and continue doing this every year after that. When looking at potential portfolios of solutions to achieve this, regardless of the strategy selected, the numbers are staggering (see Figure 2 for an example).

Figure 2

CO_2e removals need to accelerate at an unprecedented scale



Sources: IEA, 2022, World Energy Outlook 2022; US Government Energy Information Administration

Legend: 1 icon represents 1 $GtCO_2e$

Carbon markets everywhere

In the future, it is expected that carbon offset markets will increasingly be everywhere. Most companies, either because of their own emissions profile or emissions across their value chain, will interact with them across their decarbonization journeys. Companies can play different roles when participating in the carbon offset markets. They can act as a source of demand, buying credits to meet their net zero and other sustainability claims. They can also play as a market facilitator, warehousing risk, capturing arbitrage opportunities, and providing liquidity to the market. Lastly, companies can participate on the supply side, investing in projects to reduce or remove emissions and hence the potential to generate credits, and maintaining the ability to trade and consume the credits they generate[1].

Market participants, think tanks, and academics are generally bullish on the potential of carbon offset markets. By our calculations, carbon markets could become a $2 trillion physical market by 2050, and more than a $10 trillion traded market[2,3] when derivatives are considered. This figure is based on our proprietary model that assumes an expected price of $120 per tonne[4], a volume of up to 16 $GtCO_2e$, and four financial derivative trades for every physical trade. A carbon market this size would be 4 times that of the global physical oil market value in 2021[5].

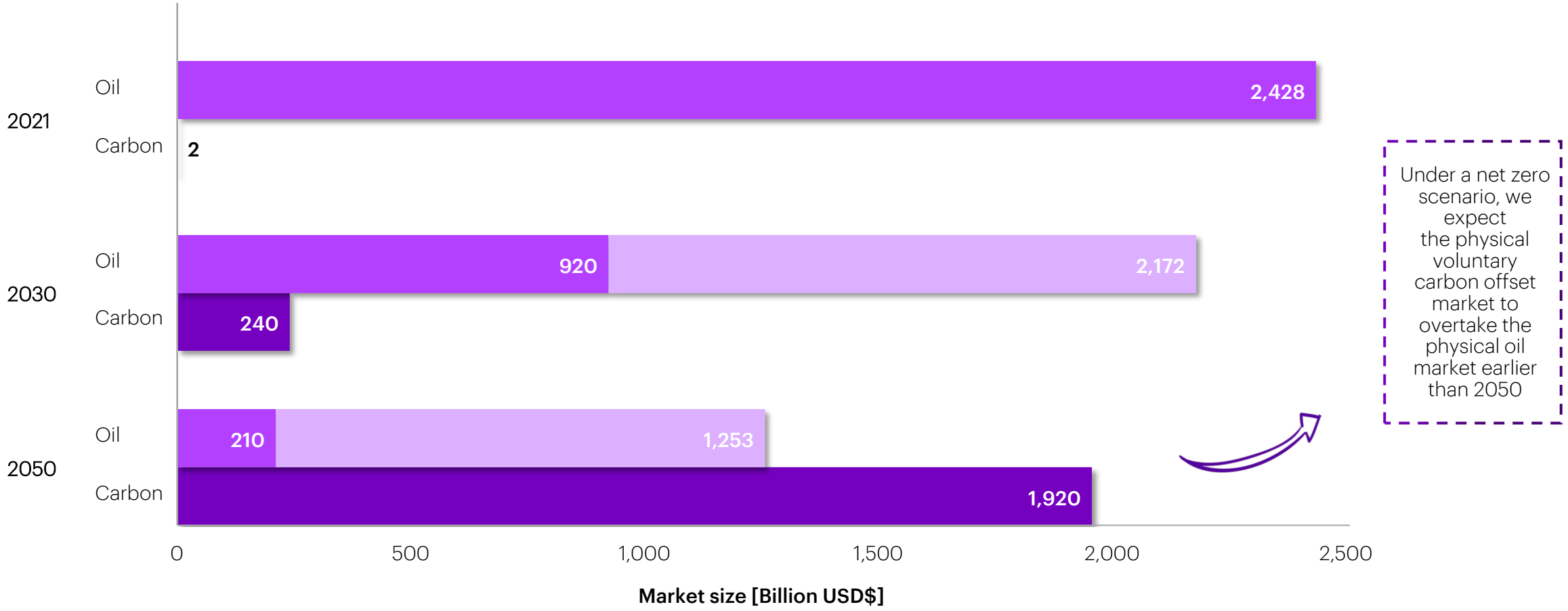
There is broad consensus on the potential size of carbon offset markets in the future, but the exact trajectory of their growth remains uncertain. This is because definitions and standards for carbon removals are still being established, not all emission reduction solutions are commercially available, there is still lack of clarity on how compliance and voluntary offset and allowance markets will interact, and businesses are still figuring out how to incorporate carbon markets into their strategies. Additionally, current regulation focuses on managing how much companies in many industries can directly emit, leaving the neutralization or offsetting of carbon footprints largely outside regulatory schemes (with a few exceptions including e.g., CORSIA, Singapore, Colombia and South Africa) and to voluntary action.

Note(s):

(1) Throughout the paper carbon credits refer to projects that remove, reduce, or avoid carbon emissions, also referred to in literature as carbon offsets. One carbon credit is equivalent to the removal, reduction or avoidance of 1 metric tonne of CO_2e.
(2) Traded market value encapsules physical and financial trades, along with the turnover rate of those (how many times each instrument is traded over - "changes hands" over a given period)
(3) The IPCC upper bound estimate of 16 $GtCO_2e$ annual carbon removals was used as the annual demand to size the market potential
(4) An average credit price of $120 per tCO_2e in 2050 was assumed in line with BNEF's carbon removal scenario
(5) Trading of oil–linked derivatives is very widely practiced by market participants that do not have a direct interest in oil as a product, due to their high liquidity. For example, oil derivatives are used as proxies for other commodities, such as long-term LNG agreements in Asia, or proprietary trading of hedge funds due to its correlation with economic activity. For reference, if the financial market was to be included, then the aggregate oil traded market value in 2021 would be $42.5 trillion

Figure 3

The carbon offset market[1] could shadow the oil market[2] by 2050, when it comes to the physical product



Sources:

ATIOS Analysis, Ecosystem Marketplace, IEA, 2022, World Energy Outlook 2022

Notes:

(1) Carbon offset market size refers to the expected demand of physical volumes of CO_2e multiplied by the expected average price.

(2) Oil market size refers to the expected demand of (physical) crude oil multiplied by the expected average price.

A tale of two markets

Compliance carbon markets have been around for over 20 years. Governments use them to decarbonize their economies and meet decarbonization commitments by imposing a limited number of CO_2e permits to different industries.[1] These are called Emission Trading Schemes (ETS) or cap-and-trade schemes. ETS typically target the highest emitting sources such as heavy industry and power generation. In simple terms, every participant from those industries is given a limit on absolute or relative (i.e., emission intensity[2]) emissions in the form of allowances or quotas. If they emit below that limit, they create a surplus of allowances that can be sold to those participants who emit above their allowance (i.e., have a deficit), creating a market for sale and purchase of allowances.

The other type of market is the VCMs. These markets are becoming more prevalent as corporates go beyond the scope of emissions regulations and set net zero targets. To meet those targets, they often need to purchase carbon credits, offsetting their emissions with emissions avoided, reduced or removed elsewhere. In the VCMs, companies invest in carbon-reducing or removing initiatives and projects, which then generate credits. Projects can be nature-based, such as planting trees, or technology-based, such as DAC.

Companies can also procure credits in secondary markets without investing directly in the project development. This creates a value chain and a market where different participants develop, buy and sell and retire credits. While VCMs tend to be more global in nature, ETS typically operate within a regional, national or subnational jurisdiction (e.g., Europe, UK or California ETS). These markets are sometimes linked. ETS can allow for the use of offset credits as a tool to meet the "cap." And these offsets may come from the VCM or from regulated offset schemes.

There is still considerable uncertainty on how these different markets will evolve. Most ETS have a clear setup and guidance looking a decade or more ahead. Due to their voluntary nature, VCMs lack that certainty. Article 6 of the Paris Agreement has already taken a first step in outlining the mechanisms of interlinkages and potential convergence between the VCM and regulated compliance markets.

In the years up to 2030, we expect the current dynamic to continue. VCMs will continue to grow and ETS will increase their coverage to include more industries and countries, serving as the main liquidity hub for carbon trading.

Figure 4

Mandatory and voluntary action present two different pathways to achieve a unified objective

Notes:
(1) In some cases, such as Switzerland, Canada, and Singapore, governments have opted for imposing a tax on carbon emissions directly to meet their decarbonization goals.
(2) In the case of China's ETS, there is yet no absolute cap: following a national benchmarking method, companies are allocated free allowances based on their emission intensity free of charge. There is still an incentive to reduce emissions and sell any unutilized allowances.
(3) Other examples of carbon taxes include those in South Africa, Mexico, Japan, and the EU.
(4) Additional examples of ETS include Mexico, New Zealand, and Korea.

By 2030, the voluntary carbon market is set to experience a rapid surge in growth, presenting vast opportunities for corporates to capture market share while offsetting their emissions.

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Figure 5

VCM and ETS head-to-head

Voluntary Carbon Markets (VCM)		Emission Trading Schemes (ETS)
Carbon credit	Instrument traded	Carbon allowance
Carbon avoidance or removal project developers	Suppliers	International, national or regional policies
Exchanges, marketplaces, over-the-counter, greenfield investment	Trade channels	Exchanges, over-the-counter
6.30 $/tCO$_2$e (+40% YoY)[1]	Price performance (2021)	56.80 $/tCO$_2$e (+120% YoY)[2] 50% of prices range between 8-70 $/tCO$_2$e
$2 billion (+282% YoY)	Market value (2021)[3]	$270 billion
>$250 billion[4]	Future market value (2030)	>$1000 billion[5]

Sources: Trove Research; Credit Suisse, 2022, Carbon Markets: The Beginning of the Carbon Age; Ecosystem Marketplace

Notes:

(1) Weighted average VER market price (all projects).
(2) Weighted average of EU ETS, UK ETS, WCI, RGGI, China ETS, China ETS Pilots, South Korea ETS, New Zealand ETS and CDM CERs.
(3) Market value is the product of market volume and price, lower than the traded market value which is sometimes quoted taking into account trades per instrument.
(4) By our calculations, this is expected to scale to a $2 Trillion physical market by 2050
(5) Credit Suisse estimation, regulatory uncertainty limits the ability to forecast beyond the early 2030s.

Demystifying the voluntary carbon markets

Supply and demand roller coaster

VCMs are like other commodity markets in many ways. They are driven by supply and demand balance, require long-term investments and consist of physical and financial elements. They are also subject to regulation and are priced based on product specifications.

However, VCMs are also quite unique. Their demand is determined by voluntary commitments and regulation; scarcity is not physical. They are also less mature than other commodity markets, such as oil, corn or aluminum. Only some exchange-traded products are available for a spot or forward exposure; credit-generating projects have limited access to financing, and markets are less liquid and lack transparency.

The outlook for voluntary carbon credits demand is strong. First, only 34% of the largest enterprises are currently covered by net zero commitments.[i] The number is even lower for smaller companies. Second, even among companies that have made pledges, only a few have clear plans that result in outright demand.

The market for carbon credits will need to grow at CAGR of 19% for the next 27 years to reach the 10 $GtCO_2e$ or so required to be removed by 2050, if we are to stay within reach of the objectives stated in the Paris Agreement.

The supply of carbon credits has consistently outpaced demand in VCM over the past decade. Available market forecasts suggest that this trend will largely remain until 2030. However, the picture is not as clear as Figure 6 would suggest.

There is a lag of approximately two years between when project developers apply for credits to be verified, and verification being granted. That's because verifiers are struggling to cope with the number of projects coming online. There are also challenges with keeping the pace on validating new credit-generating methodologies.

Figure 7 shows how the VCM is consistently in contango – a situation where delivery of a commodity tomorrow is more expensive than delivery today. While this would be the typical situation in a commodity market, the cost of carry of carbon credits is almost negligible as there is no physical "storage" required. While financial cost of carry is still at play, the fact that the curve is steeper at later years (when rates are expected to drop) begs the question of whether the market expects a shortage of credits corporates would want to buy in the future. This view is further supported by the fact that the contango is stronger (the forward curve is steeper) for products of higher quality (more on what those are later), indicating that greater scarcity is expected on this side of the market.

Figure 6

Historic and short-term forecast of credit issuances and retirements in the VCM leading to an increase in near-term inventory

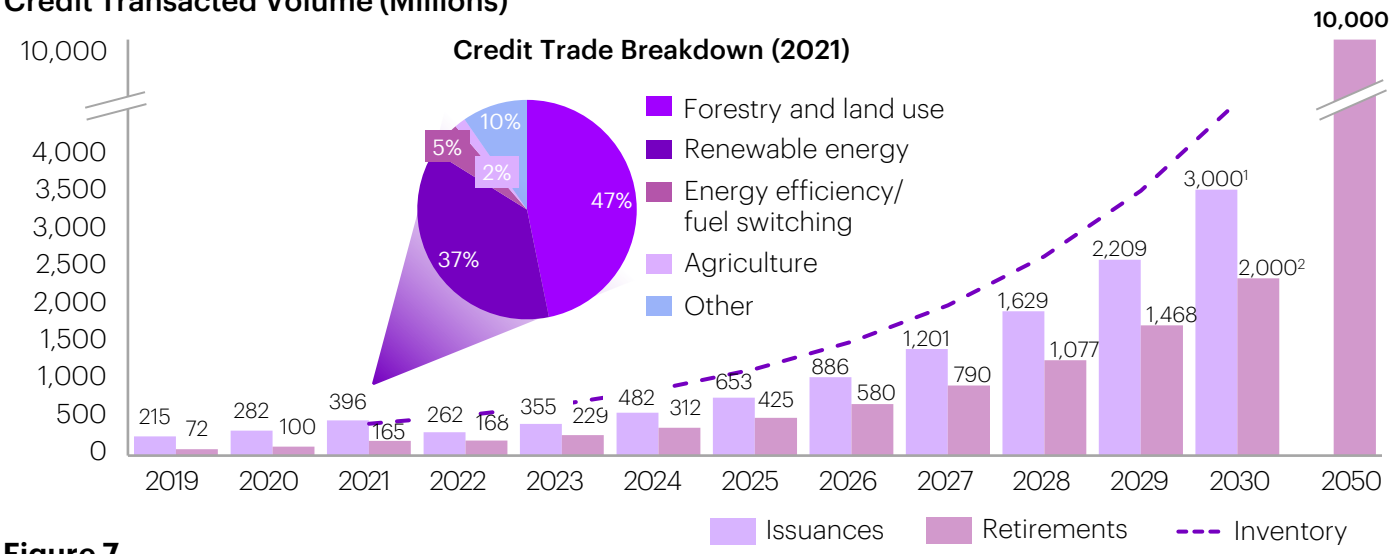
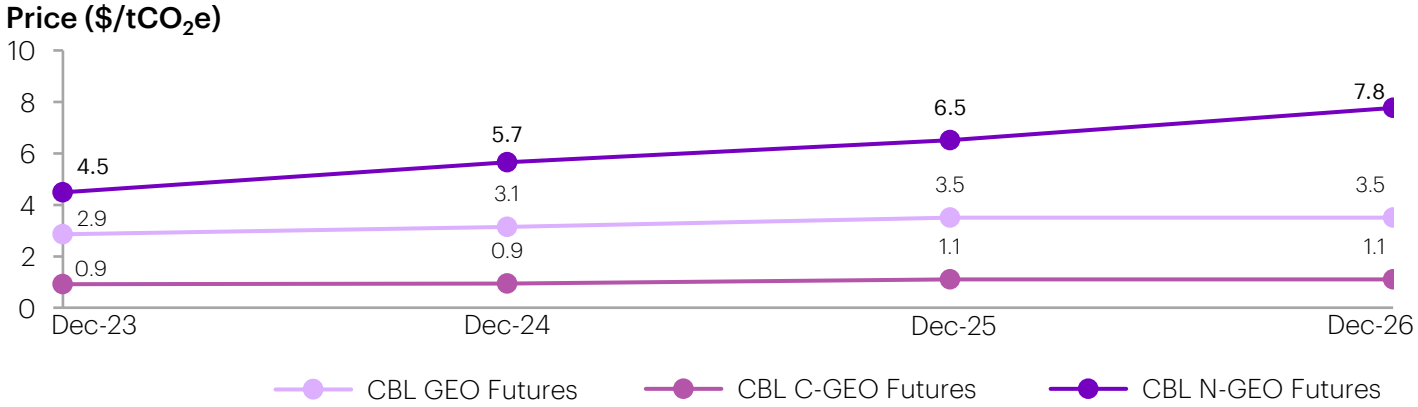


Figure 7

Future Prices in Voluntary Carbon Markets[3]



Sources:
ATIOS Analysis, Ecosystem Marketplace, TSVCM, Trove Research, CME Group, Bar chart

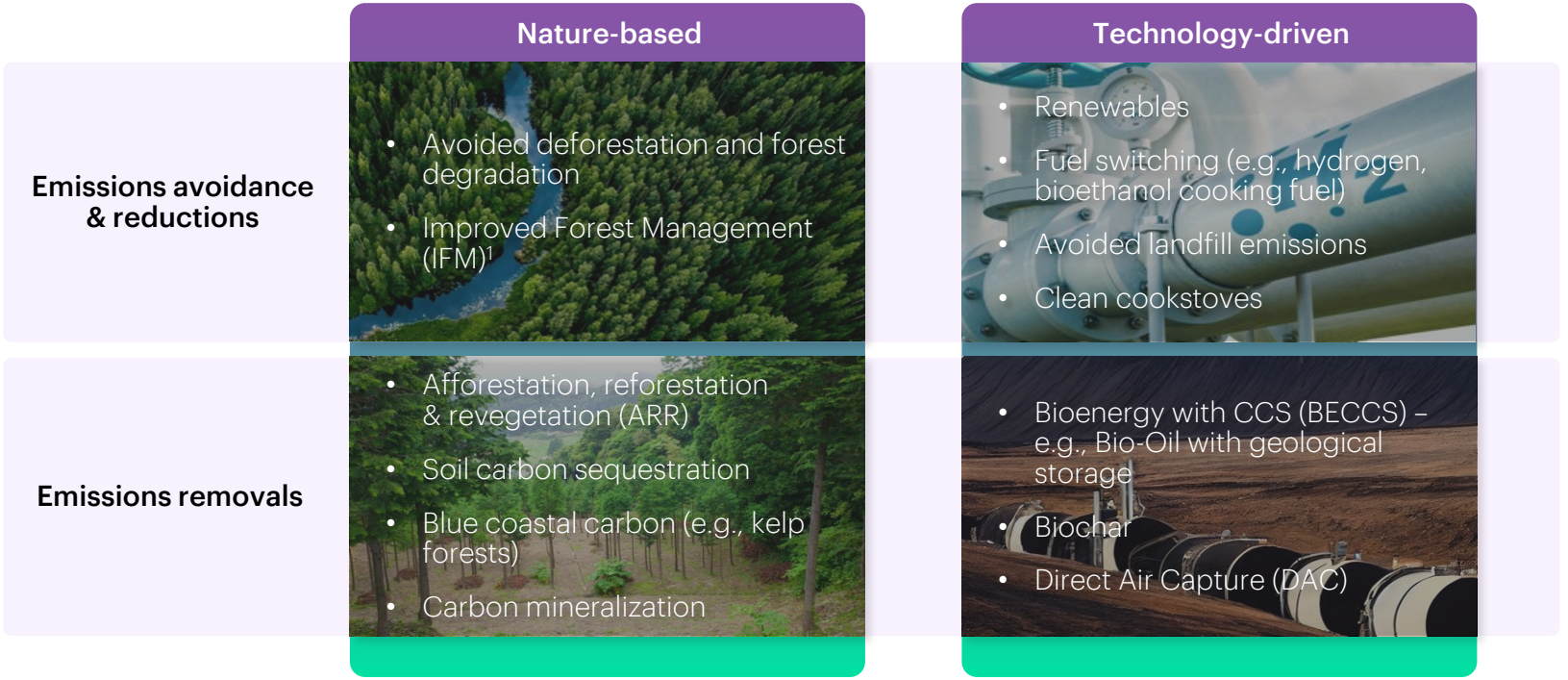
Notes:
(1) Supply is consistent with TSVCM median "practical" potential of carbon credit issuances in 2030.
(2) Demand is consistent with NGFS voluntary demand 2030 scenario.
(3) Prices shown are settlement prices from time of analysis (May 2023).

Credit-issuing projects differ depending on the type of project. Projects can remove, reduce or avoid CO_2 e and the confidence level and durability around those claims can vary. The way they are verified can also differ, as well as the time that has passed since the issuance of the credit and the transparency behind the claims. Figure 8 provides a simple classification of credit-generating projects. Finally, projects may provide environmental and other benefits beyond carbon (sometimes called co-benefits) such as biodiversity conservation, watershed protection or support for indigenous communities.

These credit attributes typically distinguish high-quality projects from low-quality ones. When comparing among credits, market participants need to be mindful of the multiple features of the projects and credits and how these align with their net zero and other sustainability objectives.

Figure 8

Credits differ based on the approach they follow and the outcome they target



Note:
(1) Improved Forest Management projects occasionally drive emissions removals outcomes as well

Not all credits are created equal

Renewable energy credits linked to the deployment of renewable projects that are often already cheaper to deploy than fossil alternatives are considered lower quality. The argument goes that, as renewables are already beating alternatives on levelized cost of energy (LCOE), investments in switching to renewables would take place anyway. As these credits do not drive any additional climate benefit compared to business as usual, there is a growing body of criticism of companies employing them against net-zero targets.

Nature-based avoided emissions credits issued to date have represented more than 90% of the nature-based solution credits in the market.[ii] These are credits mainly arising from projects that aim to reduce emissions from deforestation and forest degradation (REDD+) in parallel with delivering other environmental benefits (e.g., biodiversity, watershed protection, community economic growth). Creating a credible baseline for such projects and measuring their outcomes has been a challenge in the market, with the outcomes of several projects being questioned. Also, given that removals are required to achieve net zero, there is an ongoing debate over whether only credits that facilitate emissions removal should be allowed to be used against neutrality claims. If this debate prospers, avoided emissions credits would move down in the pecking order, and their merit in a carbon credit portfolio could be severely compromised.

Removed emissions credits are primarily financing afforestation and reforestation activities. Forests can be net carbon sinks for 30-40 years on average but take up a lot of land and are exposed to risks such as natural disasters (e.g., floods or fires) or regulatory changes (e.g., deforestation permits) during that period. Project outcomes are easier to verify, as one can count the trees or measure the biomass. Furthermore, while that timespan gets us to 2050, additional investment is required as the forest ages. As a result, we already observe strong traction towards permanent carbon capture and storage through technology (e.g., DAC) or hybrid approaches (e.g., accelerating carbon mineralisation) which are more scalable and capture carbon for hundreds or thousands of years. In 2022, purchases and pre-purchases of these types of projects increased from less than 100,000 tCO_2e in 2021 to almost 600,000 tCO_2e.[iii]

Carbon credit vintage is the year that the climate outcome was achieved (e.g., emissions were removed) and is an important indicator of perceived quality. Early vintage credits, typically pre-2016, command significantly lower premiums and are perceived as low quality due to the advancement of verification methodologies, introducing a risk that the credit may not be achieving the intended environmental benefits under current quality criteria. Currently, the average years from vintage to retirement across registries is six years. This is longer than the 1-3 years that is perceived of acceptable quality, and the market assigns a heavy discount. For example, last year's credits for the 2021 vintage at the Katingan project in Indonesia were selling at 3x the price of the pre-2016 vintage and 1.3x the price of the 2018 vintage. Katingan is one of the largest Removal Emissions from Deforestation and Degradation (REDD+) projects ever.

Other factors affect corporates' ability to make decisions to manage their exposure to VCMs. For example, limited transparency and reputational risk related to the lack of regulated standards on measurement, reporting and verification (MRV) mechanisms for offsets is a recurrent source of concern. Additionally, for projects relying only upon carbon credit revenue to be financially viable, and with prices still very volatile, some corporates are finding it hard to underwrite that risk.

Also, the risk of double counting, where the same credit may be claimed more than one time by different parties, especially those traded internationally, is another oft-cited structural challenge. While Article 6 of the Paris Agreement is working towards developing solutions to some of these issues, these may still take several years to materialize in the markets.

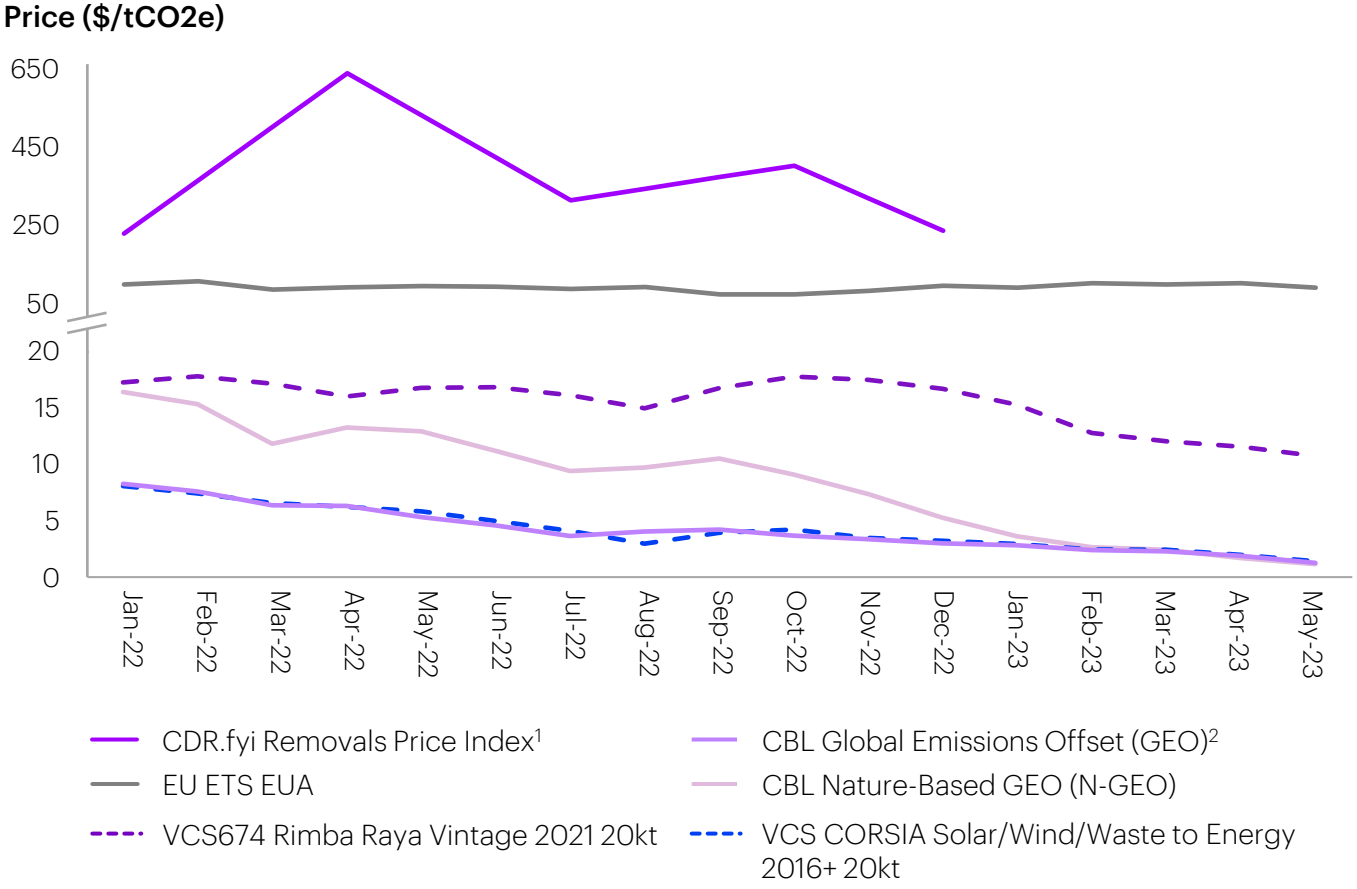
The consequence is that carbon credits from different types of projects command different valuations, as illustrated in Figure 9. In other words, credit quality is real, and the market accounts for the risks and value associated to different project and credit attributes when determining prices.

For example, credits derived from technology-based removal projects, such as direct air capture (DAC), are 20 times more expensive than nature-based removals, such as reforestation. While the higher price of DAC is related to the project delivery cost, it is also reflecting the higher quality of these credits relative to some of its nature-based counterparts.

As the VCM ecosystem matures, we expect corporates to incorporate more quality attributes into their evaluation frameworks, such as permanence, performance transparency, uniqueness, societal and biodiversity co-benefits to name a few.

Figure 9

Prices vary significantly based on credit type and perceived quality



Sources
Chicago Mercantile Exchange (CME), Intercontinental Exchange (ICE), Quantum Commodity Intelligence, CDR.fyi
Notes:
(1) The CDR.fyi removals price index represents a weighted average of price per ton sold from publicly announced transactions, using a pricing model where only credit volume is disclosed.
(2) GEO Products differ based on the underlying projects, they include: C-GEO: Verra tech-based projects (non-AFOLU, excluding most large hydro); N-GEO: Verra nature-based projects (AFOLU, including REDD+).

Currently, it's easier to compare projects and assign a fair quality premium by engaging a third-party rating agency to assess the quality of the credits. Even in cases where exchange-traded products are available, such as REDD+, we see price differences despite projects being in the same country and investments taking place during the same period. For example, in late 2022, a set of Brazilian REDD+ projects referring to the same vintage had prices differing by 100%. It is expected that as data becomes more widely available, reporting standards improve, and more products are available, it will become easier to discern across credit qualities. This will increase the level of scrutiny on companies' net-zero commitments. Companies that do not meet their commitments or do so with low-quality credits will be exposed to reputational risk. As a result, building a portfolio of high-quality credits will be increasingly important.

Investors, policy makers, customers and other stakeholders are expected to hold carbon projects and credits to ever-higher standards as pressure to act on climate change intensifies. As a result, carbon credits derived from projects that met certain quality standards at the time the investment happened may be downgraded over time. This will reduce the potential return of the project for the investor and could compromise net-zero claims for buyers. This has already been observed in the market. Bloomberg Green analysed 215,000 carbon credit transactions in public datasets over the past decade,[iv] highlighting that many global companies have claimed neutrality based on renewable energy credits from projects that would have happened anyway, particularly in Greater China and India. With this trend observed across credit types, we see credit certifiers under pressure to keep updating and tightening their methodologies (e.g., Verra bringing forward their planned REDD+ methodology update). The Core Carbon Principles (CCPs) recently launched by the ICVCM constitute an effort to standardize these efforts globally with a benchmark of what defines a high-quality credit. The messaging is being reinforced through similar initiatives like the TSVCM, VCMI and from the IETA. Moreover, with emissions regulations being driven at a country level and pressure to deliver on Paris Agreement commitments, we expect "localization" of offsets to intensify. Companies should consider offsetting activities with credits sources collocated in the same country as the company's emissions activity.

Navigating the landscape of carbon credits is complex, putting a lot of pressure on buyers. Purchasing low quality credits does not only impact the economics of the transaction, but might put the company's neutrality claims and overall reputation at risk.

As market frameworks and guidance are being more clearly articulated, reporting integrity is expected to improve across crediting methodologies, and quality amongst credits will become easier to discern.

VCMs bring new risks and challenges that participants need to learn how to manage. Some credit-generating projects may be based on unproven technologies and may underperform relative to plans; crediting and MRV standards are likely to change; and regulators may limit the usability of certain project sources or types.

Companies will need to learn how to measure and value quality and risk of carbon projects and credits, to develop a balanced portfolio of high-quality credits without overpaying.

In commodity markets, products are highly fungible. Globally accepted benchmarks are readily available, and specifications and grades act as guide rails for quality attributes. The carbon markets have yet to reach this stage; there are more than 170 types of credit-generating projects to choose from. Many projects promise solutions that lack a standard verification methodology, and there aren't many standardized, tradable products. Additionally, there are no exchange-traded products for high-quality removals, so credits of the highest quality are available only over-the-counter (OTC) . This represents a challenge for buyers, who must assess this complex landscape of different types of projects and define a premium for quality, and for developers, as projects typically require the support of carbon credits to become financially viable (this is often referred to as passing an “additionality” test).

VCMs need to evolve through four steps to develop sufficient price benchmarks and standardized methodologies where companies can safely attach a premium for quality.[v,vi]

1 **Establish new methodologies to verify emissions avoided or removed from novel approaches**.

As new promising types of projects emerge, verifiers need to accelerate the development of credit verification guidance for those projects. There is still considerable uncertainty, and regulators are working towards providing guidance through initiatives such as the EU Carbon Removal Certification Framework (CRCF). Including such approaches under Article 6, which at the time of this writing is being deliberated, is an integral step towards entrenching their place in the carbon markets. This will allow project developers to understand the proof points required and process they need to follow, reference contracts to be established, and provide more clarity on project financials. In parallel, existing methodologies would benefit from further standardisation and alignment, clearly articulating the signals of high quality.

2 **Accelerate project verification and subsequent verified credit issuance.**

This would help clear the current 2-year backlog and allow credits to be sold at a price that reflects their quality attributes. This distinction between high and low when certifying credits is key for establishing the trust layer underpinning any market of significant scale. It will also help developers to start realizing cash flows from mature projects (such as reforestation), paying down debt and investing in new supply. With more novel approaches, where a few or no projects have been verified yet (but methodologies exist), verification would allow buyers to access them, and developers to capitalize on the increased trust and free up some of the committed capital. The issuance of credits enables them to be sold OTC at prices more closely reflecting their quality.

3 **Structure and launch spot exchange-traded products.**

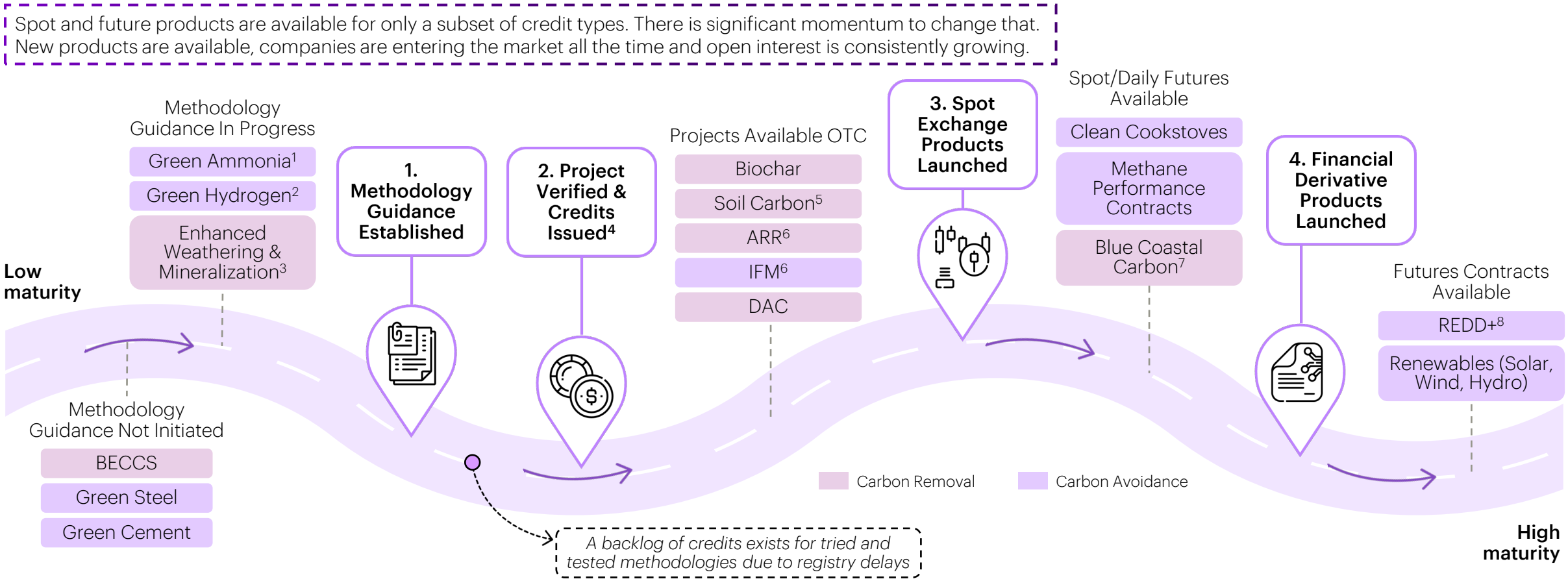
Standardized instruments traded on an exchange will simplify carbon credit procurement for participants. This will allow the market to scale, broadening market access and enhancing price discovery. Furthermore, it will allow developers and buyers to index individual projects to the closest standardized reference price and adjust premiums accordingly to reflect the project's quality attributes.

4 **Develop financial derivatives, allowing companies to get future price exposure.**

More futures and options need to be introduced to the market so that buyers can manage their price risk more effectively and cover their future volume needs, and developers can index their future output, de-risking their cash-flows and making more projects bankable.

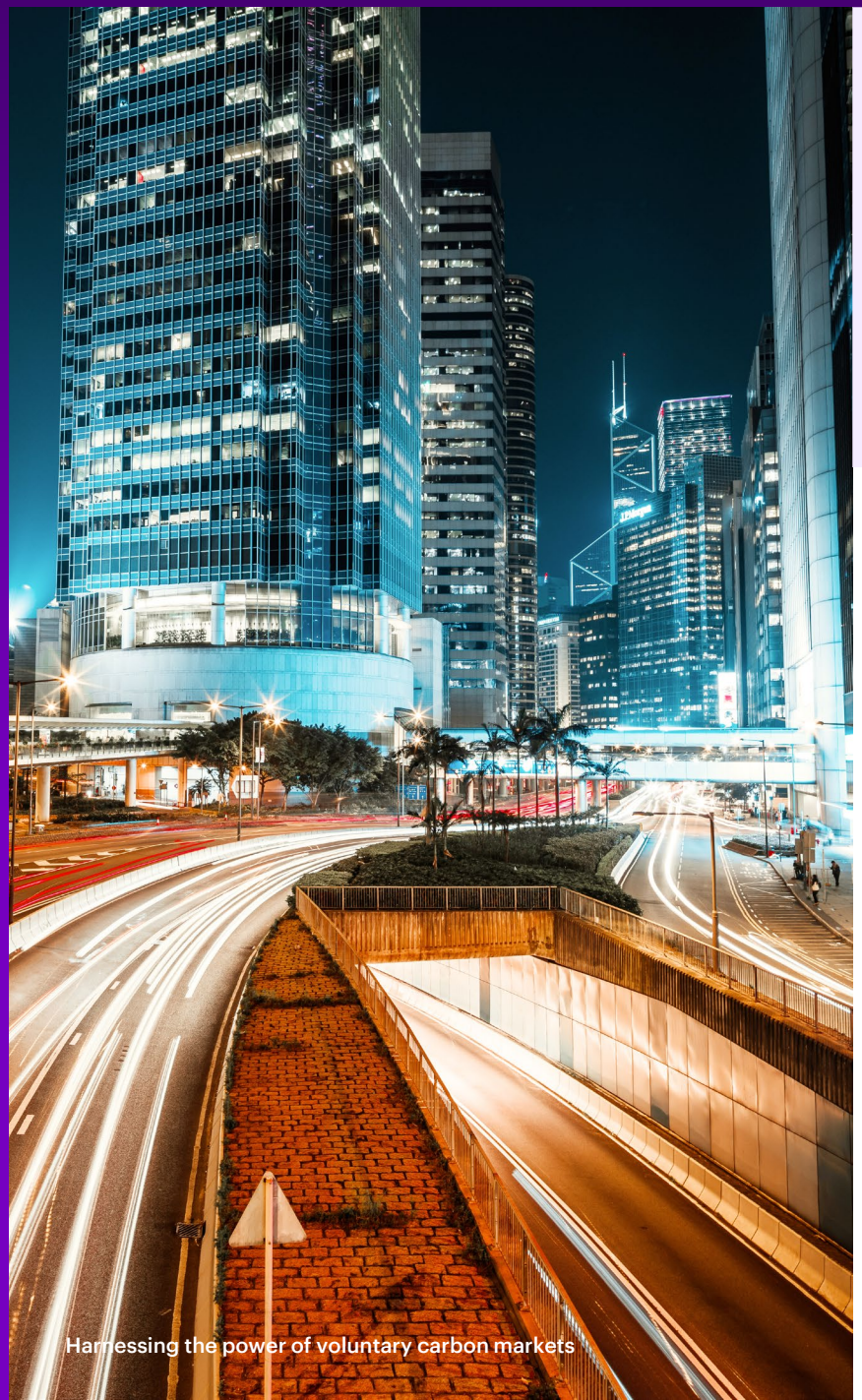
Figure 10

Examples of products available at the 4 stages of maturity of a fully developed commodity market



Sources: Accenture ATIOS, Verra Carbon Standard (VCS), Gold Standard (GS), CBL, Air Carbon Exchange, Quantum Commodity Intelligence

Notes:
(1) In Q4 2021, the H2NZ collaboration with VCS & GS announced plans to develop a green NH3 methodology by Q1 2023.
(2) In Q4 2021, as part of their H2NZ collaboration, VCS & GS announced plans to develop carbon methodologies for the H2 industry – set to launch after Q1 2023.
(3) In Q4 2022, VCS announced plans to support the development of Enhanced Weathering & Mineralization initiatives, incl. methodologies.
(4) Puro Earth currently certifies and trades the following carbon removal approaches: biochar, carbonated building materials, enhanced rock weathering, carbon capture with geological storage, and woody biomass.
(5) As of Q1 2022, VCS's methodology was marked as 'inactive' whilst it is revised – during a set grace period, the previous methodology can still be used to quantify project benefits.
(6) ARR & IFM are not available as a pure exchange traded instrument, it is included within VCS AFOLU projects, which can be used for N-GEO derivatives.
(7) First blue carbon issuances became available on CBL in 2022, achieving record high prices above $30 per tCO_2e.
(8) Agriculture, Forestry and Other Land Use (AFOLU) projects are eligible for N-GEO derivatives, however, in 2022 Sylvera announced 75% of issuances were from avoidance REDD+ projects.



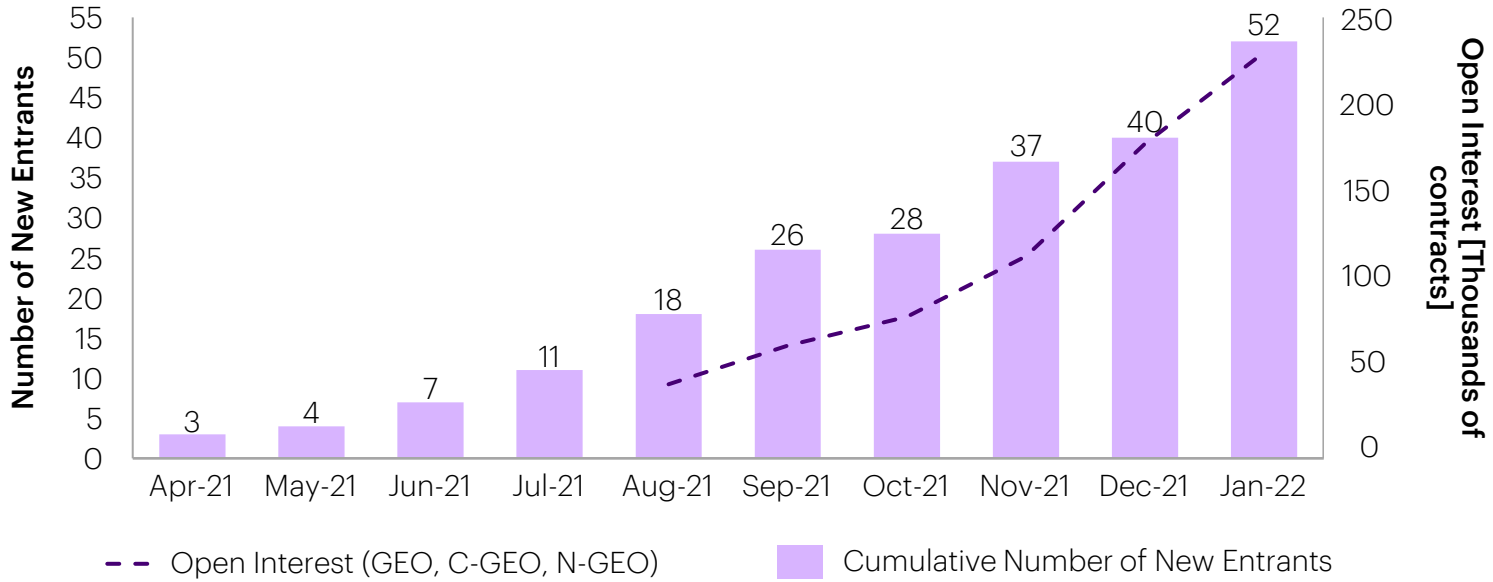
Liquidity is increasing but is still limited; measuring the total number of outstanding derivative contracts, established commodities markets such as oil are more than two orders of magnitude more liquid.

As the VCM develops, new and innovative approaches are also appearing. For example, decentralized blockchains may become critical to deal with risks such as double counting.

We are also seeing a shift toward less common approaches in other commodity markets, such as exchanges venturing upstream and aiming to capture funds typically claimed by brokers. As a result, they are starting to facilitate auctions in their platforms, enabling project developers to sell to the highest bidder in one-off events. Xpansiv's CBL Markets, Climate Impact X (CIX), AirCarbon Exchange (ACX), Bursa Malaysia and Intercontinental Exchange (ICE) have all announced such initiatives in recent months.

Figure 11

There is growing interest from companies to promote liquidity in the VCM and trade standardized offset contracts through traditional exchanges



Source: CME Group

Moving forward

Companies are under pressure to define and execute their net zero strategies. This includes defining the role of carbon offset markets and credits, and then to begin building their capabilities and portfolio of VCM instruments. Given the current challenges of the VCM, it will still take some time to solve, but there are several actions that companies can take to start their journey and future-proof their strategies.

Invest directly in credit-generating projects

Companies are increasingly going public with investments in carbon credit-generating projects. This approach requires upfront capital expenditure but can yield benefits down the line: Historically, more than 30% of the credit price has been claimed by investor intermediary fees.

The typical cash flow profile of carbon removal projects, both nature and technology-based, resembles that of traditional commodity infrastructure. And the potential to generate credits through their own operations, allows businesses to experiment with new technologies at an earlier stage. For example, adopting green hydrogen in steelmaking or producing CO_2-reinforced concrete. By monetizing the emissions avoided through these processes, businesses can reduce their environmental impact and generate additional revenue streams.

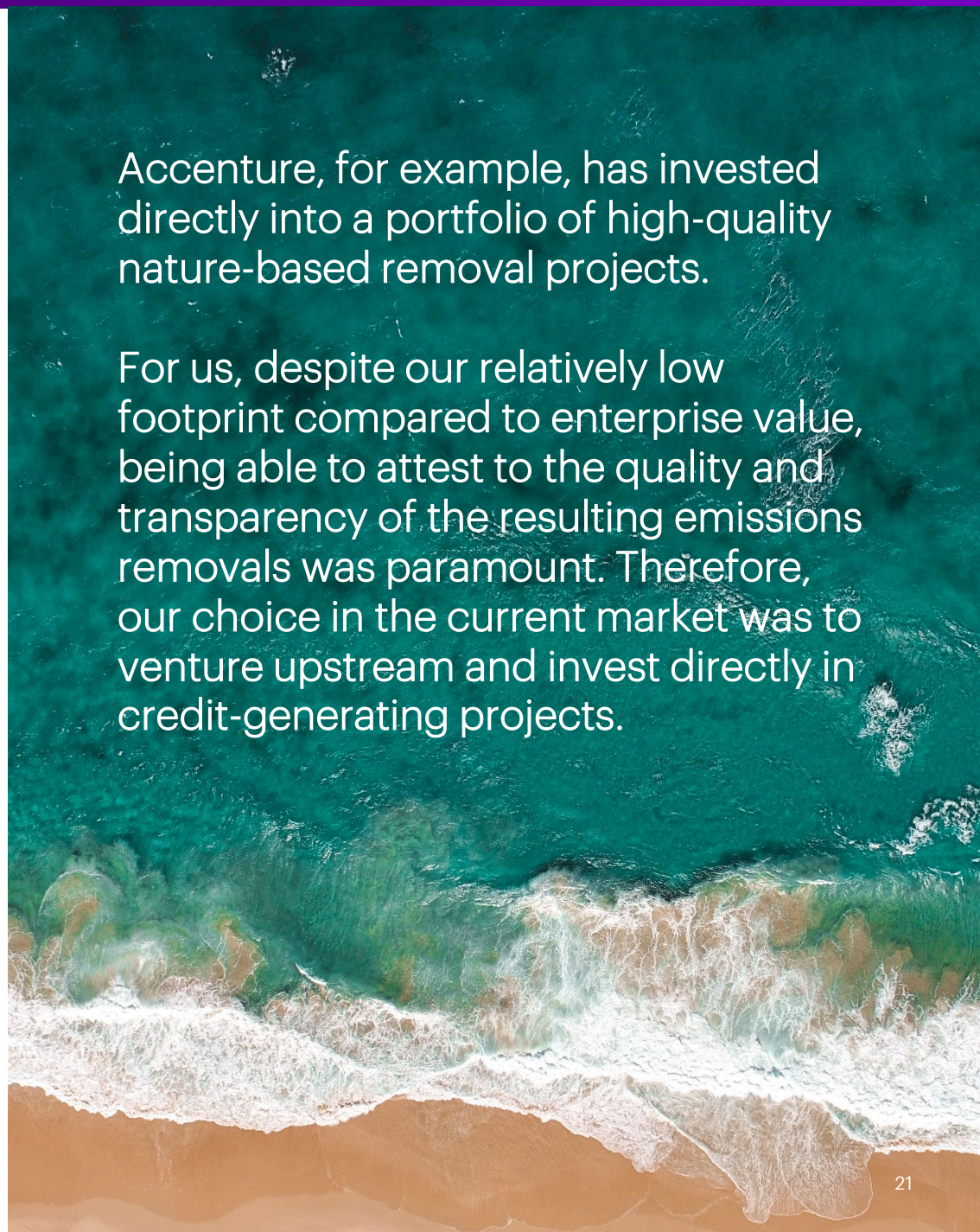


Figure 12

Big corporations are investing in the millions to accelerate carbon credit project development as part of their decarbonization strategies

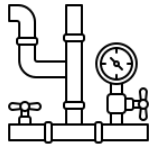
Large technology company

$1 Billion

Fund creation to accelerate the global development of carbon reduction, capture and removal technologies, partnering with carbon project developers to evolve the market framework

1.4 Million

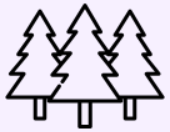
Metric tons of carbon removal credits were contracted in FY22



Large oil & gas company

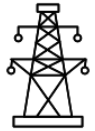
$40 Million

Investment into a Brazilian forestry preservation-focused carbon credit developer; adding to portfolio of 35 nature-based solution projects



120 Million

Metric tons of nature-based solution carbon credits targeted to be annually retired by 2030



Large energy company

$8 Billion

Pledged investment in carbon reduction projects by 2028; notably including Boomitra, Blue Planet and Carbon Engineering in 2021

13 Million

Metric tons of carbon offsets retired in 2021, through both credit purchases and in-house development

Big metals & mining company

$5 Million

Commitment as part of a consortium to develop “Biomas,” a Brazilian-based venture to restore, conserve and preserve local rainforests

900 Million

Metric tons of carbon will be removed from atmosphere over 20 years from the 4 million hectares goal

Secure a financial position in the long term

An alternative option to obtain exposure to carbon markets without investing directly in credit-generating projects or indirectly through offtake agreements is to develop a financial position by buying futures contracts.

However, securing futures on VCM credits currently presents a challenge. Products offered on CME now provide exposure 24 months down the line, but the liquidity on those is low. An alternative can be building a position on the ETS markets. Major ETS, such as the EU ETS, are up to two orders of magnitude more liquid than VCM exchange traded products, when measured by open interest. Prices on major ETS markets are expected to be increasingly correlated with the VCM, as is already the case in jurisdictions where offsets can be used against regulated emissions. In parallel, Article 6.2 is expected to only make that correlation stronger, as countries might select not allowing the export of credits internationally, to be able to use them against Nationally Determined Contributions (NDCs).This would create a direct link between mandatory schemes, decarbonization actions and the VCM. Building a financial position would allow corporates to manage carbon price risk, while they are building the capabilities to secure the physical exposure in the VCM that will be required to meet their decarbonization targets.

Growth of the VCM will likely increase liquidity and awareness of other green instruments, which are non-CO_2e denominated credits, such as US Renewable Identification Numbers (RINs) and EU Guarantees of Origin (GoOs), and even California Low Carbon Fuel Standard credits, all of which have been part of the environmental markets for some years now. As a result, we expect such instruments to continue to show a correlated profile with carbon credits. This provides businesses with the desired price exposure, plus additional opportunities to profit from their carbon reduction efforts and a diversified portfolio of green products.

Optimizing the path to net zero

Every company in every industry will be exposed to carbon markets in the future. To deal with this exposure, companies need to develop five core capabilities to successfully navigate the carbon markets in a net-zero strategy context.

Companies across industries will have different requirements to deal with carbon markets and must develop different maturity levels across these five capability areas over time.

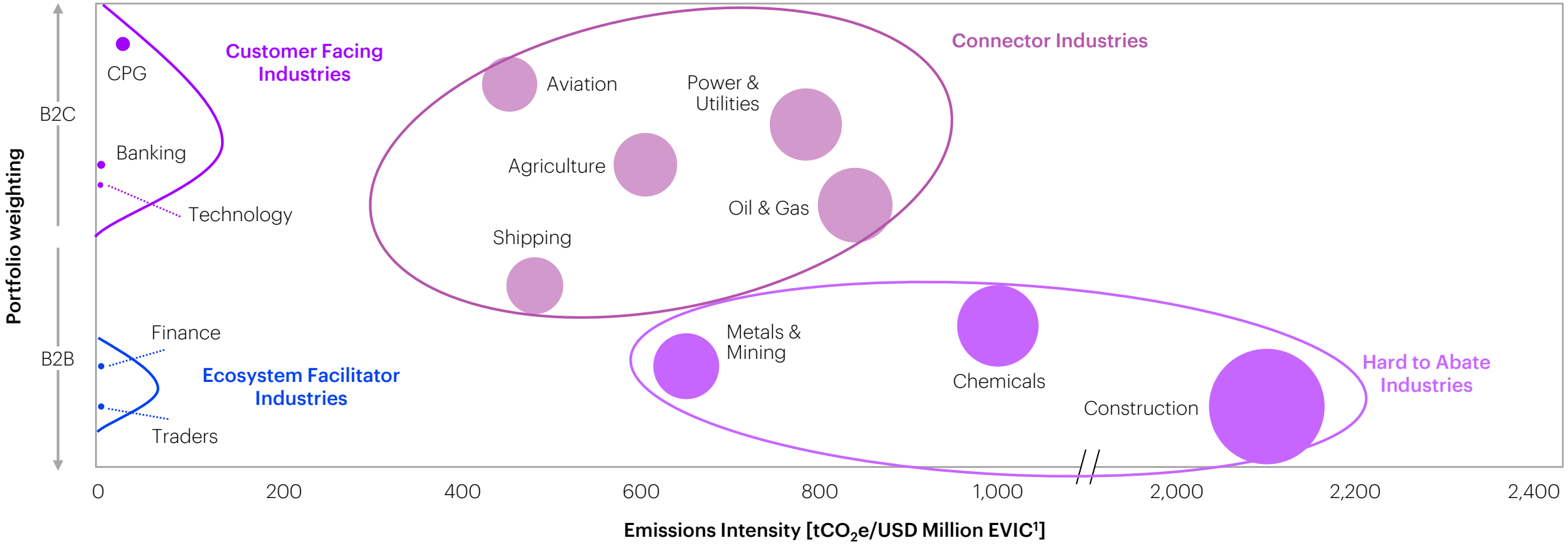
Figure 13

Five core capabilities required to manage exposure to carbon markets

1	**Sourcing & procurement**	Secure high quality credits at a fair price through a diversified set of channels; building and managing relationships across the value chain
2	**Trading & commercial optimization**	Maximize the value from credits and integrate to commercial value proposition
3	**Risk management**	Manage the exposure to market, credit, reputational and natural hazard risk, and creating or leveraging products that warehouse or transfer that risk (e.g., insurance programs)
4	**Portfolio management**	Integrate carbon into the commodity portfolio and manage holistically, while maintaining a well diversified portfolio of high-quality carbon credits
5	**Measurement, reporting & compliance**	Make credible claims and report accurately to enhance transparency in the VCM, through integrity, accuracy and timeliness in a highly automated manner

Figure 14

Mapping of industries against their operations' carbon intensity and proximity to end consumers. Four distinctive groups appear.



Sources: MSCI, The Economist, UBS Global Research, Zang, D. Research on the Relationship between Agricultural Carbon Emission Intensity, Agricultural Economic Development and Agricultural Trade in China
Note: (1) EVIC – Enterprise Value Including Cash

Hard to abate industries

The "hard to abate" industries are responsible for nearly one-third of global CO_2 emissions. Carbon is an unavoidable part of their value chain and the technological solutions available to reduce it carry a prohibitively high abatement cost. The cement, metals and chemicals industries fall into this category and are under significant regulatory pressure to decarbonize their operations. They can directly reduce carbon emissions through process efficiency improvements, electrification and developing lower carbon-intensity products. They can also look at ways to use lower carbon feedstocks as energy and inputs to process their products. However, these industries will likely remain net carbon emitters even after implementing available and future carbon-abating technologies.

Connector industries

The "connector" industries include power and utilities, agriculture, oil and gas, shipping, and aviation. Although they also have carbon-intensive operations, with some also harboring high downstream indirect emissions. The main characteristic of these companies is that they sit in the middle of the value chain and can become part of the solution to both sides. They can develop low-carbon solutions, such as low-carbon energy (e.g., renewables, clean hydrogen) or lower footprint food solutions (e.g., sustainable crops from non-deforestation areas). These industries are also in contact with the end consumer, through retail brands, fuel and convenience retail networks, home electricity, commercial aviation and shipping. From a regulation standpoint, power is included under most ETS and aviation under CORSIA, while the others are sometimes in scope regarding their direct emissions.

Customer facing industries

The "customer-facing" industries have lower direct carbon emissions but higher upstream supply chain emissions and a large number of customer touchpoints. This makes them very "exposed" to customer sentiment and can significantly affect customer perception and demand for net-zero products. These industries are not yet under the radar of regulation for decarbonization. Instead, their urgency to become net-zero has come from their corporate pledges to do so, partly by the pressure of end consumers seeking greener products and services.

Ecosystem facilitator industries

The "ecosystem facilitator" industries, such as financial institutions and asset light traders include companies that don't necessarily have carbon intensive operations. However, they can play a key role in providing liquidity to the carbon markets by buying, holding and selling carbon credits. They also provide risk management solutions that can help other industries navigate their carbon exposure. These companies, in some instances, may also own assets (e.g., a commodity trader may be an investor in a mining or oil asset and an oil and gas company may have a trading arm). They are also exposed to the end consumer (e.g., a financial services company may also have a retail banking business). These industries will look to develop risk management solutions and a business model from which to extract value by helping their clients manage their carbon exposure.

Each industry cluster presents different challenges and opportunities related to carbon markets. This results in specific recommendations across the five key capability areas identified.

1 Sourcing & procurement

Secure high quality credits at a fair price, through a diversified set of channels

Hard to abate industries

- Develop plan to buy / build exposure to carbon credits and leverage the scale of emissions footprint to negotiate favorable terms for procuring the large volume of credits required
- Partner with ecosystem facilitators acting as brokers or providing financing for purchases
- Develop a Suppliers Management Framework tailored to ensuring security of supply, diversification and quality of carbon credits

Connector industries

- Seek to develop a portfolio of direct investments, leveraging relationships with hard to abate companies for project financing and skills in managing capital projects
- Negotiate mutually beneficial offtake agreements, leveraging capability to handle physical CO_2 streams (storage, transportation)
- Define and introduce optionality to carbon offtake agreements (e.g., tiered pricing based on volumes lifted, take-or-pay)

Consumer facing industries

- Take advantage of access to consumer and invite participation in VCM purchases through loyalty programs and incentives, making them a stakeholder to the company's pledges
- Leverage access to the end-customer whose preferences are shifting to greener products, to apply pressure upstream for decarbonization, promoting green suppliers & the generation of carbon credits upstream
- Partner with ecosystem facilitators to secure access to high-quality carbon credits, outsourcing project assessment and pricing

Ecosystem facilitators

- Build a portfolio of credit sourcing avenues and a pipeline of projects across solutions and geographies to help clients get access to projects
- Develop leading capabilities on evaluating and pricing credits based on their quality attributes and risk exposure (reputational and regulatory)
- Leverage access to capital and project financing capabilities to participate in the largest carbon projects, and subsequently benefiting from economies of scale

2 Trading & commercial

Maximize the value from credits and integrate to commercial value proposition

Hard to abate industries

- Create bundled products, pairing an emissions intensive product with a carbon credit
- Syndicate with downstream partners to finance credit-generating decarbonization activities (e.g., e-fuels for chemicals)
- Establish VCM market access to manage exposure through derivatives, as higher quality products become exchange traded (securing liquidity for part of their large position)

Connector industries

- Create a suite of bundled products, offering carbon offsetting solutions to both hard to abate and direct to consumer clients
- Leverage physical carbon management capabilities to deliver captured carbon where required (e.g., e-methanol)
- Capitalize on upstream and downstream supply chain relationships to market the credits generated

Consumer facing industries

- Partner with connector industries to develop green products and leverage their brand power to market, providing incentives for customers to buy
- Market solutions offering to end-consumers the opportunity to co-invest in credit generating projects
- Provide data on shifting customer preferences (towards greener products) to strengthen the case for carbon reduction investments plans

Ecosystem facilitators

- Launch offerings such as underwriting the emission footprints of players across industries and managing them for a fee or a value-based mechanism
- Take advantage of the global nature of the VCM, and market inefficiencies, such as pricing quality premia, to arbitrage across products
- Develop structured finance products to enable large scale institutional financing to access the carbon markets
- Introduce and market carbon project insurance products

3 Risk management

Manage the exposure to market, credit, reputational and natural hazard risk

Hard to abate industries

- Enhance capability to deal with new, long-term risks related to managing carbon credits, such as nature events and reputational risks
- Extend commodity price risk management capabilities to cover carbon or outsource carbon risk management for a fee
- Proactively manage retirement schedules, avoiding situations of accumulating early vintage unretired credits

Connector industries

- Enhance management capabilities for reputational risk, ensuring that carbon projects of high quality are selected
- Enhance CRM solutions to incorporate criteria for partners' emissions, mitigating reputational risk from association with bad actors
- Develop off-take agreements that facilitate risk-sharing of natural risks between developer and off-taker

Consumer facing industries

- Extend commodity price risk management capabilities to cover carbon or outsource carbon risk management for a fee
- Hire talent from hard to abate and connector companies to proactively manage reputational, regulatory and physical risks associated with participating in the VCM
- Enhance CRM solutions to incorporate criteria for partner emissions to mitigate the reputational risk
- Leverage carbon insurance products, transferring the risk of lower effectiveness of carbon project

Ecosystem facilitators

- Enhance market and credit risk management capabilities to be able to warehouse risk from companies across industries
- Integrate climate risks to enterprise risk management frameworks
- Manage liquidity risks through pooling supply and demand, and providing financing solutions
- Understand correlated behaviors and externalities across carbon and traditional asset portfolio (e.g., commercial loan book)

4 Portfolio management

Integrate carbon to the commodity portfolio and manage holistically

Hard to abate industries

- Develop a portfolio of long-term solutions to place the company in a long-term net zero trajectory
- Optimize decarbonization pathway, based on the carbon price trajectory and the marginal costs to decarbonize, within the carbon neutrality target timing
- Enhance decarbonization efforts to limit credits to 10% of base year emissions.

Connector industries

- Monitor impact of carbon on other business lines and drive optimization through integrated insights
- Optimize decarbonization pathway, based on the carbon price trajectory and the marginal costs to decarbonize, within the timeframe set for carbon neutrality
- Integrate emissions profiles and internal carbon pricing in portfolio capital allocation decisions

Consumer facing industries

- Strengthen brand value by developing a portfolio of very high-quality credits
- Integrate emissions profiles and internal carbon pricing in portfolio capital allocation decisions
- Tilt the portfolio of credits towards project types that have a direct impact in the daily lives of consumers (e.g., reused cooking oil), which are synergistic with products and services offered or enable the company to tell a story of impact

Ecosystem facilitators

- Develop a diversified portfolio across geographies and credit types
- Integrate emissions profiles and internal carbon pricing in portfolio capital allocation decisions
- Take advantage of arbitrage opportunities stemming from the ability to unbundle products across the portfolio (e.g., carbon offset LNG)

5 Measurement, reporting & compliance

Enhance transparency in the VCM, through integrity, accuracy and timeliness

Hard to abate industries

- Work with partners to ensure easier to decarbonize downstream activities (e.g., logistics and storage) are performed, reducing scope 3 emissions
- Automate emissions reporting and align reporting standards to facilitate transparency downstream in the value chain
- Work with credit verification agencies to develop solutions streamlining verification (e.g., APIs to submit / request data)

Connector industries

- Determine and accept ownership of scope 3 emissions early on and drive actions for emissions reduction across scopes
- Leverage their supply chain influence to ensure alignment with monitoring and reporting standards upstream and downstream
- Work with credit verification agencies to develop technology solutions streamlining verification (e.g., APIs to submit / request data)

Consumer facing industries

- Partner with hard to abate and connector companies to enhance supply chain transparency (e.g., through blockchain)
- Develop final product-level carbon accounting and reporting capabilities, and integrating them to decision-making
- Leverage carbon project reporting to educate consumers on the benefits of supporting initiatives that remove or reduce carbon, outside their value chains

Ecosystem facilitators

- Build in-house capabilities to understand and track the environmental impact of portfolio
- Develop industry-specific frameworks to provide measurement, reporting and compliance as a service
- Leverage cross-industry exposure and learnings to contribute to the setting of universal reporting standards for access to financing

Understanding the complexity

The world faces an unprecedented challenge to limit the consequences of climate change. Achieving net zero will be incredibly hard, and every tool at our disposal will be necessary. Carbon markets have an important role to play in the global net zero response, enabling the balancing of residual emissions sources with removals. They can help fund these critical carbon removal projects, foster collaboration and new business models for net zero, and support capability development and technology transfer.

There is significant complexity in the carbon markets. Sophisticated regulatory frameworks in compliance markets will continue evolving and expanding, while voluntary markets will experience substantial growth. New products will be introduced in both, and liquidity will increase to make carbon markets a major tool across all decarbonization agendas.

Yet not all carbon credits are the same. Those of poor quality may become worthless in the future, creating reputational issues for those that used them to support claims. Others will suffer the financial consequences of having built up a portfolio with the 'wrong' type of credits, for example, as rules on compliance and voluntary market interaction evolve. But others will benefit. Understanding the complexity will be critical as carbon markets grow in participation, liquidity and sophistication.

Companies need to develop five core capabilities. They need to be able to source and procure carbon credits of the highest possible quality at the lowest possible price. At the same time, they need to help drive market maturity, including by maintaining a healthy portfolio of suppliers to help ensure access to those credits.

They must develop capabilities across trading and commercial to convert carbon exposures into profit centres wherever possible. Companies also need to enhance their risk management capabilities and frameworks to cope with reputational risks and those arising from managing carbon credit generation projects.

Companies also need to develop a well-balanced portfolio of carbon credit solutions. They must decide whether to build or buy in the market to manage their exposure to carbon emissions while delivering their sustainability commitments in the best possible way.

Finally, they need a robust reporting capability to measure their emissions along their value chains, avoid double counting, and comply with standards and regulations.

Not all industries will be impacted in the same way and we see four segments emerging based on their relative exposure. Those that have emissions that are hard to abate, the connectors along the value chain, the ones with direct contact with consumers, and the ecosystem facilitators. All of them have a role to play in the future of carbon markets and will face risks, but can also seize significant value.

The opportunity to leverage and benefit from a market that is forecasted to become one of the largest markets by value in the world is clear. Will you be ready?

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