



Voluntary Carbon Markets

A SIX White Paper



Foreword

Climate change and the ensuing global warming are two of the most defining and pressing problems of this century. More greenhouse gases have been released into the atmosphere in the last 30 years than in the entire history of our planet, causing average temperatures to rise by about one degree Celsius. If this continues, 50 billion tons of Greenhouse Gas (GHG) are released into the atmosphere every year – according to the Intergovernmental Panel on Climate Change calculations – until 2030. Moreover, temperatures may increase by two degrees Celsius until 2050. How can this be stopped or at least been slowed down to levels that guarantee continuation of the life we know?

Most practitioners and academic experts agree that carbon pricing is the most important economic tool in the fight against climate change. Carbon pricing can be defined as assigning a market value to the GHG released into the atmosphere. Ever since 2005, compliance carbon credit markets (such as the European Union Emissions Trading System – EU ETS) are organized on professional Financial Market Infrastructure (FMI) providers, while markets for voluntary carbon offsets are only just emerging. This is a serious shortcoming as voluntary carbon offset markets are seen to be extremely important and crucial in fighting climate change. FMI providers have the power to play a very important role in this regard by shaping markets for voluntary carbon credit offsets.

To foster the debate how organized FMI providers can contribute to tackle the problem of climate change and global warming, SIX Swiss Exchange has partnered with the Università della Svizzera Italiana (USI) in Lugano, tasking a team of students and members of the Center for Climate Finance and Sustainability (CCFS) at USI to research the current state of carbon markets, in particular voluntary carbon markets as transparency and understanding of these markets are still in their infancy.

We hope you are intrigued by their findings presented in this white paper and we wish you a pleasant read.

Christian Reuss

Head SIX Swiss Exchange

Marco Estermann

Head Business Development Exchanges, SIX

Dr. Maneesh Wadhwa

Senior Business Development Manager Exchanges, SIX

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Executive Summary

Climate change is the biggest threat humankind is facing nowadays. More greenhouse gases (GHG) have been released into the atmosphere in the last 30 years than in the entire history of our planet, causing average temperatures to rise by about one degree Celsius thus far. If this continues, 50 billion tons of GHG are released into the atmosphere each year, according to calculations of the Intergovernmental Panel on Climate Change. Moreover, temperatures will increase by two degrees Celsius within the next 25 years. This may have catastrophic consequences that range from the rise of sea levels and the ensuing disappearance of whole cities and even islands to the increase of the occurrence of fatal climate catastrophes.

There has been an increase of initiatives to combat climate change in recent years, but these are not enough. One of the most powerful economic tools to fight climate change is carbon pricing. Carbon pricing can be defined as assigning a fair market value or price to the GHG released into the atmosphere. In compliance carbon offset markets prices are often set by governments or regulators, while in voluntary carbon offset markets they follow market forces. The fight against climate change can only be won if both compliance and voluntary carbon offset markets function efficiently and potentially should have interoperability between the compliance and voluntary markets. This implies that proper ways to guarantee transparent price discovery, liquidity, and the provision of needed funding to finance projects must be found and followed.

One of the most powerful economic tools to fight climate change is carbon pricing.

Organized trading platforms are essential for voluntary carbon credits to solve existing market frictions such as lack of standardization, funding opportunities, lack of liquidity and price transparency.

While compliance carbon markets like cap-and-trade systems seem to function well, organized marketplaces for voluntary carbon offset markets are still in their infancy and most transactions are still over-the-counter (OTC) and fragmented. These OTC markets suffer from a lack of pricing transparency, due to fragmentation and lack of standardization, as well as a lack of liquidity and funding opportunities. All these frictions lead to a lack of transparent price discovery and less project funding. Because of these frictions, not enough projects to protect the environment are being undertaken.

Hence, there is a clear need for organized trading platforms for voluntary carbon credits to solve the existing market frictions. It is a significant opportunity for Financial Market Infrastructure (FMI) providers to step in and solve this need. An FMI provider would be able to trade standard voluntary carbon credits and more complex products such as prepurchase agreements that aim at supplying financing for developers of voluntary carbon offset projects or funds that allow investors to diversify their portfolio of carbon credits. Furthermore, there is an increasing trend to tokenize voluntary carbon offsets, which gives FMI providers such as SIX a unique opportunity to create a professional and liquid marketplace for these tokens and become the global market leader in this promising new and growing area.

1 Introduction

Climate change is one of the most serious threats human-kind is facing nowadays. Global temperatures have risen by 1.18°C since 1880, the arctic ice has decreased by 13% over the past decade, and the carbon dioxide level in the atmosphere has reached new heights every year (NASA, 2021). Because of these developments, 11,000 species face extinction (IUCN, 2021). Figure 1 shows 100 stripes, representing the temperatures over the past century. The dark blue stripes represent lower temperatures, and the dark red and black bars represent higher temperatures. Beyond 2021, two paths are shown, one with the Glasgow

Conference in November 2021 (COP 26) implementations, i.e., “Net-Zero by 2050s: a 1.5°C world” and one following the current path, i.e., “Current pledges: a 3°C world”. Existing commitments are simply not enough (Hawkins, 2021). As the IPCC report projecting global temperature change highlights, even if all COP26 commitments are fully implemented, the increase will amount to 1.8°C (when compared to the pre-industrial average) by 2100 (Figure 2) in the optimistic scenario. Fortunately, there are ways to change course and fight climate change.

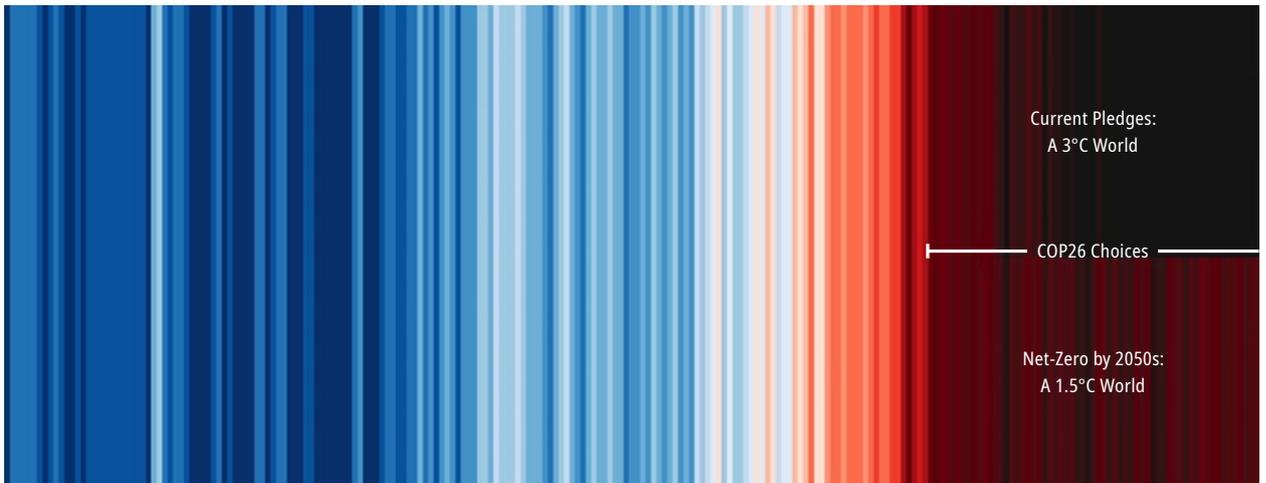


Figure 1: A Century of Temperature Measurements. Source: E. Hawkins (2021).

The causes and the solution are known. It is simple: the emission of greenhouse gases (GHG) must be reduced. One of the most powerful economic tools to achieve this goal is carbon pricing, which can broadly be defined as assigning a fair market value to a ton of GHG. One of the most decisive questions in this context is what the fair

market value of a ton of carbon is? Price finding and smart financial innovation are crucial in this context. FMI providers such as organized exchanges should be determined to take the lead in answering this and related questions to meet science-based decarbonization aligned with Paris Agreement objectives.

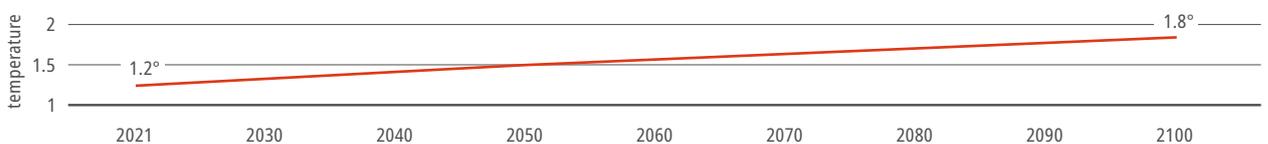


Figure 2: Projections for global temperature change if all commitments are fully implemented. Source: IPCC Report

2 Carbon Pricing and Compliance Carbon Offset Markets

One of the most straightforward mechanisms to implement carbon pricing is to impose a carbon tax on companies that emit GHG¹. This measure aims at providing an incentive for corporations to emit less CO₂. Another way to stimulate the reduction of GHG emissions are compliance carbon markets. In a compliance carbon market, companies (for instance from the utility and energy sector) and governments are required by law to account for their GHG emissions using CO₂ certificates.

If companies emit less CO₂ than the limit imposed on them, they will have access to permits that can be traded with other companies. In 2021, the global market for cap-and-trade permits had a volume of 238 billion euros, 90% of which came from the EU ETS (Refinitiv, 2021), and prices for carbon credits vary widely, depending on the jurisdiction. Conservative estimates are that the size of global compliance carbon credit markets will grow to one trillion US-Dollars in absolute numbers by 2030. The EU ETS is the largest carbon market globally. Since its inception in 2005, the market's objective has been to find a universal price for one ton of GHG in the atmosphere. It aims to achieve this objective through climate credits of European Union Allowances (EUA), where one credit or allowance represents one ton of GHG reduced in the atmosphere.

The introduction of EUA has successfully reduced emissions by 20% in the sectors for which it had been enforced (such as the energy and utility sector). It accomplished this goal by imposing a cap or limit on the CO₂ emissions of companies. If a firm's emissions exceed its limit, it must offset these emissions through compliance carbon credits (European Commission, 2021).

The development of the EU ETS can be split into four phases. Initially, there were many trials to learn about the market's demands and which mechanisms it would need to function optimally. Fifteen countries participated in the first phase which lasted from 2005 until 2007. Almost all the EUA in this phase were allocated without cost using each country's historical emissions. The penalty imposed on companies for non-compliance was 40 euros per ton.

Phase 2 spanned from 2008 to 2012, during which Norway, Iceland, and Liechtenstein joined the EU emissions trading system (EU business, 2007). The cap on GHG emissions was reduced by 6.5%, and the penalty for companies for non-compliance rose to 100 euros per ton. In addition, this stage saw the implementations of the CDM (Clean Development Mechanism) and the JI (Joint Implementations), which were set up under the Kyoto Protocol from 1997. These two new mechanisms allowed the use of different types of carbon credits, for instance, carbon credits from forestry projects. The CDM allowed for CER (Certified Emissions Reductions), whereas the Emissions Reductions Units (ERU) originated from JI. These new methods ultimately enabled the development of more carbon credit projects and more GHG reductions.

Phase 3 of the EUA system that started in 2013 and ended in 2020 was bound to bring innovation and change. During this period, 31 countries became members of the EUA system. A standard European Emissions cap aimed at levelling the international playing field. Previously, every country in the system had different regulations and emissions limits, and the cap was decreased by 1.74%. Contrary to the shift from phase 1 to phase 2, in phase 3, the allowances of phase 2 were useable. These changes resulted in stable prices in the market until 2018, when prices started to rise to 30 euros per ton. Figure 3 shows the price development of EUA from 2005 till 2021, spanning the four phases of the EU ETS.

In 2021, the global market for cap-and-trade permits has a volume of 238 billion euros, 90% of which came from the EU ETS covering 20% in the sectors for which it had been enforced.

¹ Stock and Gillingham (2018) provide a comprehensive discussion of carbon taxing.



Figure 3: Continuous ETS prices in each phase. Sources: eea, datastream.

Even though the previously mentioned measures proved to be effective, they are not sufficient. Figure 4 shows the estimated path to net-zero emissions in 2050, as per the Paris Agreement from 2016. It shows two types of emissions in the form of bars. The dark grey bars represent the best possible reductions we can achieve by compli-

ance market mechanisms and supply chain optimization. It is not possible to achieve net-zero emissions with the measure covered in the dark grey bars. Alternatively, the world needs the negative emissions that are shown in the red bars (Blaufelder, Levy, Mannion, & Pinner, 2021).

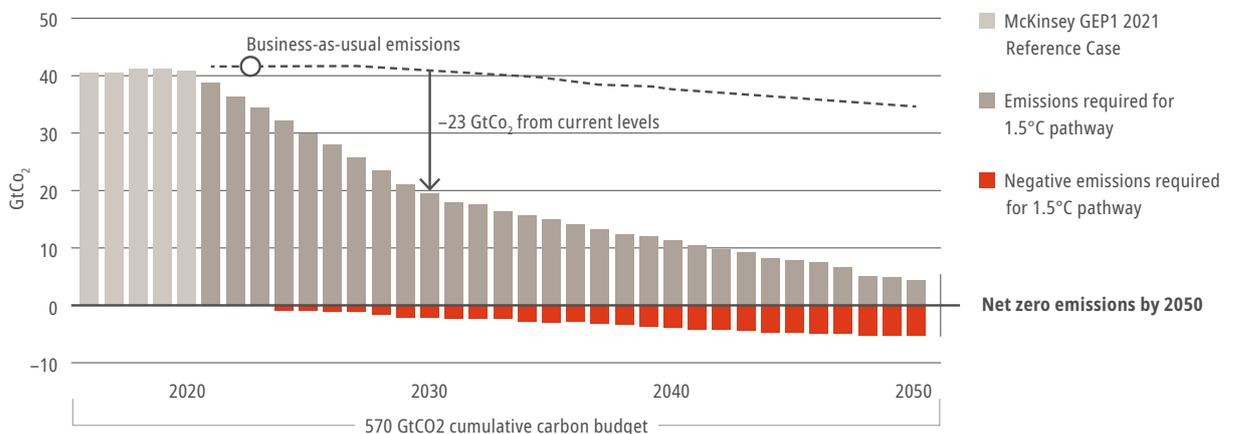


Figure 4: Global carbon-dioxide emissions, gigatons (GtCO₂) per year. Source: McKinsey Data

3 Voluntary Carbon Offset Markets

Voluntary carbon credit offset markets are essential and needed to achieve the desired net-zero goal. A voluntary carbon credit is produced when an independent organization voluntarily reduces one ton of GHG from the atmosphere. This reduction is verified by independent third parties according to recognized standards (e.g., Verra in the United States or Gold Standard in Switzerland). Corporations, financial institutions, and individuals can use the credits as voluntary compensation for their respective carbon emissions.

According to the Special Ecosystem Marketplace COP26 Bulletin, as of 9 November 2021, voluntary carbon markets had sold a volume of USD 1,006.2 million of carbon credits, each worth one ton of carbon dioxide equivalent. This reflects a 113% year-to-date increase in value (up from USD 472.9 million) and a 59% increase in credit volume over 2020 (USD 298.4 million up from USD 188.2 million credits transacted). Despite the emergence of COVID-19, 2020 was already a boom year for voluntary carbon markets, following 2019's robust growth trend. The forecast for this market for the next ten years is very optimistic. The value of the transactions during 2021 has exceeded USD 1 billion for the first time ever and estimates are that it may reach USD 50 billion by 2030 (McKinsey, 2021).

The main driver behind this expected growth in demand is increased awareness of corporate responsibility. The consumer market is trending towards more sustainable companies, and consumers are willing to pay premiums of up to 40% for sustainable products (Kronthal-Sacco and Whelan, 2021). Hence, if corporates and financial institutions want to differentiate themselves towards consumers and investors alike, they will have to aim for net-zero. In addition, early off-setters will likely be ahead of the inevitable imposition of legislation on emissions. Moreover, studies have shown that employee productivity increases when companies employ sustainable policies. In addition to corporate buyers, there has also been an increase in demand from speculators (Ecosystem Marketplace Insights Team, 2021).

The Conference of Parties that took place in Glasgow in November 2021 (COP 26) has the potential to further boost the supply of and demand for voluntary carbon offsets, at least in some areas of the voluntary carbon offset markets. Specifically, Brazil, the country with the largest share of tropical rainforest in the world, has committed to put an end to illegal deforestation by 2030. A direct effect of this commitment could be that more voluntary carbon offset projects in forestry and land use will be conducted, which could help to further develop voluntary carbon markets. A recent study (Behr et al., 2021) shows that prices in nature-based solutions, in which forest and land use projects make up the major part, reacted positively to the COP 26 announcements and decisions, while other voluntary carbon offset markets such as renewable energy, waste disposal, or wind energy seem to have been disappointed by the outcomes of COP 26.

In 2021, voluntary carbon markets exceeded USD 1 billion, a 59% increase in value over 2020.

Another important factor that will boost demand is the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA). This is a plan adopted by the International Civil Aviation Organization (ICAO) to reduce the emissions of GHG based on the voluntary scheme. CORSIA will lead to an increase in the demand for voluntary carbon offsets by the aviation sector (Ecosystem marketplace, 2021). Hence, more voluntary carbon offset projects are needed, and a professional infrastructure is essential to be developed.

The voluntary carbon markets operate independently of, but in tandem with, the compliance market. This market allows institutional and retail-investors to purchase carbon credits to offset their emissions voluntarily. The credits can be credits produced under the CDM or other voluntary market standards. The voluntary market works as a matter of own corporate social responsibility (CSR) or in reaction to market pressure and public opinion rather than due to government obligations. A major difference between the compliance and voluntary markets is that companies cannot utilize a Voluntary Emission Reduction (VER) to satisfy their responsibilities under the Kyoto Protocol's compliance framework.

Another major difference between the compliance and voluntary markets is the scope of the emissions. The compliance market covers the scope 1 and 2 emissions, whereas in the European Union the voluntary market covers only scope 3 (see figure 5). Scope 1 emissions refer to the direct emissions from company resources. It is composed of stationary combustion (e.g., fuels, heating sources), mobile combustion, GHG leakage, and process emissions. Scope 2 concerns indirect company-owned emissions such as purchased energy consumption. On the other hand, scope 3 emissions are the most comprehensive and refer to indirect emissions that the firm does not own. (GHG Protocol, 2004)

3.1 Players in Voluntary Carbon Offset Markets

The players in this market are public and private companies, governments and individuals who are interested in buying the credits resulting from the development of a voluntary carbon offset project. Project developers create the projects under one of the approved standards such as Verra or Gold Standard. The standards require that the projects are validated and regularly certified by an independent third-party organization (e.g., Sustainability Carbon Services (SGS), Technischer Überwachungsverein (TÜV), Bureau Veritas Certification (BVC) etc.). The purchase and sale of the generated carbon credits usually take place over-the-counter or through organized marketplaces which are currently emerging in different parts of the world (e.g., London and Singapore).

Project developers represent the producers of carbon credits. Once the voluntary carbon credits are generated, the project developers sell them, most often to companies that are interested in voluntarily offsetting their carbon emissions. The developers generate profits from their projects and reinvest the profits into their activities. Most project developers, some of them being non-profit organizations, also invest in local communities to provide social benefits and strive for strict environmental progress (Serrano, 2021). By reinvesting into their activities and following the idea of a circular economy, project developers aim at achieving a sustainable progress and are able to protect more of the environment.



Figure 5: Parties involved in the Compliance and Voluntary Carbon Markets

After a project has been started and claims to have reduced GHG from the atmosphere, the developer must follow the rules of an established standard. There are a number of standards in the market, for instance, Verra (United States), Gold Standard (Switzerland), American Carbon Registry (United States) and Climate Action/UN-FCCC (United Kingdom). Their objective is to set and manage the standards for voluntary carbon credits. They oversee the guidelines and principles of carbon credit production. Furthermore, the standard specifies the accounting methodology and sets specific parameters for measuring GHG reductions.

A project must have a certification from an accredited validator to become eligible for voluntary offsetting goals. The certifying entities accomplish the validation following the rules defined by the standards mentioned above. The role played by these entities is crucial for the correct functioning of the market, similar in spirit to the role played by rating agencies in bond markets. The validators act in an oligopolistic environment with a high entry barrier. It is expected that the current players will maintain their dominant position in the future (EY, 2021). The ensuing projects are then registered and tracked to assure transparent documentation.

Forest and land use credits represent 79,63% of the voluntary carbon market which underpins the importance without geographical limitation compared to ETS systems.

Finally, there are conscientious corporations and individuals that buy carbon credits to achieve their climate goals. There is currently a high demand for voluntary carbon credits, especially from the energy and finance sectors (Ecosystem marketplace, 2020). We also note a difference between the prices that buyers are willing to pay for voluntary carbon offsets in different sectors. Figure 5 also summarizes the players and processes in voluntary and compliance carbon markets.

The main advantage of the voluntary carbon market is the possibility to buy credits without geographical limitations which is a significant barrier in the compliance market. Figure 6 shows the segmentation of the voluntary carbon market. Credits originating from forestry and land use represent 79,63% of the market, followed by renewable energy with a market share of 12,94% (Ecosystem marketplace, 2020). Forestation credits experienced a 166% increase in the avoided unplanned deforestation project type and a 972% increase in the avoided planned deforestation. As pointed out above, carbon reductions from forestry are excluded from (most) the ETS system such as the EU ETS. This implies that the ETS systems could be considered successful even if the entire Amazon rainforest were completely cut down (Ecosystem marketplace, 2021). This underlines the importance of the existence and further development of voluntary carbon offset markets.

A recent study revealed that prices in the voluntary market could increase by a factor of fifty by 2050. The price of carbon credits is estimated to be between 47 USD and 120 USD per ton. This surge is dependent on sustainably growing the supply of carbon offset credits to meet future demand. If properly done, the market could reach a market value of 550 billion USD by mid-century. (Henze, 2022).

	2019				2020				2021 (Jan–August)			
	Volume (MtCO2)	Price per ton (USD)	Value (Mil. USD)	% of Total	Volume (MtCO2)	Price per ton (USD)	Value (Mil. USD)	% of Total	Volume (MtCO2)	Price per ton (USD)	Value (Mil. USD)	% of Total
Forestry and Land Use	36,7	\$4,33	\$158,9	56,34%	48,1	\$5,60	\$269,36	64,95%	115,00	\$4,73	\$543,95	79,54%
Renewable Energy	42,4	\$1,42	\$60,2	21,35%	80,3	\$0,87	\$69,86	16,85%	80,00	\$1,10	\$88,00	12,87%
Energy Efficiency / Fuel Switching	3,1	\$3,87	\$12,0	4,25%	31,4	\$1,03	\$32,34	7,80%	16,10	\$1,57	\$25,28	3,70%
Waste Disposal	7,3	\$2,45	\$17,9	6,34%	8,3	\$2,73	\$22,66	5,46%	2,70	\$3,93	\$10,61	1,55%
Transportation	0,4	\$1,70	\$0,7	0,24%	1,1	\$0,64	\$0,70	0,17%	2,10	\$1,00	\$2,10	0,31%
Household Devices	6,4	\$3,84	\$24,6	8,71%	3,5	\$4,95	\$17,33	4,18%	1,80	\$5,75	\$10,35	1,51%
Chemical Processes/ Industrial Manufacturing	4,1	\$1,90	\$7,8	2,76%	1,3	\$1,90	\$2,47	0,60%	1,10	\$3,22	\$3,54	0,52%
Total			\$282,0				\$414,7				\$683,8	

Figure 6: Voluntary Carbon Market Size by Project Category

3.2 Frictions in Voluntary Carbon Markets that Regulated Exchanges Could Overcome

A significant source of uncertainty and lack of transparency in the voluntary carbon market originates from discrepancies in prices. At present, it is challenging for companies to assess the fair value of a voluntary carbon credit. There is speculation on what drives the prices of voluntary carbon credits. Geography, the fulfilment of sustainable development goals, transparency, and climate policy events are considered drivers of the ultimate price of a voluntary carbon credit, but no conclusive evidence is available at present (Behr et al., 2021; Lavan, 2021).

Furthermore, in the OTC markets today, there is a significant risk associated with transparency. Corporations might opt to buy carbon credits that do not have desirable results. That is, a company may buy credits that harm the local community. Purchasing such double-edged credits could lead to a reputational problem for the corporation. If the market were to be more centralized and transparent, corporations could hedge against this risk through diversification. It is thus paramount to establish centralized marketplaces.

There is also a discrepancy between the moment a project needs funding, and the moment a carbon credit is validated. The result of this disparity is that there is a significant need for funding to obtain enough carbon credits validated for future demand. According to a study by BloombergNEF, the current supply and scale of voluntary carbon offset credits is not equipped to handle future demand. It is essential to create transparency to scale the market to its growth potential in a sustainable manner (Henze, 2022). On an organized voluntary carbon offset exchange, the needed funds could be channelled where they are most needed, and an active asset / liability management would become possible.

Other impediments facing voluntary carbon markets cited by Boston Consulting Group include the absence of a taxonomy as it relates to different voluntary carbon market credit types; a lack of trading and liquidity in the market itself; and an absence of firm market-wide consensus on how companies can use voluntary carbon credits in their reporting and communications. Moreover,

there are currently no escrow mechanisms available. Likewise, settlements for cash and voluntary carbon credits are not sufficiently outlined. This is making it very difficult for investors and companies to leverage the voluntary carbon market.

If a regulated exchange were to centralize the market, it could solve these problems and mitigate risk. In addition to an organised or centralized marketplace, there is also a need for the credible provision of independent third-party data and information on the market. As of today, the only such provider is Ecosystem Marketplace, which is an initiative of the non-profit organization “Forest Trends”. It is a web-based service that publishes news, articles, and annual reports about market-based solutions for ecosystem services. It publishes a yearly overview of the voluntary carbon market. Their annual reports help to investigate the evolution of the prices in the market as they provide an annual average for each category of projects. Figure 7 shows the price increase in 2005 after the Kyoto Protocol became effective and a decline after the financial crisis from 2007/2008. From 2015 onwards, the period of the Paris Agreement, the average has a stable pattern between 3 and 4 euro per ton of CO₂.

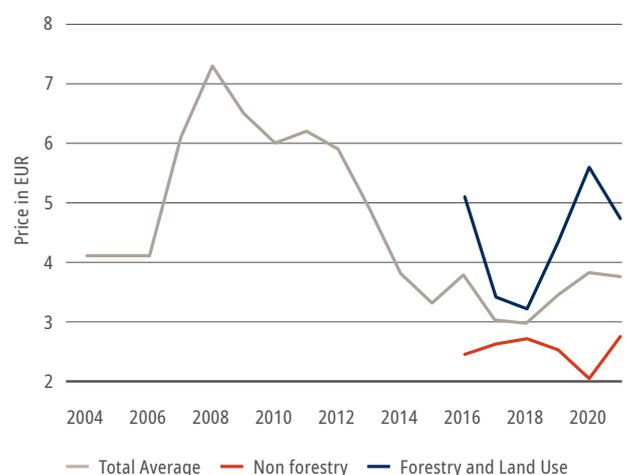


Figure 7: Prices in the Voluntary Carbon Market.
Source: Ecosystem Marketplace

3.3 Recent Developments in Carbon Pricing

CBL is a global platform that provides the opportunity to trade energy and environmental commodity products. It developed two different types of standard products linked with the voluntary carbon market. The Global Emissions Offset (GEO) future is a contract traded on the CBL exchange, successfully launched by the Chicago Mercantile Exchange (CME) Group. It provides delivery of physical carbon offset credits from three different registries: Verified Carbon Standard (VCS), American Carbon Registry (ACR) and Climate Action Reserve (CAR). The underlying of GEO is an offset that meets the eligibility criteria defined by ICAO for CORSIA. This new contract increases price transparency in the voluntary carbon market, reduces the risk of carbon offsets, and finds a convergence for different projects and other registries (CME Group, 2021). There is significant interest from the market in this new product. This is confirmed by the price development, as shown in Figure 8. From its inception, the value increased by a factor of four.

The Natural-based Global Emissions Offset (N-GEO) future is a contract that is built on the first voluntary carbon future, the GEO. The difference is that N-GEO offers the possibility for companies to reach their emission reduction goal due to quality natural-based solutions from agriculture, forestry, and other land-use projects. These projects require an additional verification process from VERRA with the VCS and Climate Community and Biodiversity (CCB) Standards (CME Group, 2021). Like the GEO contract, N-GEO experienced considerable growth in value from its inception. As shown in Figure 8, the price has recently hit the 10-dollar mark.

Both products offer a reliable benchmark for the price in the voluntary carbon market. They also demonstrate the immense potential of voluntary carbon offset markets.

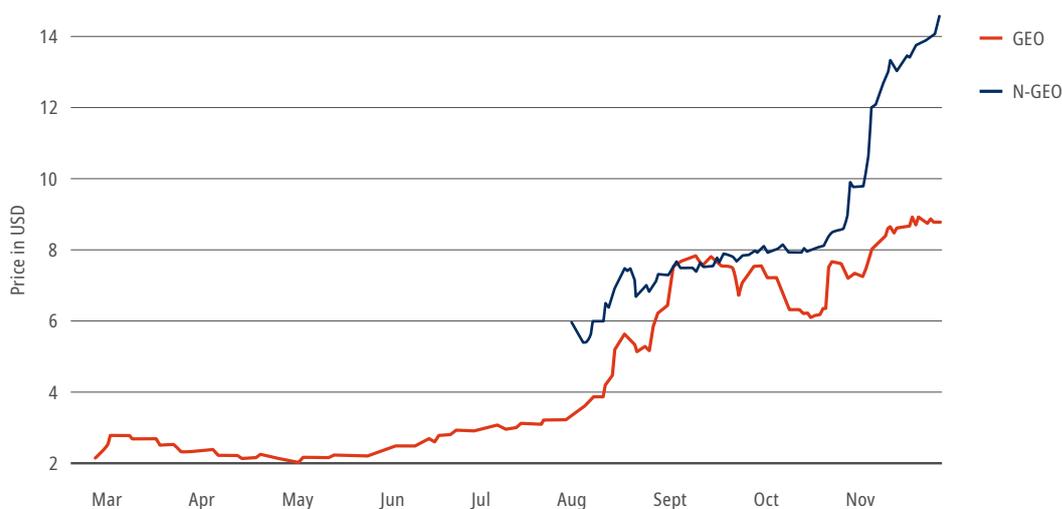


Figure 8: Geo and N-Geo Prices in 2021. Source: Bloomberg

3.4 The Competitive Landscape in Voluntary Carbon Offset Markets

The voluntary carbon market is largely unorganized and fragmented, and many small players experience high implementation costs for their operations. At present, there are only a few exchanges for carbon credits in the market. Most trades are conducted OTC. The few exchanges in the market charge 10%–20% transaction fees due to the high implementation costs. Over the past months, several regulated exchanges have launched voluntary carbon exchanges in what could help bring some order and consensus to the market. The London Stock Exchange (LSE), the Singapore Exchange (SGX) and the European Energy Exchange (EEX) are three of those. However, they are not likely to be the only players moving into this market. The growth potential and the growing activity in the market suggests that more players will soon emerge.

Figure 9 shows the most important players in the market. Most of the players are located in Europe or the United States, and these regions are the primary regions for the trade of voluntary carbon credits. Some of the major players focus on consumer sales in addition to business-to-business (B2B) sales. Furthermore, it should be noted that most players are project developers or brokers and not organized exchanges. Many of the players are also operating in the compliance market besides the specialization on voluntary carbon credits. While most carbon credits are produced in Asia, Africa, and South America, the majority of transactions are conducted in Europe and the United States.

Players	Location	B2C	Developer	Compliance	Forestry	Consulting
Exchange in the voluntary market						
XPansiv	United States		×	×	×	×
CTX	United Kingdom				×	
AirCarbon	Singapore			×	×	
BEF	United Kingdom	×			×	
Traditional or Compliance Exchanges						
Climate Impact X	Singapore	×			×	
EEX	Germany	×		×		
LSE	United Kingdom	×			×	
Brokers and Auction Platforms						
3Degree	United States	×	×	×	×	×
Native	United States	×	×			×
CarbonFund	United States	×			×	
ClimateCare	United Kingdom		×	×	×	×
CO2Balance	United Kingdom		×			×
Atmosfair	Germany	×	×	×		
First Climate	Germany		×	×	×	×
MyClimate	Switzerland		×		×	×
SouthPole	Switzerland		×	×	×	×
Climate Neutral Group	Netherlands		×		×	×
Climate Partner	Netherlands	×	×		×	×

Figure 9: Overview of Players in the Voluntary and Compliance Carbon Markets

Climate Impact X is an extension of SGX and offers a spot trading exchange and a marketplace targeting consumers. 90% of the companies listed on SGX are non-American and non-European companies. It is thus unlikely that SGX would have a significant outreach in the American and European markets (SGX, 2021).

Early in November 2021, the London stock exchange (LSE) announced the plan to develop a market solution for the voluntary carbon market to increase investment in carbon mitigation projects worldwide by providing capital for projects that reduce GHG. The LSE intends to utilize its current market infrastructure, reinforced by carbon credit project needs. The initiative will list funds investing in projects to reduce GHG emissions and remove carbon from the atmosphere. The goal is to make it easier for carbon funds to go public by creating a transparent market with a precise price signal and ensuring that investors can actively assist the development of high-quality climate change mitigation projects worldwide. Enterprises and other organizations with long-term carbon credit requirements are supposed to become investors, utilizing the carbon credits generated by these vehicles – which can, for instance, be paid as a dividend – to cover a portion of their offset requirements. Julia Hoggett, CEO of the LSE, said in her last interview about this new project that:

“Climate change is the most urgent challenge of our lifetime. It is essential that the global capital markets, long the drivers of economic activity, are reoriented to act in service of the planet. By creating solutions to direct capital flows into projects that address the climate crisis, many in the Global South, the London Stock Exchange can play its part in supporting a just transition to a low carbon economy.”

(Mann, 2021).

4 Tokenization of Carbon Credits: A Promising Innovation in Voluntary Carbon Offset Markets

In addition to exchanging carbon credit and derivatives on traditional exchanges, credits can also be tokenized and traded on a digital exchange in what would help drive liquidity and transparency. Cryptographic tokens are essentially a set of regulations that are encoded into a smart contract, which is a program that is executed when specific criteria are satisfied and are maintained on a blockchain. They are used to automate the execution of an agreement so that all parties are confident of the conclusion right away, without the need for any intermediaries. In addition, they can automate workflows as well.

A pool of carbon credits from a project can be tokenized, and just as each carbon credit, a token represents the offset of one ton of carbon. The token will store all the information related to the carbon credit, starting with the certified carbon credit, auditing, project monitoring, integrated into the pool of carbon credits in the international standard. After taking possession of the carbon credit, a third-party verifies the transaction and confirms the ownership of the carbon credit. Such transparency will be integral to the voluntary carbon market's growth.

The market for tokenized carbon credits is currently quite fragmented. Most tokens only have access to a small inventory of carbon credits which inhibits their potential growth. This is something that needs to change especially as tokenisation is widely acknowledged as being an effective tool for democratising investment and generating liquidity – especially in illiquid markets.

In addition, the secondary market is specific to each token. The fragmentation in the market leads to low levels of liquidity. There is no prominent digital exchange in the market that allows various tokenized carbon credits to be exchanged. The primary tokens that can be considered in the market today are listed below.

BCT

Base Carbon Tones is a reference token created by the KlimaDAO organization representing one ton of carbon from the Verra Verified Carbon Unit (VCU) registry from 2008 or later, bridged by the Toucan Protocol (docs.klimadao.finance). The Toucan Bridge is the first to allow any user to bridge their VCUs into crypto and is listed on the Coinbase exchange platform (CoinMarketCap, 2021).

MOSS (MCO2)

MOSS purchases carbon credits from high-quality Amazon Forest environmental projects. MOSS allows businesses and investors to purchase these credits, simplifying and transparentizing a previously difficult procedure. Global institutes such as VCS Standard, Social Carbon, and CCB Standards certify the credits. MOSS has exchanged over 1.3 million carbon credits and indirectly conserved 1 million hectares of Amazon Forest in just one year since its inception. Their token is traded on Coinbase, Gemini, and ProBit Global, but they plan to list it on more exchanges in the near future (CoinMarketCap, 2021).

In December KLIMA and Moss have announced a liquidity collaboration to seed a USD 1 million KLIMA/MCO2 liquidity pool.

NORI

Nori aims to build a blockchain-based market for carbon credits by paying farmers to remove GHG from the atmosphere. When a GHG reduction is validated, the farmer is awarded a Nori Carbon Removal Tone (NRT) electronic certificate, which they may sell to purchasers in return for one Nori token. According to NORI, one token is always worth one ton, but the token price will fluctuate depending on supply and demand (Allison, 2020).

CTN

Carbon Neutrality Token, a proprietary asset-backed token developed by CTX, enables cross-border trading of high-quality voluntary emission reductions. Using blockchain technologies and operational procedures ensures carbon integrity, avoids double-counting and enhances transparency. Every CNT is legally recognized as a unit of a restricted Collective Investment Scheme for non-capital markets products under Singapore's Securities and Futures Act (Exchange, 2021).

Tokenization of voluntary carbon credits can become a major innovation in voluntary carbon markets, once such tokens become accepted by institutional and retail investors and once professional marketplaces in which the tokens can be traded are established.

5 Conclusion

Climate change is a significant problem that affects everyone, regardless of wealth, age, gender, race, and geography. If immediate action is not taken, irreversible damage to our planet will be caused. There are several market-driven solutions that have the potential to combat rising temperatures. Carbon pricing has made significant contributions to decreasing GHG emissions in, for instance the European Union or California, and it has already reduced appropriate emission levels by 20%. However, governmental measures (compliance markets) are not sufficient to win the fight against climate change.

Thus, in addition to compliance markets like the EU ETS or the California Cap-and-Trade, there is a need for the generation of voluntary carbon credits. The market for voluntary carbon markets has substantial potential and is expected to grow to 50 billion US-Dollars by 2030. The outcomes of COP 26 in Glasgow in 2021 can spur market growth even further because of the commitment to stop illegal deforestation by 2030 and because of the increased importance of adaptation finance in the fight against climate change.

Despite the projected growth, the market currently experiences a variety of market frictions. Most transactions are still over-the-counter trades. This results in non-transparent prices, a lack of liquidity, and a lack of funding to develop more projects and protect the environment to help in the fight against climate change. Moreover, it is a highly fragmented market without clear market leaders and very little standardization.

A possible solution is to provide price transparency, market liquidity and bringing together demand and supply. This is the core activity of organized FMI providers. Consequently, the role of professional FMI providers is crucial in developing efficient voluntary carbon offset markets, fostering financial innovation in these markets – such as tokenization – and therewith taking an important role in fighting climate change. FMIs can and have to become crucial players in the creation and the trading of new products that help sharpen voluntary carbon credit markets. To provide liquid and efficient platforms for voluntary carbon offsets, it will be key to create new products such as carbon bonds, carbon backed securities, and carbon offset based derivative instruments enabling efficient science-based decarbonization aligned with the Paris Agreement objectives

Professional FMI providers are crucial in developing voluntary carbon offset markets, fostering innovation and therewith taking an important role in fighting climate change.

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Dr. Maneesh Wadhwa,
Senior Business Development
Manager Exchanges, SIX



Prof. Dr. Eric Nowak,
Swiss Finance Institute,
Università della Svizzera
italiana



Dr. Patrick Behr,
Center for Climate Finance
and Sustainability (CCFS)

With the participation of

Ivana Pallister, Alec Bernasconi, Riccardo Cosenza and Niccolo Maiò
from the Università della Svizzera italiana



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SIX

Pfingstweidstrasse 110

Postfach

CH-8021 Zürich

www.six-group.com