

Road to Carbon Neutrality: Hong Kong's Role in Capturing the Rise of Carbon Market Opportunities



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Executive Summary

Seeing sustainability as the key to a better future, many countries have embarked on their sustainability journey of achieving net-zero carbon emissions by mid-century, collective efforts have surged globally across sectors in combating climate change. Among these, Mainland China has pledged to reach a carbon emission peak by 2030 and to attain carbon neutrality before 2060, while Hong Kong has committed to halve its carbon emission before 2035 and to reach carbon neutrality by 2050. The journey to decarbonisation is becoming more challenging and costly given the enormous scale of emissions that need to be removed. Voluntary carbon markets (VCMs), among others, emerge as one of the key tools to mobilise finance for the transition to a low-carbon economy. Hong Kong, being a leading international financial centre and regional green finance hub, should take on the mission of playing a pivotal role in the regional and global carbon markets, thereby contributing to the decarbonisation goals of Hong Kong, the country and beyond.

Riding on the concerted efforts of the Government and the community, including the Hong Kong International Carbon Market Council and the Core Climate, an international carbon marketplace set up by the Hong Kong Exchanges and Clearing Limited (HKEX), the Financial Services Development Council (FSDC) formed a Working Group comprising industry experts to conduct a study. The research aims to identify the common challenges facing the current VCMs and put forward key considerations for building a holistic ecosystem conducive to the development of carbon trading and in particular, VCM in Hong Kong. Our key considerations include:

- To accommodate carbon credits generated from projects verified by standards that are widely recognised by international stakeholders.
- To adopt technological solutions to boost the performance of the trading mechanism and address key operational challenges.
- To facilitate standard setters and registries to operate in Hong Kong to attract quality carbon projects and asset owners.
- To call upon the wider financial services industry and the government to support the healthy development of VCM.
- To cultivate a conducive ecosystem.

We believe these recommendations will bolster Hong Kong's stature as Asia's leading green finance hub, thereby further strengthening the city's positioning as an international financial centre.

Introduction

Global economic development in the last few decades has, arguably, been accompanied by drastic adverse changes to our climate, including rising sea levels, melting polar glaciers, heatwaves, and extreme weather conditions. Human-induced climate change was described as “inevitable” and “irreversible” by the Intergovernmental Panel on Climate Change (IPCC) in their report published in February 2022.¹ With global warming of 1.5°C, it was estimated that the world would face increasing unavoidable climate risks over the next two decades.

As mitigating global climate risks needs immediate action, roadmaps were generated to “[accelerate] efforts towards the phasedown of unabated coal power” and “[increase] provision of climate finance”, arguably at an accelerated pace.² In addition to regional and government commitments curbing carbon emissions, participation from the private sector has gained prominence. The United Nations global campaign, “Race to Zero”, has rallied leadership and support from 1,049 cities, 67 regions, 5,235 businesses, 441 of the world’s biggest investors, and 1,039 higher education institutions as of August 2022³ for a resilient and zero carbon recovery that unlocks inclusive and sustainable growth. Together with countries which have pledged for net-zero, these public and private stakeholders collectively account for nearly 25% of global carbon dioxide (CO₂) emissions and over 50% GDP.⁴

Such a campaign not only mobilised resources from the private sector, it also identified carbon market as a primary emissions reduction strategy. The key to assessing net-zero targets is closely tied to the robustness of carbon offsets and the concept of additionality.⁵ **Thus, carbon credits play a pivotal role in the race to net-zero, particularly so to hard-to-abate sectors, as they provide an effective way for businesses to manage their greenhouse gas (GHG) emissions. As a result, carbon markets, among others, have emerged recently as one of the most widespread tools in the private sector to mitigate climate risks.**⁶

While transacting in carbon markets may be a common practice in Europe and the US, Asia’s carbon market is only just beginning to emerge and catch up. The voluntary carbon market (VCM) in Southeast Asia, for instance, will reportedly create US\$10 billion in economic opportunities annually by 2030.⁷ In Mainland China, since the commencement of its national emission trading scheme (ETS), the country’s ETS cumulative trading volume reached 194 million tonnes carbon dioxide equivalent (MtCO₂e) as of July 2022, with a cumulative turnover of US\$1.26 billion.⁸ **In light of Hong Kong’s proximity to Mainland China and its access to the Southeast Asian markets, the fast-growing carbon markets in Asia present opportunities for Hong Kong, particularly in terms of giving full play to our strengths as an international financial centre.** With the establishment of the Green and Sustainable Finance Cross-Agency Steering Group (CASG), as well as the launch of the Hong Kong International Carbon Market Council, the establishment of a VCM in Hong Kong will bolster the city’s stature as Asia’s leading green finance hub.

Prior to exploring the possibility of having a vibrant carbon exchange in Hong Kong, it is crucial to understand the landscape of and recent development in the global VCM.

¹ IPCC, Climate Change 2022 – Mitigation of Climate Change, February 2022, https://www.ipcc.ch/report/ar6/wg2/downloads/report/IPCC_AR6_WGII_SummaryForPolicymakers.pdf

² UNFCCC, Decision – COP26 Glasgow Climate Pact, https://unfccc.int/sites/default/files/resource/cop26_auv_2f_cover_decision.pdf
United Nations, Race to Zero Campaign, <https://unfccc.int/climate-action/race-to-zero-campaign>

³ Ibid

⁴ Data-Driven EnvironLab & NewClimate Institute, Accelerating Net Zero – Exploring Cities, Regions and Companies’ Pledges to Decarbonise, September 2022, http://datadrivenlab.org/wp-content/uploads/2020/09/Accelerating_Net_Zero_Report_Sept2020.pdf

⁵ McKinsey & Company, A Blueprint for Scaling Voluntary Carbon markets to meet the Climate Challenge, 2021, <https://www.mckinsey.com/business-functions/sustainability/our-insights/a-blueprint-for-scaling-voluntary-carbon-markets-to-meet-the-climate-challenge>

⁶ McKinsey & Company, A Blueprint for Scaling Voluntary Carbon markets to meet the Climate Challenge, 2021, <https://www.mckinsey.com/business-functions/sustainability/our-insights/a-blueprint-for-scaling-voluntary-carbon-markets-to-meet-the-climate-challenge> Business Times, Asia’s Booming

⁷ Carbon Market – the Road to Net-zero or a Minefield of Risks, 15 March 2022, <https://www.businesstimes.com.sg/government-economy/asias-booming-carbon-market-the-road-to-net-zero-or-a-minefield-of-risks>

⁸ Global Times, China’s national carbon market celebrates one year anniversary, becoming world’s largest, 17 July 2022, <https://www.globaltimes.cn/page/202207/1270724.shtml>

Voluntary Carbon Markets

With the increasing global efforts in reducing carbon emissions and promoting activities of storing and removing carbon from the atmosphere, reduced carbon emission has become a valuable asset. Similar to the financial market, reduced carbon emission can be traded on the carbon market, in which the currency or unit used for trading is known as carbon credits.

In essence, there are two main types of market where carbon credits can be traded: voluntary carbon markets and compliance carbon markets. While a compliance (or mandatory) carbon market refers to systems established or regulated by governments and mandated emission sources for participants to meet binding emission reduction targets, VCMs are based on specific organisations certifying emission reductions.⁹ VCMs are crucial in helping the decarbonisation process as the current compliance markets only cover 11% of global emissions.¹⁰ Given the rapid development of the global VCM, as well as the fact that Hong Kong does not generate a substantial amount of carbon credits locally for a compliance market, this paper intends to emphasise the voluntary market. The following section will look into some key characteristics of VCMs.

Characteristics of voluntary carbon markets

Mechanism and participants

VCMs function outside of the compliance market and are operated on a voluntary basis, including registration, buying, and selling of carbon credits.¹¹ In short, a VCM is where a buyer and seller come to terms on trading a certain amount of carbon credits.

To not be exclusive by involving only targeted industries or emitters, VCMs allow a higher degree of participation from the private sector, enabling businesses, not-for-profit organisations, governments, and individuals to take part in relevant activities. Buyers, who are usually corporations, are able to voluntarily purchase carbon credits from sellers who engage in carbon emission reduction work, i.e., projects that mitigate climate risks and remove GHG emissions. This way, corporates can compensate for their carbon footprint by purchasing carbon credits, which purchasing is done largely through funding projects contributing to a greener and more sustainable future.¹² Coinciding with the voluntary nature of VCMs, such markets provide a possible outlet for firms to support their decarbonisation journey. Private sector participation also helps to finance projects that combat climate change.

⁹ Carbon Market Watch, Carbon Markets 1010, The Ultimate Guide to Global Offsetting Mechanisms, <https://carbonmarketwatch.org/wp/wp-content/uploads/2019/06/CMW-CARBON-MARKETS-101-THE-ULTIMATE-GUIDE-TO-MARKET-BASED-CLIMATE-MECHANISMS-WEB-FINAL-SINGLE.pdf>

¹⁰ BCG, Voluntary Carbon Market, August 2022

¹¹ United Nations Development Programme, What are carbon markets and why are they important, 18 May 2022, <https://climatepromise.undp.org/news-and-stories/what-are-carbon-markets-and-why-are-they-important>

¹² Food and Agriculture Organization of the United Nations, Carbon Finance Possibilities for Agriculture, Forestry and Other Land Use Projects in a Smallholder Context, 2010, <https://www.fao.org/3/i1632e/i1632e.pdf>

Standards

To ensure the integrity of GHG emissions reduced and the quality of the carbon credits created, these credits are required to be registered through verified registries and to adhere to the respective standards of such registries. Hence, these standards and their compliance are often central to the operation of the VCM as they provide guidance and rules as to how credits can be verified.

Unlike the compliance carbon market which relies on a top-down approach from governments and enforcing bodies, carbon standards are developed and governed by standard-setting bodies, oftentimes international non-governmental organisations (NGOs) in the VCM space. Comprehensive sets of rules, procedures, and methodologies to which “certified carbon credits are generated and issued” have been established by respective standards organisations.¹³ These NGOs are obliged to provide clear guidance and requirements for credit generation, as well as key elements such as mechanisms for stakeholder consultations and grievances, specific environmental and social safeguard requirements,¹⁴ and robust methodologies for determining baseline and project contributions, etc.¹⁵

In short, a comprehensive set of standards should comprise accounting frameworks, monitoring, verification and certification standards, and registration enforcement systems. The standards, and their compliance, provide certainty and transparency to investors in their carbon neutrality journey as these protocols are often designed to furnish credit sellers with quality assurance certification. A more detailed comparison of major VCM standards can be found in the latter part of this section.

Pricing

In general, carbon pricing is not only key to a VCM, it is also an important element in the overall carbon emission reduction journey. It is an instrument that captures the externalities of GHG emissions, provides an economic signal, and serves as an indicator for emitters to transform their activities and lower their emissions.¹⁶ Carbon pricing can take many forms and its definition varies in different carbon emission mechanisms.

As its name suggests, purchases on a VCM do not derive an official carbon price, nor does it directly affect the international carbon price like that of a compliance market. With a total traded value of around US\$2 billion in 2021 on VCMs,¹⁷ the trading price of the carbon credits is determined by the supply and demand of credits within a VCM. The VCM mechanism serves more as a platform for credits to be traded on a voluntary basis. However, if the credits are permitted to be traded in a compliance market, such credits would have a potential impact on the carbon price.¹⁸

¹³ Climate Focus, The Voluntary Carbon Market Explained, December 2021, <https://vcmprimer.org/chapter-7-what-is-the-role-of-carbon-standards-in-the-voluntary-carbon-market/>

¹⁴ Ibid

¹⁵ UNFCCC, Guideline: Quality assurance and quality control of data used in the establishment of standardized baselines, https://cdm.unfccc.int/filestorage/e/x/t/extfile-20140605162815656-meth_guid46.pdf/meth_guid46.pdf?t=NW18cmdzeTJ4fDBNqrsZHpFpDqIltHxtFH3Wa

¹⁶ The World Bank, Carbon Pricing Dashboard, <https://carbonpricingdashboard.worldbank.org/what-carbon-pricing>

¹⁷ Ecosystem Marketplace, The Art of Integrity – State of the Voluntary Carbon Markets 2022 Q3, August 2022, <https://app.hubspot.com/documents/3298623/view/433338095?accessId=3abc8b>

¹⁸ Boston Consulting Group and Global Financial Markets Association, 2021, Unlocking the Potential of Carbon Markets to Achieve Global Net Zero, <https://www.gfma.org/wp-content/uploads/2021/10/unlocking-the-potential-of-carbon-markets-to-achieve-global-net-zero-full-report-consolidated-vfinal1.pdf>

Asset classification of carbon credits

As the trading activities of carbon credits have flourished in the past decade, together with its market potential and gathering interest, discussions have also revolved around the asset classification of carbon credits. Investment demand for carbon credits as an asset class is expected to grow.¹⁹ As a point of reference – compared to the US\$1.4 billion of VCM trading mentioned above – over one-fifth (21%) of the world's 2,000 largest public companies (whose combined sales revenue accounts for US\$14 trillion) and 220 global asset managers (with US\$57 trillion in assets under management) have committed themselves to meet net-zero targets and will drive demand for carbon credits to neutralise unabated emissions.²⁰

While there is no global consensus as to which official asset classification should carbon credits fall into, major markets and global asset managers often identify or correlate carbon credits to a derivative or commodity. Emerging as a liquid and investable asset class, carbon traded approximately at US\$1 billion per day across physical carbon, futures, and options in 2020.²¹ In the US, the commodities market regulator, the Commodity Futures Trading Commission (CFTC), also emphasised that its jurisdiction and regulations are applicable to both carbon credit futures transactions and the markets underlying the pricing of carbon credits traded on US exchanges.

¹⁹ CASG, Carbon market Opportunities for Hong Kong – Preliminary Feasibility Assessment, Mar 2022, <https://www.hkma.gov.hk/media/eng/doc/key-information/press-release/2022/20220330e3a1.pdf>

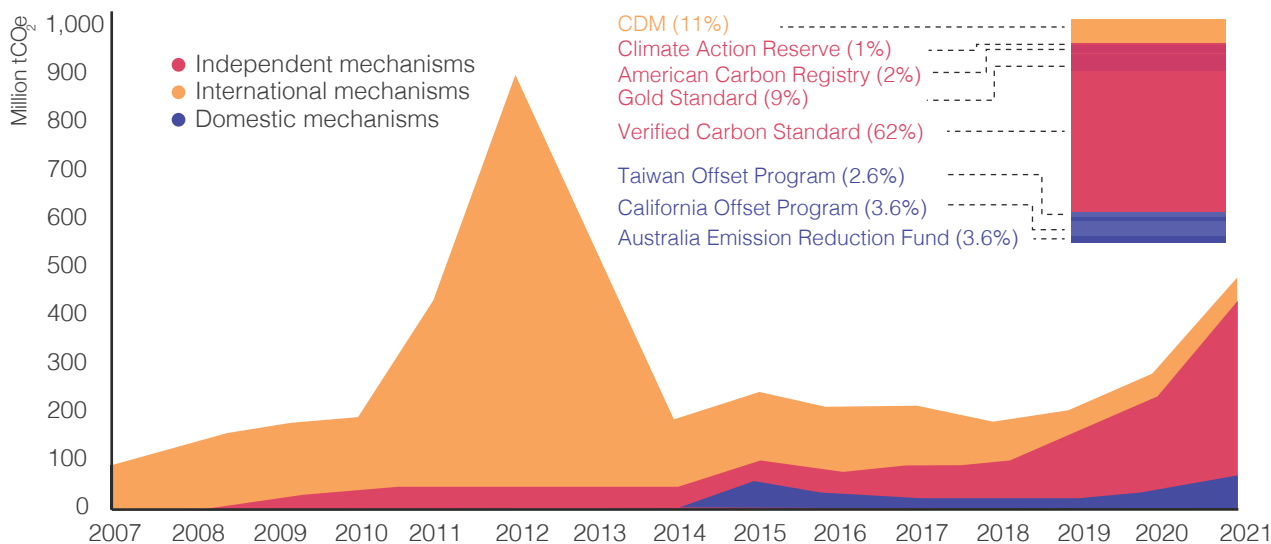
²⁰ The Energy & Climate Intelligence Unit and Oxford Net Zero, Taking Stock: A Global Assessment of Net Zero Targets, March 2021, https://ca1-eci.ed-cdn.com/reports/ECIU-Oxford_Taking_Stock.pdf?v=1616461369

²¹ CFA Institute, Carbon as an Emerging Asset Class, October 2020, <https://www.cfainstitute.org/en/research/industry-research/case-study-carbon-as-emerging-asset-class>

Market landscape of the global voluntary carbon market

Due to its increasing popularity as an instrument across domestic and international markets to mitigate climate change, carbon trading's growth has further accelerated in recent years with a sharp increment in issuance/registration, transactions, and prices. Carbon credit markets, on the whole, grew 48% in 2021 – the total number of credits issued from international, domestic, and independent credit mechanisms recorded an increase from 327 MtCO₂e in 2020 to 478 MtCO₂e in 2021. The cumulative number of credits issued since 2007 is around 4.7 billion tonnes carbon dioxide equivalent (GtCO₂e).²²

Figure 1. Global volume of issuances by crediting mechanism category



Source: World Bank

By providing a higher degree of certainty, VCM growth is stimulated by the introduction of an international governance framework to Article 6 of the Paris Agreement.^{23,24} With such updates, more corporates are willing to utilise VCMs as their climate change mitigation solution.

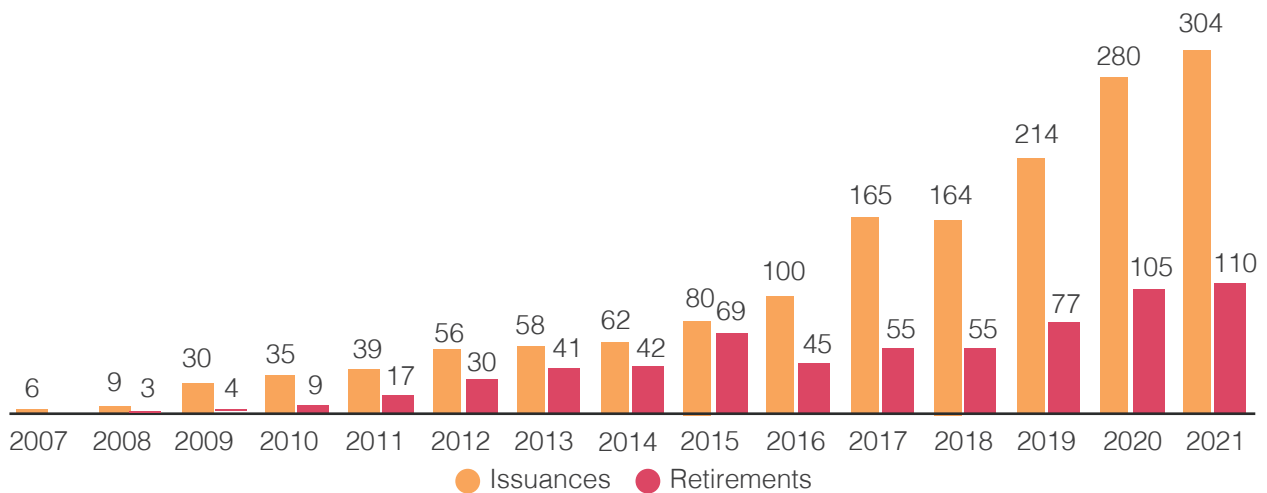
²² The World Bank, State and Trends of Carbon Pricing, 2022, <https://openknowledge.worldbank.org/handle/10986/37455>

²³ United Nations, Report of the Conference of the Parties serving as the Meeting of the Parties to the Paris Agreement on its Third Session, held in Glasgow from 31 October to 13 November 2021, Mar 2022, https://unfccc.int/sites/default/files/resource/cma2021_10_add1_adv.pdf#page=11

²⁴ These rules cover such areas as bilateral actions to reduce and remove GHG emissions, the "Internationally Transferred Mitigations Outcomes", and the new sustainable development mechanism. It is generally believed that the decisions could progressively increase the environmental and social integrity, liquidity, and value of international carbon markets.

According to Boston Consulting Group (BCG), the global VCM has grown significantly in recent years, with a compound annual growth rate (CAGR) of 30% between 2015 and 2021.²⁵ In 2021 alone, the global carbon market value soared to US\$852 billion, representing an expansion of 164% over 2020.²⁶ The actual issuance of emission reductions also accelerated. Between 2007 and 2021, the issuance of emission reductions grew from ~6 MtCO₂e to ~300 MtCO₂e. During the same period, the retirement of voluntary carbon credits, although in a smaller volume compared to that of issuance, increased from 2.7 MtCO₂e in 2007 to 110 MtCO₂e in 2021. Despite such growth, the aggregate carbon market of VCM credits still only covers a fraction of global emissions (< 0.5 percent of the ~50 GtCO₂e total emissions as of 2020).²⁷ In terms of volume, the total credits transacted in the voluntary market exceeded 362 million tonnes, 92% more than that in 2020.²⁸

Figure 2. Annual voluntary carbon credit issuances and retirements (2007–Oct 2021)



Source: BCG & GFMA

Beyond the current insignificance of VCM credits as a share of overall emissions, global demand for voluntary carbon credits is still predicted to increase by 15 times by 2030 and 100 times by 2050.²⁹ Bloomberg predicts that the global VCM will be valued at US\$190 billion by 2030 and US\$546 billion in 2050,³⁰ showing a strong appetite from the private sector as well as promising VCM growth.

²⁵ Boston Consulting Group and Shell Plc, 2021, An outlook on the voluntary carbon market, https://www.shell.com/shellenergy/othersolutions/carbonmarketreports/_jcr_content/par/relatedtopics.stream/1642259539869/71ec61dc11bd18fdb02de0f71d0eca4fb36f8466/shell-bcg-report-english.pdf

²⁶ DutchGreen Business, Global carbon market value soars to \$851 billion in 2021, 7 February 2022, <https://www.dgb.earth/carbon-offset-blog/global-carbon-market-value-soars-to-851-billion-in-2021>

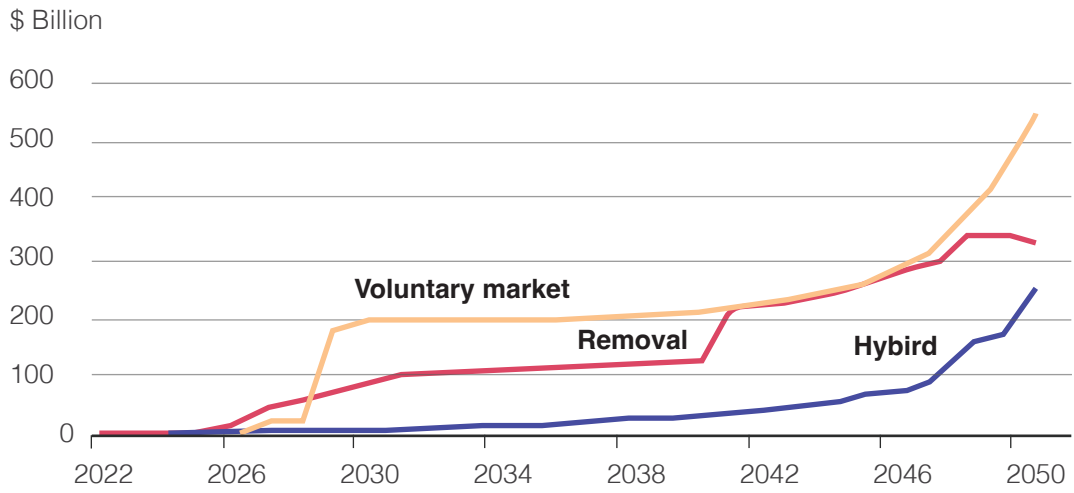
²⁷ BCG & GFMA, Unlocking the Potential of Carbon Markets to Achieve Global Net Zero, <https://www.gfma.org/wp-content/uploads/2021/10/unlocking-the-potential-of-carbon-markets-to-achieve-global-net-zero-full-report-consolidated-vfinal1.pdf>

²⁸ McKinsey & Company, A blueprint for scaling voluntary carbon markets to meet the climate challenge, 29 January 2021, <https://www.mckinsey.com/business-functions/sustainability/our-insights/a-blueprint-for-scaling-voluntary-carbon-markets-to-meet-the-climate-challenge>

²⁹ Bloomberg, The complexities – and opportunities – of the carbon offset market, 2022, https://spotlight.bloomberg.com/story/carbon-offset-trading/page/3/5?utm_medium=Adwords_SEM&utm_source=pdsrch&utm_content=UM&utm_campaign=582644&tactic=582644&gclid=Cj0KCQjw8O-VBhCpARIsACMvVLMtJpheSFSm9RvZ2pyNb3QTwy7evSHY6yzW1t8-y7qnuB8C-AH8OwkaAjvhEALw_wcB

³⁰ Bloomberg, The complexities – and opportunities – of the carbon offset market, 2022, https://spotlight.bloomberg.com/story/carbon-offset-trading/page/3/5?utm_medium=Adwords_SEM&utm_source=pdsrch&utm_content=UM&utm_campaign=582644&tactic=582644&gclid=Cj0KCQjw8O-VBhCpARIsACMvVLMtJpheSFSm9RvZ2pyNb3QTwy7evSHY6yzW1t8-y7qnuB8C-AH8OwkaAjvhEALw_wcB

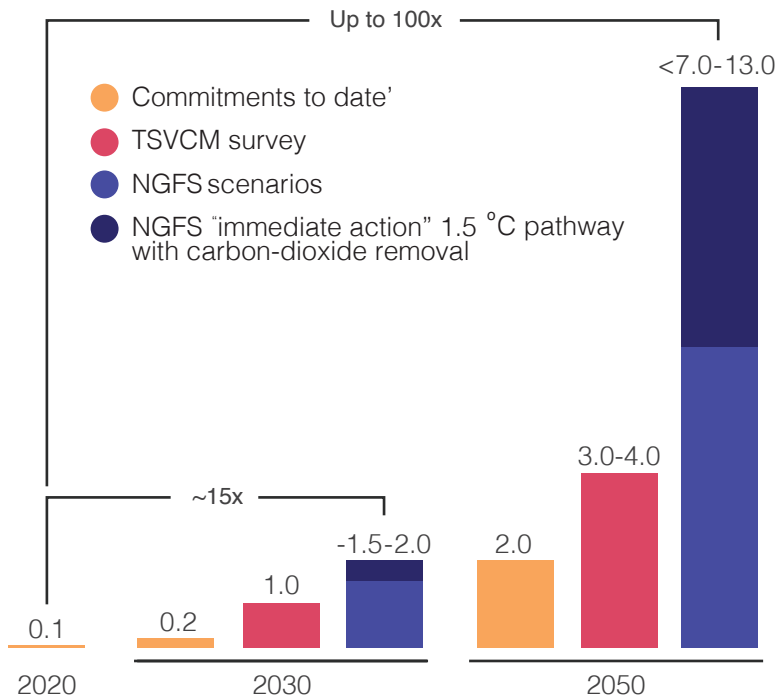
Figure 3. Global VCM value by scenario



Source: BloombergNEF

Notes: Scenarios are based on intersection of price, supply and demand, and are not necessarily representative of how the market will evolve.

Figure 4. Global demand for voluntary carbon credits, gigaton per year



Source: McKinsey

Comparison of current carbon credit offset project registries and standards

As market interest and participation in VCMs grows, more carbon removal projects could be financed to reduce the level of GHGs in the atmosphere. With a wide range of activities, ensuring the quality and accreditation of projects and the corresponding carbon credits generated has become a top priority. As a result, the importance of broadly represented standards and protocols being in place has emerged.

As mentioned in the earlier part of the paper, carbon standards are governed by organisations that are often NGOs in the VCM space. In the global arena, commonly accepted offsetting programmes usually serve as one-stop shops, offering services from carbon credit verification to registration. These one-stop shops are referred to as fully-fledge standards, which are also the most recognised across regions.³¹ In general, the standards designed by fully-fledged programmes in the market are built on existing well recognised mechanisms from the compliance carbon markets which provide guidelines and frameworks. Most notably is the Clean Development Mechanism (CDM), a Green House Gas offset mechanism under the Kyoto Protocol. However, the Kyoto Protocol lapsed in 2020 and it is expected that CDM will be replaced by the Sustainable Development Mechanism (SDM) under the Paris Agreement.³²

Collective efforts have been made by various stakeholders in creating standards and protocols to improve the quality and credibility of voluntary offsets. Nonetheless, it is important to note that a unified codification or benchmark for carbon credit issuance and certification remains absent. The standards available in different registries across jurisdictions could differ significantly in terms of the goals and services provided. Moreover, the methodologies adopted, detailed requirements, and industries and sectors covered could vary.

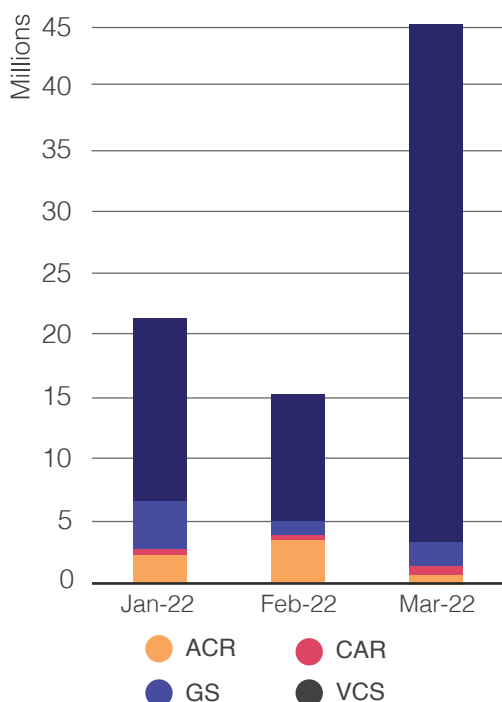
In view of the lack of standardisation, the volume of carbon credits issued in global markets was dominated primarily by four fully-fledged carbon registries, or standard setters, namely the Verified Carbon Standard (VCS or Verra), Gold Standards (GS), American Carbon Registry (ACR), and Climate Action Reserve (CAR). The total issuance of these four registries reached US\$45 million by March 2022. As shown in Figure 6, VCS and GS are the major standards worldwide, issuing 72.6% and 15.3% of credits, respectively. ACR (5.4% of credits) is mainly active in North America and CAR (6.7% of credits) is active only in the US.³³

³¹ Stockholm Environment Institute, Making Sense of the Voluntary Carbon Market A Comparison of Carbon Offset Standards, 2008, https://wwfint.awsassets.panda.org/downloads/vcm_report_final.pdf

³² Carbon Market Watch, Good-Bye Kyoto: Transitioning Away from Offsetting After 2020, April 2018, https://carbonmarketwatch.org/wp-content/uploads/2017/04/Good-bye-Kyoto_Transitioning-away-from-offsetting-after-2020_WEB_1final.pdf

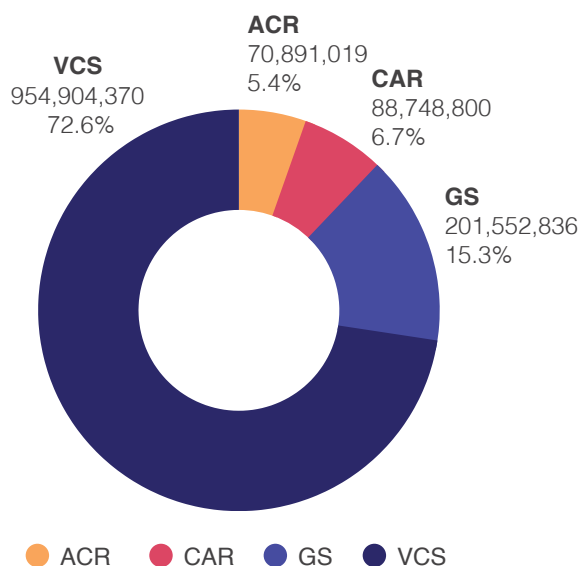
³³ Berkeley Carbon Trading Project, Voluntary Registry Offsets Database, <https://gspp.berkeley.edu/faculty-and-impact/centers/cepp/projects/berkeley-carbon-trading-project/offsets-database>

Figure 5. Issuance by Registry



Source: Berkeley Carbon Trading Project

Figure 6. Offset Credits Issued by Registry (As of Mar 2022)



Source: Berkeley Carbon Trading Project

While these globally recognised standards are designed based on existing frameworks with a common goal of sustainable development and environmental integrity, the sectors covered by and the scope of these standards, among others, differ. For instance, VCS covers projects from all sectors except nuclear and some forestry projects, while standards such as GS, China Certified Emission Reductions (CCER), and Guangdong Puhui Certified Emission Reductions (PHCER) focus on renewable energy and forestry. Such differences in the designed scope of registries can be attributed to the demand for and supply of carbon credits and projects generated in their respective regions.

In Asia, although the VCMs are not as developed as those in the US and Europe, Mainland China has begun devoting resources to relevant initiatives since early 2000s. For instance, Mainland China's first experience of carbon trading was under the CDM, with the first project registered in 2005.³⁴ In 2012, the country started issuing CCERs, China's version of the Kyoto Protocol's Certified Emission Reduction. The GHG Voluntary Emission Reduction Programme was subsequently piloted in 2015.³⁵ While the issuance of new CCERs was halted in 2017 due to low trading activities, the pilot CCER programme laid a foundation for carbon credit standardisation issued in Mainland China, including the PHCER.³⁶

³⁴ China Dialogue, Rebooting China's Carbon Credits: What will 2022 Bring?, 9 June 2022, <https://chinadialogue.net/en/climate/rebooting-chinas-carbon-credits-what-will-2022-bring/>

³⁵ Environmental Defense Fund & SinoCarbon Innovation, Analytical Report on the Status of the China GHG Voluntary Emission Reduction Program, July 2022, https://www.edf.org/sites/default/files/documents/Analytical-Report_on_the_Status_of_the_China_GHG_Voluntary_Emission_Reduction_Program-ENG.pdf

³⁶ China Emissions Exchange, Trading Rules on Puhui Certified Emissions Reduction of China Emissions Exchange, 2019, <https://files.gemas.com.cn/carbon/201907/20190724120322620.pdf>

In essence, CCER refers to emission reduction activities conducted by companies on a voluntary basis that are certified by the Chinese government. CCER covers renewable power generation, as well as waste-to-energy and forestry projects. As of April 2020, 1,047 CCER projects were registered and expected to reduce emissions by 139.57 MtCO₂e annually.³⁷ CCERs play an important role in China's national ETS as they currently cover 5% of the emission compliance obligations of covered entities. It is estimated that the initial demand for CCERs, if issuance is resumed as expected,³⁸ could reach 165 MtCO₂e per year, and it is predicted to reach 400 MtCO₂e per year in the long run.³⁹

As mentioned above, while the issuance of CCERs in Mainland China was suspended, the PHCER is an on-going scheme in Guangdong province, locally called the Tanpuhui system. The PHCER allows corporates and individuals to generate carbon credits from low-carbon behaviour, and subsequently exchange them for credits to purchase consumer products or contribute to participant rankings.⁴⁰ Debuted in 2017, the pilot scheme covers six cities in Guangdong province: Guangzhou, Dongguan, Zhongshan, Heyuan, Huizhou, and Shaoguan. Corporates can acquire PHCERs generated from the Tanpuhui platform, and then utilise these credits as CCERs to offset a maximum of 10% of their yearly emissions.⁴¹

Despite the lack of standardisation across markets, it is worth noting the efforts that have been made in this regard in the international market. The establishment of the Integrity Council for the Voluntary Carbon Market (ICVCM) is an attempt at setting and enforcing definitive global threshold standards.⁴² The setting of threshold standards for high-quality carbon credits, Core Carbon Principles (CCPs), is expected to be established and hosted by the ICVCM and will define CCP-eligible carbon-credit programmes and types of methodology.⁴³

³⁷ Environmental Defense Fund & SinoCarbon Innovation, Analytical Report on the Status of the China GHG Voluntary Emission Reduction Program, July 2022, https://www.edf.org/sites/default/files/documents/Analytical-Report_on_the_Status_of_the_China_GHG_Voluntary_Emission_Reduction_Program-ENG.pdf

³⁸ Hong Kong Green Finance Association, China's carbon market first cross-border deal in August, September 2021, <https://www.hkgreenfinance.org/chinas-carbon-market-first-cross-border-deal-in-august/>

³⁹ Soochow Securities, 各行業受益 CCER幾何? 碳價展望及受益敏感性測算, June 2021, https://pdf.dfcfw.com/pdf/H3_AP202106091496826931_1.pdf

⁴⁰ Harvard Project on Climate Agreements, The Offsetting Mechanism in Guangdong Province's ETS: Lessons Learned and the Way Forward, February, 2022, <https://www.belfercenter.org/sites/default/files/files/publication/yang-guangdong-offsetting-220227.pdf>

⁴¹ China Dialogue, Shanghai to trial personal carbon accounts, July 2022, <https://chinadialogue.net/en/digest/shanghai-to-trial-personal-carbon-accounts/>

⁴² ICVCM, About the Integrity Council for the Voluntary Carbon Market, <https://icvcm.org/about-the-integrity-council/>

⁴³ ICVCM, The Core Carbon Principles, <https://icvcm.org/the-core-carbon-principles/>

Table 1. Comparison of existing carbon standards/ carbon emission offset mechanisms

	Founding organisation	Type	Founding year	Average price (US\$) ^{44,45}	Credits issued ⁴⁶	Market position
American Carbon Registry (ACR)	Winrock International	Private	1996	\$11.4 /tCO ₂ e	8.8 MtCO ₂ e	Main provider of voluntary credits to the California cap-and-trade scheme
Clean Development Mechanism (CDM)	United Nations through the Kyoto Protocol	Public	1997	\$1.1 /tCO ₂ e	59.5 MtCO ₂ e	Low-cost option for companies without reputational concerns
Climate Action Reserve (CAR)	State of California	Private	2008	\$2.1 /tCO ₂ e	4.8 MtCO ₂ e	National programme focused on reduction projects in North America
Gold Standard (GS)	WWF and other international NGOs	Private	2003	\$3.9 /tCO ₂ e	43.8 MtCO ₂ e	High-quality standards with a focus on environmental and social benefits
Verified Carbon Standard (VCS)	Verra	Private	2005	\$4.2 /tCO ₂ e	295.1 MtCO ₂ e	Leading high-quality standard with added option to increase co-benefits
China Certified Emission Reductions (CCER)	National Development and Reform Commission (Currently, the Ministry of Ecology and Environment is in charge)	Public	2011	¥ 40.0 /tCO ₂ e	443.7 MtCO ₂ e	Main provider of voluntary credits to the China cap-and-trade scheme
Guangdong Puhui Certified Emission Reductions (PHCER)	Department of Ecology and Environment of Guangdong Province	Public	2016	¥ 30.8 /tCO ₂ e	5.4 MtCO ₂ e	Main provider of voluntary credits to the Guangdong cap-and-trade scheme

⁴⁴ American Carbon Registry, Clean Development Mechanism, Climate Action Reserve, Gold Standard, Verified Carbon Standard, In USD, average full-year 2021 price

⁴⁵ China Certified Emission Reduction, In CNY, average full-year 2021 price; Guangdong Puhui Certified Emission Reductions, In CNY, average full-year 2022 price

⁴⁶ As at April 2022

Cap-and-trade, of which is eligible	Geography/ covered regions	Sectors covered/ sectoral eligibility	Services offered	Underlying methodologies and protocols	Compatibility with other standards
California, Quebec, CORSIA	Global, some sectors only in the US	Restricted to fuel combustion, industrial processes, LULUCF, CCS, livestock, waste handling, and disposal	Credit scheme and registry	International Standards Organization (ISO) 14064	Clean Development Mechanism
EU, NZ and South Korea ETS; ICAO	Developing countries	All except nuclear, some limits on forestry projects (only AF/RF6 allowed)	Credit standards and registry	Kyoto Protocol	Gold Standard
California, Quebec, CORSIA	US and Mexico	Restricted to California's offset programme + landfill gas, livestock, nitrogen, and organic waste	Compliance / voluntary offset programme and registry	N/A	Verified Carbon Standard
CORSIA	Global	Restricted to renewable energy, energy efficiency, industrial waste handling, and AFOLU	Credit scheme and registry, and some retail offering	N/A	Clean Development Mechanism
California, Quebec, CORSIA	Global	All except nuclear, some limits on forestry projects (only A/R allowed)	Credit scheme and registry, and independent assessment	N/A	Clean Development Mechanism, Joint Implementation
China	China	Renewable energy, forestry carbon sink, methane utilization projects	Credit scheme and registry	Clean Development Mechanism	Clean Development Mechanism
China	Guangdong	Renewable energy, forestry carbon sink, methane utilization projects (marine carbon sinks, mangrove carbon sink projects in the future)	Credit scheme and registry	CCER	Clean Development Mechanism

Comparison of Voluntary Carbon Market Mechanisms and Related Infrastructure in Different Markets

As mentioned in previous sections, carbon markets, broadly categorised as compliance and voluntary markets, are now one of the most important policy tools for many jurisdictions to combat climate change. In the case of Hong Kong, while the city's "super-connector" role can help in bridging the Mainland and other economies of the world in terms of carbon markets, the city has a limited domestic supply of carbon credits. Hence, rather than establishing a compliance market in Hong Kong, opportunities in VCM should be explored.

The emission reduction goals of many large-emitting jurisdictions has sparked the growth of VCMs, with some of the significant ones being in the US, Europe, and Asia. This section aims to take a closer look at the VCMs of various jurisdictions, covering Mainland China's Beijing Green Exchange and the Shanghai Environment and Energy Exchange, US's Xpansiv (CBL), Europe's European Energy Exchange, and Singapore's AirCarbon Exchange and Climate Impact X. These VCMs have been selected as they are examples of leading or pioneering VCMs in their respective operating jurisdictions, some of which are heavy GHG-emitting jurisdictions.

Each VCM varies in terms of the types of product and offset project covered, the standards/methodologies used, quality control approaches, and technology adopted, etc. As such, this section will compare the selected VCMs by focusing on these characteristics. In addition, while it may not be the focus of this paper, please refer to Appendix 1 for a brief comparison of the various compliance markets.

Overview of selected voluntary carbon markets

China Beijing Green Exchange

China Beijing Green Exchange (北京綠色交易所有限公司; CBGEX), formerly known as China Beijing Environment Exchange (CBEEEX), was established in 2008 and adopted its new name in 2020 as a platform for trading various environmental equities. CBGEX is designated by Mainland China's economic development body, the National Development and Reform Commission (NDRC), as a trading organisation for voluntary carbon credits, including CCERs. Some notable partners of CBGEX are UNDP, UNEP, World Bank, Korea Exchange, and Africa Carbon Trade Exchange.⁴⁷

In November 2011, the State Council issued a document entitled "Opinions of the State Council on Supporting the High-quality Development of Beijing Municipal Administrative Centre",⁴⁸ which supports the CBGEX to become a global green exchange and a sustainable financial centre.⁴⁹

CBGEX was one of the eight pilot cities for carbon allowance trading in 2011. When Mainland China decided that Shanghai was to be the platform for trading on the national carbon market, CBGEX transitioned into becoming a trading platform for voluntary carbon credits by adding more green products to its offering.⁵⁰ CBGEX's positioning is to serve the emitters that are not covered by Mainland China's compliance markets, but who have carbon neutrality targets.

⁴⁷ China Beijing Green Exchange (CBGEX), About Us, <https://www.cbeex.com.cn/article/gywm/hzhh/>

⁴⁸ The document is known as《國務院關於支持北京城市副中心高質量發展的意見》in Chinese.

⁴⁹ Sina, 對話北京綠色交易所董事長王乃祥：碳量化、碳定價與碳金融是雙碳利器, June 2022, <https://finance.sina.com.cn/esg/pa/2022-06-21/doc-imizirau9712100.shtml>

⁵⁰ CCTV, 專家解讀北京綠色交易所升級：在全球碳市場的規則制定中將會有中國的聲音, December 2021, <https://auto.cctv.com/2021/12/02/ARTIjYr0lqIuuBX19ZmUuM0u211202.shtml>

Volume: In 2021, CCER's trading volume in CBGEX accounted for 11% of Mainland China's annual CCER trading volume, with ~17.28 MtCO₂e transacted.⁵¹ In 2021, the average price of a carbon quota transaction on CBGEX reached 72.86 yuan (around US\$10) per tonne, and the highest price exceeded 107 yuan (around US\$15) per tonne.⁵² The cumulative turnover of Beijing's carbon market allowances exceeded 2.11 billion yuan (around US\$300 million) by the end of 2021.⁵³

Trading mechanisms: CBGEX has three trading platforms,⁵⁴ namely the Beijing Carbon Emission Rights Electronic Trading Platform (北京市碳排放權電子交易平台) CCER Electronic Trading Platform (核證自願減排量電子交易平台) and Voluntary Emission Reduction Electronic Trading Platform (自願減排量電子交易平台), which offer spot trading for CCERs, Beijing Emission Allowance, Forest Certified Emission Reduction, and Green Transport Certified Emission Reduction.⁵⁵

Industry covered and product offerings: CBGEX covers 800 key emitters⁵⁶ from sectors such as electricity, heating, cement, petrochemicals, other industrial enterprises, manufacturers, services, public transport, and domestic aviation.⁵⁷ CBGEX's business includes carbon emission trading, pollution permit trading, usage permit trading and financing, and low-carbon transformation services. The exchange aims to become a value discovery platform and market trading centre for domestic and international environmental rights products (環境類權益).

Standards/methodologies: Prior to listing on one of the trading platforms in CBGEX, the energy-saving project needs to have the relevant energy-saving methodology audited and certified by a third-party agency. The following three energy-saving methodologies published in Mainland China are accepted by the CBGEX:⁵⁸

- i. CN-TZ-01-1 Energy Saving Product Application Mechanism Energy-Saving Baseline Methodology and Monitoring Methodology
- ii. CN-TZ-02-1 Energy Conservation Project Mechanism Energy-Saving Baseline Methodology and Monitoring Methodology
- iii. CN-TZ-03-1 Organizational Energy Efficiency System Optimization Mechanism Energy-Saving Baseline Methodology and Monitoring Methodology

⁵¹ Shanghai Environment and Energy Exchange (SEEE), 2021碳市場工作報告, April 2022, <https://www.cneee.com/upload/resources/file/2022/04/29/28212.pdf>

⁵² King & Wood Mallesons, China's National Carbon Market: A Guide for Investors, August 2022, <https://www.kwm.com/content/dam/kwm/insights/download-publication/hongkong/2022/China%20National%20Carbon%20Market%20A%20Guide%20for%20Investors.pdf>

⁵³ Beijing Review, Trade carbon for a green future, 21 February 2022, https://www.bjreview.com/Business/202202/t20220221_800276368.html

⁵⁴ CBGEX, 碳交易中心, <https://www.cbeex.com.cn/article/ywzx/tjyz/tjrlw/>

⁵⁵ Lexology, China's national carbon market: a guide for investors, August 2022, <https://www.lexology.com/library/detail.aspx?g=896b54ca-ac93-46f8-9ff6-d1e1da4b5899>

⁵⁶ Beijing Review, Trade carbon for a green future, February 2022, https://www.bjreview.com/Business/202202/t20220221_800276368.html

⁵⁷ Lexology, China's national carbon market: a guide for investors, August 2022, <https://www.lexology.com/library/detail.aspx?g=896b54ca-ac93-46f8-9ff6-d1e1da4b5899>

⁵⁸ CBGEX, 項目掛牌, HYPERLINK "about:blank" <https://www.cbgex.com.cn/article/xmgp/gpsp/zyjnxm/>

Shanghai Environment and Energy Exchange

The Shanghai Environment and Energy Exchange (上海環境能源交易所, SEEE) was officially opened in November 2013. Specialising in climate change mitigation and adaptation services, SEEE is the designated trading platform of the Shanghai Emission Allowance (SHEA), and one of the trading platforms for China Emission Allowance. In addition to trading carbon emission allowances, SEEE also facilitates the trading of CCERs.

SEEE is the trading platform for Mainland China's national-level carbon market for carbon allowance. In 2021, the total turnover of China Emission Allowances (CEA) in the national carbon market was 179 million tons,⁵⁹ with a total transaction value of RMB 7.7 billion.⁶⁰ SEEE also leads the national carbon market among other pilot cities. While the national carbon market and provincial carbon markets are traded separately, the latter are expected to be integrated into the national one eventually. It is worth noting that while SEEE is responsible for building the trading system, the China Hubei Emission Exchange in Wuhan, Hubei province, is responsible for applications and data collection.⁶¹

Volume: In 2021, CCER's volume traded on SEEE reached 60.5 MtCO₂e, representing a 187.78% increase from the year before. Its turnover was up to RMB 1.32 billion, accounting for 35% of the national total CCER transaction volume and ranked top in Mainland China.⁶²

Trading mechanisms: CCERs trading on SEEE is conducted in the secondary market either through public listing (掛牌交易) or negotiated transfer (協議轉讓). In 2021, near 100% (99.99%) of the CCERs⁶³ traded on SEEE were made via negotiated transfer. This is because the Shanghai carbon market has flexible CCER trading rules, facilitating both parties to easily realise online agreement transactions with agreed prices and quantities.

Industry covered and product offerings: Sectors covered by SEEE include airports, domestic aviation, chemical fibres, chemicals, commercial, power and heat, water suppliers, hotels, financial, iron and steel, petrochemicals, ports, shipping, nonferrous metals, building materials, paper, railways, rubber, and textiles.⁶⁴ In addition to trading CCERs, SEEE also trades carbon emission rights/allowances (Shanghai Emission Allowance and China Emission Allowance), carbon emission forward products trading, carbon finance, and carbon consulting services.

⁵⁹ Refinitiv, One year in : China's national emission trading system, 25 July 2022, <https://www.refinitiv.com/perspectives/market-insights/one-year-in-chinas-national-emission-trading-system/#:~:text=A%20total%20of%20179%20million,detail%20in%20a%20subsequent%20blog.>)

⁶⁰ Hongkou District Ecological Environmental Bureau, Bulletin of Hongkou District Ecological Environment in 2021, June 2022, <http://www.shhk.gov.cn/English/006002/006002001/20220606/b9f09571-9d1a-4437-9a5c-77b39882421d.html>

⁶¹ Government of China, Carbon trading trials gain traction in China, May 2021, http://english.www.gov.cn/news/topnews/202105/25/content_WS60ac31d8c6d0df57198da06e.html

⁶² Shanghai Environment and Energy Exchange (SEEE), 2021碳市場工作報告, April 2022, <https://www.cneee.com/upload/resources/file/2022/=04/29/28212.pdf>

⁶³ In 2021, 229 market entities were involved in CCER trading, of which 51% were investment institutions.

⁶⁴ Lexology, China's national carbon market: a guide for investors, August 2022, <https://www.lexology.com/library/detail.aspx?g=896b54ca-ac93-46f8-9ff6-d1e1da4b5899>

Xpansiv (CBL)

Xpansiv, based in the US, is a global exchange platform for trading energy and environmental commodity products such as carbon, renewable energy, natural gas, and water. One of its key business units is CBL – the largest spot exchange for ESG commodities, including carbon. There are more than 150 market participants active on the platform, including project developers, corporate sustainability managers, banks, brokers, and trading firms.

Volume: In 2021, carbon volume on CBL exceeded 121.5 MtCO₂e, representing a 288% increase from the year before.⁶⁵ Its market share of the global VCM doubled to 36% based on volume and 41% based on notional value, according to CBL’s self-disclosed data and figures from Ecosystem Marketplace.⁶⁶ It reportedly hosts 90% of all voluntary carbon credit transactions worldwide, making it the dominant player in the global VCM.⁶⁷

Trading mechanisms: Carbon credits are traded on the CBL platform, on which investors can choose to trade a range of offset projects from leading registries across the globe. Xpansiv offers market participants a transparent order book⁶⁸ that enables market participants to see live pricing. The order book also offers project-level information and is integrated with leading registries such as ACR and GS.⁶⁹ Xpansiv has also implemented other initiatives to improve its trading transparency. In 2020, Xpansiv launched the XSignals market data service to offer exchange-derived data for the VCM and ESG commodity market to support companies with compliance and risk management.⁷⁰ In 2021, it also partnered with S&P Global Platts to create new benchmarks that seek to increase transparency, rigorousness, and integrity for the pricing of VCM assets.⁷¹

Industry covered and product offerings: On CBL, apart from carbon credits from major registries around the world, including ACR, VCS, and GS, the platform also facilitates the trading of emission allowances from the California Air Resources Board (CITSS). The platform also offers three flagship offset contracts which are designed for those who are hesitant to choose an individual carbon offset project, but would rather credits from contracts that meet a specific standard, such as ICAO-CORSIA criteria or Verra’s CCB criteria.⁷²

⁶⁵ Xpansiv, 2021 Xpansiv Carbon Volume Rises 288% Driven by Surge of Corporate Net-Zero and ESG Demand, January 2022, <https://xpansiv.com/2021-xpansiv-carbon-volume-rises-288/>

⁶⁶ CarbonCredits.Com, The Top 4 Carbon Exchanges for 2022, May 2022, <https://carboncredits.com/the-top-4-carbon-exchanges-for-2022/>

⁶⁷ Ibid

⁶⁸ An order book is a list of orders that presents different offers from buyers and sellers for a specific security. <https://corporatefinanceinstitute.com/resources/wealth-management/order-book/>

⁶⁹ CarbonCredits.Com, The Top 4 Carbon Exchanges for 2022, May 2022, <https://carboncredits.com/the-top-4-carbon-exchanges-for-2022/>

⁷⁰ Xpansiv, XSignals, <https://xpansiv.com/xsignals/>

⁷¹ Xpansiv, S&P Global Platts and Xpansiv Partner to Advance Price Transparency in Global Carbon Markets, November 2021, <https://xpansiv.com/sp-global-platts-and-xpansiv-partner-on-vcm-transparency/>

⁷² Xpansiv, N-Geo, <https://xpansiv.com/n-geo/>

European Energy Exchange

The European Energy Exchange (EEX) is based in Germany and belongs to the EEX Group – a group of companies that offer energy commodity products and provide market platforms for trading related products. The AirCarbon Exchange in Singapore is EEX Group's strategic partner for related VCM products on this exchange platform.

Volume: n/a

Trading mechanisms: According to an EEX Group press release, VCM products will be made available to market participants across multiple time zones. EEX Group also collaborates with industry partners to support product development, risk management, client relationships, and geographic coverage.⁷³

Industry covered and product offerings: EEX Group launched a VCM product suite in June 2022 in North America at its Nodal Exchange, and planned to launch the same set of products for EEX in Europe in 2023. The VCM contract suite which EEX Group intends to offer will cover four products with different areas of focus:⁷⁴

- **Verified Emission Reduction (VER) CORSIA-eligible** – aligned with the eligibility rules of the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA), overseen by the International Civil Aviation Organisation.
- **Verified Emission Reduction (VER) Nature-based** – carbon credits from nature-based solutions. Separate vintage contracts are offered with a view to carbon credits by year of occurrence of CO2 reduction.
- **Carbon Removal** – a contract designed to focus on carbon removal and sequestration.
- **Global Emission Reduction (GER)** – a product that represents the entire VCM, known to be adopting a basket approach and gradual pathway to net zero.

⁷³ European Energy Exchange (EEX), EEX Group outlines roadmap for entry into Voluntary Carbon Market, May 2022, https://www.eex.com/fileadmin/Global/News/EEX/EEX_Press_Release/2022/20220524_EEX_Group_VCM_01.pdf

⁷⁴ EEX, EEX Group outlines roadmap for entry into Voluntary Carbon Market, May 2022, https://www.eex.com/en/newsroom/detail?tx_news_pi1%5Baction%5D=detail&tx_news_pi1%5Bcontroller%5D=News&tx_news_pi1%5Bnews%5D=4479&cHash=4fc9690f0a813f553aa456d0eac464d6

Air Carbon Exchange

AirCarbon Exchange (ACX), based in Singapore and launched in 2019, is a blockchain-based voluntary carbon exchange and the world's first fully digitalised carbon marketplace.⁷⁵ ACX's clients include corporate entities, financial traders, and carbon project developers, with 132 companies on the exchange (as of September 2021).⁷⁶ ACX pays the developer a portion of their trading commissions every time their carbon credits change hands.

Volume: In the first half of 2021, the platform traded 3.6 MtCO₂ equivalent.⁷⁷

Trading mechanisms: Carbon credits are organised into different tradable carbon asset classes according to the industry/sector they serve. Carbon credits are held by the exchange, which is stored in a trust. For every credit deposited into the trust, a corresponding token will reside on the exchange. ACX's exchange uses distributed ledger technology to securitise carbon credits into digital tokens (receipts), showing the ownership between the carbon credits held in the trust and the digital token (receipt). Like in traditional commodity exchanges, owners of tokens can request physical delivery of the underlying carbon credits.⁷⁸

Industry covered and product offering: Current tokens trading on the platform cover aviation industry projects, nature-based projects (e.g., forestry), renewable energy projects, improved cooking solution projects, and projects that meet the United Nations Sustainable Development Goals.

Standards/methodologies and other quality control measures: ACX uses the British Standards Institution (BSI) to verify its tokens and carbon credits, with a view to ensuring that the reported information about a carbon credit is accurate and conforms to the token specifications required by ACX. All carbon credits on the ACX platform are certified by global standards, such as GS, VCS, CAR, or CDM. They also partner with market surveillance and risk solution provider Eventus for trade surveillance, transaction monitoring, and anti-money laundering (AML) in its spot and derivatives markets globally.⁷⁹

⁷⁵ AirCarbon Exchange (ACX), AirCarbon Collaborates With Abu Dhabi Global Market to Achieve World's First Carbon Neutral International Financial Centre, <https://www.aircarbon.co/adgm-acx>

⁷⁶ Wealth & Society, AirCarbon's Thomas McMahon: "Carbon trading is not borderless", September 2021, <https://www.wealthandsociety.com/updates-and-articles/acxs-mcmahon-carbon-trading-is-not-borderless>

⁷⁷ ACX, H1 Performance Solidifies AirCarbon Exchange's International Reach and Position as a Leading Global Carbon Exchange, August 2021, <https://www.aircarbon.co/h12021>

⁷⁸ ACX, AirCarbon Exchange, <https://www.aircarbon.co/exchange>

⁷⁹ PR Newswire, AirCarbon Exchange selects Eventus as partner to introduce first comprehensive market surveillance program for Voluntary Carbon

Climate Impact X

Climate Impact X (CIX),⁸⁰ launched in 2021 through a pilot trial,⁸¹ is a Singapore-based global marketplace and exchange for carbon credits. It was developed by DBS, the Singapore Exchange, Standard Chartered, and the sovereign wealth fund Temasek. CIX is part of Singapore's efforts to position the city-state as a hub for carbon-related services. In June 2022, CIX and Nasdaq signed a strategic technology partnership to improve the price transparency and liquidity of the VCM.⁸²

Volume: CIX's pilot auction, which ran between March 2021⁸³ and November 2021, involved eight projects and 19 buyers, with 170,000 tCO₂e transacted at an average price of US\$8 per tonne.⁸⁴

Trading mechanisms: CIX has three platforms for trading carbon-related products, namely CIX Project Marketplace, CIX Auctions, and CIX Exchange, with the latter two soon to be launched.

- CIX Project Marketplace is an online platform for businesses and carbon project developers who need to list, compare, purchase, and retire carbon credits.⁸⁵
- CIX Auctions will host unique projects or customised portfolios of curated projects. It will be suitable for suppliers with rare, large-scale, or new-to-market carbon credits, and buyers looking to discover and procure such projects.⁸⁶
- CIX Exchange is designed for professional traders, brokers, and financial institutions who are seeking to trade liquid, standardised contracts without counterparty risks.

Industry covered and product offerings: The trading platform is fully operational in late 2022, offering spot trading of standardised contracts on carbon offset credits and catering to multinational corporations and institutional investors.⁸⁷ The platform allows for the trading of carbon credits sourced from nature and technology-based projects.

⁸⁰ Climate Impact X (CIX), <https://www.climateimpactx.com/>

⁸¹ CIX, CIX completes first-of-its-kind portfolio auction of voluntary nature-based carbon credits with leading global companies, November 2021, [https://uploads-ssl.webflow.com/6230bcdb48cea930e5e38a3e/6230bcdb48cea9245ae38b60_Press%20Release%20-%20CIX%20Pilot%20Auction%20-%201.11.21_FINAL%20\(003\).pdf](https://uploads-ssl.webflow.com/6230bcdb48cea930e5e38a3e/6230bcdb48cea9245ae38b60_Press%20Release%20-%20CIX%20Pilot%20Auction%20-%201.11.21_FINAL%20(003).pdf)

⁸² CIX, Climate Impact X selects Nasdaq Technology to power new global carbon exchange, June 2022, https://uploads-ssl.webflow.com/6230bcdb48cea930e5e38a3e/62bba4f9d721c4072b3b8f4d_Media%20release%20-%20CIX%20Selects%20Nasdaq%20Technology%20for%20Spot%20Exchange.pdf

⁸³ PR Newswire, Carbonplace and Climate Impact X collaborate to revolutionize carbon credit trading, March 2022, <https://en.prnasia.com/releases/apac/carbon-place-and-climate-impact-x-collaborate-to-revolutionize-carbon-credit-trading-355844.shtml>

⁸⁴ S&P Global, INTERVIEW: Singapore's Climate Impact X to hold new carbon auctions, launch standardized contracts in 2022, December 2021, <https://www.spglobal.com/commodityinsights/en/market-insights/latest-news/energy-transition/122221-interview-singapores-climate-impact-x-to-hold-new-carbon-auctions-launch-standardized-contracts-in-2022#:~:text=It%20completed%20its%20pilot%20auction,average%20price%20of%20%248%2FmCO2e.>

⁸⁵ CIX, <https://www.climateimpactx.com/>

⁸⁶ Ibid

⁸⁷ CIX, DBS, SGX, Standard Chartered and Temasek to take climate action through global carbon exchange and marketplace, May 2021, [https://uploads-ssl.webflow.com/6230bcdb48cea930e5e38a3e/6230bcdb48cea95eb0e38b63_Climate%20Impact%20X%20Press%20Release%20-%202020%20May%202021%20\(1\).pdf](https://uploads-ssl.webflow.com/6230bcdb48cea930e5e38a3e/6230bcdb48cea95eb0e38b63_Climate%20Impact%20X%20Press%20Release%20-%202020%20May%202021%20(1).pdf)

Standards/methodologies and other quality control measures: Credits and projects must go through various checks at different stages.⁸⁸

- a. According to CIX's website, it uses "satellite monitoring, machine learning, and blockchain technology to enhance [the] transparency, integrity, and quality of carbon credits."⁸⁹
- b. Credits are verified by global standards such as VCS and GS, and ratified by an International Advisory Council (IAC), which is a panel consisting of over 20 experts in sustainability, representing NGOs, project developers, standard-setting agencies, and other corporates.
- c. Projects are required to meet CIX criteria based on attributes, biodiversity, social integrity, and project governance. They also carry out due diligence on projects to ensure that they bring positive externalities, independent rating companies will conduct a project risk assessment, and that projects will be monitored on an on-going basis.

Apart from the above named VCMs, other jurisdictions around the world are also actively looking to set up a VCM in their respective jurisdictions. For example, the London Stock Exchange (LSE) launched its VCM in October 2022 after an initial consultation in May 2022.⁹⁰ The LSE VCM will be used to help developers finance projects that mitigate climate change and yield carbon credits. Closed-ended investment funds and operating companies admitted or seeking admission to trading on the LSE markets can raise capital from investors in the form of an IPO. Investors, including institutional, retail, and corporate investors seeking to reduce their carbon, will be able to invest in the carbon projects as an asset class.

Hong Kong Exchanges and Clearing Limited (HKEX) launched Core Climate in October 2022,⁹¹ its new international carbon marketplace in Hong Kong that seeks to facilitate effective and transparent trading of carbon credits and instruments. All carbon credits traded on the platform are derived from projects verified against international carbon standards.

⁸⁸ CIX, About, <https://www.climateimpactx.com/about#>

⁸⁹ Temasek, DBS, SGX, Standard Chartered and Temasek to take climate action through global carbon exchange and marketplace, May 2021, <https://www.temasek.com.sg/en/news-and-resources/news-room/news/2021/DBS-SGX-Standard-Chartered-Temasek-to-take-climate-action-through-global-carbon-exchange-and-marketplace>

⁹⁰ London Stock Exchange, The Voluntary Carbon Market (October 2022), https://www.londonstockexchange.com/raise-finance/equity/voluntary-carbon-market?accordionId=0-245e5fa9-c4b1-4cbf-86d0-92fba35ddc7a&moduleId=block_content%3A3978479c-615e-410c-8764-5b0a5c95b0f8

⁹¹ HKEX, HKEX Launches Core Climate, Hong Kong's International Carbon Marketplace, supporting Global Transition to Net Zero (October 2022), https://www.hkex.com.hk/News/News-Release/2022/221028news?sc_lang=en

Table 2. Comparison of selected VCMs

	Year of implementation	Headquartered	Carbon offset projects	With carbon emission allowance trading	Key certification mechanism(s)/ issuer(s) of credits	Participants in the trading market	Trade volume (2021)
 CBGEX	2008	Mainland China	CCER; Beijing Emission Allowance	Yes	Verified by one of the three methodologies issued by Mainland China	Eight major sectors with 800 key emitters	CCER's volume was ~17.28 MtCO ₂ e
 SEEE	2008	Mainland China	CCER; CEA; SHEA	Yes	Unidentified	229 market entities	CCER's volume was 60.5 MtCO ₂ e
 CBL	2009	US	International credits, e.g., Verified Carbon Units and Gold Standard Credits	Yes	Global registries, e.g., Verra and Gold Standard	150 market participants active on the platform, including project developers, corporate sustainability managers, banks, brokers, and trading firms	Exceeded 121.5 MtCO ₂ e
 EEX	2023 (planned)	Europe	International credits, e.g., Verified Carbon Units and Gold Standard Credits	Yes	Global registries, e.g., Verra and Gold Standard	400 members ranging from corporations to state and municipalities	n/a
 ACX	2019 (pilot) Late 2022 (full operation)	Singapore	International credits, e.g., Verified Carbon Units and Gold Standard Credits	Unidentified	Global registries, e.g., Verra and Gold Standard	Corporate entities, financial traders, and carbon project developers	During the first six months of 2021, 3.6 MtCO ₂ e traded
 CIX	2021	Singapore	International credits, e.g., Verified Carbon Units and Gold Standard Credits	Unidentified	Global registries, e.g., Verra and Gold Standard	Primarily international and multinational corporations and institutional investors	170,000 tCO ₂ e transacted (during the piloting period)
 Core Climate	October 2022	Hong Kong	International credits, e.g., Verified Carbon Units	Unidentified	Global registries, e.g., Verra and Gold Standard	Internationally-certified projects from forestry, solar, wind, hydropower and biomass initiatives in Asia, South America and West Africa. ⁹²	Around 400,000 tonnes in the first 4 weeks since launch (28 October and 24 November 2022)

⁹² HKEX, Early momentum for Core Climate, Hong Kong's new international carbon marketplace, 24 November 2022, https://www.hkex.com.hk/News/News-Release/2022/2211242news?sc_lang=en#:~:text=The%20platform%20recorded%20more%20than,400%2C000%20tonnes%20of%20carbon%20credits.

Challenges of Voluntary Carbon Markets

VCMs, as with the financial markets, can be perceived as primary and secondary markets. The primary market is where project developers sell carbon credits to buyers for the first time after credits have been generated, verified, and issued. The secondary market is where all the subsequent transactions occur.⁹³ Some of the key actors who help to transform carbon offset projects into carbon credits which can then be bought and sold on the primary markets are project developers, standard bodies, and brokers. These actors mirror some of the key stakeholders in the public listing journey of a company in the financial markets. The secondary market consists of private sector buyers and sellers who can help to provide better price discovery and efficient trading.

VCMs are the key players in supporting governments to reach their carbon emission goals. However, the voluntary markets are confronted with numerous challenges that have put their credibility in doubt, undermining the role they can play in carbon emission reduction. This section discusses some significant challenges in the primary and secondary carbon markets.

Primary Market – Registry

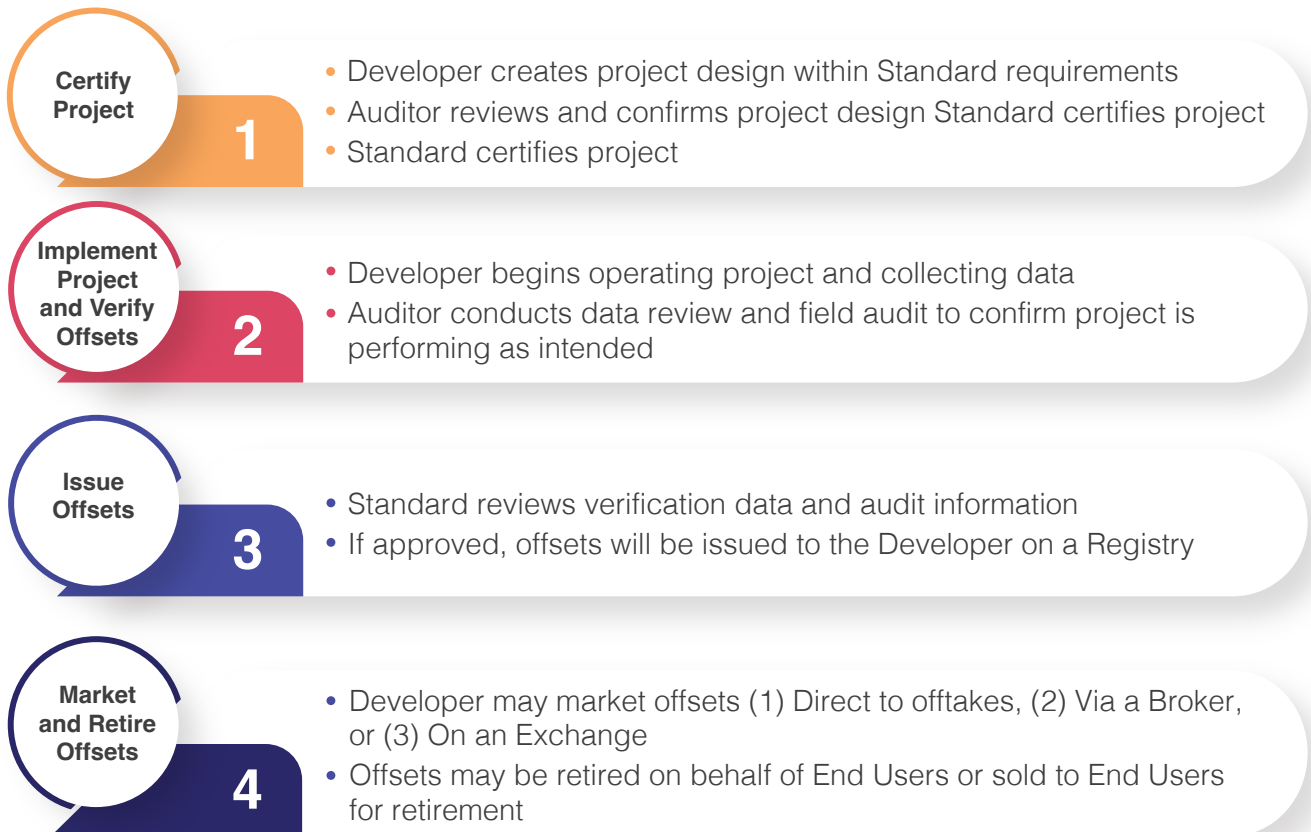
Before a carbon offset project can generate carbon credits for buyers, project developers will need to register a project with a carbon offset programme (i.e., standard). The project needs to go through several rounds of approval, including but not limited to the following steps:⁹⁴

- a. Upon designing the project according to different standards (such as Verra or the Gold Standard), it needs to go through a stakeholder consultation to ensure the project will not adversely impact the local community.
- b. An independent third-party auditor will review and validate the project design, and a standard will certify the project.
- c. The project developer will then begin to operate the project and collect data.
- d. The auditor will subsequently review the data and field audit the project to confirm that the project is performing as intended.
- e. The developer will submit the project design plan, validation report, and public consultation feedback to the standard.
- f. Upon successful verification from the standard, a registry will issue carbon credits to the project developer.
- g. Carbon credits can then be sold to buyers directly via a broker or exchange.

⁹³ Center for Climate and Energy Solutions, Secondary Carbon Markets, April 2016, <https://www.c2es.org/wp-content/uploads/2016/04/secondary-carbon-markets.pdf>

⁹⁴ Carbon Offset Research and Education (CORE), Carbon Offset Guide, <https://www.offsetguide.org/understanding-carbon-offsets/carbon-offset-projects/offset-project-implementation/>

Figure 7. Carbon offset project development process



Source: BoA⁹⁵

High registration cost

The multiple steps of getting a carbon offset project to a registry and being able to sell to buyers involve considerable costs, including registration and issuance costs payable to a registry, as well as certification, verification, on-going monitoring, and verification costs payable to validation and verification bodies (VVBs). Many voluntary market standards can be used to verify carbon offset projects.

⁹⁵ From documents provided by the Bank of America.

The costs charged by the three leading standards are summarised below.⁹⁶

Figure 8. Cost comparison of selected standards

Key cost	VCS (as of April 2020) ⁹⁷	ACR (as of January 2021) ⁹⁸	Plan Vivo ⁹⁹
Account fee	US\$500	US\$500	US\$1000 ¹⁰⁰
Registration fee	US\$0.10 x estimated annual volume of emission reductions or verification period quantity; capped at US\$10,000 The registration fee is credited towards the future VCU issuance fee.	For projects using California ARB protocols: US\$7,500 For projects using ACR methodologies: US\$1,000	Variable
Credit issuance	<ul style="list-style-type: none"> • 1 – 10,000 - US\$0.05 • 10,001-1,000,000 - US\$0.14 • 1,000,001-2,000,000 - US\$0.12 • 2,000,001-4,000,000- US\$0.105 • 4,000,001-6,000,000- US\$0.085 • 6,000,001-8,000,000 - US\$0.06 • 8,000,001-10,000,000- US\$0.04 • > 10,000,000 - US\$0.025 	No fee. An activation fee (per offset) of US\$0.15 needs to be paid before a credit can be transacted, retired, or cancelled.	<ul style="list-style-type: none"> • ≤ 50,000 PVC¹⁰¹ p.a. = \$ 0.40/PVC • > 50,000 PVC p.a. = \$ 0.35/PVC • > 250,000 PVC p.a. = \$ 0.30/PVC

Source: Verra, American Registry, and Plan Vivo

Validation, verification, and on-going monitoring costs vary by project, depending on the type of project and scale of the project. Larger projects are able to enjoy economies of scale, hence lower per unit costs. As the validation, verification, and related fees vary, they are not widely disclosed by VVBs. However, attempts have been made by third-party studies to identify the fee amount. According to a 2021 study conducted by Trove Research and University College London, the project validation, management, and monitoring cost is around US\$40,000 per project per year for a restoration project with a size of 72,000 tCO₂.¹⁰²

Therefore, if we were to use the above restoration project as an example, the cost of developing and registering a carbon offset project on three standards ranges from US\$51,300 to US\$70,300.

⁹⁶ USAID, Protecting Ecosystems and Restoring Forests in Malawi (PERFORM), February 2016, https://pdf.usaid.gov/pdf_docs/PA00TFCR.pdf

⁹⁷ Verra, Program Fee Schedule, April 2020, https://verra.org/wp-content/uploads/2020/04/Program-Fee-Schedule_v4.1.pdf

⁹⁸ American Carbon Registry, Membership, <https://americancarbonregistry.org/how-it-works/membership>

⁹⁹ Plan Vivo, Costs & Fees, <https://www.planvivo.org/costs-and-fees>

¹⁰⁰ Plan Vivo does not charge an account fee, but it charges a US\$ 1,000 fee for a Project Idea Note (PIN) review, which defines the main elements of a proposed project and how it will contribute to sustainable livelihoods. Please see Plan Vivo, Registration Process, <https://www.planvivo.org/registration-process>

¹⁰¹ PVC standards for Plan Vivo Certificates.

¹⁰² Trove Research, Future Demand, Supply and Prices for Voluntary Carbon Credits – Keeping the Balance, June 2021, <https://trove-research.com/wp-content/uploads/2021/06/Trove-Research-Carbon-Credit-Demand-Supply-and-Prices-1-June-2021.pdf>

Figure 9. Cost comparison for registering a restoration project with a size of 72,000 tCO2 on selected standards

Key cost (US\$)	VCS	ACR	Plan Vivo
Account fee	500	500	1000
Registration fee	7,200	1,000 ¹⁰³	4,100 ¹⁰⁴
Credit issuance	9,180	10,800	25,200
Validation, verification, and on-going monitoring	40,000	40,000	40,000
Total cost	56,880	51,300	70,300

Source: Trove Research, University College London and FSDC calculations

A high registration cost has frequently been cited as the main deterrence for project developers to start offset projects.¹⁰⁵ Project developers will be more willing to develop offset projects if the high upfront cost can be partially funded through carbon financing or/and if the perceived return on investment is sufficient to cover the cost. When the demand for such credits is insufficient, it poses a risk that new voluntary market projects will not be able to attain a reasonable level of cost efficiency, which will deter project investors from providing financing facilities to local communities for such projects.

Long registration / approval process of carbon credits

As the development of a carbon offset project must go through multiple steps, as outlined above, the lead time required for different steps brings about a lengthy registration process, depending on the standard that a project developer chooses. In some cases, the approval process can take two to three years.¹⁰⁶ For instance, the monitoring process can take one¹⁰⁷ to two¹⁰⁸ years before the next step (project verification) can begin. While the industry acknowledges that a thorough approval process can ensure the high quality of carbon credits, the unnecessarily long waiting time makes the process cumbersome. Moreover, for issuers, the ability to time the market or justify such investment will be hurt.¹⁰⁹

¹⁰³ Assumed an ACR methodology was used.

¹⁰⁴ Calculated based on the average fee charged by VCS and ACR, as the registration fee charged by Plan Vivo varies.

¹⁰⁵ ICIMOD, Opportunities for small-scale forestry in carbon markets, 2010, <https://lib.icimod.org/record/9230>

¹⁰⁶ Climate Impact Partners, Carbon Market Insights For Project Developers, February 2022, <https://www.climateimpact.com/news-insights/insights/carbon-market-insights-project-developers/>

¹⁰⁷ CarbonCredits.Com, When to Purchase Carbon Offsets in the Project Lifecycle, <https://carboncredits.com/when-to-purchase-carbon-credits-in-the-project-lifecycle/>

¹⁰⁸ Climate Partner, What is the life cycle of a carbon offset project? <https://www.climatepartner.com/en/carbon-offset-projects/project-life-cycle>

¹⁰⁹ McKinsey Sustainability, A blueprint for scaling voluntary carbon markets to meet the climate challenge, January 2021, <https://www.mckinsey.com/business-functions/sustainability/our-insights/a-blueprint-for-scaling-voluntary-carbon-markets-to-meet-the-climate-challenge>

Figure 10. Project development cycle for a carbon offset project

Using Gold Standard as an example, project development takes approximately two years.

Steps for a project to be able to issue Gold Standard (GS) credits ¹¹⁰	Time frame
Project developer initiates a project	Varies
Project developer conducts a stakeholder consultation	Varies
GS conducts a preliminary review	4 weeks
GS-VVB conducts project validation	Must be completed within 2 years after completing the Preliminary Review mentioned above
GS conducts a design review	Minimum 4 weeks
Project proponent monitors the project	1–2 years
GS-VVB conducts verification	Depends on the VVB
GS conducts a performance review	3 weeks
Upon receiving a positive conclusion from Gold Standard, the project will receive “Gold Standard Certified Project” status, thereby allowing the project to issue any Gold Standard Certified Products upon payment of a required fee.	

Source: Gold Standard

According to a 2022 study conducted by a climate tech start-up, delays in verification can cost VCM project developers as much as US\$2.6 billion, preventing the issuance of 4.8 billion tonnes worth of credits by 2030.¹¹¹

¹¹⁰ Gold Standard, Gold Standard for the Global Goals, October 2019, https://globalgoals.goldstandard.org/standards/101_V1.2_PAR_Principles-Requirements.pdf

¹¹¹ Thallo, Fast Forward: Challenges to Scaling the Voluntary Carbon Market, October 2022, https://www.thallo.io/wp-content/uploads/2022/10/Thallo-VCM-report_FINAL.pdf

Secondary Market – Trading

The VCM is highly fragmented, with heterogeneous suppliers, standards, and carbon credits, etc. Such market fragmentation creates issues such as the absence of an economy of scale, making secondary carbon credit trading less attractive, especially to institutional investors. As a result, VCMs are dominated by the primary market, where credits are sold only once and then retired by the purchaser,¹¹² leading to low trading activity and low liquidity. The compliance market has a market value of over US\$100 billion. In contrast, the current global VCM is notably smaller, with a value of US\$300 million in 2020.¹¹³ However, it has the potential to grow to US\$190 billion by 2030 and US\$546 billion by 2050.¹¹⁴ For the secondary market to further develop, some key challenges have to be addressed.

Lack of transparency

As discussed in detail earlier, the quality of carbon credits is subject to scrutiny, and the standards of carbon credits are central to the recognition of such. Since there is no requirement to disclose the price paid for carbon credits in the VCMs, companies may claim to have offset emissions, while they may be purchasing cheaper carbon credits of inferior quality, or credits that are less accepted by international stakeholders. The lack of transparency also makes VCMs more prone to fraud.

The issue of transparency is also related to the secondary market, which suffers from insufficient data sharing on pricing information. Transparency is crucial for market participants to quickly find data and information about products or services and to make informed decisions. The lack of pricing information makes it difficult for carbon credit buyers to know if they are paying a fair price for the types of product they want. Information insufficiency also makes it problematic for suppliers to manage risks around financing and participation in offset projects as the equilibrium price of carbon credits is not efficiently derived.

As with transactions in other markets, pricing transparency is crucial to carbon credit trading as it can lead to sustainable economic viability and investments in developing carbon offset projects. To many participants, the lack of pricing transparency partly explains why VCMs are characterised as buy-and-hold or buy-and-retire markets. Buyers cannot compare carbon credits due to insufficient market data (e.g., price level and transaction volume) that hinders buyers from benchmarking different VCM credits and identifying carbon credits that can be traded at a premium or discount.¹¹⁵

Voluntary carbon credit pricing is driven by several factors, and credits showing certain features tend to be priced higher given the stronger investor demand. Some of the key elements are elaborated as follows.

¹¹² UNFCCC, Submission: New market-based mechanisms to enhance the cost-effectiveness of, and promote, mitigation actions, 2011, <https://unfccc.int/resource/docs/2011/smsn/ngo/227.pdf>

¹¹³ McKinsey Sustainability, Putting carbon markets to work on the path to net zero, October 2021, <https://www.mckinsey.com/capabilities/sustainability/our-insights/putting-carbon-markets-to-work-on-the-path-to-net-zero>

¹¹⁴ Bloomberg, The complexities – and opportunities – of the carbon offset market, 2022, https://spotlight.bloomberg.com/story/carbon-offset-trading/page/3/5?utm_medium=Adwords_SEM&utm_source=pdrch&utm_content=UM&utm_campaign=582644&tactic=582644&gclid=Cj0KCCQjw8O-VBhCpARIsACMvVLMtJpHeSFSm9RvZ2pyNb3QTwy7evSHY6yzW1t8-y7qub8C-AH8OwkaAjvhEALw_wcB

¹¹⁵ BCG & GFMA, Unlocking the Potential of Carbon Markets to Achieve Global Net Zero, <https://www.gfma.org/wp-content/uploads/2021/10/unlocking-the-potential-of-carbon-markets-to-achieve-global-net-zero-full-report-consolidated-vfinal1.pdf>

Figure 11. Voluntary carbon market credit pricing

	Description	Drivers
Base price	The average price in the voluntary market in any given year	Higher demand/lower supply in the market pushes prices up
Registry	The level of verification of the credit	More trusted registries drive a premium
Project type	Forestry/land use, renewables, etc.	Active sequestration and nature-based solutions generally preferred by buyers
Co-benefits	Other benefits stemming from activity around creating the core credit (e.g., education)	Better story for the credit drives a premium with buyers
Location	Region (e.g., North America region)	Proximity drives a premium
Vintage	Time from year issued	Older credits sell at a discount
Project size	High or low credit volume	High volume projects generally sold at a discount

Source: BCG & GFMA

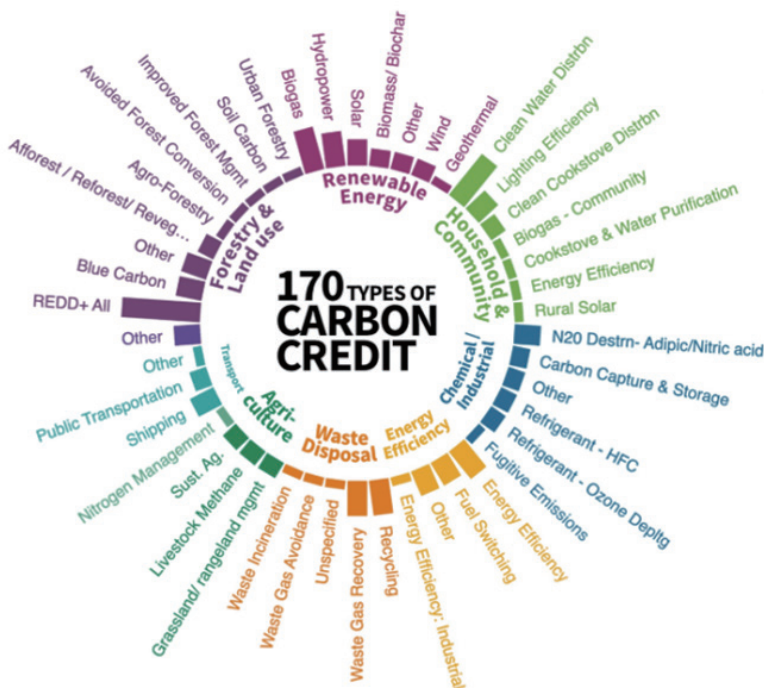
Double counting of carbon credits

A VCM consists of a range of offset projects that generate carbon credits for hundreds of market participants to trade through various exchanges or over-the-counter.¹¹⁶ According to Ecosystem Marketplace, there are 170 types of carbon credit in the global VCM.¹¹⁷ With a fragmented market landscape and the absence of a universally agreed set of regulations and tracking mechanism, challenges such as double counting of voluntary carbon credits has arisen.

¹¹⁶ Norton Rose Fulbright, Creating carbon offset units on the voluntary market, <https://www.nortonrosefulbright.com/-/media/files/nrf/nrfweb/knowledge-pdfs/voluntary-carbon-markets.pdf?revision=&revision=4611686018427387904>

¹¹⁷ Ecosystem Marketplace, The State of the Voluntary Carbon Markets 2022 Q3 briefing, August 2022, <https://www.ecosystemmarketplace.com/articles/the-art-of-integrity-state-of-the-voluntary-carbon-markets-q3-2022/>

Figure 12. Types of carbon credit



Source: Ecosystem Marketplace

In the carbon market, double counting is when two parties claim to have the possession/ownership of the same share of carbon removal or reduction initiatives. This may occur when a voluntary carbon offset project is registered under more than one standard (Gold Standard and VCS), and/or when credits are issued for the same emission reduction project. This is explicitly prohibited and can be verified by registry comparisons.¹¹⁸ Similarly, carbon credits are double counted when carbon credits are issued to more than one party, leading to a situation when parties with possession both claim the same emission reduction result.

Various leading international standards have introduced measures to mitigate the risks of double counting,¹¹⁹ which has been a growing problem confronted by the VCMs as more companies take part in the voluntary market to offset their carbon footprints.¹²⁰ According to a 2018 study conducted by the Environmental Defense Fund, the percentage of the world's emission reduction at risk of double counting could be as high as 29.5%. That is about as much as the combined emissions of China and the US, the world's two most significant emitting countries, put together. According to a 2018 study conducted by the Environmental Defense Fund, the percentage of the world's emission reduction at risk of double counting could be as high as 29.5%.¹²¹ That is about as much as the combined emissions of China and the US, the world's two most significant emitting countries, put together.¹²²

Double counting undermines the integrity and credibility of the VCMs. Inaccurate counting leads to an overestimation of the scale of carbon reduction and an underestimation of the actual global emissions, undermining international carbon reduction efforts. Double counting can disincentivise jurisdictions from implementing much-needed climate action.¹²³

¹¹⁸ Gold Standard, Future Proofing the Voluntary Carbon Markets – Double Counting Post-2020, March 2018, https://www.goldstandard.org/sites/default/files/documents/future_proofing_the_voluntary_carbon_market_double_counting_final_report.pdf

¹¹⁹ Shearman & Sterling, Trust, But Verify: The Recipe for A Global Carbon Credit Trading System, July 2022, <https://www.shearman.com/en/perspectives/2022/07/trust-but-verify-the-recipe-for-a-global-carbon-credit-trading-system>

¹²⁰ Gold Standard, Future Proofing the Voluntary Carbon Markets – Double Counting Post-2020, March 2018, https://www.goldstandard.org/sites/default/files/documents/future_proofing_the_voluntary_carbon_market_double_counting_final_report.pdf

¹²¹ Environmental Defense, Fund, Global Emissions Within and Outside the Scope of Nationally Determined Contributions, June 2018, https://www.edf.org/sites/default/files/documents/EDF_NDC%20Emissions%20Coverage%20Analysis_0.pdf

¹²² CNBC, China's greenhouse gas emissions exceed those of U.S. and developed countries combined, report says, May 2021, <https://www.cnbc.com/2021/05/06/chinas-greenhouse-gas-emissions-exceed-us-developed-world-report.html>; Investopedia, The 5 Countries That 121 Energy Post, Will COP26 set right the booming Carbon Offset Market, November 2021, <https://energypost.eu/will-cop26-set-right-the-booming-carbon-offset-market/>

¹²³ Energy Post, Will COP26 set right the booming Carbon Offset Market, November 2021, <https://energypost.eu/will-cop26-set-right-the-booming-carbon-offset-market/>

Lack of liquidity / supply of high-quality carbon credits

VCMs lack sufficient liquidity, which is essential for efficient trading. The lack of liquidity in the VCMs is partly due to the highly fragmented market landscape. In addition, carbon credits are highly heterogeneous due to the wide disparity of their underlying attributes, such as project offset types, origins, and standards of compliance. The low liquidity would dent the pricing efficiency of the carbon credit market.¹²⁴

The trading (liquidity) of carbon credits could be improved if most, if not all, of them could be subject to the same standards. Despite a generally accepted fact that a quality carbon credit “must represent at least one metric tonne of additional, permanent, and otherwise unclaimed CO₂ emission reductions”, it is far from having broad standardisation.¹²⁵

Largely in line with the description of other international agencies, WWF suggests that quality VCM credits should have the following characteristics: honest; measurable; additional; permanent; non-leakage; monitored, reported, and verified; and comply with social and environmental safeguards.¹²⁶ These characteristics are widely used by various market participants of the VCMs.¹²⁷

¹²⁴ McKinsey Sustainability, A blueprint for scaling voluntary carbon markets to meet the climate challenge, January 2021, <https://www.mckinsey.com/business-functions/sustainability/our-insights/a-blueprint-for-scaling-voluntary-carbon-markets-to-meet-the-climate-challenge>

¹²⁵ Carbon Offset Research and Education (CORE), Carbon Offset Guide, <https://www.offsetguide.org/high-quality-offsets/>

¹²⁶ World Wildlife Fund, WWF position and guidance on voluntary purchases of carbon credits, March 2020, <https://www.worldwildlife.org/publications/wwf-position-and-guidance-on-voluntary-purchases-of-carbon-credits>

¹²⁷ Institute of International Finance, Voluntary Carbon Markets: A blueprint, January 2021, https://www.iif.com/Portals/1/Files/TSVCM_Report.pdf; Climate Focus, A close look at the quality of REDD+ carbon credits, March 2020, <https://climatefocus.com/wp-content/uploads/2022/06/A-close-look-at-the-quality-of-REDD-carbon-credits-2020-V2.0.pdf>

Figure 13. Key features of high-quality carbon credits

Feature	Description
Be real	Each carbon credit must accurately measure how much emission reduction is based on robust methods.
Be measurable	Each carbon credit must be calculated based on robust scientific data using accurate quantification methods, and must be expressed in quantitative terms using standardised GHG metrics.
Be additional	Carbon credits must represent emission reductions or removals that would otherwise not have occurred without incentive resulting from the carbon market.
Be permanent	Carbon credits must represent emission reductions or removals that cannot be reversed. If the risk of permanence reversal is prominent, additional measures or provisions must be in place to manage such risk and account for the reversals should they occur.
Non-leakage	The generation of carbon credits should not lead to an increase in emissions elsewhere, or safeguards must be employed to monitor and mitigate such an increase.
Be monitored, reported, and verified	The emission reductions of carbon credits should be accurately monitored and reported, and must be verified by a credible third-party organisation.
Comply with social and environmental safeguards	The generation of carbon credits must be in compliance with laws, regulations, or treaties, and will not lead to social or environmental grievances; carbon credits must meet the international best practice standard for social and environmental safeguards.

Source: World Wildlife Fund

In reality, VCMs are perceived to be flooded with “poor-quality” credits, partly due to the lack of a governance structure and unified standards that allow market participants to verify the quality of a given carbon credit. Unlike the compliance carbon markets, where rules are set by regulators, VCMs may not have any authoritative governance body. Furthermore, each standard has its own criteria for offset projects and eligibility criteria for entities that can access the registry. Such a non-standardised governance structure would make comparison of carbon credits difficult, leading to lower willingness to participate in relevant trades.¹²⁸

¹²⁸ EY, Voluntary Carbon Market: Challenges and Promises of the Green Transition Tool, August 2021, https://www.ey.com/en_pl/law/voluntary-carbon-market

Key Considerations

In view of leading / pioneering VCMs in the global arena, factors leading to the success of a VCM often lie within the dynamic and solid ecosystem developed in the host city, which resonates with that of an international financial centre.

Hong Kong has developed a deep capital pool thanks to its robust fundamentals and transparent operating environment. Investors, financiers, asset managers, funds, and financial institutions are able to gain access to an all-encompassing and high-quality platform in Hong Kong. Remarkably, in 2021, Hong Kong was home to 78 of the world's 100 top banks,¹²⁹ as well as 1,457 regional headquarters and 2,483 regional offices.¹³⁰ Its strength as a leading financial hub provides a solid foundation for any trading market in terms of attracting investors and capital flow while providing stability to the ecosystem.

In addition, Hong Kong is the dominant gateway to the Mainland market and a key offshore capital raising hub for Chinese enterprises. Various mutual access programmes have further strengthened the connection of the Hong Kong and Mainland financial markets. Leveraging such a strong connection, the city can gain access to the unlimited market potential from one of the largest economies in the world.

With proximity to and support from Mainland China, together with Hong Kong's unique access to global investors and continuous efforts by the government on the ESG front, Hong Kong comes naturally as the premier location for developing the VCM market, serving net-zero needs for corporates and investors across the globe.

In a preliminary assessment¹³¹ published by CASG, developing Hong Kong into a global and high-quality VCM was identified as one of the important next steps for the city to become a regional carbon trading centre. Hong Kong can leverage the strengths of its service-oriented economy and its position as an international financial centre to develop carbon exchange(s) which recognise(s) various carbon trading standards.

With the rising awareness of ESG and carbon neutrality in both Hong Kong and the Mainland, engagement of the private sector in the VCM is expected to increase. The voluntary carbon trading platform(s) hosted in Hong Kong should also work in tandem with onshore exchanges in order to fully capitalise on the opportunities brought about by the large market size in Mainland China.

To establish a world-class carbon exchange(s), this section identifies various key building blocks which are considered crucial in laying a solid foundation for the exchange(s).

¹²⁹ Financial Services and the Treasury Bureau (FSTB), HKSAR, Hong Kong: The Facts – Financial Services, July 2020, https://www.gov.hk/en/about/abouthk/factsheets/docs/financial_services.pdf

¹³⁰ Census and Statistics Department, Foreign-affiliated Companies in Hong Kong, <https://www.censtatd.gov.hk/en/scode360.html>

¹³¹ CASG, Carbon market Opportunities for Hong Kong – Preliminary Feasibility Assessment, March 2022, <https://www.hkma.gov.hk/media/eng/doc/key-information/press-release/2022/20220330e3a1.pdf>

Carbon credit standards

Ensuring that the exchange in Hong Kong adheres to widely recognised carbon standards is of high priority. Hong Kong has historically adopted many international best practices in various aspects such as the bond market and equity trading. These frameworks have become strong fundamentals in attracting a pool of potential international investors and capital investment.

Mirroring similar experiences in the financial market in Hong Kong, the exchange should accommodate carbon credits generated from projects verified by standards that are widely recognised by international stakeholders. For instance, credits generated according to the major international VCM standard setters mentioned in Section 2 of this paper and CCERs in Mainland China should be considered. This is due to the dominance of these standard setters in international markets. Additionally, China is the world's largest source of GHGs and the potential opportunities unlocked by the resumption of CCER issuance should also be assessed. In this context, such harmonisation of standards on a centralised and interoperable platform is key to establishing an efficient and widely recognised carbon exchange in Hong Kong.

While carbon credit standards play a key role in ensuring the credibility of the carbon market on the whole, the FSDC holds the view that the VCM should also operate in a regulated manner. Given the similar nature of a VCM compared to the stock and futures trading market as well as the potential products that could be derived from carbon credits, regulatory regimes in place can further uphold the integrity of the market and to guarantee protection for investors. That said, balancing investor protection and market development is important, especially for new markets or products that are at a nascent stage of development. Hence, some flexibility in the regulatory approach and trading mechanism should be provided with a view to fostering the carbon market development in Hong Kong.

Technology-enabled trading platform

While carbon credit standards serve as gatekeepers to ensure the quality of credits is upheld, innovative digital technology should be deployed as the backbone of the market infrastructure. In view of challenges with regard to the operation of a secondary VCM, as detailed in Section 4 of this paper, the application of technological means could effectively boost the performance of the trading mechanism and address some key operational challenges.

With that in mind, a useful and possible technological solution to consider is the combination of blockchain and IoT technology. It is an acceptable solution according to the initial guidelines on the use of blockchain in VCMs issued by the International Emissions Trading Association in March 2022.¹³² On the trading front, blockchain technology could help to consolidate the highly fragmented voluntary market and reduce transaction costs. It could be applied at various stages, from registration to issuance of the carbon credits. In particular, it can play an active role in the verification process of carbon credits by leveraging its digital ledger which tracks and record transactions. With the use of IoT solutions, data can be collected directly from sources with a high level of accuracy and automation. This can drastically reduce the time to verify, as well as the accuracy of any data recorded. Combined with blockchain, a whole chain of immutable, verifiable carbon-related data can be generated for carbon credit producing projects which can be audited at any time. This combination of solutions can help to mitigate the problems mentioned in Section 4; in particular, lowering the cost and time to market for issuing carbon credits will significantly lower the barriers to entry into the VCM in Hong Kong, thus encouraging even more players to participate.

a) Verification of carbon credits

Despite the efforts of market participants to maintain the creditability of carbon credits, the trust in VCMs remains low due to the various reasons discussed above. The creditability of the VCM can be improved by leveraging blockchain technology to ensure carbon credits are verifiable and traceable, thereby reducing the concerns around double-counting, leakage, and pricing issues. Technologies such as blockchain and IoT can be used to optimise current verification and issuance methods for carbon credits, for instance, through the permanent attachment of source data to the credit itself, thereby providing ultimate transparency and product provenance.

Blockchain technology and tokenisation applications are used to validate and verify carbon credits, enhance trading efficiency, and uphold the integrity of the carbon market. Through blockchain's digitised accounting ledger, users can store, verify, and share specific information about carbon offset projects. However, this information cannot be altered by the user, which, in turn, ensures the information integrity and authenticity of a credit.¹³³ A more robust verification process for carbon credits will support trading activities, leading to higher market liquidity.

¹³² IETA, IETA Council Task Group on Digital climate markets – Key findings and recommendations, March 2022, <https://www.ieta.org/Digital-Climate-Markets-Resources>

¹³³ Reuters, Brand Watch: Can blockchain help carbon markets turn the tide on deforestation?, September 2022, <https://www.reuters.com/business/sustainable-business/brand-watch-can-blockchain-help-carbon-markets-turn-tide-deforestation-2022-09-26/>

b) Pricing and data transparency

The proposed exchange(s) should also look into mechanisms that will enhance the disclosure, exchange, and standardisation of carbon pricing and related information. In this context, the market can set a fair market price for different credits and will be better informed about the risks, thereby enabling the market to trade with higher confidence and boosting liquidity. Moreover, data authenticity and transparency of carbon emission/reduction by each emission-controlling enterprise/project party is of utmost importance. The key lies in whether falsification could be avoided and accurately located if responsibility could be clarified and corresponding actions are taken swiftly. The inalterable and traceable characteristics of blockchain and IoT could come into play in ensuring the credibility of data.

In terms of information disclosure, the exchange(s) should encourage/enforce market participants (such as project developers, buyers, and sellers) to publish related information in a regular and timely manner, such as the scope of product offerings and source of carbon credits, as well as other information that will be conducive to the transparency of the market in the long run. The disclosure specifics can make reference to HKEX's ESG disclosure requirements and other information disclosure requirements imposed by regulators or standard-setting bodies.¹³⁴

To reduce issues caused by fragmentation, the VCM ideally needs to establish a common language that can translate different attributes (standards used, types of offset, and locations, etc.) of varying carbon credits to enhance transparency and consistency.¹³⁵ There might not be a need to create a new set of rules; instead, the exchange(s) should, in collaboration with standard-setting bodies and market participants, standardise different attributes and produce reference grades and indices of carbon credits. On this basis, carbon credits will become comparable, enabling them to be traded at a premium or discount among their peers, if needed. Better availability of market data will facilitate more efficient trading of carbon credits, thereby injecting liquidity into the VCM.

Capacity building towards a conducive ecosystem

To facilitate the long-term development of the VCM in Hong Kong, it is crucial to cultivate a conducive ecosystem in all aspects, from creating quality credits and registries to onboarding and post-trading settlement. The essential components of such an ecosystem can include the establishment of a marketplace that matches projects with exchange(s), the introduction of rating agencies and risk management tools, and the initiation of custody, clearing, and settlement services for carbon credits, etc.

The cultivation of a comprehensive ecosystem that is conducive to the development of carbon-related products will require an enormous amount of data. Hong Kong can explore the potential to enable data exchange between Hong Kong and China Hubei Emission Exchange in Wuhan, the centre responsible for the registration and collection of carbon trading-related data in Mainland China.¹³⁶ With such data sources, Hong Kong can leverage its robust fundamentals as an international financial centre to offer a range of carbon-related financial services and products, such as custody service, collateral products, carbon asset management, and refinancing.

¹³⁴ HKEX, Appendix 27 Environmental, Social and Governance Reporting Guide, https://en-rules.hkex.com.hk/sites/default/files/net_file_store/HKEX4476_3841_VER18584.pdf

¹³⁵ BCG & GFMA, Unlocking the Potential of Carbon Markets to Achieve Global Net Zero, <https://www.gfma.org/wp-content/uploads/2021/10/unlocking-the-potential-of-carbon-markets-to-achieve-global-net-zero-full-report-consolidated-vfinal1.pdf>

¹³⁶ Global Times, China's national carbon trading market features two centers: trading in Shanghai, registration in Wuhan, 18 March 2021, <https://www.global-times.cn/page/202103/1218742.shtml>,

Upstream project development and product offering

Creating an abundant supply of high-quality carbon credits is a high priority. With this in mind, attracting standard setters and registries to operate in Hong Kong can be a key facilitator. While accepting internationally recognised carbon credits to be listed on the exchange(s) is a crucial first step, the presence of these stakeholders in Hong Kong can create an amplified effect in terms of attracting quality projects and asset owners, ultimately generating quality credits in the exchange platform. Verifiable and traceable data in the form of tokenised carbon credits can also drastically improve transparency, which will deter “greenwashing” – a process in which a business shares false or misleading information about its sustainable initiatives, such as double-counting carbon credits. The verifiability of data would also discourage the purchase and hence the issuance of low-quality carbon credits. Considerations can also be given to prioritising some carbon credits/products for pilot trading for market benchmarking purposes.

In addition to attracting quality projects and asset owners to Hong Kong with the presence of recognised standard setters, a comprehensive ecosystem should also be able to provide support to these projects in the development and financing arena. Project developers and financiers play significant roles in a VCM; they initiate and manage projects, conduct on-the-ground activities, and mobilise finance^{137,138} so as to achieve emission reduction goals. Therefore, providing sufficient support and an optimal operating environment for these stakeholders is crucial to the development of the VCM in Hong Kong.

In terms of increasing the product offering of the proposed exchange(s), linking Hong Kong’s VCM to the ETS of Mainland China could be considered. Hong Kong, as mentioned in an earlier section, being the super-connector between the Mainland Chinese and international markets, can play a similar role in the sphere of carbon markets. By connecting to the Mainland Chinese ETS market with a size of US\$1.26 billion,¹³⁹ Hong Kong is able to offer investors access to the Mainland’s massive carbon market. The Guangdong carbon market would be an ideal market to connect with. Hong Kong should leverage the large emission and trading volume in Guangdong and seek to be a part of the carbon market in the GBA.¹⁴⁰ This will strengthen the importance of the exchange(s) and Hong Kong’s VCM.

¹³⁷ BCG, Carbon services value chain and ecosystem, 2022

¹³⁸ VCM Global Dialogue, Project Developer Engagement with the VCM, 2021, <https://vcm-gd.org/wp-content/uploads/2021/09/20210926-VCM-GD-Project-developers.pdf>

¹³⁹ Global Times, China’s national carbon market celebrates one year anniversary, becoming world’s largest, 17 July 2022, <https://www.globaltimes.cn/page/202207/1270724.shtml>

¹⁴⁰ HKGFA, Leading the Way, 20 January 2021, <https://www.hkgreenfinance.org/leading-the-way/>

Ancillary services and government support

Moreover, other financial sectors can play a pivotal role in driving the development of the VCM in Hong Kong. One of the critical components of the ecosystem is the banking sector, particularly in the risk management arena. Efforts should be made to collaborate with the banking sector and encourage banks to innovate risk management solutions for VCM investors that are similar to the traditional financial markets, such as futures, forwards, and swaps. Taking into account the Securities and Futures Ordinance implications alongside the offering of carbon credit futures contracts for trading by banks, investors would still be able to hedge risks better with more diversified derivative products in the carbon market, and, as such, fostering a higher degree of market stability.

The banking sector can also help to mobilising funds to finance high-quality carbon offset projects. As mentioned earlier, developers struggle to finance their projects for various reasons, such as low confidence in VCMs. For projects in the development phase, the banking sector can help to channel investment into these projects and support the projects in taking off. In contrast, for projects at a more mature stage, the banking sector can help to scale up the trading by acting as liquidity providers, thereby breaking the pattern of the VCM as buy-and-hold or buy-and-retain.

On the other hand, as the VCM is regarded as complex and new to many buyers, the insurance sector can play a pivotal role in ensuring the credibility of the carbon credits and inducing investors' confidence. With its ability to underwrite risks, the support from the insurance sector adds another layer of security to both investors and project owners. The re/insurance industry can be played to its full strength by de-risking, financing, and purchasing new carbon removal services.¹⁴¹

In addition to the financial services sector, another key actor in supporting the healthy development of any VCM is the active role of the government and public sector stakeholders. In general, the participation of market makers can help boost liquidity in the market, which is important for a new market to flourish. In this context, the Government and relevant public sector stakeholders can consider spearheading a push by investing in the new carbon market.

Another way in which the government can provide support is through the introduction of financial incentives to carbon credit issuers. As mentioned in Section 4, the high cost associated with offset projects has been one of the key deterrents for project developers to start a project. With that in mind, government subsidies will therefore help to reduce development costs and incentivise developers to develop a project, as well as attract them to use Hong Kong's VCM. Adequate support from the government would cause a ripple effect throughout the VCM as more issuers and carbon offset projects would become available, ultimately giving rise to a more diversified market. In the long run, lower development or issuance costs in the VCM in Hong Kong would make the trading platform more competitive, boost trading and liquidity, and encourage emitters to purchase carbon credits and decarbonise.

¹⁴¹ Swiss-Re, The insurance rationale for carbon removal solutions, July 2021, <https://www.swissre.com/dam/jcr:31e39033-0ca6-418e-a540-d61b8e7d7b31/swiss-re-institute-expertise-publication-insurance-%20rationale-for-carbon-removal-solutions.pdf>

To illustrate the multiple benefits of the government's financial support, a similar approach has been used on other green initiatives in Hong Kong, such as the Green and Sustainable Finance Grant Scheme launched in May 2021. The scheme is a three-year subsidy plan for eligible bond issuers and loan borrowers to cover their expenses on bond issuance and external review services. According to statistics from the government, the scheme has been well-received by the industry and over 60 applications have been approved as of April 2022.¹⁴² More green and sustainable bond issuers and loan borrowers were attracted to leverage the fundraising platform and professional services available in Hong Kong.¹⁴³ The government can use the success of the scheme and consider replicating it for carbon credit issuers. We believe this will also contribute to the government's work towards achieving the carbon emission reduction goals of Hong Kong and Mainland China.

The FSDC recognises that developing a VCM in Hong Kong requires concerted efforts and coordination from all relevant stakeholders in the industry. In addition to the role of the government in fostering the development of a VCM in Hong Kong, an in-depth study would be necessary to address gaps identified in the market, which gaps might not be covered in this research report. These areas include but are not limited to the compatibility of carbon standards, registration and project initiation costs, industries covered by carbon standards, asset classification of carbon credits, and regulatory framework and clarity for carbon credits trading, etc. For instance, with the GBA identified as a main market with an abundant supply of carbon projects and credits, it is important for the VCM in Hong Kong to accommodate projects created by industries/sectors relevant to the area as well as those which cater to local needs. Projects covered by registries and standards could be expanded to industries and sectors such as manufacturing, mining and steelmaking, construction, and transportation.

¹⁴² HKSAR Government, LCQ15: Development of green finance (April 2022), <https://www.info.gov.hk/gia/general/202204/27/P2022042600529.htm>

¹⁴³ HKSAR Government, LCQ10: Developing Hong Kong into green finance centre (February 2022), <https://www.info.gov.hk/gia/general/202202/23/P2022022200567.htm>

Conclusion

As an international financial centre, Hong Kong has long been praised for its strong edge in attracting investors and mobilising global capital flows. With global carbon markets on the rise, the city can, once again, put its strengths to good use in terms of expediting the development of the VCM. With a conducive ecosystem, the best-in-class, highly efficient VCM in Hong Kong does not only fit into the roadmap of city's green and sustainable development, it could also take on the role of a gateway, a springboard and an intermediary between China and the rest of the world, bridging the Mainland and international carbon markets. The carbon exchange(s) in Hong Kong would provide a convenient channel for foreign investors to offset their carbon emissions through GHG reduction projects in Mainland China. In addition, as the market matures, innovative carbon derivatives can be introduced. For instance, allowing carbon credits issued/purchased in Mainland China to be used as collateral for financing activities or other investments could further stimulate the internationalisation of RMB.

As the setting up of a carbon exchange(s) also plays a dual role in accelerating Mainland China's road to carbon neutrality and fostering a common good for the environment overall, the FSDC believes that such an exchange would bolster Hong Kong's stature as a leading green finance hub in Asia.

Appendix: Compliance Carbon Markets

Compliance carbon markets are where carbon allowances are traded and regulated by national, regional, international, or industry regulatory bodies. These carbon trading markets, seeking to achieve the common goal of net-zero GHG emissions, vary in terms of product scope, buyers, allowance allocation methods (free allocation or auction), compliance, and price level. One of the standard set-ups of a compliance carbon market is an emission trading system (ETS) or cap-and-trade (CAT).

ETSs and CAT are market-based instruments that control carbon emission limits by providing economic incentives to companies to reduce emissions. The government usually allocates or sells a limited number of emission quantities in one or more sectors over a period. Companies covered under the cap will be allowed to emit a given emission quantity and purchase additional allowance from other companies or the carbon market to compensate for any unavoidable or residual emissions. On the other hand, companies with an excess limit can sell their limit or save it for later. According to the World Bank, there are 32 ETSs worldwide as of 2021.¹⁴⁴ Of these, the coverage of total global emissions under 29 ETSs was only about 16% in 2021.¹⁴⁵

Overview of selected ETSs in the world

Europe: The EU ETS was set up in 2005 and is the world's first international emission trading system. It is the primary tool for the EU to tackle climate change.¹⁴⁶ The idea is to provide a financial incentive for polluters to reduce emissions. The EU sets the carbon emission cap and the member states give free allowances to the companies and factories operating in their markets. These free allowances will be reduced in four phases in the coming years. Companies facing a shortfall in allocations will have to purchase additional allowances in the market or rely on previously saved carbon-free allowances. While the emission allowance will be reduced gradually over the four phases between 2005 and 2030, the industries, sectors, and gases covered in the trading scheme will become more expansive. EU Allowances (EUA) are the key currency for the EU ETS.

Mainland China: Mainland China's National ETS is the world's largest ETS in terms of emissions, covering 4.5 billion MtCO₂. It was launched in 2021 and builds on eight ETS pilots implemented in various cities and regions across Mainland China. The eight pilot schemes are expected to be integrated into the national ETS.

¹⁴⁴ World Bank, Global Carbon Pricing Generates Record \$84 Billion in Revenue, May 2022, [https://www.worldbank.org/en/news/press-release/2022/05/24/global-carbon-pricing-generates-record-84-billion-in-revenue#:~:text=The%20report%2C%20which%20presents%20the,Emissions%20Trading%20Systems%20\(ETSs\).](https://www.worldbank.org/en/news/press-release/2022/05/24/global-carbon-pricing-generates-record-84-billion-in-revenue#:~:text=The%20report%2C%20which%20presents%20the,Emissions%20Trading%20Systems%20(ETSs).)

¹⁴⁵ BCG & GFMA, Unlocking the Potential of Carbon Markets to Achieve Global Net Zero, <https://www.gfma.org/wp-content/uploads/2021/10/unlocking-the-potential-of-carbon-markets-to-achieve-global-net-zero-full-report-consolidated-vfinal1.pdf>

¹⁴⁶ EU, EU Emissions Trading System (EU ETS), https://climate.ec.europa.eu/eu-action/eu-emissions-trading-system-eu-ets_en

Mainland China's ETS covers 2,162 entities, primarily from the power sector, and covers only CO₂ emissions. The covered entities receive a free allocation at 70% of their 2018 output multiplied by the corresponding benchmark factor. The allocation was subsequently adjusted to reflect their actual generation in 2019 and 2020. The Draft Interim Regulations stated that free allocation of carbon emissions would be gradually replaced by auction. Prices for emission allowances are relatively low compared to other pricing systems.

US: The California CAT programme, the world's fourth largest cap-and-trade programme, sets a state-wide emission cap, under which companies can purchase allowances via auction or trading. Electric utilities, industrial facilities, and natural gas utilities receive a free allocation based on a set of benchmarks, with free allocation to be reduced over time. Companies can purchase additional allowances at auction or via trade.

Table 3. Comparison of selected compliance carbon markets¹⁴⁷

Name	China National ETS	EU ETS	California CAT Programme
General information			
Launch year	2021	2005	2012
Type	ETS	ETS	ETS
Government revenue (2022)	n/a	US\$34,326 million	US\$3,992 million
Scope			
Jurisdictions covered	Mainland China	EU, Norway, Iceland, Liechtenstein	California
GHG emissions in the jurisdiction (2018)	13,740 MtCO ₂ e	4,001 MtCO ₂ e	418 MtCO ₂ e
Share of jurisdiction's GHG emissions covered	33%	41%	74%
Sectors and/or fuels covered	CO ₂ emissions from the power sector,	Power sector, manufacturing industry, and aviation	GHG emissions from the industry, power, transport, and buildings sector include industrial process emissions
Mechanisms			
Cap or total emission units (current year or latest year available, ETS only)	To be determined	1572 MtCO ₂ e (2021) Allowance is determined top-down and decreases annually	308 MtCO ₂ e (2022) Allowance is determined top-down and decreases annually
Allocation approaches (ETS only)	Benchmark	Free allocation and auctioning	Free allocation and auctioning
Compliance cycle	To be determined	Meet compliance obligations on an annual basis	A three-year compliance period
Use of offsets	To be determined	Not allowed from Phase Four (from 2021)	Allowed with conditions
Price level	RMB59/tCO ₂ e (US\$9/tCO ₂ e)	EUR78/tCO ₂ e (US\$87/tCO ₂ e)	US\$31/tCO ₂ e

Source: World Bank

¹⁴⁷ World Bank, Carbon Pricing Dashboard, https://carbonpricingdashboard.worldbank.org/map_data

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About the FSDC

The FSDC was established in 2013 by the Hong Kong Special Administrative Region Government as a high-level, cross-sectoral advisory body to engage the industry in formulating proposals to promote the further development of the financial services industry of Hong Kong and to map out the strategic direction for the development.

The FSDC has been incorporated as a company limited by guarantee with effect from September 2018 to allow it to better discharge its functions through research, market promotion and human capital development with more flexibility.

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