



HKEX Reports on Global Carbon Markets & Opportunities for Hong Kong

The HKEX issued a research report on the Growth of Global Carbon Markets and Opportunities for Hong Kong in January 2023. The report highlights developments in global carbon markets and exchanges, analyses the growth of carbon markets in China, and points to Hong Kong's potential role as a green finance hub and regional carbon trading hub.

The [Research Report](#) is available on the HKEX website (the [HKEX Research Report](#)).

An Introduction to the Carbon Markets

Since the Kyoto Protocol of 1997, which established a framework for carbon emissions trading that sought to reduce Green House Gas (**GHG**) emissions by 5% on average by 2012, the United Nations (**UN**) and its member states have continued to set carbon emission reduction goals via climate change accords under the United Nations Framework Convention on Climate Change (**UNFCCC**). The Paris Agreement of 2015 called for the establishment of "binding procedural commitments" by UN member states to set up their own "Nationally Determined Contribution" in view of the end of the second commitment period of the Kyoto Protocol. The Paris Agreement also allowed countries to achieve their emission reduction targets via market mechanisms inclusive of trading systems. These UN accords have, in turn, contributed to the expansion and development of emission trading systems and voluntary carbon markets from the EU Emission Trading System (**EU ETS**), launched in 2005, to emission trading systems in jurisdictions including the US, Canada, India and China, at city, country and regional levels. Following this development in Emission Trading Schemes (**ETSs**) in general, the carbon markets have expanded to include derivatives, such as carbon futures and options, tradable on exchange platforms and over-the-counter trading (**OTC**) venues, as well as hedging tools.

Types of Carbon Markets

The global carbon markets can be classified into the following two main types:

Quota-based Carbon Markets

Quota-based carbon markets are based upon the "cap-and-trade"¹ mechanism, meaning a governing authority will set a cap, or upper limit, on GHG emissions (usually measured by a unit of tonnes of carbon dioxide (**CO₂e**)) for a defined compliance period. The cap can be either absolute (a fixed quantity of emissions) or intensity based (a "pre-specified rate of emissions relative to inputs or outputs at the level of jurisdiction"), at a declining rate over time or set compliance periods. Once the cap is set, entities covered by the ETSs are either allocated carbon emission allowances for free or allowances are auctioned in the primary market. Companies can also buy and sell their carbon emission allowances in the secondary market to meet their compliance requirements.

Project-based Carbon Markets

Project-based carbon markets are usually based upon the principle of “baseline-and-credit”, an offsetting mechanism. Under this mechanism, there is no specific cap on emissions for a jurisdiction or company. GHG emissions can be lowered to a level below the one set by third-party verifiers based on a baseline scenario formulated by considering industry sectors and their corresponding technological constraints. The carbon offsets, also known as carbon credits, are generated by the avoidance or reduction of carbon emissions, or their removal or sequestration via direct actions (e.g. reforestation) or technologies (e.g. carbon capture).

Independent auditors are brought in to verify the effectiveness of a carbon offset project or project plan and their reports will be sent to a standard-setting body, who will usually also be the issuer of the carbon credit certificates, for further verification. For carbon emitters, carbon credits can sometimes be used to offset carbon emission quotas under an ETS or its own voluntary commitments.

Mandatory and Voluntary Carbon Markets

There are two types of carbon markets: mandatory and voluntary.

Mandatory Carbon Markets

Mandatory carbon markets are usually quota-based carbon markets with legally binding emission reduction commitments for the entities covered by the ETS. These entities are permitted to trade their carbon emission allowances to meet their emission reduction requirements. However, the carbon emission allowances are also usually not fungible across mandatory markets and this can give rise to carbon leakage (i.e. where entities deliberately move to jurisdictions with lower carbon prices). Nonetheless, there are mechanisms such as Carbon Border Adjustment Mechanisms (**CBAMs**) that seek to plug the leak by imposing tariffs, taxes, and/or rebates on import and exports so as to ease any potential burden on developing countries with weaker regulatory regimes, or alternatively emission-intensive and trade-exposed sectors may receive free allowances to cover their carbon emissions.

Voluntary Carbon Markets

Voluntary carbon markets usually have non-legally binding carbon emissions reduction commitments and will primarily handle the purchase of carbon offsets from emission reduction project owners to voluntarily offset their GHG emissions. Much like mandatory carbon markets, there are few or no connections between different voluntary carbon markets as there is still no universal standard to verify the underlying projects.

At present, there is limited interoperability between mandatory and voluntary carbon markets. Existing links between the two, via the use of voluntary carbon market credits, only cover 3%-10% of covered entities' compliance obligations and only a few mandatory market ETSS will accept carbon offset as a means to meet compliance obligations, and even then, they have to be high-quality offsets based upon a “taxonomy for categorisation”.

The Global Carbon Market: The Facts and Figures

Major Emission Trading Systems

The HKEX Research Report noted that, as of the end of 2021, there were 12 major multinational, national or regional ETSS² around the globe with the top three, in terms of the ratio of emissions covered in 2021, being Quebec (78%), California (US) (74%) and Korea (73%). However, although the amount of carbon emissions covered by global ETSS increased to 8.9 gigatonnes of CO₂e in 2022, compared to 2.1 gigatonnes of CO₂e in 2005, the ratio of global emissions covered by ETSS was only 17% at the end of 2021.

The ratio of emissions covered in the major ETSS varied significantly (the highest at 78% (Quebec) and the lowest at 10% (Switzerland)) due to the differing carbon policies implemented by policymakers in the regions or nations. Nonetheless, the HKEX does expect the coverage of carbon emissions through ETSS to increase in the future.

Carbon Allowance Auctions

As mentioned above, the majority of carbon emission allowances are either distributed for free or auctioned under the cap-and-trade mechanism. According to the HKEX Research Report, carbon allowance auctions in the global markets have raised over US\$161 billion between 2008 and 2021 and there has been an upward trend in terms of the price of carbon allowances in the major ETSS of the global market. However, it was noted that, in spite of the upward trend, the current prices are still far below the US\$40 to US\$80 per tonne of CO₂e required to achieve the goal of limiting the global temperature increase to within 2°C under the Paris Agreement given that, as of 2020, only 3.76% of carbon emissions covered by global ETSS exceeded that range. Nonetheless, the total trading volume on major global ETSS increased from 5,850 million tonnes of CO₂e in 2016 to 15,773 million tonnes

of CO₂e in 2021 and logged a 5-year compound annual growth rate of 22%. As of 2021, Europe and North America remained the largest ETSs markets based upon annual trading volumes with 12,214 million tonnes of CO₂e and 2,680 million tonnes of CO₂e traded respectively.

Voluntary Carbon Markets

In terms of voluntary carbon markets, the annual issuance of global carbon offsets reached 304 million tonnes of CO₂e during the first ten months of 2021 compared with 6 million tonnes of CO₂e in 2007, with trading values of carbon offsets having reached US\$2.0 billion in 2021. Yet, the average price and trading volume of carbon offsets have been much lower, compared with those on the mandatory market, having settled at about US\$3 per tonne of CO₂e in recent years and only having reached a trading volume of 104 tonnes of CO₂e in 2019.

The HKEX Research Report also noted a large disparity in prices across different projects - in August 2021, afforestation or reforestation carbon offsets averaged US\$8.10 per tonne of CO₂e while renewable energy credits remained at US\$1-2 per tonne of CO₂e. The HKEX Research Report attributed the disparity to the challenges in standardising a carbon offset due to the differing types of carbon reduction projects and potential buyers having different preferences for the projects. It also noted that the majority of carbon offsets in voluntary carbon markets are still being traded in the over-the-counter market.

Carbon Markets around the World

The European Union Emissions Trading System

The European Union Emissions Trading System (**EU ETS**), established in 2005, was the world's first ETS and is based upon the cap-and-trade mechanism. Since 2005, the EU ETS has progressed through four stages of development.

During Phase 1, the EU ETS covered CO₂ emissions of power generators and energy-intensive industries, and the carbon allowances (**EUAs**) were given for free. National Allocation Plans (**NAPs**) were used for the allocation of EUAs and allowed member states, having regard to the EU allocation standards and principles and subject to a requirement to report to the EU ETS Management Committee, to decide for themselves the total amount of EUAs to issue. Due to the substantial surplus of free allowances, the price of EUAs fell to zero by 2007, while the trading volumes rose from 321 million EUAs in 2005 to 2.1 billion by 2007.

In Phase 2, the EU ETS was extended to other industries, such as aviation, and GHG emissions other than CO₂ (e.g. sulphur dioxide and fluorine). Although EUAs were still mostly allocated for free, their supply was set to reflect economic conditions to avoid a price drop if the number of EUAs released exceeded the actual carbon consumption. The price per tonne of CO₂e of EUAs saw another drop (from US\$30 in 2008 to US\$8 in 2012) with the HKEX Research Report citing the weak economic activity in the wake of the 2008 global financial crisis as a reason. Nonetheless, the trading volumes of EUAs continued to rise and jumped to 7.9 billion in 2012, more than double the 3.1 billion in 2008.

By Phase 3 of the EU ETS, the NAP system was replaced by a single EU-wide cap on emissions and auctions became the default means of allocation. Thus, during Phase 3, 57% of EUAs were auctioned and the remainder were allocated for free. The Market Stability Reserve (**MSR**) was also implemented under Phase 3 as a means to address imbalances between the demand and supply of EUAs. The cap on EUAs for stationary installations under the EU ETS was set to the level of emissions allowed in 2013 and a target to decrease emissions annually by a linear reduction factor (**LRF**) of 1.74% from baseline emissions in 2008-2012 was also set. The EUA price managed to reach about US\$30.1 per tonne of CO₂e by 2020.

Under the current Phase 4, the ratio of EUAs auctioned and freely allocated has remained the same as in Phase 3 and the MSR remains in place. However, much more ambitious targets were set with the phasing out of free allocation for less-exposed sectors after 2026 from 30% of the total cap to zero by 2030, a one off reduction of 117 million allowances and a decline with an increased LRF of 4.2% annually between 2021 and 2030 and a "more ambitious" cap for stationary installations with an LRF of 2.2% annually having been set in 2021.

In terms of the products available under the EU ETS, both spot trading of EUAs and futures trading of carbon have been possible since 2005. EUA futures (including spot contracts) can currently be traded on the European Energy Exchange (**EEX**), Intercontinental Exchange (**ICE**) Europe, NASDAQ Commodities and the Chicago Mercantile Exchange (**CME**). In 2021, there were over ten million EUA futures contracts traded on ICE Europe, over six hundred thousand futures contracts traded on EEX and 830 futures contracts traded on Nasdaq Commodities.

The US Carbon Market

There is, at present, no nationwide ETS within the US. There are, instead, a number of major regional carbon trading markets:

- the Regional Greenhouse Gas Initiative (**RGGI**) – is a mandatory carbon trading market based on the auction mechanism established in 2009 and, at the time of the HKEX Research Report, covered 225 power stations in eleven participating states. From inception to September 2021, emissions covered by the RGGI dropped by 50% with US\$4 billion having been raised for investment in local communities. Its trading volume reached 270 million tonnes of CO₂e in 2020 with a turnover of EUR 1.695 billion;
- the Western Climate Initiative (**WCI**) – launched in 2007, was the first cross-border emissions trading market. It consists of seven states in the US and four provinces in Canada and covers 90% of the total carbon emissions of the aforementioned states and provinces. As of 2020, the trading volume and turnover on the WCI were 1,739 million tonnes of CO₂e and EUR 24.3 billion, respectively; and
- California's Cap-and-Trade Program (**CCTP**) – is linked to the cap-and trade system of Quebec via the WCI. The CCTP set a 2020 target for reducing overall GHG emissions to the levels produced in 1990 and has proposed setting annual emissions reduction targets of 4% per year from 2021 to 2030.

US Carbon Derivatives Trading

Exchanges in the United States offer standardised futures and options contracts on GHG emission allowances and offsets. In the second quarter of 2021, trading volume of these futures and options amounted to 641.1 thousand lots.

The Chicago Climate Exchange (**CCX**) was launched in 2003 as a contractually binding, rules-based GHG emission allowance trading system. It mainly trades Carbon Financial Instrument (**CFI**) contracts representing 100 tonnes of CO₂e which were launched as cash contracts.

The Chicago Climate Futures Exchange (**CCFE**) handles CFI futures and options trading on CCX. The underlying assets of the futures contracts on CCFE include CO₂ and other GHG emission credits and Certified Emission Reductions (**CERs**). The CCX and CCFE were acquired by the Intercontinental Exchange (**ICE**) in 2010.

The CME offers a range of emissions contracts for hedging exposures in the European and US carbon markets including RGGI allowance futures and options, in-delivery-month EUA futures and options, and California low-carbon fuel standard futures. The HKEX Research Report also noted that the CME has recently launched the following:

- o nature-based global emissions offset (N-GEO) futures – these are based on eligible voluntary offsets from agriculture, forestry and other land-use projects that have additional climate, community and biodiversity accreditation; and
- o global emissions offset (GEO) futures – based on eligible voluntary carbon offset credits under the Carbon Offsetting and Reduction Scheme for International Aviation (CORSA) at three registries.³

India: Carbon Trading in a Developing Country

Identified in the HKEX Research Report as a potential reference for developing ETSs in the developing world, India was not required to make specific commitments in the first phase of the Kyoto Protocol and thus does not have domestic markets that provide trading of carbon emission allowances. Instead it has adopted a “single-sided strategy” to store CER's generated from projects registered under the Clean Development Mechanism under the UNFCCC to reduce emission costs.

CER futures can currently be traded on two major local exchanges in India – the Multi Commodity Exchange of India and the National Commodity and Derivatives Exchange. The former entered into an alliance with CCX in 2005 to begin trading CER futures and the latter has, since 2008, launched a number of CER futures contracts with varying maturities. The CER futures are also primarily denominated in Rupees.

China's Carbon Market Development

Having pledged to reach peak carbon emissions by 2030 and carbon neutrality by 2060, China has in the past decade sought to develop its domestic carbon markets by implementing ETSs in pilot regions before expanding them at a national level.

The Chinese Regional Pilot Carbon Trading Markets

Eight regions have been designated as pilot regions for carbon emissions trading (Beijing, Shanghai, Tianjin, Shenzhen, Guangdong, Chongqing, Hubei and Fujian). The ETSs were intended to:

- help enterprises use market mechanisms to manage environmental risks and costs;
- ensure the credibility of carbon trading by providing standardised trading procedures and transparency; and
- support market liquidity with financial innovation.

The details of the various ETSs of the pilot regions including the industry covered, the enterprises eligible under the scheme, their derived carbon products and particular innovations are set out in Table 4 of the HKEX Research Report.

The Chinese National Carbon Market

On 16 July 2021, the China ETS commenced trading of carbon emission allowances (**CEAs**). In the current initial phase the only sector covered is the power sector, comprising a batch of 2,162 power plants across China. This is expected to expand to the steel, petrochemical, construction materials and other key materials over the “14th Five-Year Plan” period, and ultimately to the chemical, iron, non-ferrous metal, papermaking and aviation industries.

The *Administrative Measures for Carbon Emission Trading (Trial Implementation)*, effective 1 February 2021, stated that key carbon emissions industries would not participate in the regional carbon pilot trading markets but would instead move to the national carbon market. Trading of the China ETS will be conducted on the Shanghai Environment and Energy Exchange while the national registry, registration and settlement systems for CEAs will be in Wuhan.

Co- Existence of China Certified Emission Reductions

The 2012 *Interim Measures for the Administration of Voluntary Greenhouse Gas Emission Reduction Transactions* allow Chinese entities to file and register voluntary emissions reduction projects. The emissions reductions resulting from these voluntary emissions reduction projects are recognised as CCERs which can be sold to entities with high emissions to offset a percentage of their emissions beyond the allowances they are allocated.

Allowances under the mandatory regulatory regime currently account for the majority of the trading volume in China’s carbon market, although voluntary trading of CCERs is a useful supplement to mandatory allowance trading. Companies in China are currently allowed to cover up to 5% of their mandatory obligations with CCERs. The HKEX Research Report noted the effectiveness of carbon emissions reduction efforts would be improved by combining the two trading models.

China Carbon Markets: Outlook and Development

The HKEX Research Report noted increases in the price of CEA’s which were 13% up, at RMB 54.22 (US\$ 8.52) per tonne of CO₂e at the end of 2021, from the opening price of CEA’s on the commencement day of 16 July 2021. A total of 179 million tonnes of CEAs changed hands over 114 trading days in 2021. The coverage and access of both China ETS and the voluntary carbon markets are expected to expand over time with ETS coverage reaching 60% of total emissions and the cumulative trading value reaching RMB 100 billion by 2030.

Opportunities for Hong Kong

Given China’s commitment to carbon neutrality by 2060, the HKEX Research Report highlights the “huge opportunities” for the development of Hong Kong into a green finance hub and regional carbon trading centre. Specifically, it envisages:

- Hong Kong’s ability to bridge the gap between international investors and China’s carbon markets, by offering access to China’s national ETS and those in the Greater Bay Area;
- That Hong Kong’s internationally recognised green certification services and knowledge of the international and Chinese could assist in connecting Chinese and international investors and carbon projects via a carbon trading platform; and
- The potential for Hong Kong to develop as a regional carbon trading centre and an offshore risk management centre to support the development of China’s carbon markets.

In 2022, the Hong Kong Stock Exchange launched two carbon emissions initiatives – the Hong Kong International Carbon Market Council and Core Climate (a new international carbon marketplace providing a one-stop solution for trading, custody and settlement).

The report concludes that by connecting international investors to China's carbon markets, Hong Kong could play a superconnector role linking investors with carbon projects.

[1] All quotations are taken from the HKEX Research Report.

[2] See Table 1 of the HKEX Research Report.p7

[3] See para 2.4 of the HKEX Research Report.p18

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CHARLTONS
易周律師行

Hong Kong Office

Dominion Centre 12th Floor
43-59 Queen's Road East Hong Kong

enquiries@charltonslaw.com

www.charltonslaw.com
Tel: + (852) 2905 7888
Fax: + (852) 2854 9596