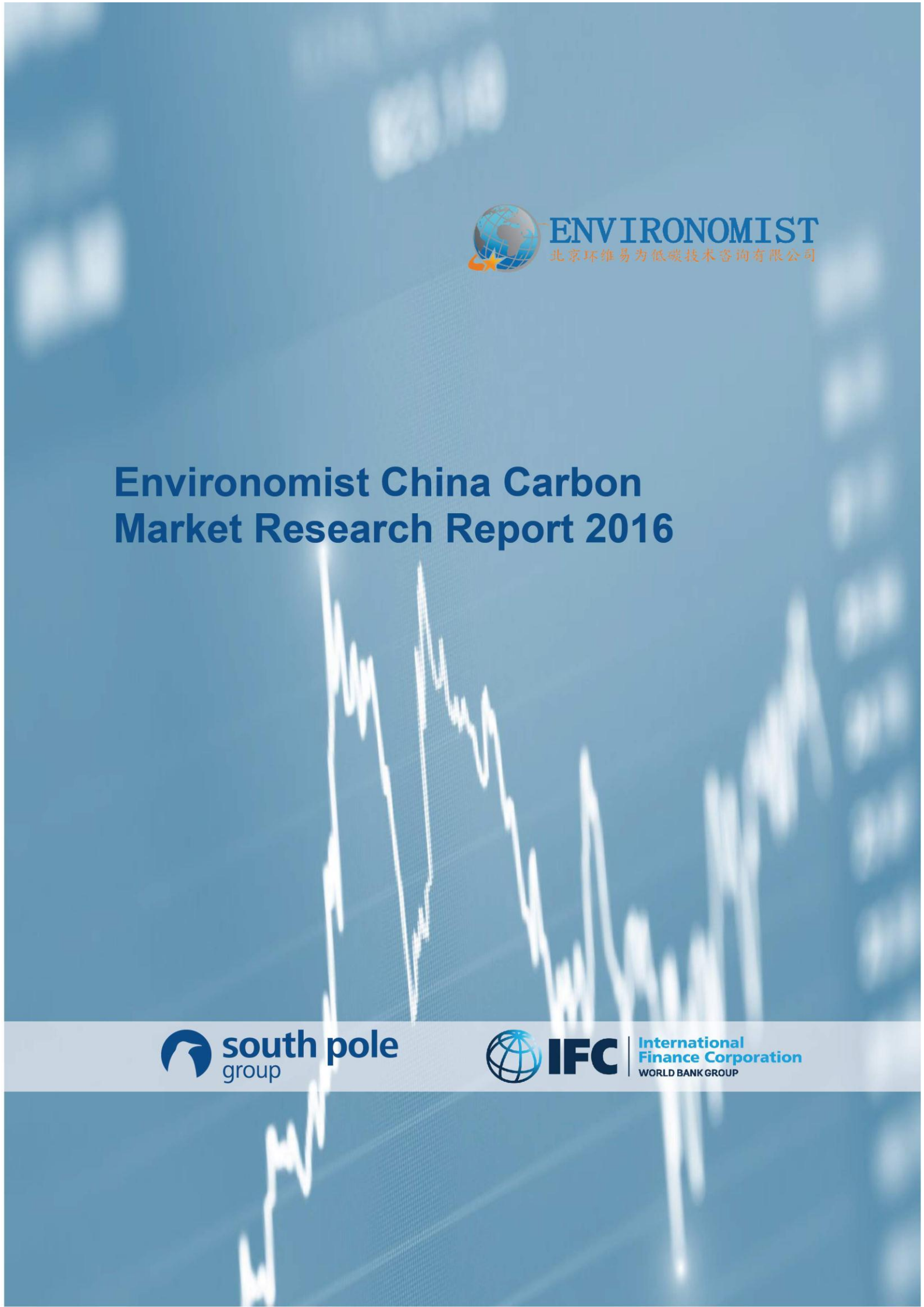
ENVIRONOMIST
北京环维易为低碳技术咨询有限公司
Environomist China Carbon Market Research Report 2016
south pole group
IFC
International Finance Corporation
WORLD BANK GROUP

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Acronyms and abbreviations

ANU	Australian National University
APEC	Asia-Pacific Economic Cooperation
AQSIQ	General Administration of Quality Supervision, Inspection and Quarantine
BAU	Business as Usual
BJ	Beijing
bn	billion
CaCO3	Calcium carbonate
CaO	Calcium oxide
CBEEX	China Beijing Environmental Exchange
CCEP	Centre for Climate Economics and Policy
CCER	China Certified Emissions Reductions
CCF	China Carbon Forum
CCICED	China Council for International Cooperation on Environment and Development
CCPG	Central China Power Grid
CDM	Clean Development Mechanism
CEEX	China Emissions Exchange
CEMS	Continuous Emissions Monitoring System
CER	Certified Emission Reduction
CFDAM	Climate financing demand analysis model
CGN	China General Nuclear Power Corporation
CGNPC	China General Nuclear Power Group
CH4	Methane
CNEEEX	Shanghai Environment and Energy Exchange
CO2	Carbon dioxide
CO2e	Carbon dioxide equivalent
CSPG	China South Power Grid
CQ	Chongqing
CUFE	Central University of Finance and Economics
DG	Directorate General

DRC Development and Reform Commission

EA Emission Allowance

EB (CDM) Executive Board

EBRD European Bank for Reconstruction and Development

ECMS Environomist Carbon Management System

ECPG East China Power Grid

ECX European Climate Exchange

EE Energy Efficiency

EFET European Federation of Energy Traders

ESG Environmental, Social and Governance

ETF Exchange-Traded Funds

EU European Union

EU ETS European Union Emissions Trading System

EUA European Union Allowance

EUCCC European Union Chamber of Commerce in China

EY Ernst & Young

FNI Fridtjof Nansen Institute

FTZ Free Trade Zone

FX Foreign Exchange

G8 Group of Eight

GD Guangdong

GDP Gross Domestic Product

GHG Greenhouse gases

GSP Generalised System of Preferences

ha Hectare

HFC Hydrofluorocarbon

HB Hubei

IBRD International bank for Reconstruction and Development

ICF ICF International

IOSCO International Organization of Securities Commissions

Kg	Kilogram
Kt	kilotonne
LLGHG	long-lived greenhouse gases
MgCO3	Magnesium carbonate
MgO	Magnesium oxide
MRVA	Monitoring, reporting, verification and accreditation
MWh	Megawatt hour
N2O	Nitrous oxide
NCPG	North China Power Grid
NCSC	National Centre for Climate Change Strategy and International Cooperation
NDC	Nationally Determined Contribution
NDRC	National Development and Reform Commission
NEPG	Northeast China Power Grid
NGO	Non-governmental Organisation
NHDR	National Human Development Report
NPK	Nitrogen, Phosphorous and Potassium or Potash
NRDC	Natural Resources Defense Council
NSC	National Standards Commission
NWPG	Northwest China Power Grid
OECD	Organisation for Economic Co-operation and Development
OTC	over-the-counter
PFC	Perfluorocarbon
PLN	Perusahaan Listrik Negara
PoA	Programme of Activities
RCCEF	Research Center for Climate and Energy Finance
RGGI	Regional Greenhouse Gas Initiative
SF6	Sulphur hexafluoride
SH	Shanghai
SZ	Shenzhen
t	tonne

tCO_2e tonnes carbon dioxide equivalent

TJ Tianjin

UN United Nations

UNDP United Nations Development Programme

UNFCCC United Nations Framework Convention on Climate Change

VCS Verified Carbon Standard

VER Verified Emission Reduction

Preface

This report is a sequel to the Environomist's *China Carbon Market Research Report* published in early 2015. That report took a close look at the embryonic carbon market in China which at that point was into its first year of existence. This year's report describes and analyzes the Chinese carbon market as it developed in its second year. Providing a rich source of market information and data, we hope the report will be useful for all public and private stakeholders and participants in this market.

The level of trading activity has been modest in the early stages of the market. This is to be expected, as shown by the experience from other regional emissions trading systems, such as the EU ETS. Among the main reasons are a general low level of awareness and capacity constraints within companies, and policy and regulatory issues also need to be resolved as necessary. Furthermore, Chinese companies are not yet clear on their carbon position and their abatement cost and, as a result, are not likely to trade. It is also important that companies are largely unfamiliar with price hedging strategies and their traders may not be incentivized to trade carbon. Finally, most companies in China will likely trade with the help of intermediaries and financial intermediaries are still to engage in the market. Such teething issues are only to be expected.

At the same time, there are several indications in the report showing that the market is already making headway. First, and perhaps most important, a majority of market participants and stakeholders expect that a functional national market for carbon will emerge in China in the future. Second, expectations about the future price of carbon have started to form among market participants. Third, while some stakeholders expect carbon pricing to affect investment decisions by companies somewhat already in 2016, almost all stakeholders expect companies to be factoring in a price of carbon by 2020.

China is the first developing country to control CO_2 emissions through a cap-and-trade system. The Chinese government should be congratulated for working hard to make this new market a success. Setting up a carbon market will be a significant challenge for any country. And it is indeed a steep challenge in the case of a country as large and diverse as China.

Being the biggest source of CO_2 emissions globally, China accounts for more than 27% of the world's emissions. Once a national carbon market is established, which could be as early as 2017, China will overtake the EU to become the biggest carbon market in the world. The Chinese market will significantly alter the balance of power in global carbon markets in the mid-term. Environomist's *China Carbon Market Research Report* 2016 documents and analyzes the second year of market-building and identifies key challenges and opportunities for the future Chinese carbon market.

Lasse Ringius,

Senior Carbon Finance Specialist

International Finance Corporation

Introduction

This report is based on information and legal documents made publicly available prior to 31 December 2015, some of which may be out of date by the publication date.

This report was conducted by Environomist Ltd. who shall not be held liable for any damage, loss and/or claim that arises from the use of any information, in full or in part, presented in this report.

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We are grateful to receive feedback and comments from our valued readers

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Environomist Ltd.

Environomist Ltd. was established with the vision of facilitating the low carbon economic transition and promoting carbon management capacity in the public and private sectors. Over the past several years, we have become the most reputable professional carbon consulting company, with rich experience in the area of carbon management in China.

The company's employees have a wide range of backgrounds, both Chinese and Western, who are familiar with international carbon market rules while also deeply understanding the unique characteristics of carbon management in China. We differ from other consulting firms in that we serve our customers with a set of carbon management solutions, which include both planning and execution methodologies, to best achieve the desired goals.

Our team members include registered financial professionals, certified greenhouse gas (GHG) auditors, international carbon asset managers, registered engineers, carbon management experts and other senior professionals.

Through the successful completion of many high quality service solutions, we have developed a rich network of international organisations, government bodies and private companies. Since our establishment, we have provided large-scale Clean Development Mechanism (CDM) carbon asset development and management services for regional governments, a series of training workshops for national-level ministries, product carbon inventory projects for large state-owned enterprises and low-carbon development planning and carbon trading rules consulting for several local governments.

South Pole Group Asset Management Ltd.

South Pole Group (www.thesouthpolegroup.com) is a leading developer of Certified and Voluntary Emission Reductions projects (CERs and VERs) and a provider of specialised consultancy and carbon IT services.

South Pole's carbon project portfolio focuses on high-quality carbon emission reduction credits for a wide range of sectors. The advisory and consulting services span from GHG accounting and carbon foot-printing to project and sector level Measuring, Reporting and Verification (MRV), carbon credit issuance and transaction services, capacity development for project partners and policy advice to governments and international institutions, including reform of the CDM and the design and piloting of New Market Mechanisms (NMMs), including: bilateral sectoral crediting, domestic emission trading schemes, Nationally Appropriate Mitigation Actions (NAMAs), and their integration into Low Carbon / Low Emission Development Strategies (LCDS/LEDS).

South Pole is consistently rated among the most successful carbon companies. The company's current portfolio includes more than 400 emission reduction projects (CERs, VERs and Programme of Activities - PoAs) in over 25 countries, totalling more than 100 million tonnes carbon dioxide equivalent (tCO_2e) expected to be issued up until 2020, and more than 55 million tCO_2e already issued and delivered in less than six years, making South Pole one of the leading market players worldwide. In particular, the company is a world-leading project developer and seller of Gold Standard CDM and voluntary emissions reduction credits.

Since its inception in 2006, South Pole has grown very rapidly and now has offices covering all regions of the world. South Pole is headquartered in Zurich and has offices in Bangkok, Beijing, Hanoi, Hong Kong, Jakarta, Kampala, London, Medellín, Mexico City, New Delhi, Stockholm and Taipei, as well as a representative office in San Francisco, Addis Ababa, São Paulo, Sydney and Melbourne. The company is privately owned and employs more than 130 carbon market experts from over 20 countries.

International Finance Corporation

Global

Climate change is not just an environmental challenge – it is a fundamental threat to development in our lifetime. The World Bank Group has made confronting climate change a top priority in our push to eradicate extreme poverty and boost shared prosperity. As the World Bank Group's private sector arm, IFC is stepping up the investments in climate change mitigation and adaptation and helping our clients understand and manage the risks and opportunities presented by climate change.

Since 2005, IFC has provided about $13 billion in long-term financing for renewable power, energy efficiency, sustainable agriculture, green buildings and private sector adaptation to climate change. Since IFC made its first investment in renewable energy in 1989, IFC has become a leading global financier of solar and wind energy for developing countries. IFC has co-financed more than 2,700 MW of wind power, more than 1,200 MW of solar and close to 6,000 MW in hydro power in places including China, India, Pakistan, Jordan, South Africa, and Chile, Mexico.

In fiscal year 2015, IFC's total climate-related investments were $2.3 billion, covering 103 climate investment projects in 31 countries. IFC mobilized a record $2.2 billion from other investors, reflecting a growing appreciation that clean energy, resource efficiency and climate change adaptation represent areas of opportunity for us and our clients. As a result, $4.5 billion was invested through IFC's direct involvement.

IFC is also working to leverage new sources of funding for green growth through its green bonds program that has raised $3.8 billion, as well as through the Catalyst Fund and its co-investments with governments through its blended finance work.

China

In 2011, the National Development and Reform Commission, NDRC, announced that China would introduce the use of emissions trading on a pilot basis in order to put a price on carbon, thus leveraging private sector forces to reduce future growth in carbon dioxide (CO_2) emissions from the power, industry, and manufacturing sectors. Seven emission trading pilots are being implemented during 2013-2016 across the provinces of Guangdong (GD) and Hubei, and in the cities of Beijing, Shanghai, Shenzhen (SZ), Chongqing and Tianjin. These pilots will provide the groundwork for a mandatory nationwide emissions trading scheme expected to be rolled out around 2017.

Current regulations only allow for spot trading of allowances but it is important that futures contracts and other types of derivatives become available in the market at some point. In the European carbon market, over 90% of volume comes from non-spot products. NDRC and China Securities Regulatory Committee (CSRC) are jointly analysing such products and are interested in collaborating with the World Bank Group in this area.

IFC is keen to work, in collaboration with IBRD, to promote a robust and sustainable carbon market in China. IBRD's intervention is primarily focused on working at the national level on framework formulation, monitoring and verification system design and other systemic issues. IFC intends to complement this at the local level, beginning with pilot exchanges. Stakeholder platforms have been established at the local level to support further development of the emissions trading pilots through access to global best practices, opportunities for learning and experimentation, and stakeholder dialogue provided or supported by IFC. Non-spot emissions trading products will be designed and tested by the emission exchanges with IFC support.

1 Global background to China's Carbon Market

According to the IPCC 5th Assessment Report (AR5) (Working Group III Technical Support Unit, 2014), human activity has been the main cause of global warming since 1950. Addressing climate change is therefore a common challenge to be faced by all of humanity. CO_2 emissions in the atmosphere should be limited to under 3.2 trillion tonnes if the 2°C goal in the Copenhagen Accord is to be achieved (China Economic Net - "Economic Daily", 2015). Only 1.2 trillion tonnes of this total now remain, meaning that there is an urgent need for energy saving and emissions reductions around the world. The IPCC AR5 provides an emissions reduction pathway for achieving the 2°C goal, stating that global GHG emissions should peak before 2020; by 2030 should fall back to 2010 levels, marking a reduction of 40%; in 2050 should be 40-70% less than 2010 levels; and that near-zero emissions should be realised by the end of 21st century (Green & Low Carbon Development Think Tank Partnership, 2015).

Carbon pricing is an indispensable tool for achieving the global GHG emission goal. Expert bodies, including the US National Academy of Sciences, have suggested that establishing a carbon pricing system is the most effective way of reducing GHG emissions, given that "a system that places a price on greenhouse gas emissions (through cap-and-trade, taxes, or some hybrid of the two) creates incentives for emission reduction efforts" (Beijing Academy of Science and Technology, 2010).

Carbon pricing systems include both emissions trading schemes (ETSs) and carbon taxes, of which China has prioritised ETS. Research by Peking University (Yu Yekui, 2014) has shown that the slope of marginal income curve of carbon emission reduction is bigger than marginal cost in the long term. An ETS is therefore best suited to the China's future situation. Utilising an ETS in China will enhance the effectiveness of market mechanisms in allocating resources and controlling GHG emissions, making it an important measure in addressing climate change that is both scientific and effective.

1.1 Global response to climate change

1.1.1 Overview of global GHG emissions

The concentration of GHGs in the atmosphere has reached its highest level in at least 800 thousand years (Technical Support Unit, 2014). The trend since the beginning of the Industrial Revolution is shown in Figure 1. The latest analysis of the World Meteorological Organization (WMO) Global Atmospheric Watch (GAW) shows that average CO_2 concentration around the globe reached a new high in 2014 of around 397.7ppm, which is 43% above the pre-industrial level (WMO Secretariat, World Data Center for Greenhouse Gases, GAW GHG Scientific Advisory Group, 2015). The rate of increase in CO_2 concentration has been highest in the past 10-20 years, and the increment in 2014 was close to the average for that period. The GHG index of the National Oceanic and Atmospheric Administration (NOAA) indicates that radiation intensity of long-lived GHGs (LLGHGs) increased 36% from 1990 to 2014, of which CO_2 accounts for about 80%.

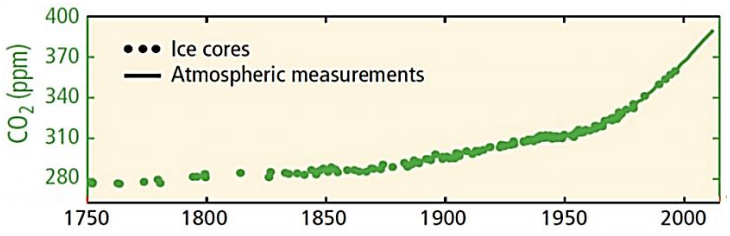

Figure 1: The trend of global CO_2 concentration in the atmosphere since industrialisation
Source: (Technical Support Unit, 2014)

China has been among the world's top three emitters of greenhouse gases since 2000. One of the reasons that the USA dropped out of the Kyoto Protocol in 2001 was the view that the absence of some large developing countries in participating in effective emission reduction activity was unfair, especially China, India, and Brazil (Human education network, 2010). Indeed, as a large carbon emitting country, China's emissions have continued to soar since 2007, when China first exceeded the USA's annual emissions. As a result, the emissions of China accounted for 26% of the world total, 8.5 billion tCO_2-e, in 2012, making China the biggest GHG emitting country. Currently, China's annual emissions are almost equal to the sum of those of the EU and the USA together. Consequently, China's government has faced intense international pressure during the last ten years regarding its GHG emissions.

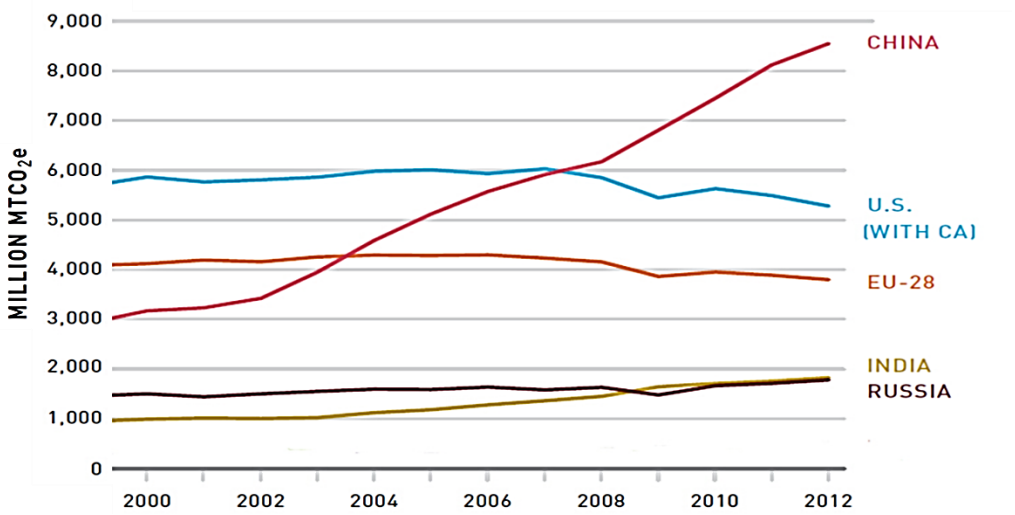

Figure 2: Global CO_2 emissions from the world's major economies since 2000

Source: (Next 10, 2015)

As a result, if China wants to establish a responsible image for itself in the international community and mitigate the "China threat" theory, it should make a fair contribution to reducing GHG emissions. This should be seen as an opportunity to achieve a transformation in the pattern of economic growth.

1.1.2 Outcome of the Paris Climate Conference

On December 12, 2015, in the northern suburbs of Paris at Le Bourget Exhibition centre, a total of 195 parties to the United Nations Framework Convention on Climate Change (UNFCCC) reached a new global climate agreement (China Youth Daily, 2015). Under the agreement, the parties agreed to limit global average temperature increase to within 2°C compared with the pre-industrial era, and to strive to limit the temperature increase to within 1.5°C. In addition, the agreement noted that developed countries should continue to take the lead, both in efforts to achieve emission reduction targets and by providing $100 billion each year by 2020 to help developing countries cope with climate change, as a baseline. Furthermore, the parties should propose new funding targets by 2025 at the latest.

Under the agreement, the parties will respond to climate change by implementing their Nationally Determined Contributions (NDCs). As of 14 December 2015, more than 158 NDCs had been submitted, including by all developed countries and nearly 80% of developing countries. According to a report released by the UNFCCC Secretariat on 30 October 2015, the existing NDCs will decrease global per capita emissions by 8% by 2025 and 9% by 2030 (Xueyu, 2015). Assuming that the NDCs are fully implemented, it is expected that emissions growth during 2010-2030 will be about 33% lower compared with 1990-2010. The commitments will result in 4 billion tonnes CO_2e of global emissions reductions by 2030 when compared with a scenario without the NDCs. However, the estimated total GHG emission reductions by 2025 and 2030 resulting from the NDCs cannot achieve the goal of a rise in temperatures of less than 2°C. Current NDCs will only be able to limit global warming to within 2.7°C by 2100. In 2030, the total level of GHGs in the atmosphere will reach 55 billion tonnes. This means that future emission reduction efforts need to be far greater than those associated with the NDCs alone in order to cut emissions to 40 billion tonnes. Only then can global average temperature increase be kept below 2°C compared with the pre-industrial level, let alone 1.5°C.

The "Paris Agreement" suggests that, if the aim is to adopt a cooperative, voluntary approach, including the international transfer of mitigation measures to achieve independent national contributions, Parties should not only promote sustainable development but also ensure environmental integrity and transparency, including for governance. Prudent accounting methods should be used, in particular to ensure that double counting is avoided, consistent with the guidance adopted by the Agreement of the Conference of the Parties (COP).

The "Paris Agreement" also establishes a mechanism for inventory. From 2023, every five years an inventory of the progress of global action will be conducted in order to help countries improve and strengthen international cooperation to achieve the long-term goals of the global response to climate change. After the adoption of the "Paris Agreement", it will be submitted to the United Nations for formal signature by 22 April 2016, and will enter into force once it is ratified by 55 countries, accounting for more than 55% of global carbon emissions.

1.2 Status of carbon pricing in major economies

1.2.1 Carbon pricing instruments in major economies

According to the World Bank, there is increasing momentum toward carbon pricing around the globe (World Bank and Ecofys, 2015). Currently, approximately 40 countries and more than 20 cities, states, and regions, which together account for 25% of global GHG emissions, have implemented a carbon pricing system. These carbon pricing systems cover half of the emissions in those regions, about 3.5 billion tonnes CO_2e or 12% of global GHG emissions. World Bank President Jim Yong Kim was clear: “There has never been a global movement to put a price on carbon at this level and with this degree of unison. It marks a turning point from the debate on the economic systems needed for low-carbon growth to the implementation of policies and pricing mechanisms to deliver jobs, clean growth and prosperity.” (Wang, 2015).

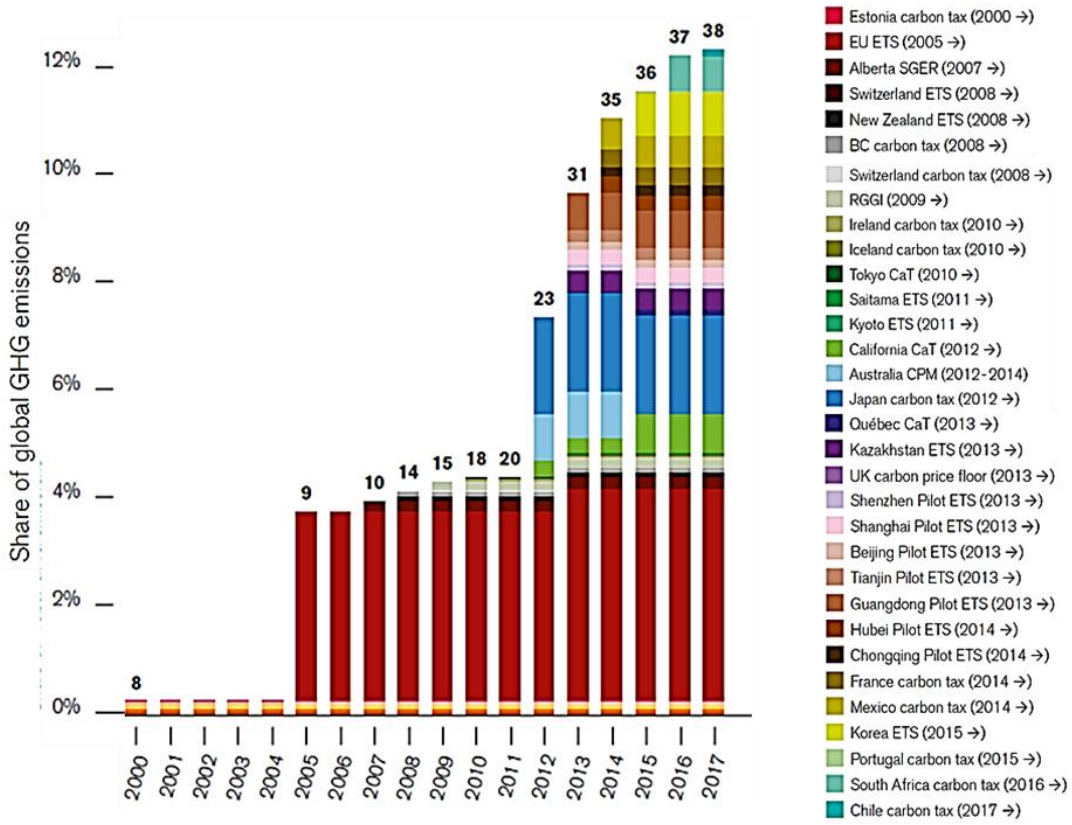

Figure 3: Main carbon pricing systems worldwide since 2000

Source: (World Bank and Ecofys, 2015)

1.2.2 Prices in the main carbon markets

The total value of global carbon trading systems in 2015 was $34 billion, 6% more than the $32 billion 2014 (World Bank and Ecofys, 2015). This increase is mainly due to the opening of the Korean carbon trading system, as well as the expansion of the carbon market in California and Quebec. At present, carbon prices in the world's major carbon markets range from $1/t$CO_2$e to $13/t$CO_2$e, of which 90% is valued at less than $10/t$CO_2$e (World Bank and Ecofys, 2015). However in scenario analysis, only when the global average carbon price is between $80/t$CO_2$e and $120/t$CO_2$e, can the 2°C goal be met by the end of this century. Therefore, current pricing levels are insufficient with regards to their market role.

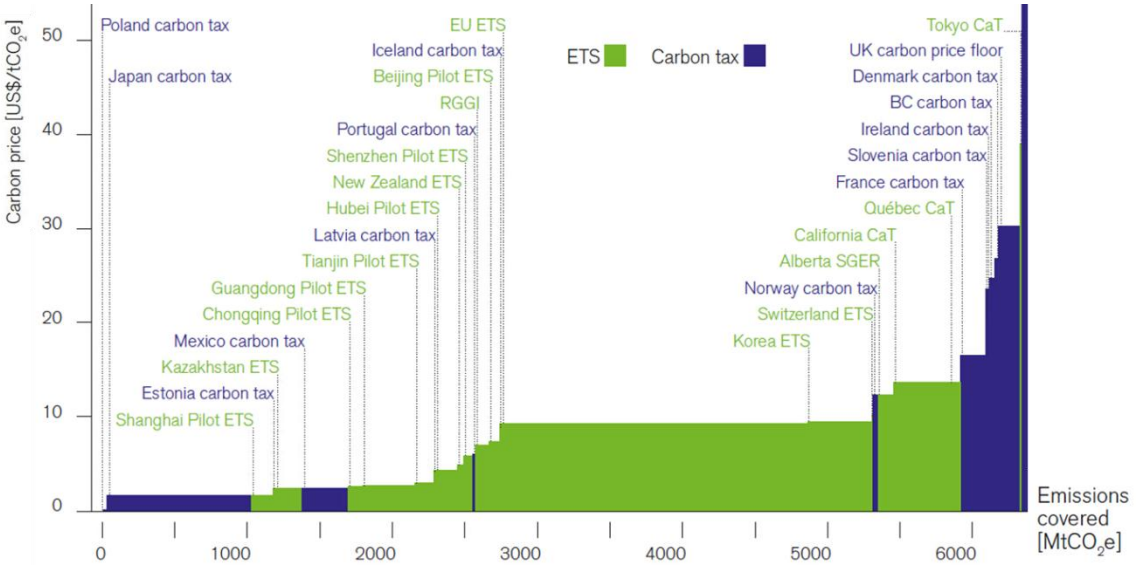

Figure 4: Market value of global carbon pricing systems in 2015

Source: (World Bank and Ecofys, 2015)

1.2.3 Confidence in the global carbon market

According to the Point Carbon Market Survey 2015, most respondents hope to see the adoption of a cap and trade system by 2020, rather than carbon taxes or subsidies (Zhang Qing L. X., 2015). About 19% of respondents said that cap and trade is an ideal tool, while 66% think that it is the best option available.

The report concluded that the European resolution on a market stability mechanism and the new 2030 climate targets have allowed the market to believe that policymakers are indeed serious about their commitment to the European carbon market. The surplus allowances will take some time to be absorbed, but there is no reason to think that the European carbon market will be inactive in the next few years.

Respondents were more pessimistic in relation to the North American carbon market. Only 17% of respondents had confidence that the United States, with its existing policy mix, will achieve its climate goal to reduce emissions by 26% to 28% by 2025. 33% of respondents were not sure, and 34% believe that this goal cannot be achieved at all.

However, it is noteworthy that respondents have higher expectations for China's carbon market, providing the background for a recovery in confidence in the global carbon market. According to the report, 43% respondents believe that Chinese authorities will launch a national ETS in 2017 at the earliest, and another 40% think the ETS will be officially launched between 2018 and 2020.

2 Construction process of China's carbon market

At the end of September 2015, in the U.S.-China Joint Presidential Statement on Climate Change, Xi Jinping said that China would set a goal to decrease CO_2 emissions per unit of Gross Domestic Product (GDP) by 60-65% by 2030 compared to 2005 (Xi Jinping, 2015). According to relevant sources, for China to achieve its planned emissions reduction, the investment required may reach more than 41 trillion Yuan. (Guangchazhe, 2015) The market mechanism of carbon trading systems will have a promising future in promoting energy saving and achieving the carbon reduction targets. The Joint Statement said that China will launch a national carbon emissions trading system in 2017, covering the iron and steel, electric power, chemicals, building materials, paper, non-ferrous metals and other key industrial sectors.

Since 2013, China has launched carbon trading pilots in seven provinces and cities, giving it highly relevant experience in the operation of ETSs (Qi Shaozhou, 2015). Because the seven pilots are spread across the east, centre, and west of China, they reflect regional economic differences, and their institutional design reflects regional characteristics. Shenzhen's institutional design is market-driven, Hubei has greatly encouraged market activity, Beijing and Shanghai focus on managing the system's performance, Guangdong places emphasis on the primary market, and Chongqing adopted autonomous allocation of allowances for enterprises. All of these provide a wealth of experience and lessons for policy makers in the establishment of the national carbon market in 2017, leading to full functionality by 2020 (The Paulson Institute, 2015).

2.1 Working progress in China's carbon market

2.1.1 Policy documents at the national level

Since the NDRG issued Decree No.17 in December 2014, the development of China's carbon market has made great progress. In 2015, seminars on the draft Climate Change Law were held by the NDRC Climate Department in Chengdu, Beijing, and other cities (NDRC Climate Change Department, 2015). Relevant representatives from government, research institutions, associations, and enterprises participated in the discussion. As a result, the legislation will soon be issued at the national level. The NDRC also held hearings on the draft National Carbon Emissions Trading Regulations in July, which involved hearings on the issue of administrative licensing (NDRC Climate Change Department, 2015). According to Reuters, the new draft will impose more stringent penalties on the companies under the cap who are not able to successfully fulfil their obligations. For these companies who exceed their quota, each unit of excess carbon emissions will be penalised three to five times the average annual carbon market price, and the number of allocated allowances for the next year will be reduced by the corresponding amount. Companies who fail to submit allowances in the required period will be penalised according to the number of days of the extension required.

Date	Name	NO.	Institution
12/12/2014	Interim Measures for the management of carbon emissions trading	DRC Order No.17	NDRC
5/5/2015	Opinions of the Central Committee of the Communist Party of China on accelerating the construction of ecological civilization		State Council
14/5/2015	Notice of the NDRC on the implementation of the relevant work arrangements for the construction of the national carbon emissions trading market	DR Climate (2015) No.1024	NDRC

Date	Name	NO.	Institution
30/6/2015	Strengthening the response to climate change - China's national autonneomous contribution		State Council
10/8/2015	NDRC climate implement hearing on the administrative licensing related matters of national carbon emission rights trading management regulations (Draft)		NDRC Climate Change Department
31/8/2015	White book of forestry policy and action on climate change in 2014	Banzaozi (2015) No.134	SFB Office
21/9/2015	The CPC Central Committee and the State Council issued "the overall plan for the reform of the system of ecological civilization"		State Council
26/9/2015	Sino US Joint Presidential Statement on Climate Change		State Council
3/11/2015	Sino French Joint Presidential Statement on Climate Change		State Council
3/11/2015	CPC Central Committee proposal on the formulation of national economic and social development of the thirteenth five year plan		State Council
11/11/2015	Notice of the NDRC Office on issuing the third GHG accounting methods and reporting guidelines for enterprises of 10 industries (Trial)	DR Office Climate (2015) No.1722	NDRC
16/11/2015	Notice on the release of the registration scheme for GHG inspectors	Zhongrenxiezhuer (2015) No.286	CCAA
20/11/2015	Announcement on approving "the release of greenhouse gas emissions accounting and reporting rules for industrial enterprises" etc. 11 national standards	National Standard Announcement 2015 No.36	AQSIQ, SAC
22/12/2015	Announcement on issuing green financial bonds in the inter-bank bond market	PBC Announcement (2015) No.39	PBC
22/1/2016	The NDRC general office notice on earnestly implementing the key work of the national carbon emission trading market	DR Office Climate (2017) No.57	NDRC[1]

Table 1: Carbon market policy documents at the national level in 2015

Source: Desk research by Environomist

[1] Note: Due to the importance of this document, this 2016 published Notice is included in the report.

2.1.2 Timeframe and milestones of China's carbon market

In 2009, the Chinese government announced its target of decreasing CO_2 emissions per unit of GDP by 40%-45% by 2020 compared with 2005 to the international community. In addition, the Chinese government has repeatedly identified its independent goal for CO_2 emissions to peak by 2030 and to strive to reach this peak as soon as possible. Over the same time, CO_2 emissions per unit of GDP would decrease 60-65% from 2005 (Xinhua, 2014). In order to achieve such an ambitious goal while not affecting the domestic economy, and promoting enterprise to independently reduce emissions as far as possible, a fully functioning national carbon market is particularly critical.

With its strong administrative powers, China completed the design of the registration and transaction systems in less than two years, which contrasts with the more than six years that developed economies spent for the same process. Based on the pilot experience, China will initiate a national carbon market in early 2017. The construction of the national carbon market is divided into three stages: 2015-2016 is the preparatory stage during which work on the carbon market infrastructure should be completed; 2017-2020 is the stage for improving operation, which will see the introduction of carbon emissions trading, and is when the trading system will be adjusted and improved in order to achieve stable market operation; and post-2020 is the stage for deepening the role of ETS when coverage will be further expanded, the rules of the system will be improved, and international carbon market links should be explored and researched (Qi Shaozhou, 2015).

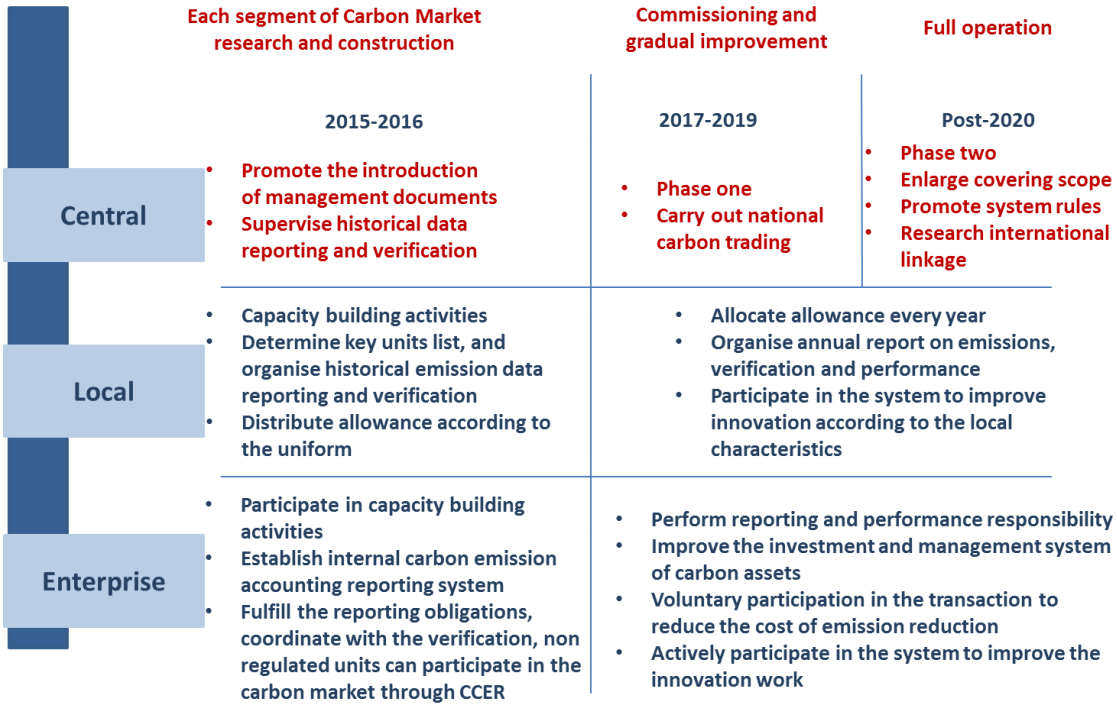

Figure 5: Pathway towards the national carbon market

Source: (Renhu, 2014)

Commentary 1: Aspects that are important to consider in the design phase of the national ETS

Commentary 1: Aspects that are important to consider in the design phase of the national ETS

Special commentator: Ms. Goerild Heggelund, INTASAVE Asia-Pacific, Fridtjof Nansen

Institute

China has decided to establish a carbon market as proposed in its 12th Five Year Plan (FYP, 2011-2015) and a national Emissions Trading Scheme (ETS) is under preparation. The carbon market and market mechanisms are regarded as complementary approach to command-and control mechanisms (Duan 2015). China has turned to more market based approaches such as the carbon market, in line with its deepening of and market reform and economic restructuring as decided at the Party 18th Communist Party Congress in November 2012. Seven pilots were established in 2013 and 2014 to provide experience for the national system. The national ETS is set to begin operation in 2017 during the 13th FYP (2016-2020) as announced by President Xi Jinping during his state visit in the US in November 2015. President Xi's announcement to start the national ETS in 2017 is an important signal for all stakeholders, including ministries, provinces, cities and enterprises in China to actively prepare for the ETS.

China submitted its Intended National Determined Contribution (INDC) to the UNFCCC before COP21 in Paris. China aims to peak CO2 emissions around 2030 (or earlier); to lower carbon dioxide emissions per unit of GDP by 60% to 65% from the 2005 level; non-fossil energy increase to 20 percent by 2013; increase the forest stock volume by around 4.5 billion cubic meters on the 2005 level; and control coal consumption, i.e. set a cap on coal use. The national ETS when operational will contribute to China' efforts to reach emissions reduction objectives in the forthcoming 13th FYP (2016-2020), as well as support the INDC goals.

The recent Paris Agreement from COP21 included a central role for market mechanisms, and provides an additional incentive for China to further cement its ETS. China has already gained important experiences through the pilot phase and through international collaboration, both on the pilot level and on the national ETS.

China's national ETS will be a system with unified rules for all provinces, with two-level system, central and provincial (Duan 2015). All provinces will be included in the system from the beginning. The National Development and Reform Commission (NDRC), responsible for coordinating climate efforts in China including the ETS, issued Interim Management Rules on Emissions Trading, in December 2014 that provide basis for the ETS.

I would like to highlight three aspects that are important to consider in the design phase of the national ETS (pls see Duan 2015 for additional challenges).

Legal foundation: One of the most critical areas for the successful implementation of ETS in China (and elsewhere) is the establishment of a legal basis. The government and experts have expressed the need for a strong legal basis for the national ETS for effective implementation and potential punishment of non-compliance. NDRC is well aware of the legal challenges and is working with the Legislative Affairs Office of the State Council to have the Interim measures promoted to State Council regulation (Duan 2015). This may still take some time due to procedures and compulsory hearing. There is positive experience in the pilots, such as in Beijing and Shenzhen, where the local People's Congresses have passed ETS legislation. In the other 5 pilots currently have weaker legal basis; some have decrees issued by the local governments (Tianjin, Shanghai, Guangdong and Hubei); in Chongqing a notice has been issued (Duan 2015). The valuable experience from Beijing and Shenzhen is worthwhile sharing with pilots and others starting to initiate carbon market.

Equity and distribution for allocation to provinces: In the design of the national emissions trading

system capacity, equity and distributional aspects are relevant. The different development levels of China's provinces need to be taken into consideration in the design phase. Scholars consider potential allocation schemes in line with equity principles in China (Zhang et al 2014). Development gaps between urban and rural areas and among regions are still large, and so are income disparities. Developing a low-carbon economy is the goal of many provinces and cities in China, yet, sometimes hard to achieve due to varying needs and priorities as well as institutional restrictions, such as lack of staff.

President Xi recently pledged that poverty alleviation will be a major part of China's post-2015 agenda, and the 70 million poor in China will be lifted above the poverty line by 2020 (Xinhua 2015). The pledge may not directly link to the ETS, yet, illustrates existing challenges in China. The varying levels and lack of capacity and knowledge of the ETS is a challenge. Not all provinces have come as far as the pilots. Some provinces are very active, while others will need extensive capacity building and training.

Synergies and policy coherence: It is important to identify synergies between the ETS and other climate and energy policies. China will bring 10,000 enterprises on board when the ETS goes into effect in 2017, covering six sectors and 15 sub-industries (Carbon Pulse 8 December 2015). Linking with other important policy processes such as the mandatory Top 10,000 programme of enterprises in the 12th Five-Year Plan period would be highly relevant.[2] Industrial energy efficiency is regarded as crucial to reduce energy demand and GHGs emissions (Lu et al 2014). It is likely that the Top 10,000 programme will continue under the 13th FYP in some form (though perhaps a different name). The importance of policy coherence between the energy saving programmes and the national ETS cannot be stressed enough as industry is the main contributor to China's emissions. More importantly, for China to reach an emission peak in 2030 (or before), industry will have to peak in 2020 (ERI et al 2016).

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[2] The Top 10,000 Program aims to cover two thirds of China's total energy consumption, or 15,000 industrial enterprises that use more than 10,000 tonnes of coal equivalent (tce) per year (), and around 160 large transportation enterprises (such as large shipping companies), and public buildings that use more than 5,000 tce per year. The total number of enterprises covered by this programme reaches to around 17,000. See LBNL 2015.

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Goerild is an energy and climate policy expert with excellent research credentials. Goerild has lived and worked in China for many years and is fluent in Chinese having studied at Peking University. During the 1990s, Goerild held various positions at the United Nations Development Programme (UNDP) China office, covering energy and environmental issues. From 2009-2014 she was Senior Climate Change Advisor at UNDP China where she was responsible for the work of the Climate Change Unit. At UNDP, Goerild coordinated the 2010 National Human Development Report (NHDR): China and a Sustainable Future: Towards a Low Carbon Economy and Society. She coordinated the work for the Low Carbon Development in China and India: Issues and Strategies launched in March 2014. Goerild also co-edited and coordinated UNDP China's 2013 Sustainable and Liveable Cities: Toward Ecological Civilization.

Since 2003, Goerild has also led a number of key research projects including 'Design of CDM-system in China' and 'China's Climate Change Policy: Through the Prism of Energy Policy". She has also participated as an international expert in projects such as 'Blueprint for East-Asian Energy Efficiency Cooperation: International Framework to Promote Energy Efficiency in East Asia', 'Building Capacity for the Clean Development Mechanism in China' and in the 'OECD Environmental Performance Review of China' published in 2007, with responsibility for the chapter on energy.

Goerild is an international expert in the China Council for International Cooperation on Environment and Development (CCICED) Special Policy Study on Good City Models under the Concept of Ecological Civilization. Prior to this, Goerild took part as an international expert and international coordinator in the Task Force on Environmental Protection and Social Development in 2013, as well as in the Task Force for China Environment and Development Outlook.

Goerild is also a Senior Research Fellow and the chief representative of the Fridtjof Nansen Institute (FNI) in China. Back in her native Norway, she previously held the position of Director of Global Programme for FNI, carrying out research on China's environmental, energy and climate change policy. At INTASAVE, Goerild is the project lead for the Norwegian Embassy funded 'Adaptation and Mitigation Co-benefits Project' and leads the Resource Hub as Head of Climate Change and Energy Policy.

INTASAVE Asia Pacific's Beijing office work is founded on the organisation's global work on energy and climate change, in which it innovates, connects and implements practical solutions for sustainable development and climate change.

FNI of Norway has long experience in research on international environmental, energy and resource management politics and law. International and national climate policies is a core area of its research.

Commentary 2: The important role of central enterprises in the carbon market

Commentary 2: The important role of central enterprises in the carbon market

Special commentator: Department of carbon assets in China Water Conservancy and Electric Power Material Group Co., Ltd.

In September 2015, President Xi Jinping visited the United States, with both heads of state issuing the Sino-US joint statement on climate change. China officially committed to launching a comprehensive national carbon trading market in 2017. China plans to closely combine carbon emission reductions with carbon trading and to effectively promote carbon asset trading, through the establishment of a carbon market and trading rules. As the major central enterprises are the industries that are most constrained by their carbon emissions and are the most important carbon market participants in the domestic carbon market, they should strengthen their carbon asset management as quickly as possible.

Central enterprises will play an important role in the carbon market, mainly in the following ways. Firstly, the relevant authorities of the central enterprises should act as the engine for promoting the spread of the carbon market in the future, should have more responsibilities and obligations in the carbon market's future development, should drive the group's enterprises to strengthen capacity building, and should constantly improve their internal management system for carbon assets. They should also help the relevant departments improve market transactions, management, and other laws and regulations, and should actively participate in allowance allocation.

Secondly, after the establishment of the carbon market and in the management regulations, the central enterprises will be given a certain amount of authority to carry out over-the-counter (OTC) transactions under the conditions of the trading rules. Carbon trading is designed to reduce emissions, and considering the special nature of the power industry, central enterprises can play a swap, and manage carbon assets effectively by way of OTC. Minimisation of social costs and maximisation of social benefits would be achieved, not only meeting the regulatory principles of carbon trading, but also playing a positive role in the management and guidance of the carbon trading process.

Thirdly, it is very difficult for each enterprise to develop the capacity needed for carbon trading and management. The central enterprises and enterprises that form their group can effectively achieve management of the carbon assets of the subsidiary company. Compared with other enterprises in the carbon market, central enterprises have their own characteristics in terms of geographical distribution, industry, ownership structure, energy consumption and so on. They occupy a special position in the national economy, so the participation of central enterprises is essential to ensuring the efficiency and success of the national carbon market and the carbon trading system.

For example, as the central business department on carbon asset projects business negotiation, technology development, and carbon assets operation of Datang Power Group, the carbon assets department at China Water Conservancy and Electric Power Material Group Co., Ltd. has created a number of boutique CDM projects and a number of "firsts" in the CDM market in China since its inception in 2005, creating more than one billion Yuan in economic benefits for Datang Group.

With the backdrop of the establishment of the national carbon market, relied on the Datang business logistics segment, carbon assets department of China Water Conservancy and Electric Power Material Group Co., Ltd. constructs the collectivization carbon assets management platform through docking the regional companies and e-commerce platform of each logistics.

Firstly, inner management on project level even installation level and external management on carbon market management institutions, carbon trading participants, and third-party verification institution level to the partners outside of the region, would be extended via carbon assets management and operation network of related enterprises and organisations on each level of Group, combined with the detailed situation of producing. The group scale advantage could be effective via the professional management of carbon assets management department; the varied forms of group carbon assets could be integrated combined with the strategy of the Group; the carbon assets of the Group would be put into ETS in a planned, systematic, and directional way via connecting link method, so the emission cost minimization of the Group could be realized and emission compliance tasks of enterprises on each level of the Group could be completed. Secondly, professional management service in full life circle would be realised with the construction of inner carbon assets management information system; the Group carbon assets could be internally adjusted with the connection between e-commerce platform and trade logistics platform within the Group. Last but not least, while the carbon assets professional management team is being built, the carbon assets operation channels outside the Group should be developed via the mode of internet plus carbon; when the time is right, the targets that preserving or increasing the value of the Group carbon assets and enterprises carbon assets profits maximization could be realised via diversified financial instruments.

2.2 Elements of a national ETS

At present, China is in the process of researching and developing its carbon market. Domestic and foreign experts have different opinions on the plan to start China's national carbon market in 2017. For example, Dr. Yang Fuqiang, the Beijing-based Senior Adviser to the Natural Resources Defense Council (NRDC), has said that 2017 represents only the initial regulatory start date of the national emissions trading mechanism. The so-called “start” of the ETS is only a beginning point. He believes that key problems can only be solved once administrative management of the ETS is transferred to the nationally coordinated administrative institutions in 2017. For example, such problems include: “How the regulations should be formulated? How should the provinces collect data? Which administrative agency should collect data? Which third party should be responsible for inspection? How should they be certified? All of these problems need to be solved. I believe the real deal will not start until 2019 or 2020." (Han, 2015). It is therefore necessary to look at the current stage of development of the national carbon market, in which the government has made substantial progress.

	Main content	Information resource
Emission reduction target	Carbon emissions intensity: 2015 should be 17% lower than 2010, 2020 should be 40-50% lower than 2005, 2030 should be 60-65% lower than 2005 and efforts should be made to reach peak emissions before 2030	12th FYP on controlling GHG emissions; National Climate Change Plan (2014-2020); NDC
Regulated	CO_2, methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons	Notice on the Organisation of GHG

	Main content	Information resource
gas	(PFCs), sulphur hexafluoride ($SF_{6)}$ (based on the situation of enterprises)	Emission Reporting by Key Enterprises
Market opening date	2017 (planned)	U.S. - China Joint Presidential Statement on Climate Change
Trading platform	China Certified Emissions Reductions (CCER) National voluntary emission reduction trading registry system	China certified emission reduction exchange info-platform
Trading platform	Allowance, CCER (initial stage)	Interim Measures for the Management of Carbon Emissions Trading
Trading participants	Key entities and other institutions or individuals, in accordance with trading rules	Interim Measures for the Management of Carbon Emissions Trading
Compliance coverage	15 sub industries of six industrial areas: electric power, metallurgy, nonferrous metals, building materials, chemical industry, and paper, including enterprises' with annual emissions of more than 26,000 tCO_2e	China Carbon Emissions Trading High-level Forum UN Conference on Climate Change – China side event: 'China's carbon market development pathway'
Reporting obligations only	Legal entities whose GHG emissions reached 13kt CO_2e in 2010 or whose total energy consumption reached 5kt standard coal	Notice on the Organisation of GHG Emission Reporting by Key Enterprises
Allowance allocation	Free allocation will be the main approach in allocating emissions allowances in the initial stage and compensation allocation should be introduced at the appropriate time, whose proportion would be increased gradually	Interim Measures for the Management of Carbon Emissions Trading
Allowance reserve and banking	A certain amount of total emissions allowance should be reserved in advance for compensation allocating, market regulation, and key construction projects. The earnings obtained from compensation should be used to accelerate the promotion of relevant national activities, such as decarbonisation and related capacity building	Interim Measures for the Management of Carbon Emissions Trading
Offset mechanism	Key emissions enterprises could use CCER to offset a part of verified carbon emissions, according to relevant regulations	Interim Measures for the Management of Carbon Emissions Trading

	Main content	Information resource
MRV	GHG emissions accounting and reporting rules for industrial enterprises, as well as the other 10 key industries, GHG emission verification and reporting requirements for power generation, steel, aviation, chemical, cement, etc.	Website of NSC
Incentives and non-compliance fines	Key emitting organisations breaking the law should be ordered to comply within a limited timeframe or accept an administrative penalty. Key emitting organisations that don't implement changes on time should be ordered to fulfil their obligations or accept an administrative penalty	Interim Measures for the Management of Carbon Emissions Trading
Reporting date	Mar. 30th (to competent provincial department)	Notice on the Organisation of GHG Emission Reporting by Key Enterprises
Total allowance	3-4 billion tonnes	China Carbon Emissions Trading High-level Forum
Number of enterprises	About 10 thousand enterprises	UN Conference on Climate Change - 'China's carbon market development pathway'

Table 2: Elements of the national carbon market

Source: Desk research by Environomist

Commentary 3: Comparative analysis of the provincial platform and Environomist Carbon Management System for developing the GHG emission reporting system

Commentary 3: Comparative analysis of the provincial platform and Environomist Carbon Management System for developing the GHG emission reporting system

Special commentator: Mr. Lang Jian, Environomist Ltd.

After studying a report by Xu Huaqing, Deputy Director of the National Centre for Climate Change Strategy and International Cooperation, I learned a lot. The report, on 'Designing a provincial GHG emissions reporting system', investigated the design and development of a reporting platform. Director Xu took a comprehensive view of the situation of each province's economic development and industrial structure, introduced the process for developing a provincial GHG emissions reporting system, and related it to the relevant provisions in the 'Interim Measures for Provincial GHG Emissions Reporting' (hereinafter referred to as the "management measures"). The report demonstrates the function of the reporting platform.

Referring to the method of analysis of Deputy Director Xu, combined with the Environomist Carbon Management System (referred to as ECMS), and the corresponding interim management

measures, we provide further analysis of the function of the provincial platform. Development of the ECMS was officially started in 2010 and there have been two areas of successful application so far.

1) National situation

China is a major GHG emitting country. The current annual GHG emissions account for about 30% of the world total, and it continues to be the world's largest GHG emitter. Under enormous international pressure, and in order to better control emissions, China committed to launch a national carbon emissions trading system in 2017. In the early stage of the national carbon market, controlled enterprises will include those with more than 26,000 tonnes CO_2e annual emissions, from six industries. Enterprises whose GHG emissions in 2010 were more than 13,000 tonnes CO_2e, or whose energy consumption was more than 5,000 tonnes of standard coal, will be required to report their emissions. It is estimated that the total number of enterprises across the country required to report will be about 20,000 or more, covering 3-4 billion tonnes of carbon dioxide emissions.

The MRV system of GHG emissions and reductions is key to the whole regulatory mechanism. The accuracy and consistency of the quantitative emissions results are the basis of GHG management and the carbon trading mechanism. The central government has paid special attention to the development of the MRV system. MRV guidance for 24 industries has been introduced, including national standards for the first batch of 10 industries. In order to build capacity, from March 2015 the NDRC and the local development and reform commissions held irregular intensive training sessions on GHG emissions reporting and verification. The targets for training include government agencies, enterprises and institutions, third-party verification agencies, and consulting firms. Training content includes the purpose, scope of application, reporting threshold, report contents, reporting method, reporting platform, reporting cycle, reporting process, third-party evaluation, and verification system, as well as the penalties and incentives for MRV.

2) Provincial situation

Xu's report looks at the case of a province with a large economy and significant greenhouse gas emissions. In this province there are about 1,200 industrial enterprises with energy consumption of 10,000 tonnes of standard coal and 3,000 enterprises with emissions of 13,000 tonnes of CO_2e or annual energy consumption of 5,000 tonnes of standard coal. In recent years, the province has actively explored carbon emissions trading, accelerated the establishment of a GHG emissions statistics, accounting and reporting system. The provincial GHG reporting platform (hereinafter referred to as the "platform") was launched in 2013 and put online in 2014. The platform has accelerated the establishment of GHG emissions statistics, accounting and reporting, helping meet the requirements of both the mandatory and voluntary reporting of enterprises. In order to implement the spirit of the NDRC's notice on organising the GHG emissions reporting of key enterprises, the provincial Development and Reform Commission drafted a management approach, which was issued in the name of the provincial government's General Office in April 2015. The approach presented a clear explanation of the reporting platform, including its functions.

3) Comparison of system processes

Regulatory authorities will focus on security of data management, accuracy of baseline calculations, and reasonable allowance allocation setting. Third parties will focus on efficient verification work, data reliability and reducing verification costs, which together will lead to a greater market share. Companies or agencies using the system will value the convenience of data entry and storage of original documents. Therefore, the system processes will be set up to facilitate ease of operation, the experience of the operator and the accuracy of the final data.

Under the provincial platform, the municipal governments first verify the data, then the provincial

government will review it. Meanwhile, companies can upload annexes to confirm data reliability through the platform, but also to help facilitate the verification agency or government department in carrying out the online data verification. Because only a proportion is verified both at the provincial and municipal levels of government, there exits the possibility for some doubt over the emissions data of regulated entities who were not selected. In addition, given that companies only upload an annex, third-party verification agencies have to verify the data via a combination of offline and online work, leading to inefficiency.

The ECMS system increases the regulated entities on the platform, meaning that the administrator can check 100% of the enterprises. If the reporting data is inconsistent with certificates when enterprises submit their carbon emissions data, the system can automatically remind regulated entities to refill data and credentials. Because the certification can be uploaded entirely via the platform, whether it is a high-level user or third party verification agency, they can check and verify the data directly in the system and work efficiency is substantially increased.

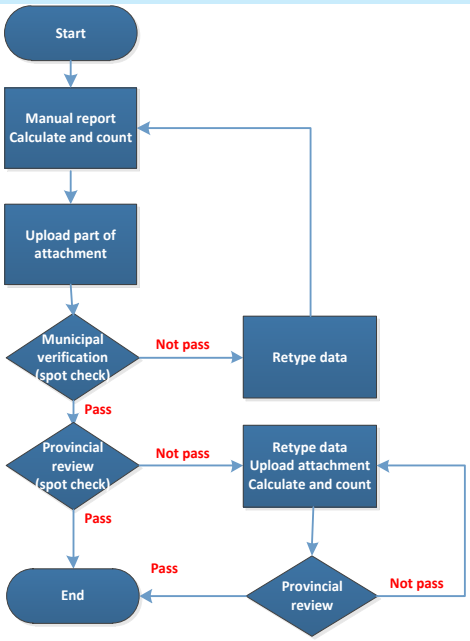

Figure 6: Provincial platform system flow

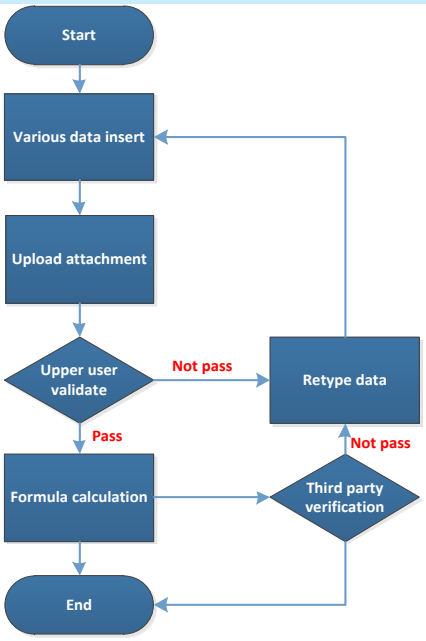

Figure 7: ECMS system flow

4) Comparison of platform features

Platform functionality is actually reflected in the required management approach. Borrowing the words of director Xu, the reporting platform should play an important role in the implementation of the national and provincial MRV system requirements, assist in establishing administrative reporting at all levels, strengthen government capacity for data acquisition, analysis and decision-making, strengthen the regulatory capacity, and enhance the ability of enterprises to conduct monitoring, accounting and reporting.

In the application of MRV standards, the provincial platform is compatible with national and provincial MRV standards. However, the ECMS is open, which means it is compatible with any country, region, and industry MRV standards.

The provincial platform enables management at the three levels of province, city and enterprise, and can provide emissions data for statistical analysis. However, it does not consider management at district or county level or consider the requirements of the government agencies at that level. In order to solve these two problems, ECMS sets multi-level management functions, such as for the various levels of country, province, city, district (counties) and enterprise

management. Statistical analysis of the carbon emission data at these levels is also achieved. This means the ECMS can realise multi-level management from the smallest level of district or county to the highest level of the country. In addition, the ECMS can flexibly configure user permissions, or authorise the non-super admin user to configure the system. The ECMS can help allocate internal tasks for the relevant level of government department, so the appropriate staff can only check the designated enterprises, industries or areas, enhancing work efficiency and also ensuring the confidentiality of enterprise information, which the provincial platform has not yet achieved.

The provincial platform collects data through manual input. In addition to manual input, the ECMS also supports CEMS collection, third party platforms, smart metering and four other collection methods. Enterprises can transmit data through smart meters and the third party platforms directly to ECMS, which reduces the workload and reduces artificial reading errors. This can enhance work efficiency and reduce the cost.

The provincial platform involves functions for enterprise reporting data, municipal third party user verification and provincial third party user review. It supports data archive management, and enterprises can upload partial documentation while reporting data. The ECMS system involves functions for enterprise data reporting, high-level user validation, and third party user verification. ECMS allows for data archive management. The data can be accurate to each facility of enterprises. Users can select different frequency, including daily, monthly, yearly, etc., according to the actual situation of the enterprise for reporting data. When enterprises are reporting data, all the documents can be uploaded to the system for archiving, so emissions data consistency, accuracy and transparency can be ensured.

No.	Function	Description	Provincial platform	ECMS
1	Multi-level management	Multi-level		✓
		Province, city, county	✓	✓
2	Statistical analysis	Statistical analysis	✓	✓
3	System configuration	Configured by authorised user		✓
4	Verification	Third-party verification	✓	✓
5	Review	Third-party verification again	✓	
6	Validation	Validate all data and certificates		✓
7	Data archive management	Data archive management	✓	✓
8	Data collection	Manual type-in	✓	✓
		CEMS collection		✓
		Third-party platform		✓

		Intelligent instrument		✓
9	MRV system	National MRV system	✓	✓
		Principal MRV system	✓	✓
		Any other MRV system		✓

Table 3: Function comparison between provincial platform and ECMS

5) Challenges and prospects

The carbon market will start soon and the users of the reporting platform will be faced with a variety of challenges and opportunities.

Regulatory agencies of the pilots will be faced with the challenges of transition to the national carbon market, including alteration of MRV guidelines, whether the allowances will be continued, quantification of allowances and allocation, and changes in the scope of coverage. Agencies in non-pilot areas will be faced with the challenge that a carbon market needs to be built from scratch, capacity needs to be built, and support tools need to be developed. Third party verification institutions will be faced with challenges including the degree of support for verification tools, support tools for extending market access, the profitability of verification work and other related issues. Enterprises will be faced with the challenges of further reducing emission reduction costs, weeding out obsolete equipment, and preparing capacity for carbon trading. Support tools will help to tackle various challenges and problems.

In the future, the premise for such support tools is to meet the needs of all parties. Government needs accurate data to calculate baseline emission quantities and allowance allocations, third party verifiers need to achieve higher market share, increase profits and lower cost, as well as achieve higher efficiency, and enterprises need to manage carbon assets scientifically, reduce costly emissions and maximise profits by participating in carbon trading. All of these can be met via ECMS.

Mr. Lang Jian

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Mr. Lang Jian has more than ten years professional experience on billing, and statistical IT technologies in the financial and educational fields. Before joining Environomist, he developed and implemented dozens of specialised systems as the main technical director. After joining, he brings his experience to the development of a low-carbon management IT system, and led development of the world's first MRV system satisfying all relevant criteria. Mr. Lang Jian graduated with a major in Software Engineering from Jilin University.

2.3 CCER offset mechanism

At present, the seven carbon trading pilots are composed of both the quota market and the voluntary emissions trading market. Approved by the relevant government department, the total amount of GHG emissions that enterprises are allowed in a certain period of time is considered to be their quota. The voluntary emissions trading market involves China Certified Emission

Reductions (CCERs). These reductions are mainly from projects in clean energy, energy conservation and other areas. CCERs can be used to settle the quota, offsetting a part of the actual emissions, meaning that they have a market value. CCER transaction is one link for a unified national carbon market, but also a valuable tool for regulating the market. Its importance is self-evident.

At this stage, China's carbon trading market is mainly allowance trading, with CCER trading still being in its infancy. However Jiang Zhaoli, Deputy Director of the Climate Change Department of the NDRC, forecasts that CCER transactions will undergo a boom in the future, and these reductions will also help unify the national carbon market to a certain degree (Central Broadcasting Network, 2015). Due to the relatively fragile balance of supply and demand in the early stage of the carbon market, the regulators will not allow a large volume of CCER emission reductions, in order to limit the impact on the market. Jiang Zhaoli said that the system will be designed to allow the market to form a positive interaction between the allowance market and voluntary emission reduction trading market.

2.3.1 CCER life cycle

2.3.1.1 CCER procedures and development cycle

The development process of CCER projects largely follows the framework and concept of the CDM, including six steps: project design documentation, project approval, project filing, project implementation and monitoring, emission reduction verification and certification, emission reduction issuance. The NDRC defines four types of CCER projects in the 'Interim Measures on GHG Emissions Trading Management' (NDRC Climate Change Department, 2015). The first category of projects are newly developed by project owners, so the development cycle is relatively long; second category projects have been approved by the CDM programme, but the development process is the same with the first category projects, so the development cycle is also long; and third category and fourth category projects are based on already developed CDM projects, so the development cycle is relatively short. In theory, a CCER project development cycle is at least five months (Sinocarbon, 2015). Through the process of CCER project development, there may appear some issues, such as varying levels difficulty for different categories, communication difficulties between project owners, consulting institutions and third party agencies, the validation and certification procedures may not meet requirements, as well as the time required for preparing approval, certification reports, internal assessment and other aspects. Usually a CCER project development cycle will be more than six months. In addition to the project development process, in order for a CCER project to be filed and the emission reduction to be approved successfully, it needs to go through the approval procedure of the NDRC, which generally requires 3-6 months. So in normal circumstances, the shortest period for a CCER project from development to the final traded release of emissions, requires at least eight months. Referring to records for CCER projects that have already been released, the cycle is generally more than 10 months.

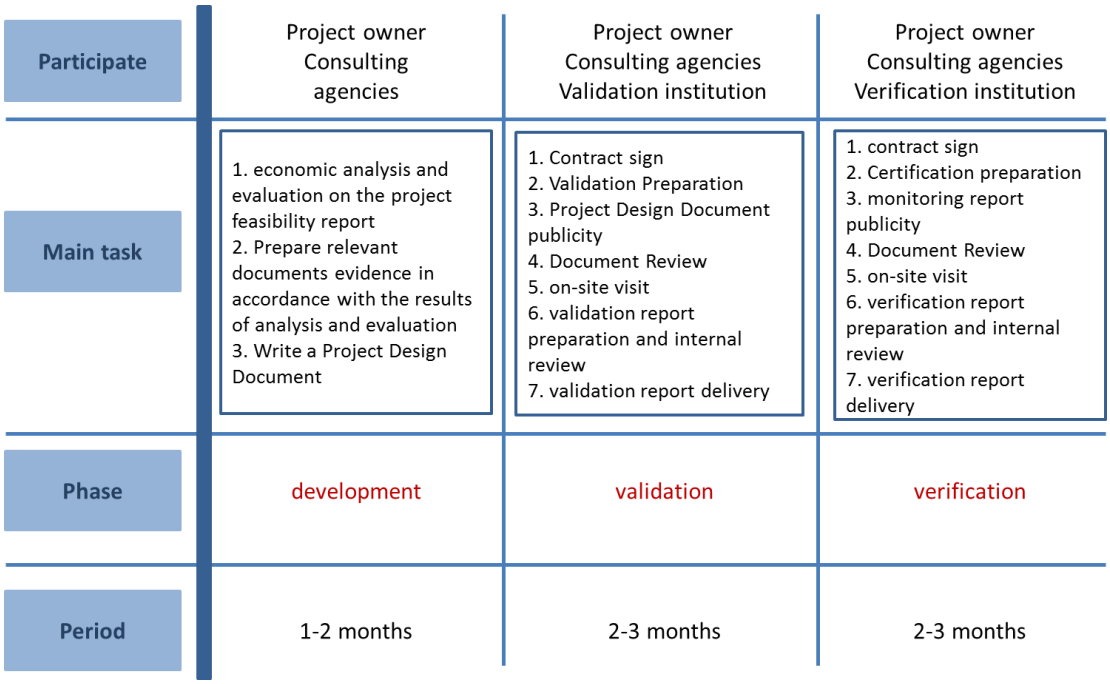


Figure 8: Sample figure CCER project development procedure and cycle

Source: (Sinocarbon, 2015)

2.3.1.2 CCER account opening procedure

Following an announcement by the NDRC, the GHG voluntary emission reduction trading registration system formally launched on 14 January 2015.

Whether for investment or for compliance, the first requirement for CCER transactions is opening an account in the national registration system. The process of opening an account on the national registration system involves three stakeholders: the applicant, a designated agency and the registration management institution. 'Agency' refers to the seven pilot exchanges approved by the NDRC. Voluntary emission trading participants may submit an application for an account at any designated agency. Parties that may open accounts include: CCER project owners, regulated enterprises, investing institutions, other organisations and individuals.

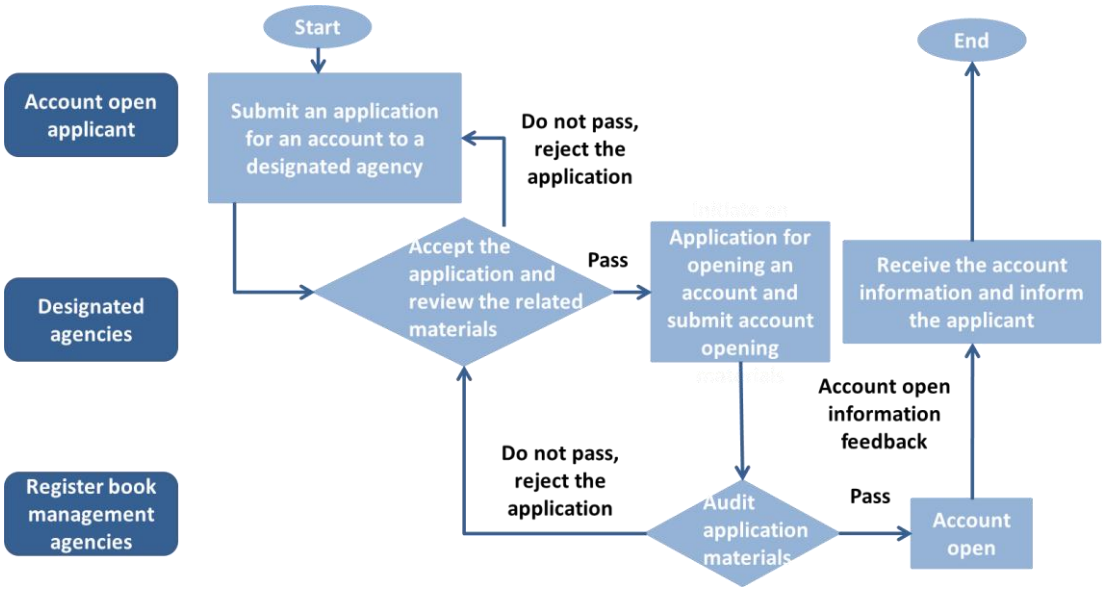


Figure 9: Account opening procedure of the national VER registry system

Source: (NDRC, 2012)

2.3.1.3 CCER trading procedure

The registration system needs to be connected with the trading platform through exchange accounts. The trading platform can operate the exchange account in the registry system through a data exchange interface, including operations like pending CCERs, liquidation etc.

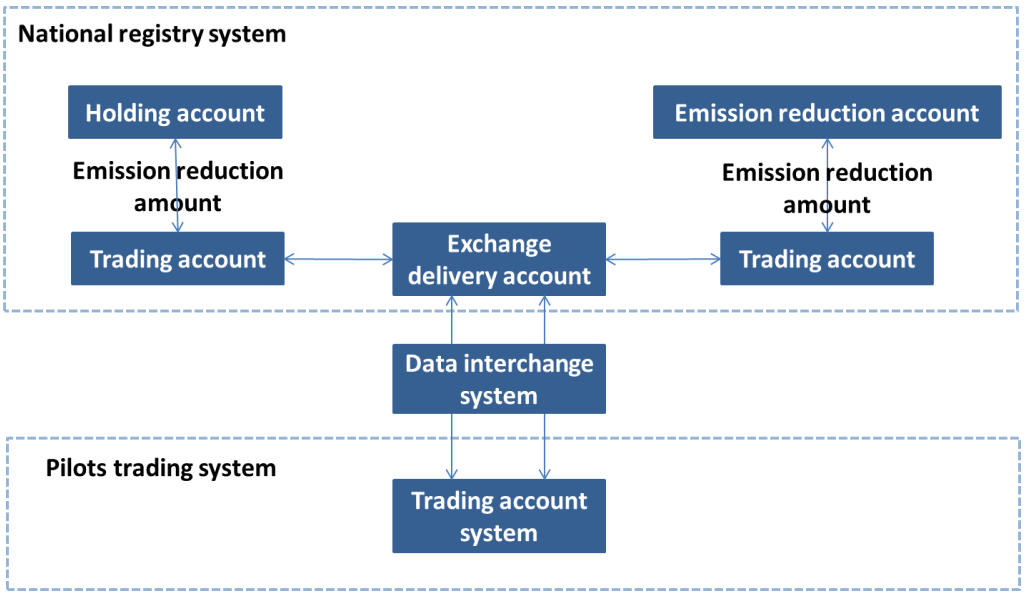


Figure 10: Trading procedure of national VER registry system

Source: (Sinocarbon, 2015)

2.3.2 Analysis of CCER types and emission reduction

As of 30 November 2015, there were a total 1,024 validated CCER projects on the Chinese voluntary emissions trading information platform. The number of projects without emission reductions recorded is 341, and with both project information and emission reductions recorded is 83.

Recorded project	Number	Annual emissions reduction （tCO_2e/y）	Cumulative emissions reduction from 2013-2020 （tCO_2e）	Cumulative emissions reduction from 2015-2020 （tCO_2e）
Category one	146	2,511,160	79,614,955.4	71,930,223.16
Category two	28	3,201,402	20,527,171.46	17,645,722.77
Category three	164	31,793,946.03	1,426,294	0
Category four	0	0	0	0
Afforestation	1	242,523	1,492,257	1,268,049
Total	339	37,749,031	103,060,677.9	90,843,994.93

Table 4: General situation of recorded CCER projects

Source: Desk research by Environomist

According to the entry conditions for offsets of the seven carbon trading pilots, the recorded emission reductions eligible in each pilot can be roughly estimated.

The Hubei ETS can use the largest amount of CCERs: about 7 million tCO_2e. However, the Hubei carbon market has an oversupply of allowances, so the demand for CCERs may simply substitute for quota allowances.

In the Guangdong ETS, it is required that 70% of the applicable CCERs should be generated in Guangdong province, which limits the use of offsetting for compliance to a significant extent. The volume of eligible CCERs is only about 10,000 tCO_2e.

In the Beijing, Shanghai, Shenzhen and Tianjin carbon markets, the volume of eligible CCERs is roughly the same. But considering the higher prices in Beijing and Shenzhen, more CCERs may be attracted to those markets.

Due to serious excess of allowances in the Chongqing carbon market, the trading possibility for CCERs is negligible.

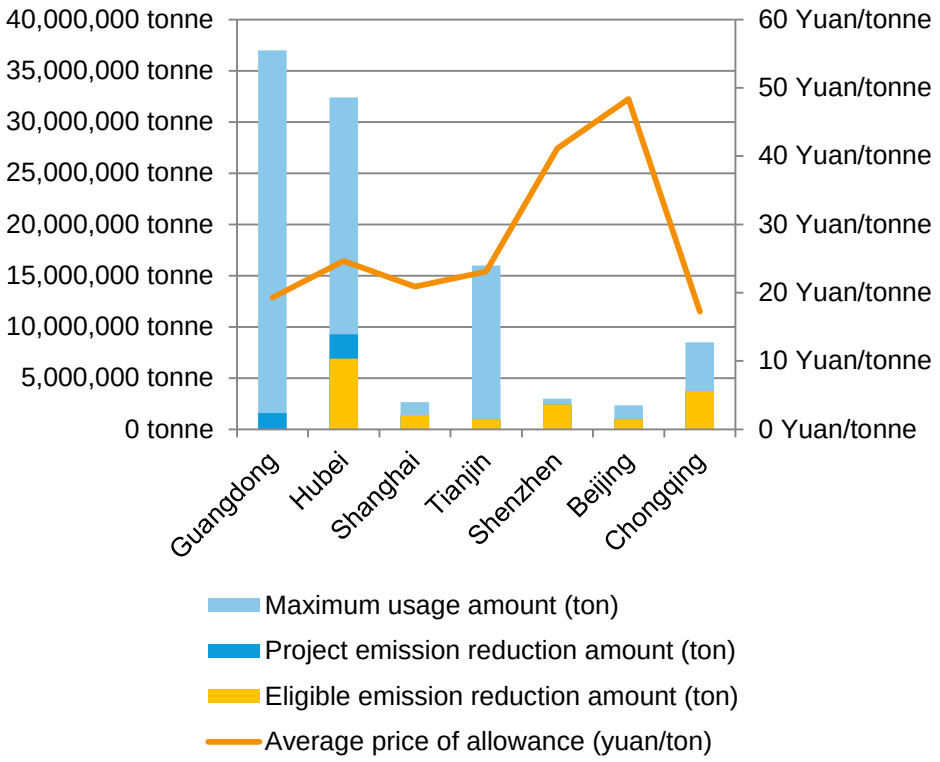


Figure 11: Analysis of compliant CCERs of pilots

Source: CCER exchange info-platform, desk research by Environomist

- Maximum usage amount refers to the maximum amount of CCERs in each pilot area
- Project emission reduction amount refers to the amount of CCERs whose emission reductions have been recorded, and can be used in the pilot area
- Eligible emissions reduction amount refers to the total amount of emissions that can be used in pilot area

Commentary 4: Analysis of CCER Trading and Offsets of Each Pilot Area in Compliance Year 2014

Commentary 4: Analysis of CCER Trading and Offsets of Each Pilot Area in Compliance Year 2014

Special commentator: Ms. Kong Qingxi, Timing Carbon Asset Management Co., Ltd.

Once the CCERs were issued by the NDRC, compliance companies first attempted to purchase them for settlement in compliance year 2014. According to the related statistics, about 2.7 million tonnes of CCERs were settled by compliance companies in Beijing, Shanghai, Tianjin, Shenzhen, Hubei and Guangdong, of which 0.5 million CCERs were traded by Timing Carbon in Beijing, Shanghai, Tianjin and Shenzhen for companies' settlement obligations. This accounts for approximately 30% of the volume of those four pilot markets and 20% of the volume of the national market.

Shanghai

Allowances allocated to the power sector were in short supply, while other sectors saw a surplus. According to the statistics of the Shanghai Development & Reform Commission (DRC), four power companies purchased a total of 503,000 tonnes of CCERs for settlement. A total of 1.4

million tonnes of applicable CCERs were issued up to the end of compliance year 2014, at four board meetings of the NDRC. CCERs generated after 1 January 2013 that were purchased by compliance companies in Shanghai account for 36.4% of the total volume. At the Shanghai exchange, Timing Carbon traded 217,000 tonnes of CCERs, accounting for 43.4% of the total volume, with two power plants. One of the power plants fulfilled the single largest deal since the exchange opened.

Beijing

According to the website of Beijing Development and Reform Commission, nine companies accepted a total of 60,308 tonnes of CCERs for settlement, of which 13,784 tonnes were traded by Timing Carbon. This accounts for 22.9% of the total volume. Moreover, Timing Carbon also provided 100,000 tonnes of CCERs to a regulated entity for compliance year 2015. This represents the single largest deal on the Beijing exchange. Compliance companies in Beijing are mainly in the service sector which usually leads to smaller deals.

Tianjin

There is a relative surplus of allowance supply in Tianjin, which led to the situation that CCER trading is mainly replacing quota allowances. According to the statistics of the exchange, only three companies purchased 311,000 tonnes of CCERs for settlement, which includes 136,000 tonnes traded by Timing Carbon, accounting for 43.8% of the total volume.

Shenzhen

Approximately 900,000 tonnes of CCERs have been purchased by companies for settlement. As Shenzhen is the only pilot to accept previously developed CDM CCERs, there is a relative surplus in supply. Meanwhile, price of allowances is relatively high in Shenzhen. As a result, CCER trading is mostly aimed at earning profit due to the price difference between CCERs and allowances. This could be realized by CCER and allowance replacement. Timing carbon traded 115,000 tonnes of CCERs in Shenzhen province, accounting for 12.8% of the total volume.

Hubei

According to the actual amount issued by Hubei DRC, the CCERs that can enter the Hubei market totals 560,000 tonnes. Besides this, CCERs from provinces which have cooperation agreements with Hubei can be accepted, up to 50,000 from each such province. All CCERs should be first recorded by the Hubei DRC.

Guangdong

It is required by the government that 70% of the CCERs should be generated in Guangdong province, which greatly limits the extent of offsetting for compliance given that very few Guangdong CCERs were issued in this compliance year. According to the statistics of the exchange, regulated entities settled only 350,000 tonnes of CCERs.

Kong Qingxi (Kathy Hung)

CEO and Founder of Timing Carbon, co-founder of Arreon Carbon UK Ltd., Master degree in Management Science, expert in carbon trading and finance. Kathy has more than 10 years' experience in carbon-related business. She previously held the position of Director of the Low Carbon Economy Institute at the International Cooperation Center, NDRC.

Introduction of Timing Carbon Asset Management Co., Ltd.

Timing Carbon Asset Management Co., Ltd. (abbreviated as “Timing Carbon”), founded in 2007, is a leading firm focused on development, trading and management of carbon assets. Timing also serves as a top business provider of carbon asset management and high-level consulting of carbon finance. Our registered capital is 10 million YUAN.

We have a proven track record in developing and trading CDM, VER (including Verified Carbon Standard - VCS and Gold Standard), and China’s domestic CCER projects. We are working jointly with a few large finance institutions to develop carbon finance derivatives, and participate in trading activities on carbon trading platforms. Timing Carbon has memberships in all seven pilot carbon trading platforms, and is a broker member of the Hubei platform and a liquidity trading provider for the Shanghai platform. Timing Carbon has set up two offices, one in Beijing and the other in Shanghai. Our employees have diversified technical and business backgrounds, all with degrees of Masters level or above, including two Ph.D.’s. We combine the expertise of a wide range of professionals – from CDM and CCER specialists, carbon traders to clean technology specialists and low carbon business professionals.

With sufficient capital resources, rich experience in carbon trading and technology promotion, and a professional legal team, we work closely with our clients to ensure the security of carbon trading business, and help them realise the maximum value of their carbon assets.

3 Province-level progress of carbon market development

Jiang Zhaoli, the Deputy Director of the NDRC Climate Change Department, said at the climate conference in Paris that China's national carbon market will be launched in 2017, involving nearly 10 thousand enterprises, covering nearly 50% of national carbon emissions (Reuters, 2015). China's carbon market will then become the largest carbon emissions trading market in the world. The scale will be even larger after 2020, involving more industries and enterprises. The market, once launched, will cover 31 provinces, 6 industrial sectors and 15 sub-sectors, covering 4 billion tonnes of carbon emissions per year.

The latest forecast, presented at the Paris Climate Conference, indicates that this larger carbon emissions trading market is indeed imminent.

3.1 Progress of the ETS pilots

At this stage, the actual oversight of China's carbon market is performed by provincial governments. Firstly, the system and method of carbon market development in the pilot areas and the problems exposed in their operation, can provide experience for the construction of a unified national carbon market; secondly, whether the non-pilot areas can meet the pace of development of the national carbon market will to a large extent influence its effectiveness in facilitating efficient allocation of GHG emissions, and promoting the shifting of the national industrial structure, energy consumption and economic development from high carbon to low carbon.

3.1.1 Key policy documents for the pilots

Du Dande, a member of the committee for the CCICED, believes that the next step towards the national level ETS must start from an assessment of the seven pilots. In an interview with the *Economic Daily*, Xie Zhenhua, China's special envoy on climate change, recently said that since China launched the seven pilot ETSs, progress to date has been very smooth (China Economic Net, 2015). Not only have all the pilots realised online transactions, but the trading price is relatively stable. According to Xie Zhenhua, the key for the pilots is to explore the operation of carbon market mechanisms, "such as how to determine the total allowances, how to allocate, how to verify the trading volume and emissions, and aim to achieve precise and scientific methodology". The seven carbon trading pilots have issued a number of carbon trading policies in 2015.

Date	Name	NO.	Institution
31/12/2014	Public consultation on "several provisions of the Shenzhen Special Economic Zone's carbon emissions management" (Revised Draft) (Exposure Draft)		Shenzhen DRC
1/3/2015	Shenzhen DRC notice on the timely submission of 2014 annual carbon emissions verification report		Shenzhen DRC
13/3/2015	Shenzhen Bureau of statistics notice on carbon trading regulated organisations in 2014 to submit a special audit report on the value added		Shenzhen Bureau of Statistics
18/5/2015	Shenzhen market supervision and Management Bureau notice on the issuance of bus and taxi companies GHG emissions		Shenzhen market supervision

Date	Name	NO.	Institution
	quantification and reporting standards and guide		and Management Bureau
8/6/2015	Shenzhen DRC notice on the issuance of the "Shenzhen carbon trading market offset credit management (Interim)"	Shenzhen DR (2015) No.628	Shenzhen DRC
23/11/2015	Shenzhen market supervision and Management Bureau notice on organising the training of carbon emission verification agencies and inspectors		Shenzhen market supervision and Management Bureau

Table 5: Policy documents of the Shenzhen ETS in 2015

Source: Desk research by Environomist

Date	Name	NO.	Institution
9/2/2015	Guangdong DRC letter on complement of related work of carbon emissions information verification and reporting of the allowance settlement performance in 2014	Guangdong DR Climate letter (2015) No.503	Guangdong DRC
16/2/2015	Guangdong DRC Notice on issuing the Guangdong DRC enforcement regulation on carbon emissions allowance management and the Guangdong DRC enforcement regulation enterprise information of carbon emissions reporting and verification	Guangdong DR Climate (2015) No.80	Guangdong DRC
20/4/2015	The State Council Notice on the issuance of the general plan of China (Guangdong) FTZ	State Council (2015) No.18	State Council
21/5/2015	Guangdong DRC notice on issuing the national low carbon work key points for the pilot of Guangdong Province in 2015	Guangdong DR Climate (2015) No.259	Guangdong DRC
10/7/2015	Guangdong DRC notice on issuing the implementation plan for the 2015 annual carbon emission allowance allocation		Guangdong DRC
17/7/2015	Guangdong DRC notice on issuing the "Guangdong Province carbon GSP pilot implementation programme"	Guangdong DR Climate (2015) No.408	Guangdong DRC
20/7/2015	Guangdong government notice on issuing the implementation plan of China (Guangdong)	Guangdong Government	Guangdong Government

Date	Name	NO.	Institution
	FTZ	(2015) No.68	
21/7/2015	Views of Guangzhou government on further development and utilisation of the capital market	Guangzhou Government (2015) No.19	Guangzhou Government
24/8/2015	Guangzhou China Emissions Exchange (CEEX) carbon emissions allowance trading rules		Guangzhou CEEX
8/9/2015	Guangdong DRC official reply on the 2015 annual carbon emission allowance allocation paid programme	Guangdong DR Climate letter (2015) No.3915	Guangdong DRC
16/9/2015	Notice on issuing guide of carbon emission allowance repurchase business		Guangzhou CEEX
23/9/2015	Implementation plan of GHG emission reporting of key enterprises in Guangdong Province	Guangdong DR Climate (2015) No.550	Guangdong DRC
23/9/2015	Notice on carrying out the work of historical carbon emission information reporting of enterprises in Guangdong Province	Guangdong DR Climate letter (2015) No.4193	Guangdong DRC
17/12/2015	Guangzhou CEEX carbon emissions trading risk control management rules		Guangzhou CEEX

Table 6: Policy documents of the Guangdong ETS in 2015

Source: Desk research by Environomist

Date	Name	NO.	Institution
15/1/2015	Shanghai Environment and Energy Exchange (CNEEEX) notice on launching the national registration system of voluntary emissions trading accounts		CNEEEX
21/1/2015	Notice on the use of offset mechanisms in the pilot period of carbon emissions trading		CNEEEX
26/1/2015	Notice on the organisation of key organisations in Shanghai for 2014, annual energy use and GHG emissions reporting and other related work	Shanghai DR Huanzi (2015) No.12	Shanghai DRC and EIC
26/1/2015	Shanghai CNEEEX notice on GHG certified		CNEEEX

Date	Name	NO.	Institution
	emission reduction (CCER) trading		
11/2/2015	Opinions on the establishment and strengthening of the city's statistical work on climate change	Shanghai DR Huanzi (2015) No.16	Shanghai DRC and Statistics Bureau
12/2/2015	Notice on the city's 2014 carbon trading pilot enterprises annual carbon emissions reporting work	Shanghai DR Huanzi (2015) No.27	Shanghai DRC
18/3/2015	Notice on the verification of the 2014 annual carbon emissions reporting of the ETS pilot enterprises	Shanghai DR Huanzi (2015) No.39	Shanghai DRC
30/3/2015	Notice on the issuance of the organisation of work for energy-saving measures and and key responses to climate change of Shanghai in 2015	Shanghai DR Huanzi (2015) No.41	Shanghai DRC
21/4/2015	Notice on the relevant provisions on further regulating the use of offset mechanisms during the pilot period of carbon emissions trading	Shanghai DR Huanzi (2015) No.53	Shanghai DRC
25/5/2015	Shanghai CNEEEX pledge to assist with business rules	CNEEEX (2015) No.11	CNEEEX
28/5/2015	Notice on completing 2014 annual carbon emissions allowance settlement work	Shanghai DR Huanzi (2015) No.87	Shanghai DRC
3/6/2015	Notice on pilot enterprises use of national carbon trading CERs of 2014 for compliance	Shanghai DR Huanzi (2015) No.91	Shanghai DRC
15/6/2015	Shanghai CNEEEX notice amending the trading rules		Shanghai DRC
23/6/2015	Shanghai CNEEEX carbon trading business rules (Trial)		CNEEEX
1/7/2015	Shanghai CNEEEX carbon emission trading risk controlling management measures (Trial)		Shanghai DRC
6/7/2015	Shanghai CNEEEX carbon emissions trading rules		CNEEEX
17/8/2015	Shanghai CNEEEX notice on GHG voluntary emission reduction trading		CNEEEX
18/9/2015	Notice issued on accelerating the	Shanghai DR	Shanghai

Date	Name	NO.	Institution
	implementation construction of key energy enterprises online monitoring system	Huanzi (2015) No.139	DRC
23/11/2015	Notice on carrying out the work of allowance declaration of new projects in the pilot industrial enterprises of carbon trading in 2015	Shanghai DR Huanzi (2015) No.160	Shanghai DRC

Table 7: Policy documents of the Shanghai ETS in 2015

Source: Desk research by Environomist

Date	Name	NO.	Institution
4/3/2015	Hubei DRC notice on the development of carbon trading pilot enterprises carbon emissions verification work 2012-2014	Hubei DR Climate (2015) No.69	Hubei DRC
15/4/2015	Hubei DRC notice on the relevant issues of carbon emission offsetting mechanisms in 2015	Hubei DRC Office (2015) No.154	Hubei DRC
30/6/2015	Hubei DRC notice on 2014 corporate carbon emissions compliance work	Hubei DR Climate (2015) No.342	Hubei DRC
15/7/2015	Hubei Government notice on issuing measures for the supervision and administration of trading venues	Hubei Zhengfa (2015) No.43	Hubei Government
29/9/2015	Management measures for the circulation and repurchase of carbon emission allowances in Hubei (Trial)	Hubei DR Climate (2015) No.600	Hubei DRC
25/11/2015	Distribution scheme of carbon emissions in Hubei 2015	Hubei DR Climate (2015) No.708	Hubei DRC
3/12/2015	Interim measures for the revenue and expenditure of carbon emission permits in Hubei Province	Hubei DRC Rule (2015) No.3	Hubei DRC
21/12/2015	Hubei DRC notice on selecting third party verification agencies (second batch)	Hubei DR Climate (2015) No.773	Hubei DRC

Table 8: Policy documents of the Hubei ETS in 2015

Source: Desk research by Environomist

Date	Name	NO.	Institution
15/1/2015	Notice on matters relating to the opening of accounts of the national voluntary emissions registration system and trading system		TCX
3/4/2015	Tianjin DRC notice on carbon emissions trading pilot enterprises work carrying out carbon emissions reporting and verification in 2014	Tianjin DR Huanzi (2015) No.259	Tianjin DRC
20/4/2015	State Council notice on the issuance of the general plan of China (Tianjin) FTZ	Guofa (2015) No.19	The State Council
21/4/2015	Management measures of China (Tianjin) FTZ	Tianjin Government Order No.15	Tianjin Government
29/6/2015	Tianjin DRC notice on the use of offset mechanisms in the carbon emissions trading pilot and related matters	Tianjin DR Huanzi (2015) No.443	Tianjin DRC
3/7/2015	Tianjin Government notice on the issuance of the social credit system construction plan (2014-2020)	Jinzhengfa (2015) No.15	Tianjin Government

Table 9: Policy documents of the Tianjin ETS in 2015

Source: Desk research by Environomist

Date	Name	NO.	Institution
31/12/2014	Beijing DRC notice on releasing the energy management system and carbon emissions management system for the recommended list of third-party rating agencies	Beijing DRC (2014) No.2768	Beijing DRC
5/1/2015	Beijing DRC notice on further improving the carbon emissions trading pilot and related work	Beijing DRC (2014) No.2794	Beijing DRC
14/1/2015	Notice on revising the China Beijing Environmental Exchange (CBEEX) carbon emission rights trading rules (Trial) and CBEEX supporting regulations on carbon emission trading rules (Trial)		CBEEX
16/2/2015	Beijing CBEEX certified voluntary emission reduction trading rules (Trial)		CBEEX
8/6/2015	Beijing DRC and Chengde Government notice on further completing Beijing-Chengde trans regional carbon emissions trading pilot	Beijing DR (2015)	Beijing DRC

Date	Name	NO.	Institution
	work	No.1248	
25/12/2015	Beijing DRC notice on completing the work of the pilot on carbon emissions trading in 2016	Beijing DR (2015) No.2866	Beijing DRC

Table 10: Policy documents of the Beijing ETS in 2015

Source: Desk research by Environomist

Date	Name	NO.	Institution
16/12/2015	Chongqing DRC notice on 2014 annual carbon emission reporting	Chongqing DR Huan (2015) No.167	Chongqing DRC
3/3/2015	Chongqing DRC notice on the issuance of the 2014 annual carbon emission allowance of Chongqing Municipality		Chongqing DRC
13/3/2015	Chongqing DRC notice on the 2014 annual carbon emissions allowance management unit verification work	Chongqing DR Huan (2015) No.236	Chongqing DRC
17/4/2015	Notice on the review of regulated carbon emission enterprises in 2014	Chongqing DR Huan (2015) No.423	Chongqing DRC
14/5/2015	Chongqing Government's views on implementation opinion on key areas of innovation and investment and financing mechanisms to encourage social investment	Yufufa (2015) No.27	Chongqing Government
25/5/2015	Chongqing DRC notice on paying close attention to the 2013 - 2014 annual carbon emissions allowance settlement work	Chongqing DR Huan (2015) No.666	Chongqing DRC
28/5/2015	Chongqing DRC 2014 notice on annual approval carbon emissions and allowance (adjusted)		Chongqing DRC
5/6/2015	Chongqing DRC notice on the provision of a list of the carbon emissions of key enterprises	Chongqing DR Huan (2015) No.730	Chongqing DRC
14/9/2015	Chongqing DRC notice on the declaration of 2015 carbon emissions	Chongqing DR Huan (2015) No.1330	Chongqing DRC
2015/11/30	Chongqing DRC notice on 2015 carbon		Chongqing

Date	Name	NO.	Institution
	emission allowances		DRC

Table 11: Policy documents of the Chongqing ETS in 2015

Source: Desk research by Environomist

3.1.2 Market elements of pilots

The design of the carbon markets can be characterised by 16 main elements: an emissions reduction target, compliance coverage, monitored GHGs, reporting obligations, allowance allocation, allowance reserves and banking, starting time, authorised transaction platform, trading products, trading modes, trading participants, offset mechanisms, incentives and non-compliance fines, MRV, reporting date, and submission date. Table 12 gives an overview of the main elements of the seven domestic carbon trading pilots. The last two columns of the table are the total allowance and the amount of enterprises under the cap. These two columns clearly show the current situation of the ETSs.

Pilot region	Emission Reduction Target (2015)	Trading Products	Trading Modes	Trading Participants
Guangdong	19.5%	GD Emission Allowance (EA), CCER, forest carbon-sink	Public bidding, negotiated transfers	Companies under the cap and other institutions, enterprises, organisations and individuals
Hubei	17%	HBEA, CCER, forest carbon-sink	Electric bidding, online matching	Companies under the cap, corporations or other organisations holding CCERs
Shanghai	19%	SHEA, CCER, forest carbon-sink	Listed trading, negotiated transfers	Companies under the cap, other organisations and individuals
Tianjin	19%	TJEA, CCER, forest carbon-sink	Online spot, negotiated transfers, auctions	Companies under the cap and other institutions, enterprises, organisations, and individuals
Shenzhen	21%	SZA, CCER, forest carbon-sink	Spot trading, electric bidding, fixed price, block trades, negotiated transfers	Companies under the cap, other organisations and individuals

Pilot region	Emission Reduction Target (2015)	Trading Products	Trading Modes	Trading Participants
Beijing	18%	BJEA, CCER, forest carbon-sink	Public trading, negotiated transfers, OTC	Companies under the cap, voluntary participants, and other institutions; individuals according to criteria
Chongqing	17%	CQEA, CCER, forest carbon-sink	Public bidding, negotiated transfers	Companies under the cap, other organisations and individuals

Table 12a: Market elements of pilots

Pilot region	Compliance Coverage	Covering Proportion	Reporting Coverage
Guangdong	Industrial enterprises emitting more than 20,000 tonnes CO_2 or consuming more than 10,000 tonnes of standard coal	55%	Individual companies emitting more than 5,000 tonnes but less than 10,000 tonnes of CO_2
Hubei	Industrial enterprises consuming more than 60,000 tonnes of standard coal	35%	Companies consuming more than 8,000 tonnes of standard coal per year
Shanghai	Industrial enterprises emitting more than 20,000 tonnes CO_2 and non-industrial enterprises emitting more than 10,000 tonnes	50%	Other companies emitting more than 10,000 tonnes of CO_2
Tianjin	Industrial enterprises and civil buildings emitting more than 20,000 tonnes	60%	Industrial enterprises and civil buildings emitting more than 10,000 tonnes of CO_2
Shenzhen	Companies emitting more than 3,000 tonnes CO_2; owners of large public buildings and state organ office buildings with an area bigger than 10,000 square metres	40%	Enterprises emitting more than 1,000 but less than 3,000 tonnes of CO_2
Beijing	Enterprises emitting more than 10,000 tonnes CO_2	40%	Enterprises consuming more than 2,000 tonnes

Pilot region	Compliance Coverage	Covering Proportion	Reporting Coverage
			of standard coal
Chongqing	Industrial companies emitting more than 20,000 tonnes CO_2	40%	Regulated enterprises

Table 13b: Market elements of pilots

Pilot region	MRV	Third-party Institutions	Verification Fees
Guangdong	Enforcement Regulation on Guangdong Enterprises Carbon Information Report and Verification (trial), Guangdong Enterprises CO_2 Information Report Guidance (trial); Guangdong Enterprises Carbon Emissions Accounting Specification (trial)	16	Government appropriation and distribution
Hubei	Hubei Interim Measures on Carbon emissions permit management and trade	3	Government appropriation and distribution
Shanghai	Published One plus Eight GHG Emissions Accounting and Reporting Guidance; Shanghai Interim Measures on Carbon Emissions Verification Third-parties Management; Shanghai Work Regulation on Carbon Emissions Accounting (trial)	10	Government appropriation and distribution
Tianjin	Enterprises Report Compiling Guidance and Five Industries Accounting Guidance	4	Government appropriation and distribution
Shenzhen	Organisations GHG Emissions Quantification and Reporting Specification and Guidance, Organisations GHG Emissions Verification Specification and Guidance; Structure GHG Emissions Quantification and Report Specification and Guidance (trial), Structure GHG Emissions Verification Specification and Guidance (trial)	21	Enterprise self-paying, choosing verification agencies by self
Beijing	Beijing Notification on Publicly Collecting Relevant Documents Opinions of Emissions Monitoring Guidance, Beijing Enterprises (Units) CO_2 Emissions Verifying and Reporting Guidance (2014 edition), Beijing Emissions Monitoring Guidance, Beijing Emissions Report Third-	19	Enterprise self-paying, choosing verification agencies by self

Pilot region	MRV	Third-party Institutions	Verification Fees
	parties Verification Procedure Guidance, Beijing Emissions Third-parties Verification Report Writing Guidance		
Chongqing	Chongqing Specification on Enterprises Emissions Accounting Work (trial management), Chongqing Notification on Industrial Enterprises Emissions Accounting and Report Guidance (trial), Chongqing Notification on Industrial Enterprises Carbon Emissions Accounting Report and Accounting Detailed Regulations (trial)	11	Government appropriation and distribution

Table 14c: Market elements of pilots

Pilot region	Allowance Allocation	Allowance Reserve and Banking
Guangdong	The method in 2014 is baseline and historical emissions; some are free and some need to be purchased. 95% free allowances in the power sector; 97% for iron and steel, petrochemicals and cement. Paid allowances are issued by bidding, and companies can decide whether to buy or not.	Allowance reserve and banking is 38 million tonnes in 2014, including new project allowance and market regulation allowance.
Hubei	Allocation for free. Exploring allocation of paid allowances.	8% set aside from total cap with initial annual allowance, surplus reserved for new entrants.
Shanghai	Historical emission method and baseline method. Allocate allowance of 2013-2015 to pilot enterprises one time. Timely implementation of the auction and other means of compensation.	Government sets aside a portion by regulation.
Tianjin	Based on industrial emissions, mainly issued for free with partial allowance allocation drawing a charge.	N/A
Shenzhen	Based on historical emissions, allocation for free or against a charge. Free allowances are not lower than 90%. Charging for allowances includes both fixed price sales and auctioning (not more than 3% of annual allowance).	The competent department reserves 2% of the total allowance as a new entrants allowance reserve.

Pilot region	Allowance Allocation	Allowance Reserve and Banking
Beijing	Manufacturing, other secondary and service industries receive allowances based on historical emissions; heat-supply and thermal power generation enterprises based on historical carbon intensity.	No more than 5% of total allowance.
Chongqing	Based on historical emissions and industrial emission potential, issued allowance by register book.	N/A

Table 15d: Market elements of pilots

Pilot region	Offset mechanism
Guangdong	Guangdong Province carbon emissions management measure, Guangdong Development and Reform Commission carbon emissions allowance management implementation detailed rules and regulations
Hubei	Hubei Province carbon emissions management and trading interim measures, Hubei province offset carbon emissions mechanism and related issues 2015 notice 2015
Shanghai	Shanghai City carbon emissions allowance allocation and management plan in 2013-2015, Shanghai City carbon emissions management interim measures, Notice on regulations of offset mechanisms during carbon emissions trading pilot period
Tianjin	Tianjin City carbon emissions trading management interim measures, Tianjin city notice on using offset mechanisms and related matters of carbon emissions trading pilot
Shenzhen	Shenzhen City carbon emissions trading management interim measures, Shenzhen City management regulations on offset credit of carbon emissions trading market (Interim)
Beijing	Beijing City Development and Reform Commission notice on carrying out carbon emissions trading pilot work, Beijing carbon emissions offset management measures
Chongqing	Chongqing City carbon emissions trading management interim measures, Chongqing City carbon emissions allowance management rules (Trial)

Table 16e: Market elements of pilots

Pilot region	Incentives and non-compliance fines	Reporting date	Submission date	Total allowance	Number of regulated enterprises
Guangdong	The provincial Development and Reform Commission instruct to correct, deduct a certain amount of allowance, fine	Mar. 15th	Jun. 20th	About 370 million tonnes	184
Hubei	Deduct a certain amount of allowance, fine	Last working day in February	Last working day in May	About 324 million tonnes	138
Shanghai	Fine	Mar. 31st	Jun. 1st to Jun. 30th	About 53 million tonnes	191
Tianjin	Instruct to correct, criminal responsibility	Apr. 30th	May 31st	About 160 million tonnes	112
Shenzhen	Deduct a certain amount of allowance, fine	Mar. 31st	Jun. 30th	About 30 million tonnes	634
Beijing	Fine	Apr. 15th	Jun. 15th	About 47 million tonnes	543
Chongqing	Fine	Feb. 20th	Jun. 20th	About 106 million tonnes	237

Table 17f: Market elements of pilots

Source: Desk research by Environomist

3.1.3 Offset mechanisms for pilots

	Shanghai	Hubei
CCER against allowance	One tonne offset equals one tonne of allowance	One tonne offset equals one tonne of allowance
CCER quantitative	Offset use shall not exceed 5% of its annual received	Offset use shall not exceed 10% of its initially issued allowance

	Shanghai	Hubei
limit	allowances	
CCER project type limit	None	Non large-scale or middle-sized hydroelectric CCERs
CCER geographic limit	CCERs, generated within emission boundary of pilot enterprises in Shanghai, shall not be used for implementation in Shanghai	CCERs, generated within provincial boundary, or generated within the provinces signed carbon market cooperative agreement with Hubei and registered by NDRC, but CCERs used for offset should not be more than 50,000 tonnes
CCER vintage limit	CCERs generated after 01/01/2013	no limit about registered CCERs; CCERs under validation should generate from 1/1/2013 to 31/5/2015
Additional limits set up by trading platform	CCERs generated within the ETS boundary by regulated entities shall not be used to offset emissions under the ETS set up by the municipality	Only CCERs generated from outside of the boundary of the ETS covered entities
Other remarks	None	CCERs generated from projects registered by the NDRC. All registered CCERs could be used for offset; at most 60% of CCERs under validation from 1/1/2013 to 31/5/2015 could be used for offset

Table 18a: Pilot offset mechanisms

	Tianjin	Chongqing
CCER against Allowance	One CCER can offset one tonne of CO_2 emissions	One tonne offset equals one tonne of allowance
CCER quantitative limit	Offset use shall not exceed 10% of its annual emission	Prior to 2015, each covered entity shall not use CCERs for more than 8% of its verified emissions in the given compliance period
CCER project type limit	Emission reduction projects from CO_2, excluding hydro power projects	Only (1) EE, (2) clean energy and non-hydro (3) carbon sink (4) energy activity, industrial process, agriculture, waste handling CCERs can be used
CCER geographic limit	CCERs generated within the Beijing-Tianjin-Hebei region should be used in	None

	Tianjin	Chongqing
	preference. CCERs generated within the emission boundary of compliance enterprises in Shenzhen and other pilot cities shouldn't be used.	
CCER vintage limit	CCERs generated after 01/01/2013	CCERs generated from projects which were commissioned after 31/12/2010 (except afforestation projects)
Additional limits set up by trading platform	None	None
Other remarks	None	None

Table 19b: Pilot offset mechanisms

	Shanghai	Guangdong
CCER against allowance	One CCER can offset one tonne of CO_2 emission	One CCER can offset one tonne of CO_2 emissions
CCER quantitative limit	Each covered entity can use up to 5% of its annual allowance	Offset use shall not exceed 10% of its previous years physical emissions
CCER project type limit	Non HFCs, PFCs, N_2O, SF_6 and Hydro CCER.	(1) Emission reduction projects mainly from CO_2 or CH_4, which means these two GHGs emission reductions should be more than 50% of all GHG emission reductions; (2) Non hydro CCER, non-electricity generation, heat addition and complementary energy (include heat, press and gas) CCER projects from coal, oil and natural gas (except coal bed gas); (3) Non CDM projects whose emission reductions were generated before they were registered with the UN CDM EB.
CCER geographic limit	CCERs, generated outside BJ, shall not exceed 2.5% of its annually issued	CCERs used to offset emissions shall be at least 70% generated within the provincial boundary

	Shanghai	Guangdong
	allowances	
CCER vintage limit	CCERs generated after 01/01/2013	None
Additional limits set up by trading platform	CCERs generated from stationary sources' emission reductions and not within BJ administrative region	CCERs generated within the ETS boundary by ETS covered entities shall not be used in to offset emissions under the ETS set up by the province
Other remarks	Main ETS covered entities can use emission reductions generated from accredited CCERs, energy saving projects and carbon sink projects	None

Table 20c: Pilot offset mechanisms

	Shenzhen
CCER against allowance	One tonne offset equals one tonne of allowance
CCER quantitative limit	Offset use shall not exceed 10% of its annual emissions
CCER project type limit	(1) Some renewable energy and new energy projects like wind power generation, solar power generation and waste incineration power generation, village biogas and biomass power generation; (2) Clean transportation emission reductions; (3) Ocean carbon sequestration; (4) Forestry carbon sink; (5) Agricultural emission reductions.
CCER geographic limit	**Article 6:** Wind power, solar power and waste incineration CCERs should be generated in following provinces or regions: (1) Some cities like Meizhou, Heyuan, Zhanjiang, Shanwei in Guangdong; (2) Some provinces like Xinjiang, Tibet, Qinghai, Ningxia, Inner Mongolia, Gansu, Shaanxi, Anhui, Jiangxi, Hunan, Sichuan, Guizhou, Guangxi, Yunnan, Fujian, Hainan; (3) Other provinces or regions which have signed a carbon trading regional strategy cooperation agreement; **Article 7:** Village biogas and biomass power generation CCERs should be generated within Shenzhen and the provinces or regions which have signed carbon trading regional strategy cooperation agreements. **Article 8:** Clean transportation emission reduction and ocean carbon sequestration emission reduction CCERs should be generated within

	Shenzhen
	Shenzhen and the provinces or regions which have signed carbon trading regional strategy cooperation agreements. **Article 9:** Forestry carbon sink and agriculture emission reduction CCERs nationwide could be used to fulfil compliance. **Article 10:** In principle, CCERs generated within the provinces or regions which have signed carbon trading regional strategy cooperation agreements could enter the market in preference. **Article 11:** Enterprises are encouraged to invest in emission reduction projects in Shenzhen to generate CCERs.
CCER vintage limit	None
Additional limits set up by trading platform	CCERs generated within the ETS boundary by ETS covered entities shall not be used to offset emissions under the ETS set up by the municipality.
Other remarks	None

Table 21d: Pilot offset mechanisms

Source: Desk research by Environomist

3.1.4 Trading participants

At present, market participation focuses on the regulated entities in the seven pilots. For the comprehensive members and brokerage members, Tianjin carbon market sets the highest threshold. In addition to being a Chinese-owned legal entity and having a network of at least 20 outlets nationwide, comprehensive members should have capital of more than 100 million Yuan, and broker members should have more than 50 million Yuan. For voluntary participants or other self-supported institutions, Beijing has the highest threshold. Registered capital should be more than 3 million Yuan, while the other six pilots require less than 1 million or none at all. For individuals and restricted participants, the requirements in Beijing are also the highest. Individuals not only require financial assets more than 1 million Yuan, but there are also a series of restrictions on household registration. Restricted participants include staff of the exchange, inspectors in third party verification agencies, and related policy makers.

Region	Trading participants specified in management measures	Other participants
Shenzhen	Regulated enterprises and other organisations and individuals specified in trading rules	Open to individuals and institutional investors (including overseas)
Shanghai	Regulated enterprises and other organisations and individuals specified in trading rules	Open to institutional investors, not open to individual investors
Beijing	Regulated enterprises participants, non-regulated enterprises participants, and	Open to individual investors, and moderate entering conditions to

Region	Trading participants specified in management measures	Other participants
	natural person participants	non-regulated institutions, no longer specific requirements on the scope of business
Guangdong	Regulated enterprises, new project enterprises, and other organisations and individuals specified in trading rules	Open to both individual and institutional investors
Tianjin	Regulated enterprises, and other institutions, enterprises, social organisations, and domestic and overseas individuals	Open to both individual and institutional investors
Hubei	Regulated enterprises, other organisations and individuals as voluntary carbon traders	Open to both individual and institutional investors (including overseas)
Chongqing	Regulated enterprises and other organisations and individuals specified in trading rules	Open to both individual and institutional investors

Table 22: Carbon trading participants of pilots

Source: (Guangzhou Lvshi Carbon Asset Management Company, 2014)

3.2 Effectiveness of the ETS pilots

In the three stages of the national carbon market development, 2015-2016 is the preparation stage, during which the main task is to establish the fundamental infrastructure. Five of the seven pilots have completed two compliance periods, while the other two have completed their first compliance period. All pilots have accumulated experience of carbon market operation from these continuous efforts. The pilot experience can be understood from two aspects: on the one hand, the positive aspects can be adopted directly; on the other hand, some practices have been proved to be incorrect. Whether adopted or not, all are positive and useful for the future development of a national carbon market (Fang, 2015).

All data in this section comes from the Environomist Ltd. database, as of 15 December 2015.

3.2.1 Main indicators of the ETS pilots

A total of 2000 regulated enterprises are included in the seven pilot ETSs. The total allocated allowances are about 12 million tonnes. According to data released by the seven pilot exchanges, the market trading volume totalled approximately 66 million tonnes in 2015. This included allowances traded online amounting to about 24.54 million tCO_2e, block trading of about 8.5 million tCO_2e, and offsets of about 33 million tCO_2e. There is still a large gap compared with the EU ETS, with tens of billions of tonnes of trading volume, but China's carbon market as a whole has become the world's second largest.

3.2.1.1 Allowance trading online

3.2.1.1.1 Trading volume

Chronologically, Figure 12 shows the trading situation of the seven pilots, showing that the first marked increase in daily carbon trading volumes in 2015 came 70 days earlier than in 2014, meaning that enthusiasm for carbon trading in 2015 was much higher than 2014, and more participants took the initiative to participate in carbon trading. The amount of trading days for which trading volume was more than 0.2 million tonnes was 22 days in 2015, almost twice that in 2014 (12). The duration of active trading where daily trading volumes were more than 50,000 tonnes was 50 days more in 2015 than in 2014, reflecting the fact that vitality in 2015 was much higher than in 2014.

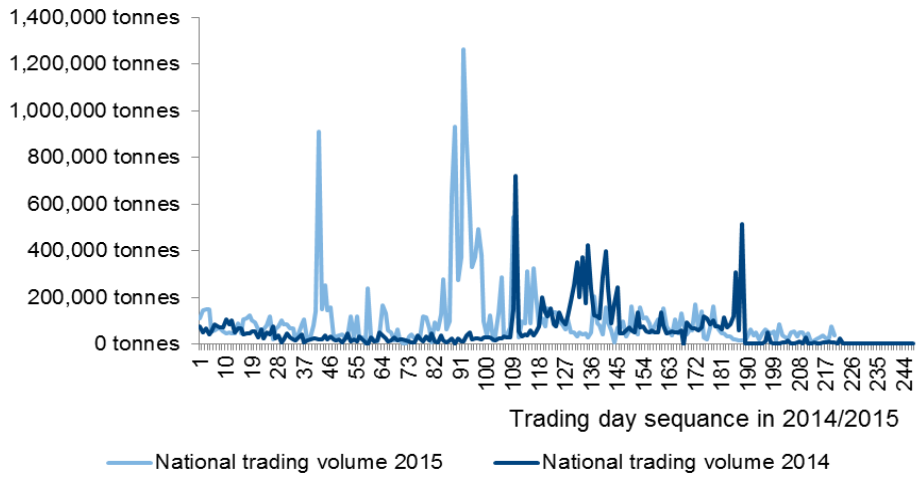


Figure 12: National daily trading volume in 2014/2015 (tonnes)

Source: Desk research by Environomist

Comparison of the respective trading situation of the seven pilots during these two years, as shown in Figure 13, shows that the biggest change was in the Guangdong ETS. Guangdong ETS's total trading volume in 2015 accounts for 27% of the total, up from only 6% in 2014. The source of this growth mainly comes from the sharp reduction of trading volume in the Tianjin ETS and Shanghai ETS, which was about 16% lower. The most stable carbon markets were the Hubei and Shenzhen ETSs, and Hubei has the largest domestic market, with a market share which accounts for about 43% of the national total. Though the Shenzhen ETS has the smallest total allowance allocation, it benefits from higher trading vitality leading to very high trading volume.

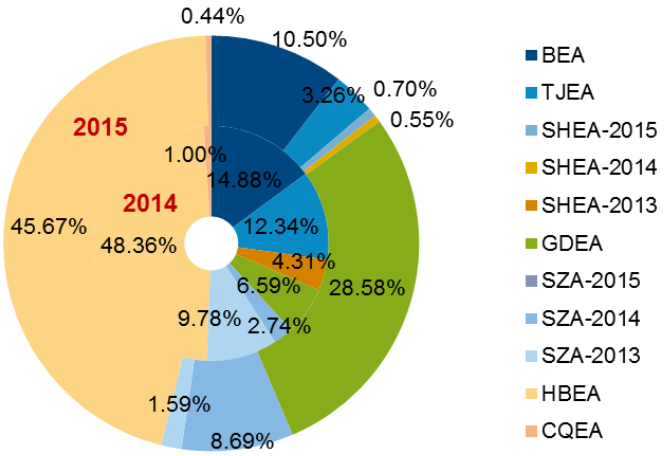


Figure 13: Comparison of annual trading volume of the seven pilots in 2014/2015

Source: Desk research by Environomist

3.2.1.1.2 Trading concentration degree and activity level

Looking at the pilot daily trading volume for 2014-2015, as shown in Figure 14, it is clear that there is excessive concentration of trading, mainly in the 1-2 months before the performance deadline. Outside this period, the pilot trading volume mainly remains below 10,000 tonnes. For the Tianjin ETS, it is clear that the 2015 annual trading volume was far below 2014, and the volume in the Hubei and Guangdong ETSs increased greatly.

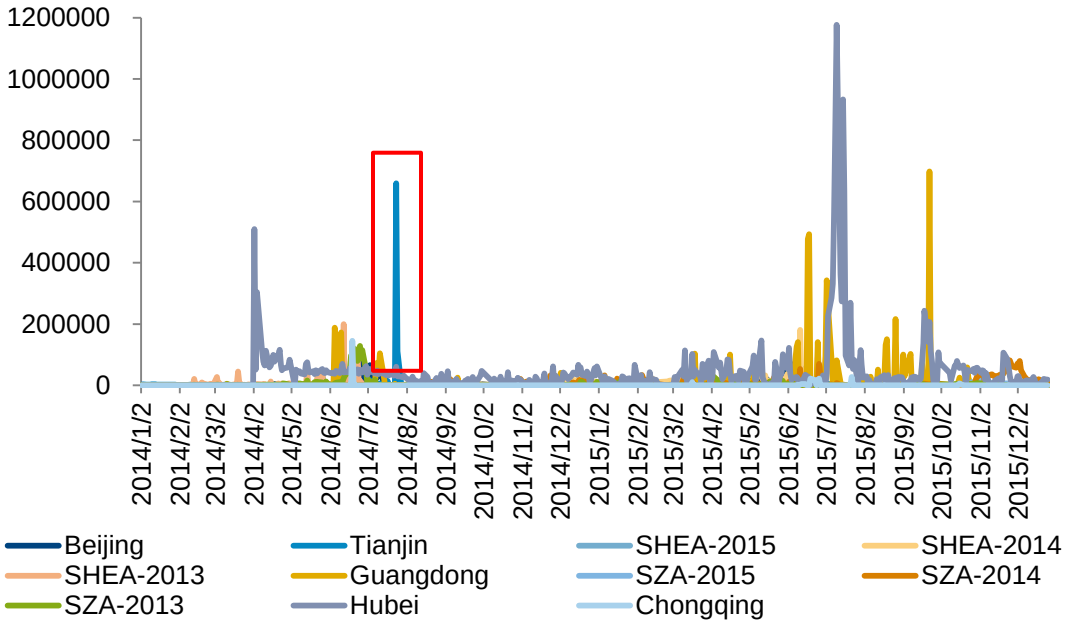


Figure 14: Daily trading volume of each pilot in 2014-2015 (tonnes)

Source: Desk research by Environomist

According to the transaction data during 2015, some important indicators for trading volume in each pilot can be calculated. As shown in Table 15, this includes the total trading volume, maximum daily trading volume, degree of trading concentration and degree of trading vitality. The most concentrated ETS is Guangdong, reaching 92.56%. The more balanced are Tianjin, Shanghai and Shenzhen, at about 50%. The highest level of vitality is in Shenzhen at about 8%, as shown in Figure 15, while the degree of trading vitality in Tianjin and Chongqing is lower.

Product	Estimated allowance (10^8 tonnes)	Total trading volume (tonnes)	Maximum daily trading volume (tonnes)	Trading concentration degree	Trading vitality degree
BJEA	0.47	1,245,203	72,380	72.28%	2.65%
TJEA	1.60	43,060	5,440	50.86%	0.03%
SHEA-2015	0.53	30,501	5,500	18.03%	0.06%
SHEA-2014	0.53	1,610,232	181,030	53.12%	3.04%
SHEA-2013	0.53	0	0	0%	0%
GDEA	3.70	4,794,603	697,541	92.56%	1.30%
SZA-2015	0.30	280,986	17,362	58.52%	0.94%
SZA-2014	0.30	2,385,625	20,002	71.78%	7.95%
SZA-2013	0.30	484,893	28,188	64.53%	1.62%
HBEA	3.24	13,337,847	1,176,197	69.59%	4.12%
CQEA-1	1.06	131932.48	26777	74.21%	0.12%

Table 23: Trading concentration and trading activity of major trading products in 2015

- Estimated allowances: except Guangdong, which announced the official total amount of allowances for 2014, the other pilots are estimated according to media reports of the total amount for 2013. The current transparency of allowance information is not high, so calculation results are for reference only.
- Trading concentration degree: references are the annual reports for 2015 and personal communication. The methodology involves ranking the daily trading volume, identifying the top 20% of trading days by volume, summing the selected trading volume and dividing it by the total trading amount. The result is the trading concentration ratio.
- Trading vitality degree: derived from the formula for calculating the liquidity stock strength index - rate of turnover, that is the trading volume / issued total shares number x 100%, to establish a carbon trading system active level index, namely the transaction volume / total allowance x 100%.

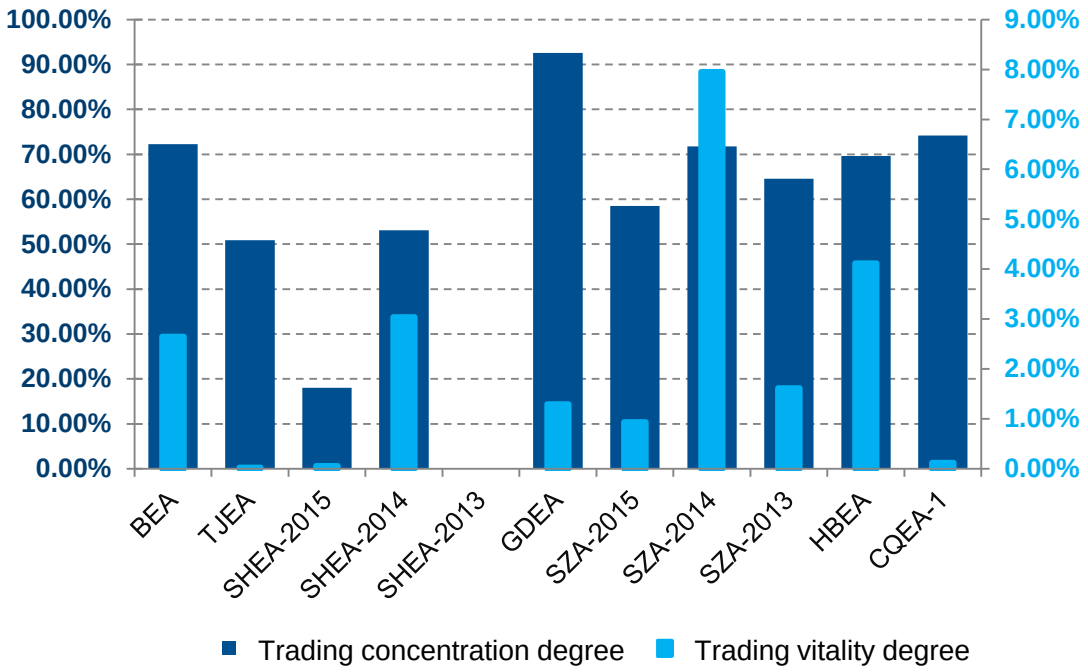


Figure 15: Trading concentration degree and trading vitality degree of each pilot in 2015

Source: Desk research by Environomist

The correlation matrix of the five indicators for trading volume in Table 16 can be calculated from Table 15 and it finds that the indicators with highest correlation are maximum total transaction volume, daily trading volume and total allowances.

Correlation matrix	Estimated allowance (10^8 tonnes)	Total trading volume (tonnes)	Maximum daily trading volume (tonnes)	Trading concentration degree	Trading vitality degree
Estimated allowance (10^8 tonnes)	1				
Total trading volume (tonnes)	0.739979	1			
Maximum daily trading volume (tonnes)	0.86669	0.960999926	1		
Trading concentration degree	0.444619	0.375002845	0.405132614	1	
Trading vitality degree	-0.0191	0.42881406	0.248161418	0.40608	1

Table 24: The correlation matrix of the five trading volume indices

Source: Desk research by Environomist

According to table above, a bubble chart can be produced, as shown in Figure 16. The observation can be made that, under normal circumstances, when the total amount of allowances is higher, the amount of high trading days is more and total trading volume is larger, such as in the Guangdong and Hubei carbon markets. Therefore, the start of the national carbon market or the connection with international carbon markets, will greatly improve market vitality and liquidity. However, the carbon markets in Chongqing and Tianjin are indeed a significant exception. Looking at possible reasons, the punishment mechanism in the Tianjin carbon market is the most liberal, which may result in insufficient pressure on regulated enterprises for performance, leading to low participation. The total allowances in Chongqing are excessive, and were mainly controlled by the enterprises themselves. The enterprises will inevitably apply for excessive allowances in order to reduce pressure for emission reductions.

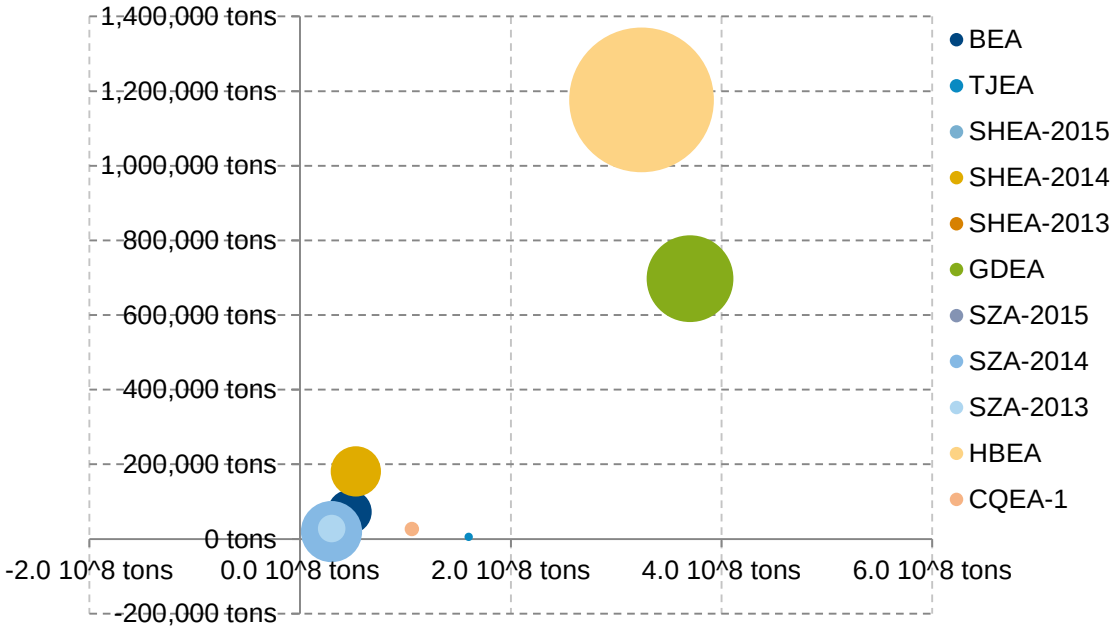


Figure 16: Total allowance - maximum daily trading volume - total trading volume bubble chart

Source: Desk research by Environomist

- Horizontal axis: Total allowance of seven pilots
- Vertical axis: The maximum daily trading volume
- The area of bubbles: Total trading volume of seven pilots

3.2.1.1.3 Settlement prices

When analysing carbon markets, the most commonly used indicators are the opening price, highest price, lowest price, and the closing price. These four prices show the carbon price fluctuations over a day: two extreme time points (opening price and closing price) and two extreme prices (the highest price and the lowest price). Of these four prices, the closing price is the most

important, as recognised by market participants. So the closing price is the main benchmark for profit and loss. Another reason is that the closing price is closest to the price of the following day.

The carbon prices in the seven pilots in 2015 is generally lower compared with 2014, but are generally more stable, as shown in Figure 17. Currently, the carbon price in the pilots can be divided into two camps. The carbon prices of five regions (Shanghai, Guangdong, Hubei, Tianjin, and Chongqing), fluctuated around 20 Yuan/tonne. The carbon prices of the other two pilots (Beijing and Shenzhen), fluctuated around 40 Yuan/tonne. Reasons for this may be related to the industrial structure of the regulated entities in the pilots, and also related to the tightness of allowance allocation.

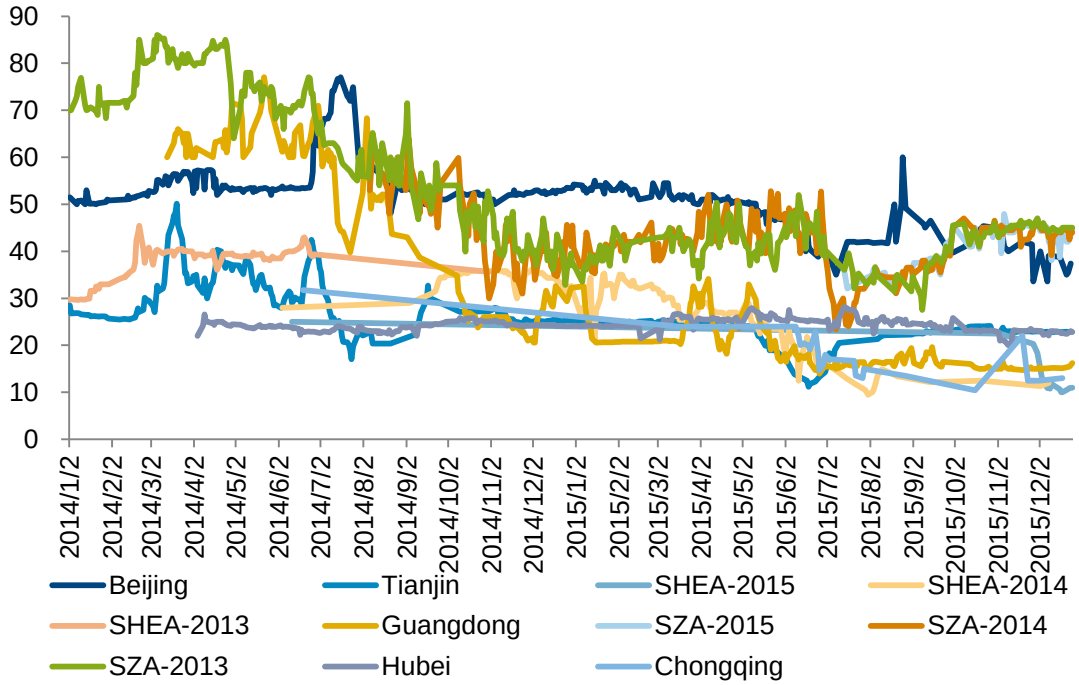


Figure 17: The daily closing price of each pilot in 2014-2015 (Yuan/tonne)

Source: Desk research by Environomist

Commentary 5: The 2015 China Carbon Pricing Survey

Commentary 5: The 2015 China Carbon Pricing Survey

Special commentator: Mr. Dimitri de Boer, China Carbon Forum (CCF); Mr. Renato Roldao, ICF International (ICF); Mr. Huw Slater, China Carbon Forum (CCF)

This is a summary of results from the *2015 China Carbon Pricing Survey*, jointly conducted by China Carbon Forum (CCF) and ICF International (ICF).

The survey, undertaken from late May to early July 2015, elicited expectations about the future of China's carbon price from 304 China-based stakeholders. The survey is a collective "best guess" by these stakeholders. It does not claim to be representative, but it does provide a clear indication of dominant stakeholder views about the likely future of carbon pricing in China. The project builds on a similar survey conducted in 2013 by CCF and the Centre for Climate Economics and Policy (CCEP) at the Australian National University.

This survey report comes at a crucial time of global interest in China's climate action. 2015 was the year of the UNFCCC COP 21 in Paris, and it also marks the end of the second compliance year for most of China's pilot ETSs, and a national ETS is planned to start in early 2017.

Respondents

The survey received 304 responses from professionals in a range of sectors, including academia and independent research institutes (37%), industry (22%), consultancies (14%), carbon trading companies (9%), and Non-governmental Organisations (NGOs) (7%). Other respondents include those from the financial sector, local and national levels of the Chinese government, foreign governments and multilateral organisations, and legal services. 79% of industry respondents are from sectors intended to be covered by the forthcoming national ETS. Despite strong efforts to reach out to industry, the survey received more responses from non-industry experts. This reflects the fact that carbon pricing is still at a very early stage in China.

The ETS pilots

Prices in the seven pilot schemes have significantly fluctuated. Prices in many schemes temporarily rose following their establishment in 2013 and 2014 (prices in Shenzhen even exceeded 100 Yuan/t for a short time in October 2013), but then declined and stabilised throughout late 2014 and early 2015. In May and June 2015 prices in most schemes dropped sharply, largely due to oversupply of allowances. At the time of the survey, prices ranged from 9 Yuan/t in Shanghai to 42 Yuan/t in Beijing.

When asked how current prices compared with their expectations, most respondents (88%) said that prices in the seven pilot schemes were similar to or lower than their expectations. However, looking forward to 2016, respondents expect prices in the pilot schemes to rebound to between 33 and 55 Yuan/t. At this stage, government intervention and regulation is still perceived to be the most important factor influencing price levels in the pilot ETSs.

Industries were asked whether they had formulated a compliance strategy for the ETS in China. Even though only 37% of industry respondents said they had formulated such a strategy, 68% of respondents who are currently operating in one of the ETS pilots claim to have a compliance strategy.

It appears that the pilots are having a significant impact on corporate strategy. Very few respondents (1%) indicated that, in their opinion, current ETS design is already quite good. Respondents selected the following areas which require further improvement: 'allocation of allowances', 'level of the cap', 'monitoring and reporting systems', 'accreditation and verification systems', and 'registry and market oversight'. Overall, it appears a lot of work must still be done to improve ETS design.

National carbon pricing

Even though the Chinese government has announced that a national ETS will be established in early 2017, when asked by when China's national ETS will be fully operational and covering all provinces and regions of mainland China, only 33% expect this to happen by 2018 or earlier. A majority (74%) expect the national ETS to be fully operational and covering all of mainland China by 2020 or earlier.

The average price expectation in the national ETS is Yuan 39/t in 2017; Yuan 45/t in 2018; Yuan 56/t in 2020; and Yuan 70/t in 2025. However, the price levels remain highly uncertain, especially in the more distant future. The 20th and 80th percentiles for 2025 are 40 Yuan/t and 100 Yuan/t respectively.

China's carbon price is expected to steadily rise

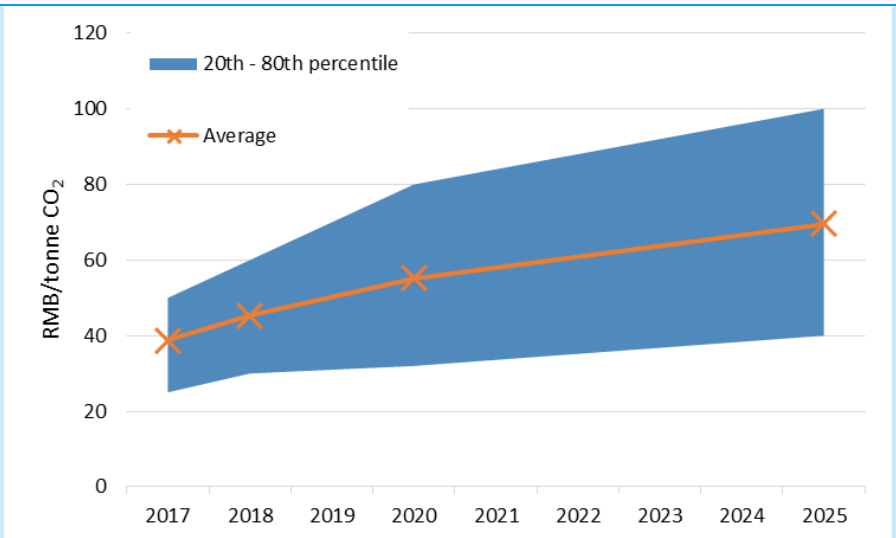


Figure 18: Q5-4 What do you expect the price in the national ETS to be?

Expectations varied somewhat between industry and other respondents, with industry expecting higher prices after 2018. This is surprising – other similar surveys conducted in Europe and Australia tended towards lower carbon price expectations from industry.

63% of government and industry respondents indicated a lack of preparedness for emissions trading. Needs for further capacity building are broad and diverse. Priorities appear to include monitoring, reporting, verification and accreditation (MRVA); carbon finance; corporate compliance strategy; and legal framework and regulation.

Respondents expect carbon pricing to increasingly affect investment decisions in the coming years. In 2016, 36% expect investment decisions to be strongly or moderately affected, and by 2020 this figure rises to 82%.

Carbon pricing is expected to increasingly affect investment decisions

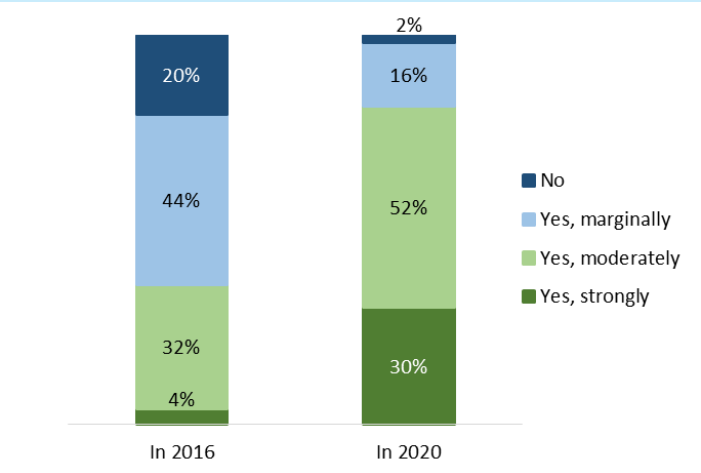


Figure 19: Do you expect the price of carbon in China to affect [your company's/major emitters] investment decisions in 2016? In 2020?

Respondents were asked what they expect will be the most important policies to reduce GHG emissions in China at different points in time (Figure 20). From now until 2025, the combined

expectation of respondents is that the emphasis will clearly shift towards ETS, environmental tax, and environmental information disclosure.

ETS, tax and information disclosure are expected to become the main policy instruments

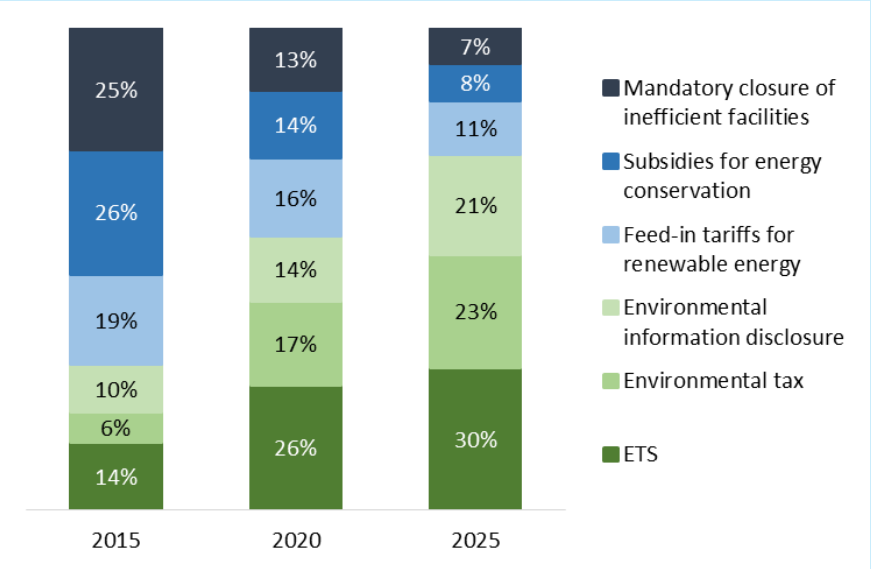


Figure 20: Q6-1 Which do you expect to be the most important policies in motivating companies to reduce GHG emissions in China at different points in time? (please select up to 3 options)

Regarding a possible carbon tax, the majority of respondents (83%) expect that China will eventually introduce a carbon tax. However, there remains much uncertainty as to when such a tax will be introduced. 45% of respondents expect a carbon tax by 2020, and this figure rises to 65% for 2025. The expectation for a carbon tax being introduced is lower than in 2013. At that time, 67% expected a carbon tax to be in operation by 2020.

Respondents who expect a carbon tax to be in effect provided average estimates of Yuan 23/t in 2016, Yuan 31/t in 2018, Yuan 40/t in 2020, and Yuan 50/t in 2025.

When asked if they expect China's national ETS to be linked with other existing schemes around the world, 52% don't expect international linking until after 2030. Of those expecting international linkages, around two thirds of respondents expect a link with the EU ETS. The expectations for international linking are much lower than they were in the previous 2013 survey. At the time, almost 70% of respondents expected a link with the EU ETS by 2025. There has been an increasing recognition that international linking between schemes is complex.

China's emissions targets and peak emissions

While 82% of respondents expect that China will stick to an emissions intensity target for 2025, a majority expects that an absolute emissions target will be set for 2030. These results seem to support the possibility that in the coming 5 to 10 years China may shift its 2030 emissions commitment from an emissions intensity target to an absolute emissions target.

There has recently been much speculation over the timing of China's peak in absolute GHG emissions. China's ambition to peak emissions by 2030 or earlier was announced in a joint statement by Presidents Xi Jinping and Barack Obama, and was formalised in China's NDC which was submitted to the UNFCCC in June 2015.

82% of respondents expect China to achieve its carbon emissions peak by 2030, and 39% even expect China's emissions to peak by 2025 or earlier.[3]

China's emissions are expected to peak ahead of 2030

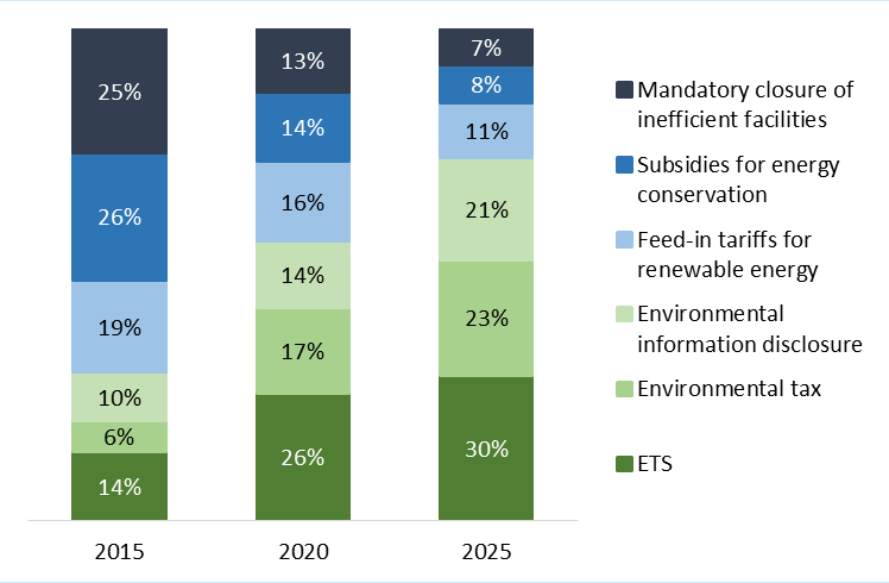


Figure 21: Q7-1 When do you expect China's GHG emissions will peak?

Dimitri de Boer

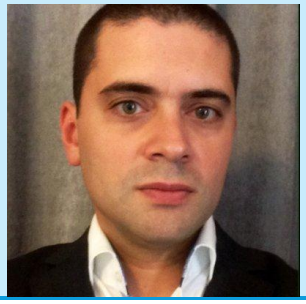
Dimitri de Boer is an international expert on sustainability, with a track record in China from 2003 to date. His current titles include:

Team Leader of EU – China Environmental Governance Programme, a 15 million Euro EU-funded cooperation programme embedded in China's Ministry of Environmental Protection;

Senior Advisor for Environment and Climate Change, United Nations Industrial Development Organization, China Regional Office;

Vice-Chairman of the Board, China Carbon Forum.

Dimitri is well known in China's environmental community for development and implementation of successful initiatives centred on environment and climate change. He has worked with the United Nations, World Bank, European Union, and GIZ, as well as the Chinese government at the local and national levels, and has been awarded a special foreign expert permit by the Chinese for outstanding contributions to environmental protection.



Renato Roldao

Renato Roldao is the Lead Managing Consultant for Climate Change at ICF International, Beijing, China. He is an industry

[3] There was some variance among respondent groups. About half of industry respondents (52%) expect the carbon emissions peak to be achieved by 2025 or sooner, compared to 36% of non-industry respondents.

respected and recognised expert in Carbon Markets and Climate Change Mitigation issues. He recently started a new assignment as Team Leader of the EuropeAid Project “Supporting the Design and Implementation of Emissions Trading Systems in China”. Renato is also Chair of the Business Advisory Council of the Portuguese Embassy in Beijing; Vice-Chair of the Carbon Market Working Group of the European Union Chamber of Commerce in China (EUCCC); Portugal’s National Representative in the Supervisory Board of the EUCCC; and Associate of the CCF.

Huw Slater

Huw is China Carbon Forum’s Research and Projects Manager. In addition to managing CCF’s regular events on low-carbon topics in Beijing, he works on CCF’s research projects and produces the regular CCF Insights research notes. Huw has been based in Beijing since 2011, originally working with Chinese NGO Institute for Environment and Development, co-authoring a report on China’s climate change adaptation strategies. Previously Huw has worked with an Australian National University (ANU) research team, reporting on Climate Change and Fiscal Policy as part of the APEC Finance Ministers’ Policy Initiatives of 2008. Huw has a Master of Asia Pacific Studies and a Master of Climate Change from ANU.

China Carbon Forum
中国碳论坛

China Carbon Forum (CCF) is a non-profit organisation that provides an independent, neutral platform to engage stakeholders in China’s climate change sector. CCF prepares research and organises focused events to discuss climate change issues in specific sectors, including invitation-only networking events, research, and policy consultations to discuss removal of barriers to emissions reductions, and to develop a more climate resilient society.

Contact for CCF: Mr. Peter Edwards, peteredwards@chinacarbon.info

ICF INTERNATIONAL

ICF International (ICF) is recognised as a leading global provider of climate change policy expertise. The firm has offices and energy/climate experts in U.K., China, Belgium, Hong Kong, India, Singapore, Philippines, Poland, Thailand, and North America. ICF has over 1500 professional employees dedicated to the study of energy, environmental, and climate change issues. ICF’s Beijing office brings in-depth knowledge of the key energy, environment, economic, and policy issues in China with a 20-year track record of continuous climate policy capacity building in China and an extensive network of partners and relevant stakeholders.

Contact for ICF: Mr. Renato Roldao, renato.roldao@icfi.com

3.2.1.1.4 Volatility of carbon prices

Carbon price volatility plays a very important role in carbon finance derivatives pricing, trading strategies and risk control. It can be said that there is no carbon financial market without carbon price fluctuations. But if the price fluctuation is too high, and risk management tools are lacking, investors may worry about risk and refrain from trading, making the carbon market lose its attraction. So it is necessary to study the historical data fluctuations of the seven carbon trading pilots. As is well known, fluctuation is the indicator most used to reflect market volatility, however

because the liquidity in China's secondary carbon trading market in 2015 is not high, the use of traditional formulas have little practical application. In this section, the volatility index refers to the annual closing carbon price fluctuations. When the changes in closing price are larger, volatility is higher, and when the change in closing price is smaller, volatility is lower. The degree of closing price change can be expressed by the difference between the highest closing price and the lowest closing price in a year. The magnitude of average closing price can reflect the value level of allowance per unit, and also can be regarded as a descriptive indicator of the magnitude of capital in investing in a certain amount of carbon allowance (see Table 17).

Product	Total trading volume (tonnes)	Highest closing price (Yuan/tonne)	Lowest closing price (Yuan/tonne)	Average closing price (Yuan/tonne)
BJEA	1,245,203	60	33.60	48.35
TJEA	43,060	25.54	11.20	23.10
SHEA-2015	30,501	22.50	12.10	16.86
SHEA-2014	1,610,232	35.30	9.50	24.93
SHEA-2013	0	0	0	0
GDEA	4,794,603	34.11	14	19.29
SZA-2015	280,986	47.92	31.05	40.87
SZA-2014	2,385,625	52.80	23.38	41.18
SZA-2013	484,893	52	27.54	41.40
HBEA	13,337,847	28.14	20.03	24.62
CQEA-1	131,932.48	24	10.40	17.22

Table 25: The highest, lowest, and average closing price of each pilot

In summary, the highest volume of transactions, the highest closing price, the lowest closing price, and the average closing price of the seven pilots during 2015 were as follows:

The trading volume in Hubei was the highest, with more than 13.33 million tonnes, while the difference between highest and lowest closing price was the smallest at about 8 Yuan/tonne, indicating low volatility. That is to say, investment risk in Hubei was smaller and the market overall was relatively stable, although the smaller risk may also correspond to lower investment revenue.

The total trading volume of the Guangdong market ranked second, at about 4.8 million tonnes, while the difference between highest and lowest closing price was about 20 Yuan/tonne, at the middle to high level amongst the pilots, indicating a high degree of vitality and volatility. So the carbon market in Guangdong has become perhaps the most ideal investment destination.

The difference between highest and lowest closing prices in the Beijing, Shanghai, and Shenzhen carbon markets was larger, at more than 25 Yuan/tonne, and the annual total trading volume was fair. Relatively speaking, because the higher price on carbon means more capital per unit of

allowance, of these three markets the investment risk in Beijing is greater than Shenzhen, and the Shanghai investment risk is relatively small.

The total trading volumes in the Tianjin and Chongqing markets were the lowest of all the pilots. Of these, in Tianjin the difference between the lowest and average closing prices was far greater than the difference between the highest and average closing prices, indicating downward pressure on the carbon price in Tianjin.

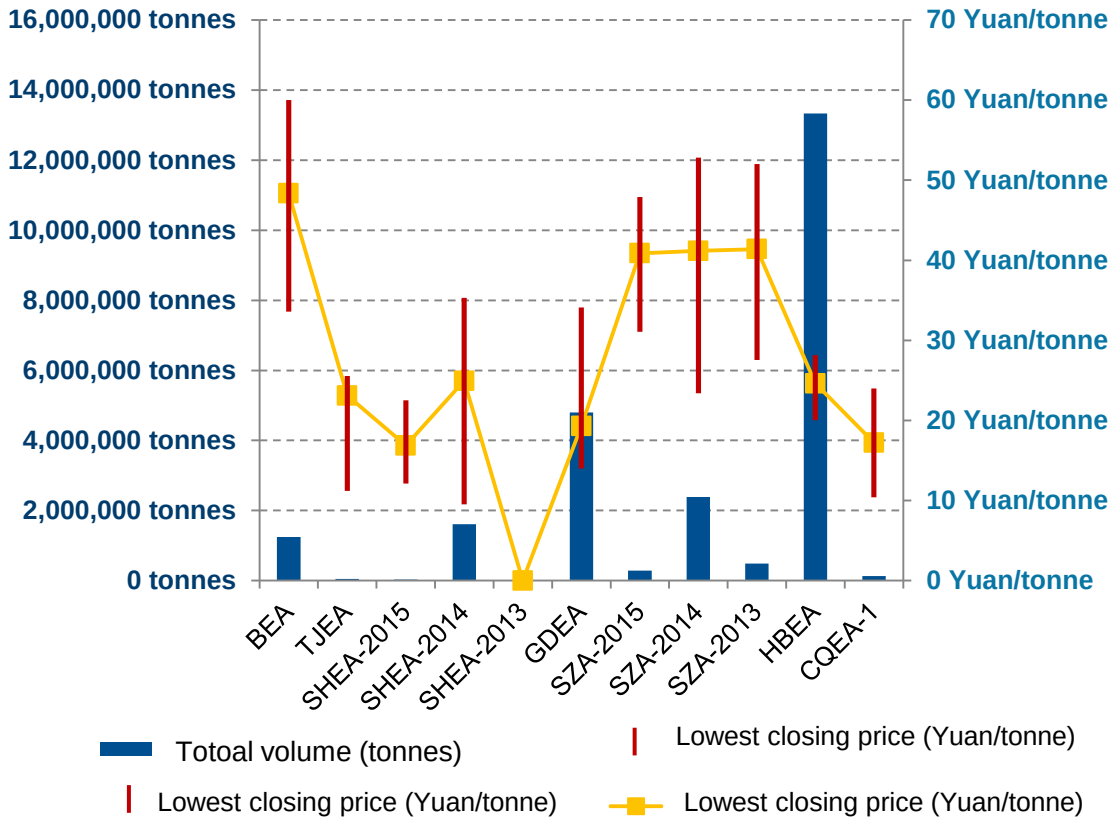


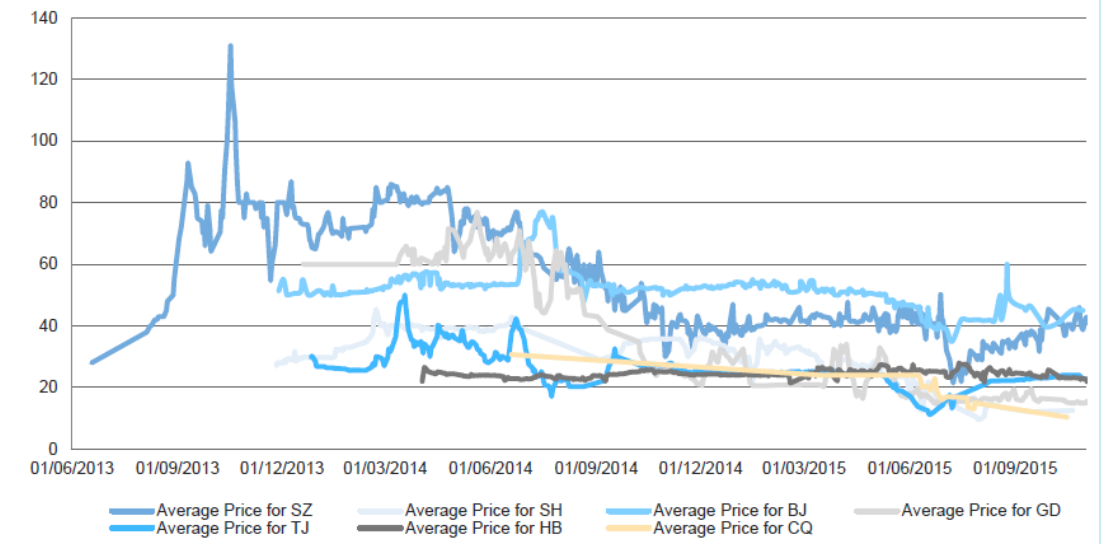
Figure 22: Total volume, highest price, lowest price, and average price of carbon

Commentary 6: Analysis of carbon price movement

Commentary 6: Analysis of carbon price movement

Special commentator: Mr. Lin Jianwei, ICIS

China's first ETS started in June 2013. After more than two years, all China's seven pilot ETSs have commenced trading and have matured rapidly. As of 15 July 2015, (right after the 2014 compliance deadline of the seven pilots), approximately 47million tonnes of allowances have been traded across the seven markets. Despite the high compliance rates across the pilots, this traded volume is a mere 4% of the combined annual cap (1.1 billion) of the seven ETSs. In terms of prices, the volatility of the allowance prices has gradually decreased over the past two years and as of the end of 2015, the pilot allowances trade in the range of 10 – 50 Yuan /tonne.



Sources: Shenzhen Emissions Exchange, Shanghai Environment and Energy Exchange, Beijing Environment Exchange, Guangzhou Emissions Exchange, Tianjin Climate Exchange, Hubei Emission Exchange, Chongqing Carbon Emissions Trading Center

Figure 23: Carbon prices of seven Chinese pilot ETSs

Characteristics of carbon price movement in the Chinese pilot schemes

There are many factors that may affect the price of carbon allowances and offsets in a carbon trading market. These include: global and regional economic development, government policies (industry or environment related), size of cap, trading rules, etc. However, one of the most important factors is the trading behaviour of market participants. The many factors mentioned above will eventually affect the trading and hedging behaviour of market participants, which will then result in the movement of carbon prices. The trading behaviour of market participants in the Chinese pilot ETSs have resulted in unique characteristics of carbon price movements.

Price surge at the beginning of an ETS

Most the seven pilot ETSs have experienced varying degrees of a carbon price surge at the beginning of their ETS. Shenzhen ETS, for example, commenced trading at around 30 Yuan/tonne in June 2013 and the Shenzhen allowance price surged above 100 Yuan/tonne (though with relatively small traded volumes) in October 2013. This phenomenon has also happened in various other ETSs abroad. In the first phase of the EU ETS, EU Allowances (EUAs) commenced trading at slightly below 10 Euro/tonne at the start of 2005, but prices later surged to 30 Euro/tonne by mid-2005.[4] There are various explanations for such a price movement and the two most likely explanations are: 1) Demand from institutional investors. At the start of an ETS, this is usually when institutional investors start entering the market to build their portfolio of allowances and offsets; and 2) Market information uncertainty. At the beginning, it is common for compliance companies, investors and market observers to be uncertain of the overall position of the market (i.e. how long or short the market actually is). Hence, many compliance companies tend to take a conservative approach – long players will not be that willing to sell their excess allowances, while short players are more aggressive in trying to cover their potential short positions. This temporary decrease in supply and increase in demand for allowances then tends to result in a surge in the carbon price.

Seasonality in carbon price

Some Chinese pilots also exhibited seasonality in their carbon price movement. During the first compliance period of Shanghai (June 2014), Beijing (July 2014) and Hubei (July 2015), the

[4] Prices are for EUA futures - Dec-2005.

allowance prices of these pilots increased between 30% and 60% as compared to the carbon price at the start of the respective pilots. Carbon prices then quickly fell right after the compliance deadlines. This price movement is a result of a surge in demand for allowances from compliance companies just before the compliance deadline. One reason why compliance companies cover their short positions so late on is possibly due to the fact that the Chinese carbon markets are primarily spot markets with minimal low-cost hedging tools. The more prominent reason for this trading behaviour is due to Chinese compliance companies' ignorance and passive attitude towards carbon trading. However, we expect this trading behaviour to improve over time and hence expect less seasonality in carbon prices as the carbon market and compliance companies mature.

Low carbon prices during period of uncertainty

As of end 2015, the various Chinese pilots are recording their lowest ever carbon prices. Many market observers attribute this low carbon price to the oversupply of allowances and CCERs in the market. It is undeniable that there is a relatively large supply of excess allowances in some of the Chinese pilots, which is then adding downward pressure on the carbon prices. However, the main reason for the current low carbon prices is due to the uncertainty in the transition from the pilot phase to the national phase. The NDRC has not released details on how the excess allowances in the pilot phase will be dealt with, i.e. will they be bankable to the national scheme or will they be voided. Due to this uncertainty, many compliance companies and investors are taking a conservative and cautious approach in the carbon market. Potential short players and investors are not demanding allowances while long players are aggressively selling their excess allowances (at least part of them) in fear that their excess allowances will be scrapped when the national ETS starts in 2017.

In conclusion, 2016 and 2017 will be an interesting period for the Chinese carbon market. We expect to see relatively huge price movement during this period, especially when the national ETS starts to take shape and there is more clarity on the rules of the game.

Jian Wei Lim – Director Chinese Emissions Markets

Jian Wei Lim heads ICIS market analysis and price forecasting for the Chinese carbon markets. With a background in quantitative finance, his skills include research, analysis and financial modelling. At ICIS, Jian oversees the research, analysis and price forecasting for the seven ETSs in China. ICIS has successfully applied the "Timing Impact Approach" in forecasting the carbon price for different Chinese ETSs. Jian is regularly invited by different carbon exchanges like China Beijing Environment Exchange to conduct workshops on carbon trading.

Prior to his current role at ICIS, Jian was a Business Analyst - Asset Management at a subsidiary of UOL Group. He managed a portfolio of properties which have a combined annual revenue of 80m Singapore dollars. Jian holds an MSc in Quantitative Finance from City University London, and a Bachelor of Business Management (Finance) and Bachelor of Accountancy from the Singapore Management University.

About ICIS:

ICIS is a division of Reed Business Information, part of RELX Group. RELX Group is a world-leading provider of information solutions for professional customers across industries. ICIS is the world's largest petrochemical market

information provider and has fast-growing energy and fertiliser divisions. ICIS's carbon team provides carbon price forecasting and analysis for major ETSs around the world. ICIS products include weekly and monthly updates/reports, carbon allowances price forecasts, in-depth analysis of the carbon market and development etc. We currently cover: EU-ETS, Australian-ETS, Californian-ETS, Chinese-ETS, Korean-ETS and the Regional Greenhouse Gas Initiative (RGGI).

3.2.1.2 Allowance block trading

Block trading is a useful supplement to online trading. With the continuous development of the carbon market, the proportion of institutional investors in the market will rapidly rise, and the proportion of block trading will increase. Block trading can not only faclitate the transfer of a large number of carbon allowances and reduce transaction costs, but also has important significance to promote the integration of carbon market players.

Through observation of large transactions, it can be seen that in the two months before the compliance deadline, the amount of trading and frequency of block trading increased significantly, and was much greater in 2015 than in 2014. Among the pilots, 1.8 million tonnes of carbon allowances in block trading occurred in the Guangdong ETS on 15 July 2015, marking a record and an amount that is almost more than the annual total trading volume of the markets in Tianjin and Chongqing.

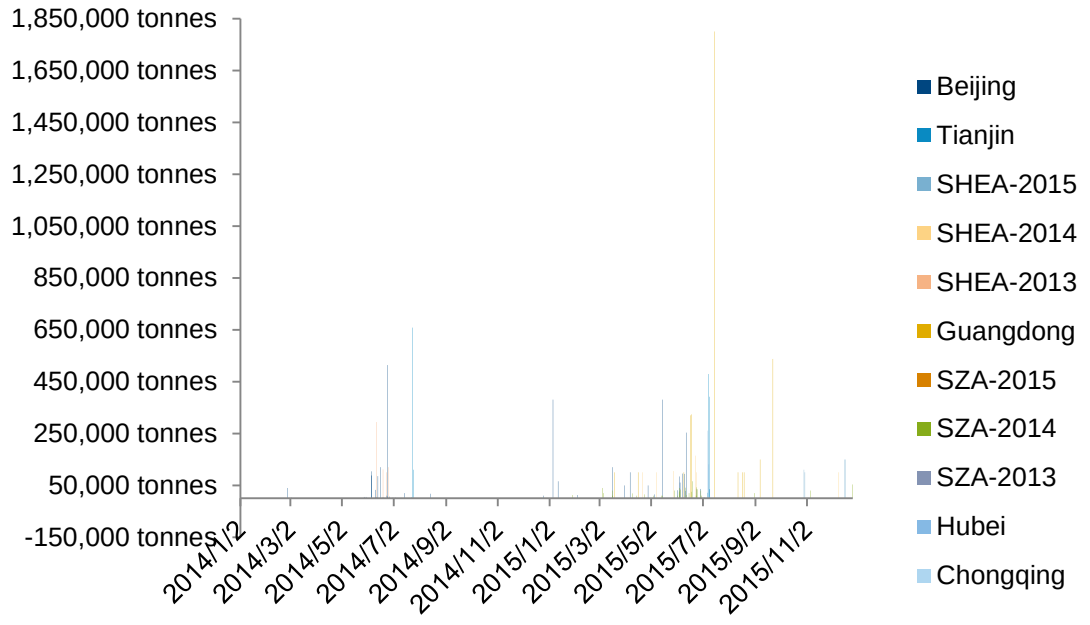


Figure 24: Daily block trading volume of each pilot in 2014-2015

Of the pilots, block trading occurred in Beijing, Tianjin and Shanghai in both 2014 and 2015. The total block trading volume in Beijing increased significantly in 2015, almost 1.5 times that of 2014, while Tianjin and Shanghai were basically the same. In the other four pilots, block trading volume was clearly the largest. This phenomenon may be explained by the fact that the Guangdong ETS

allowance demand is larger, including both compliance and investment demand, which can help verify the earlier inference that the "carbon market in Guangdong has possibly become the most desirable investment destination".

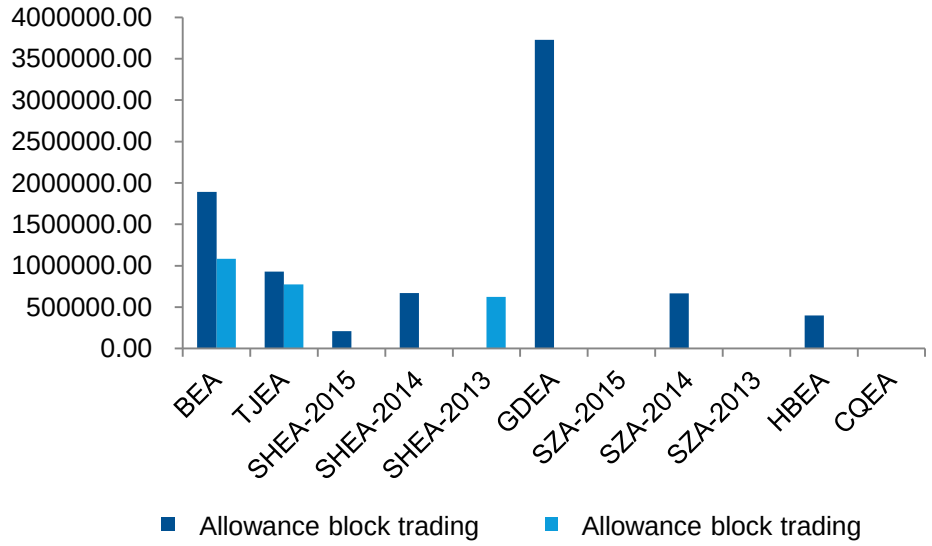


Figure 25: Allowance block trading volume in 2014/2015

3.2.1.3 CCER and forest carbon transactions

Voluntary emissions trading only started in February 2015. The voluntary emission reduction trading was scattered between February and May 2015 and the interval between each trade was relatively long. From June to July 2015, the frequency of voluntary transactions significantly increased, especially when in Beijing nearly 2 million tonnes of voluntary emission reductions were traded on 22 July 2015. The reason for the above phenomenon may be that pilots were in the compliance stage. From August to October 2015, the voluntary emission reduction market recovered relative calm following the compliance deadline. Compared with February to May, although the trading volume declined slightly, the transaction cycle shortened significantly. From November 2015, the Shanghai carbon market began to see trading days with high frequency of voluntary emissions trading of more than 1,000 thousand tonnes, and the Shanghai voluntary emissions trading volume exceeded 70% of the national total very quickly.

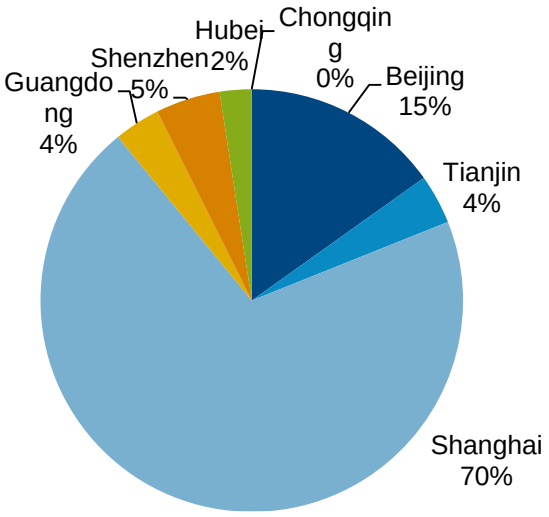


Figure 26: Offset mechanism trading in 2015

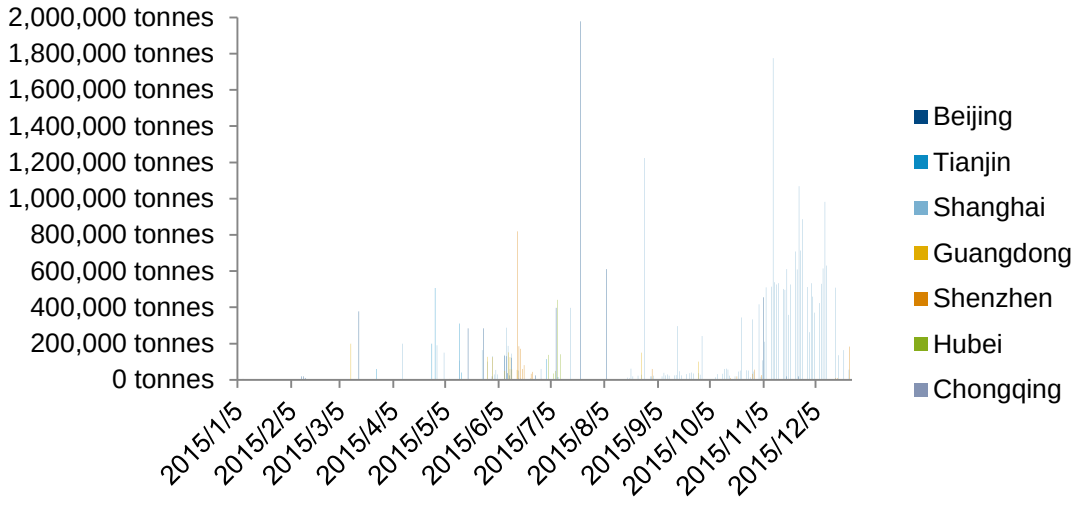


Figure 27: Offset mechanism daily trading volume of each pilot in 2015

Considering the amount of utilised CCERs, Shanghai is the largest market with about 500 thousand tonnes, accounting for 21% of the volume of CCERs (Dong, 2015). In the Beijing carbon market in the 2014 compliance period, a total of nine enterprises used 60 thousand tonnes of CCERs for compliance. Hubei enterprises used a total of nearly 100 thousand tonnes of CCERs for compliance.

Commentary 7: Relationship between CCER price and allowances

Commentary 7: Relationship between CCER price and allowances

Special commentator: Ms. Wang ZiYuan

Disclaimer: the commentary given below solely represents the view and opinion of the commentator, not the view and opinion of the entity where the commentator is employed.

The commentator shall not be held legally liable, under any circumstance, for any decision that readers make as a result of this commentary. Without written approval from the commentator, neither person nor entity shall re-distribute the commentary.

Needless to say, China's carbon market experience mainly came from one of the international offset schemes – the CDM before 2012. In the early stages, the domestic carbon market simply continued the behavioural pattern from the days of the CDM. With the promulgation of the "*CCER Interim Measure"*, many market participants who obtained rich experience in the CDM have quickly acted in the offset scheme that is familiar to them. Even before the allowance market was entirely clarified, CCER projects were rolled out broadly from project screening, documentation writing and project registration. This is one of the features that differentiated the Chinese carbon market from the European carbon market in its initial stage.

2013-2015 was the pilot phase for China's domestic carbon market, and was when each of the seven pilots had its own mandate to search and test policies that best fit its own situation. With the features mentioned above, the volume of CCER supply in the pilot phase caused concern to policy makers. To prevent the potential impact on the price of allowances, each pilot developed various restrictions on the eligibility of CCERs, from a volume cap, e.g. compliance entity can use only 5-10% of offset credits for compliance depending on the pilot's regulation; jurisdiction eligibility, e.g. the Hubei pilot only allows CCERs generated in Hubei province to be submitted for compliance; to the type of technology, e.g. the Beijing pilot does not allow its companies to use CCERs generated from large hydro projects; the project category, e.g. Type III CCERs are not allowed in Beijing and Guangdong; and vintages etc. These restrictions have led to the CCER market being very fragmented in the pilot phase. The trading price in the market can also range from as wide as 3 Yuan to 30 Yuan per CCER.

Although the CCER market price has been so fragmented, as CCERs can serve as a substitution for allowances to a certain extent, we can still observe a close relationship and mutual impacts between CCERs and allowances. At the same time, this link and impact is dominated by the supply-demand dynamic of each product. To simplify, we can assume that the CCER and allowance markets will each face two situations, in which supply exceeds demand or demand exceeds supply. We then can develop a simple matrix to illustrate four possible scenarios, as below:

A. Allowance supply > demand

B. Allowance supply < demand

C. CCER supply > demand

D. CCER supply < demand

AC Allowance & CCER are both over supplied	BC Allowance S<D CCER S>D
AD Allowance S>D CCER D<S	BD Allowance & CCER are both short supplied

Figure 28: CCER vs. allowance relationship matrix

With this simplified categorisation of the four possible market scenarios, it is easier to analyse the

main force which determines price. When the market is in the AD scenario, i.e. allowances are over supplied, CCERs or eligible CCERs further defined to be submitted for compliance is less supplied, the price of CCERs is dragged towards the allowance price while the allowance price tends to move downward, driven by its own supply-demand dynamic. As all pilots allow allowance banking and most of them (except Shanghai) reallocates allowances in the following year, the market's estimation of the supply-demand dynamics of allowances in the following year provides support to the allowance price.

When we review the compliance period 2014-2015, it is not difficult to conclude that allowance allocation was rather relaxed, and that CCERs used in the main pilots like Guangdong and Hubei were rather short after applying detailed limitations on eligibility and delaying CCER issuance & the delivery process, indicating that the market was under the AD scenario as discussed above. The market price dynamics also echoed what would happen under the AD scenario, i.e. the CCER price used as compliance substitution in certain pilots was heavily influenced/ driven by the allowance price in that pilot. This caused a move towards the allowance price constantly discounting all other risk factors. Some of the trades/deals observed in the market even defined the CCER price directly by discounting a percentage of the allowance price, or deducting a fixed amount from the allowance price. Acceptance of this pricing method in practice verified the impact of the allowance price as a driver on the CCER price in the scenario of AD.

Of course, the market can switch rapidly among different categories along with changes in policy and market force development. The interesting dynamic between CCERs and allowances is worth further detailed research along with the market's development.

Mrs. ZiYuan Wang Bio

ZiYuan Wang is CO_2 Portfolio Manager at Shell Trading (Environmental Product Trading Business). She is responsible for establishing and managing the CO_2 related business portfolio in China. At the same time, ZiYuan has managed Shell's global CDM portfolio since 2007.

Before joining Shell, ZiYuan was instrumental in the development of the Chinese CDM portfolio of EcoSecurities and one of the pioneers in the company's technical team, where she worked from 2005. ZiYuan was closely involved in the project that had the first CERs ever issued in China.

She also has professional experience in the aviation industry, and studied the EU ETS policy framework development and its effect on the aviation industry in 2005 with Cranfield University in the United Kingdom, where she obtained a M.Sc. in Environmental Management for Business.

3.2.2 Compliance results of the ETS pilots

This year, there were a total of 543 regulated entities in the Beijing pilot, increasing by 128 from last year, including six cement enterprises from Chengde in Hebei province. The compliance rate also rose from 97% in the last compliance period to 100% in this compliance period. Considering the process of compliance, compared with last year's compliance period, the number of entities ordered to improve in Beijing reduced greatly, from 257 in the first compliance period to 14 entities in this compliance period.

Among the 184 regulated enterprises in Guangdong in 2014, only one did not submit on time, however the enterprise completed the required task during the rectification period, so Guangdong's performance rate was 100%. 2014 compliance period, Guangdong had two companies which did not complete performance. The enterprise performance rate was 98.9%, while the allowance compliance rate was 99.97%.

In the 2014 compliance period, Shenzhen had 636 regulated companies, of which only two failed to complete the compliance on time, so the compliance rate was 99.7%. In the 2013 compliance period, four of the 645 regulated enterprises failed to complete the compliance on time.

Tianjin's 2014 annual carbon emission compliance date was postponed again. Of 112 regulated enterprises, there were 111 submitting enterprises with a compliance rate of 99.1%. In 2013, of 114 regulated companies, 110 submitted, so the compliance rate was 96.5%.

Shanghai was the only region that had a compliance rate of 100% in the two years consecutively.

Unlike the above five pilot regions, Hubei and Chongqing had their first compliance year in 2015 (21 Century Economic Report, 2015). Faced with their first major test, the two pilots postponed compliance. Hubei delayed for one month, to the 10 July 2015. Of 138 regulated enterprises, 112 enterprises submitted full allowances in the registration system and completed compliance, representing 81.16% of the total enterprises. For Chongqing, the first compliance year consolidated 2013 and 2014 for compliance. The deadline was July 23, delayed for a month from the original plan. As of July 13, the compliance rate was 70%.

Pilot	Scheduled compliance deadline	Actual compliance deadline	Regulated enterprises amount	Enterprises completed compliance	Compliance rate
Shanghai	6.1-6.30	6.30	191	191	100 %
Guangdong	6.2	7.8	184	184	100 %
Shenzhen	6.2	6.30	636	634	99.70%
Tianjin	5.31	7.1	112	111	99.11%
Beijing	6.15	6.27	543	543	100 %
Hubei	5.29	7.24	138	138	100 %
Chongqing	6.20	7.23	237	≥166	≥70 %

Table 26: Compliance effectiveness of each pilot in 2015

Commentary 8: Comparison of GHG emission accounting methods and reporting guidelines and national standards: Requirements for GHG emission accounting and reporting

Commentary 8: Comparison of GHG emission accounting methods and reporting guidelines and national standards: Requirements for GHG accounting and reporting

Special commentator: Ms. Mandy Wu, Environomist Ltd.

On 14 October 2013, the NDRC issued the first batch of 10 industrial GHG emission accounting methods and reporting guidelines. Since then, the NDRC has issued two more batches of such

guidelines, so far covering a total of 24 industries.

On 9 November 2015, the General Administration of Quality Supervision, Inspection and Quarantine (AQSIQ) and Standardization Administration (SA) approved 11 national standards including 'General Rules on Greenhouse Gas Emission Accounting and Reporting'. This article will take the ceramic production industry as an example to analyse the comparison of two GHG emission accounting systems.

Different publishing authorities and enforcement dates

Requirements of GHG emission accounting and reporting - Part 9: Ceramic production enterprise (the National Standard), a type of recommended national standard, was approved by AQISQ and SAC, of which the standard number is GB/T 32151.9-2015 and the enforcement date is 1 June 2016.

The National Centre for Climate Change Strategy and International Cooperation (NCSC) was entrusted by the NDRC to compile 'Trial Guidelines for China Ceramic Production Enterprises GHG Emission Accounting Methods and Reporting' (the Guidelines). The Guidelines came into effect from 1 October 2013.

Different accounting and reporting boundaries

The accounting and reporting boundary of the National Standards is divided into four parts: emissions from fuel combustion, emissions from processes, emissions from purchased electricity and heat and emissions from exported electricity and heat.

The accounting and reporting boundary of the Guidelines is divided into three parts: emissions from fossil fuel combustion, emissions from industrial production processes, and emissions from net purchased electricity production.

Although the section names in the National Standards and the Guidelines are slightly different and the accounting and reporting boundaries of the two systems are respectively divided into four and three parts, emissions from net purchased electricity production can be divided into emissions from purchased electricity and emissions from exported electricity, the important difference is that the National Standards involve emissions from purchased and exported heat, for which the accounting method is more comprehensive.

Inclusion or not of emissions from processes

The National Standards adds as follows: the reporting entity can calculate emissions from the process at the first accounting. If emissions from the process are less than 1% of the total GHG emissions of the reporting entity, it will be respectively reported in this report but not included in GHG emissions of the reporting entity and not accounted for in later reports.

This means that if emissions from the process are less than 1% of the total GHG emissions of the reporting entity, it will be excluded and respective complicated calculation and measurement are omitted, which will greatly decrease workload and improve efficiency.

Different accounting method and calculation formulas

The different accounting and reporting boundary divisions mentioned in the analysis above lead to different formulas. The clear basic difference is that the National Standards add emissions from purchased and exported heat.

The utilisation ratio of raw material in emissions from processes in the Guidelines are determined by the entity on the basis of their actual situation, while in the National Standards it is recommended as being 90% by default.

For carbonate content in raw materials, the Guidelines demand that calcium carbonate ($CaCO_3$) and magnesium carbonate ($MgCO_3$) content in raw materials is tested according to *GB/T 4743 Chemical analysis methods for of ceramic materials and products* and *QB/T2578-2002 Photometric analysis of chemical composition of ceramic raw materials*, while the National Standards state that $CaCO_3$ and $MgCO_3$ content are computed by formulas after calcium oxide

(CaO) and magnesium oxide (MgO) content are analysed according to specified standards.

For grid emission factors, the Guidelines recommend adopting regional grid emission factors: the grid is divided into the North China Power Grid (NCPG), Northeast China Power Grid (NEPG), East China Power Grid (ECPG), Central China Power Grid (CCPG), Northwest China Power Grid (NWPG) and China South Power Grid (CSPG) and the grid emission factors are computed by specified formulas. The National Standards choose the appropriate regional grid emission factors published by the national department in charge to compute the emission factors according to the entity address and the grid division (NCPG, NEPG, ECPG, CCPG, NWPG and CSPG).

Accounting procedures

The National Standards define the workflow of the GHG emissions accounting of the reporting entity:

a) Identify emission sources

b) Collect the activity data

c) Choose and obtain emission factors data

d) Calculate respectively emissions from fuel combustion, emissions from processes, emissions from purchased and exported electricity and heat

e) Calculate GHG emissions of the entity on a consolidated basis

Different requirements of data quality management

The National Standards add the following requirements:

Establish work cycle and points in time for an entity's GHG accounting and reporting; appoint full-time personnel to be in charge of GHG accounting and reporting.

Grade various GHG sources based on their importance and create a list of sources of enterprises' GHG emissions according to the different requirements (stringency) for activity data and emission factors based on different levels of importance of emission sources.

Maintain measuring instruments, testing equipment and online monitoring instruments on a regular basis and keep a record of this.

Establish an enterprise GHG emissions reporting internal auditing system. Crosscheck GHG emissions data periodically, identify possible data error risks and propose appropriate solutions.

With regards to the source of data, this highlights the importance of emission sources, strict rules for measuring instruments and even more stringent requirements for data quality management.

Different recommended values for low calorific values and the calorific values of various fuels in the Guidelines and the National Standards appendices.

Ms. Wu Feiqian is currently a senior consultant in the policy group of Environomist Ltd. She has been a lecturer at the Shandong Architectural University since she graduated from the Department of Environmental Science and Engineering at Tsinghua University in 2001. During this period, she opened the "air pollution control project", a highly valued course at the school. At the same time, she cooperated with government departments in writing the preparation of the "Ji'nan City secondary water supply" training materials, and trained incumbents from the environmental sector. She entered the carbon asset development industry in 2007. As a CDM project consultant, she worked in the Yizhirenhe company as a technical consultant, successfully completing eight registered CDM projects. She joined Environomist in early 2014 as a senior consultant, and has completed

more than 20 carbon accounting projects, a CCER category one project development, allowance allocation method research projects and carbon finance market research projects.

3.3 Progress in non-pilot regions

China's CO_2 emissions are expected to peak around 2030, and sooner if possible. CO_2 emissions per unit of GDP should decline by 60-65% compared with 2005. China plans to establish a functional carbon emissions trading mechanism before 2021. This means that there is very limited time left for non-pilot areas to participate.

3.3.1 Policy documents of non-pilots: Shandong case study

In recent years, Shandong energy consumption has increased year by year. The structure of energy consumption is relatively simple. Fossil fuel energy dependence is high. For a long time, coal has accounted for the largest proportion of energy consumption, reaching 70%. Shandong's carbon emissions once accounted for 14% of the total national carbon emissions, making it the largest CO_2 emitting province in China. CO_2 emissions per capita in Shandong are far higher than the national average (almost double) (Master's degree thesis of Beijing Institute of Technology, 2015). In the context of the development of China's regional carbon market, Shandong Province is a major economy and large CO_2 emitter. Therefore, if the opportuity of establishing a carbon market within the complex requirements of sustainable development and the optimisation and upgrading of Shandong's industrial structure can be seized, it will have positive practical significance.

Date	Document Name	No.	Institution	Key content
8/8/2014	General office of the Shandong Government notice on issuing interim measures for Shandong province equity exchange management	Luzheng banfa (2014) No.29	General Office of Shandong Government	Trading places in this measure refer to the institutions legally established in Shandong Province, engaging in carbon emissions and financial property rights trading
14/10/2014	General office of the Shandong Government notice on issuing the 2014-2015 low carbon development action plan for the implementation of energy saving programmes	Luzheng banfa (2014) No.36	General Office of Shandong Government	Implement carbon emissions trading system; explore the promotion of a carbon emissions trading system
14/1/2015	Shandong provincial financial affairs office issuance of work points for 2015		The Financial Office of Shandong	Explore the implementation of carbon emission rights and other asset securitisation
27/5/2015	Shandong Government opinion document [2014]	Luzheng banfa	General Office of	Accelerate pilot carbon emissions trading system;

Date	Document Name	No.	Institution	Key content
	No. 60 on the implementation of key points of national development and innovation regarding investment and financing mechanisms to encourage social investment	(2015) 12	Shandong Government	encourage and support social investors to participate in carbon allowance trading; actively explore the carbon emissions trading pilot
21/8/2015	Shandong local financial regulations (Exposure Draft)		Legislative Affairs Office of Shandong, the Financial Office of Shandong	Actively promote carbon emissions trading rights and other interests, including the transfer, financing and credit guarantees to create the required conditions

Table 27: Carbon market policy documents of Shandong in 2015

Source: Desk research by Environomist

3.3.2 Effectiveness of the non-pilot areas

According to the NDRC Order No.17 in 2014, local governments need to cooperate with central government to design good policies, including capacity-building training. The top priority is to help the whole country complete enterprises' carbon emissions reporting and verification work. After the start of the national carbon market, local governments will be mainly responsible for the specific allocation of allowances and related matters of enterprises' compliance. In order to accumulate adequately knowledge and capacity before the start of the national carbon market, the NDRC Climate Change Department held several nationwide trainings in 2015, and provincial Development Reform Commissions (DRCs) independently carried out research and preparation.

Region	Low-carbon development plan	Scheme to tackle climate change	GHG list	Third-party institution	Carbon emission management platform
Jiangsu	✓	✓	✓	Suzhou, Wuxi	✓
Zhejiang	✓	✓	✓	✓	✓
Anhui	✓	✓	✓	✓	✓
Jiangxi	✓	✓	✓	✓	Xinyu
Shandong	✓	✓	✓	✓	Qingdao

Region	Low-carbon development plan	Scheme to tackle climate change	GHG list	Third-party institution	Carbon emission management platform
Fujian	✓	✓	✓	✓	
Shanxi	✓	✓	✓		✓
Hebei	✓	✓	✓	✓	
Inner Mongolia	✓	✓	✓	✓	
Hunan	✓	✓	✓	✓	✓
Henan	✓	✓	✓	✓	
Guangxi	✓	✓	✓	✓	
Hainan	✓	✓	✓	✓	
Sichuan	✓	✓	✓	✓	Chengdu
Guizhou	✓	✓			
Yunnan	✓	✓	✓		
Xizang	✓	✓		✓	
Shaanxi	✓	✓	✓	✓	
Gansu	✓	✓	✓	✓	Jinchang
Qinghai	✓	✓			
Ningxia	✓	✓	✓	✓	
Xinjiang	✓	✓	✓	✓	
Heilongjiang	✓	✓	✓		Harbin
Jilin	✓	✓	✓		
Liaoning	✓	✓	✓		✓

Table 28: Progress of non-pilot areas carbon market construction

Source: Desk research by Environomist, data may not be complete.

3.4 Development process of regional carbon markets

Yang Zhi at Renmin University of China believes that the establishment of China's national carbon market must be supported by the establishment of mature regional carbon trading markets (Yang Zhi, 2010). China should innovate and plan ahead strategically, and actively build regional carbon trading markets. After the regional markets mature, the emergence of a mature national market will naturally follow.

3.4.1 Regional strategic cooperation and planning

At present, China's three most important economic zones are: the Beijing/Tianjin/Hebei region, the middle and lower reaches of the Yangtze River, and the Pearl River Delta region. These regions are actively exploring the possibility of regional carbon markets, with the actions listed in Table 21.

Regional Carbon market	Date	Events	Cooperating parties	Progress
Jing-Jin-Ji Region (Beijing, Tianjin, Hebei)	28/11/2013	Framework agreement for the development of cross regional carbon trading and cooperation	Beijing and Tianjin, Hebei, Inner Mongolia, Shaanxi, Shandong, etc.	Substantial progress has been made in Hebei - Chengde, while Inner Mongolia - Hohhot, Ordos; Hebei - Zhangjiakou, and Jiangsu - Zhenjiang continue to communicate and coordinate
	18/12/2014	Beijing and Hebei were the first to announce the initiation of a cross regional carbon emissions trading pilot	Beijing and Chengde, Hebei	Six cement companies from Chengde have been incorporated into the Beijing carbon emissions trading system
	19/5/2015	Beijing and Tianjin high-end meeting on coordinated development of an ecological environment	Beijing and Hebei, Tianjin	Beijing and Tianjin are stepping up research to carry out interregional carbon trading related measures
Middle and lower reaches of the Yangtze River	2/4/2014	Carbon emissions trading cross regional cooperation and exchange framework agreement	Hubei province and Shanxi, Anhui, Jiangxi, Guangdong and so on	The central region's first carbon emissions trading pilot is in Optics Valley, Wuhan, with official launch of property rights
	28/7/2014	Executive meeting of the Shanghai municipal	Shanghai, Jiangsu, Zhejiang and	Promotion of a regional carbon trading market, in order to promote energy conservation and emission

Regional Carbon market	Date	Events	Cooperating parties	Progress
		government	so on	reductions in the Yangtze River Delta region, so that due contributions can be made
	16/4/2015	Carbon market of the city district in the middle reaches of the Yangtze River region	Hubei, Jiangxi, Hunan	Promote carbon sequestration, afforestation and carbon emission reduction targets paid use of trading, Hubei carbon emissions trading centre building support, encourage Xinyu and other regional carbon emission rights trading markets
Pearl River Delta region	29/1/2015	Cross regional carbon market in Guangdong and Hong Kong	Guangdong, Hong Kong	Guangzhou carbon emissions exchange and Hong Kong stock exchange of emission rights, Guangzhou CEPREI Certification Center Service Co., Ltd. signed a strategic cooperation agreement with third parties
	24/7/2015	Carbon trading pilot links and regional carbon market cooperation seminar	Shenzhen, Guangdong	Project to explore the wide range of carbon market links
	9/9/2015	Baotou carbon emissions trading market system construction kick-off meeting	Shenzhen, Baotou	Comprehensive package of regional cooperation for construction of carbon market between the two cities officially initiated
	16/9/2015	Sino-US Climate Leaders Summit	Shenzhen, Jinchang	Two cities strategic cooperation on the joint construction of a regional carbon trading market

Table 29: Cooperation and planning of regional carbon markets

Source: Desk research by Environomist

3.4.2 Challenges facing the pilots

The national carbon market will start in 2017, and the pilot areas will be faced with the following major problems.

Whether the pilot allowances can continue to be used or whether they be able to be exchanged with the national allowances.

Hong Jianwu, the section chief of the Guangdong DRC Climate Change Office, noted that, "for the issued pilot allowances, especially those adopting paid allowances, regulated enterprises and investment institutions have paid high costs in the primary market auctions. Therefore, the central government had better plan as a whole and consider the situation of the pilot areas, to convert a reasonable proportion of released allowances. The best ratio is 1:1." (Jianwu, 2015)

Which industries should the pilots regulate in the period of developing the national market?

Hong believes that: “During the transitional period, the central government should consider selecting the industries regulated in all or most of the seven pilots, such as power, cement, steel and other major emitting industries, in order to formulate unified carbon emissions reporting guidelines and methods, inspection details, allowance allocation methodology, etc. Done in advance, this will help establish the practical basis for a unified national carbon market in 2017.”

What preparations should carbon exchanges in the pilot areas undertake?

The operation and ownership structure of the carbon exchanges in the pilot regions is more complex, and the national carbon market may only need two exchanges to support its related work. This means that at least five carbon exchanges are faced with transformation. The transformation has two directions: one is development of a local auction platform, and the second is becoming carbon financial services institutions (Climate and Energy Finance Research Center, Central University of Finance and Economics, 2014). Problems such as the transition cost of the carbon exchanges and the selection of national carbon trading standards should be dealt with.

3.4.3 Precautions for non-pilot regions

Non-pilot areas are faced with not only huge challenges in the development of the carbon market, but also in ushering in the transformation of economic development. The beginning of the carbon market is drawing increasingly near, and non-pilot areas must take precautions in terms of policy, technology and management in order to meet the demands of the carbon market.

To strengthen the local policy support systems and technical specifications, non-pilot areas should develop a profound understanding of the NDRCs ‘Interim Measures’, and the experience of the pilot markets.

To strengthen the development of local GHG emissions accounting and reporting systems, regulated entities should establish internal systems, with reference to the existing energy consumption management systems and experience of energy saving management.

Strengthening the capacity and management of local verification agencies and inspectors is important, so that GHG emission verification helps to facilitate the realisation of carbon emission reduction targets and trading.

To strengthen the capacity for carbon asset management, internal carbon asset management systems with high operability and effective decision-making mechanisms need to be established.

Strengthening awareness and capacity for risk control is also important, to reduce the harm caused by risk as much as possible.

Commentary 9: Carbon trading: What lessons can China offer to other developing countries?

Special commentator: United Nations Development Program (UNDP)

One of the top internet search terms following the historical climate deal achieved in Paris has been "China's emission trading scheme (ETS)", to be launched nationwide in 2017. The world has many reasons to pay close attention: China – the top greenhouse gas emitter and the second largest economy globally – is the first "developing country" that is attempting to provide market-based solutions to climate change challenges through cap and trade policies. This is a major shift.

Since the implementation of 7 ETS pilots in 2011, remarkable progress has been recorded, with China already becoming the second largest carbon market in 2013. This is certainly excellent and serves as a strong business case for an early domestic roll out. More importantly, China's experience can be shared with other developing counterparts that wish to pursue both economic and environmental sustainability. But what might distinguish China's emissions trading scheme – at least based on the experience of the pilots – from schemes that are operating or about to operate in developed countries and regions? What might be special about China's scheme that suggests other developing countries should pay close attention to it now and over the coming years?

There are at least five features we can distinguish now that form the basis for learning by other developing countries.

First, one of the common features of developing countries is that they often have a highly regulated energy sector, and the large users of energy – such as cement, iron and steel – tend to have fairly "oligopolistic" structures – that is, there are often just a few large players in the market, often including the State/Government, who may own several installations. In contrast, the smaller energy users and consumers tend to be dispersed, more informal and more difficult to tax and regulate. Therefore, in such settings, it is arguably much easier for governments to target and charge with responsibility the original sources of carbon emissions. And this is what is happening in China. One of the vital features of China's ETS pilots lies in that original sources are the target – or rather, "indirect" emissions are accounted for. This is the case even if the sources are themselves located outside of the pilot areas. In doing so, the mechanism could effectively address potential carbon leakage induced by energy outsourcing, which is often the case regarding cross-regional gas and electricity transfer in China. This unique characteristic amongst the world's ETSs may thus provide useful insights in design for other developing countries.

Second, another common feature of developing countries is that they and their constituent parts are growing rapidly. This creates several complications for developing countries' trading schemes. In particular, setting the right overall cap in the country or region is challenging, as it depends on growth projections, which can be both over and underestimated. One of the key lessons from the EU Emissions Trading Scheme is that a too large (i.e. weak) cap leads to a fall in price and a lack of functioning of the market. In essence, in the EU, firms clearly lobbied for more allowances than they needed – perhaps based on over-optimistic forecasts of their own growth potential. In contrast, the utility of China's experience is that the 7 ETS pilots have been conducted in varied parts of China; namely Beijing, Shanghai, Tianjin, Guangdong, Hubei, Shenzhen and Chongqing, which represent distinct geographical and social-economic situations. Interestingly, it is Hubei, ranking the lowest in economic terms (GDP per capita around US$7675 in 2014) among the seven, but therefore a region with further growth potential, that has actually realized the highest absolute trading volume at 1.6 million tons, which is more than 6 times the scale of other pilots. The success may owe to the active participation of firms, which with the help of clean technology become progressive credit sellers in the market given the surplus of allowances left from the credits initially allocated for free. The success in delivering strong trading

demonstrates the feasibility of implementing carbon trading in less developed but growing countries, particularly when the economy faces a healthier restructuring towards low-carbon growth. This, meanwhile, indicates the necessity to re-visit the emissions cap and the means to allocate allowances as firms continue to grow and transform against the background of ever-changing social-economic contexts, such as technological innovation.

It should also be mentioned that another related complication for growing markets aiming to use emissions trading is the fact that the rules for allocating allowances to new entrants become much more important. Too few allowances creates barriers to entry, but too many allowances could flood the market. Similarly, growing markets may also consider the use of offsets (whereby entirely new credits are generated by taking actions outside of the sectors covered by the scheme – e.g. reforestation) to create more room for maneuver – but this too requires careful consideration, as too many new credits could flood the market and cut incentives for other actions within the scheme to be taken. In China, the application of Chinese Certified Emissions Reduction (CCER) credits is a case in point. All seven pilots permit the use of CCERs, to varied levels. The CCER methods resemble mostly those of the Clean Development Mechanism (CDM) and are free for project owners in order to reduce transaction costs. The rules of CCER implementation are being managed centrally, rather than by the pilots, so that they can be monitored and adjusted carefully.

A third crucial feature of developing country markets is their diversity. They are often much differentiated economically, socially and institutionally, even when located very close to each other. Indeed, as implied above, China's ETS pilots differ from each other in quite a number of aspects, including emission caps, coverage of sectors, means to allocate allowances and enforcement, etc. This owes mainly to the considerable discretion left to local governments when it comes to design and implementation. Without doubt, it has allowed sufficient flexibility for each pilot to come up with arrangements that are best tailored to local development ambitions. Furthermore, the autonomy has enabled innovation. For instance, Shenzhen has carried out a competitive game-based allocation of allowances (i.e., participants bid for a certain amount of free allowances in successive rounds based on demand and projected output), while in other pilots allowances are mainly distributed for free. Such innovation could be very helpful going forward for other developing countries, in these and other ways. For instance, many developing countries may want to create large incentives for energy efficiency or the installation and use of renewable energy. The fact that diverse schemes can co-exist with differing features is a positive sign for governments that want to use the scheme to also deliver on other major priorities.

The fourth feature of many developing countries is less positive – the lack of credible and consistent data about and from firms. As noted, many are not well regulated and operate informally, and even where they are regulated, information can often be distorted for other purposes. This poses daunting challenges for emissions trading, and what is known specifically as the monitoring, reporting and verification (MRV) system. One way to deal with this is to allow for each scheme to have its own guidelines regarding MRV, which are issued in different formats (e.g., government documents, legislations) with varied legal effects and levels of disclosure to the public. This has been the case in China, but it has also led to a fragmented structure and divergent interpretations of rules and technical standards and disparate capacity building at the local level, which may substantially undermine the coherence of a national ETS. Another means to deal with this is to only include in the scheme what has the most credibility. For example, all China's pilots only trade CO2 while excluding other types of greenhouse gases (GHGs), because of the absence of a reasonably reliable and consistent measurement system to count all types of GHGs in China. But this itself can be problematic as it may lead to low liquidity – which has been observed in China, with even the largest trading volume in Hubei only surpassing a million credits (see above). Lack of credible data creates a lot of room for asymmetric information sharing and even fraud by participating firms and other players in the market (e.g. financial markets), a problem that has also been experienced in the EU. Thus, to get the market running requires building up a comprehensive data and information framework, but this might be easiest done step by step, and with the largest, most easily regulated players first.

Finally, a feature all countries – developed and developing – share, is that a multi-stakeholder approach is very worthwhile. China and the EU in particular have increasingly engaged the participation of financial institutions in trading, to enhance the liquidity of the markets. Other developing countries may wish to do so, but may also consider working with other partners, such as international organizations, and universities/research institutions, to ameliorate the design and conduct of ETS, for example the data collection. China has done so, including with UNDP. Since 2011, UNDP has been working with China to strengthen its data collection preparation, through the development of a national ETS registry and building awareness of accounting systems for emissions by participating firms, with the eventual aim of establishing a unified information disclosure platform.

To sum up, China's experience is promising, and is likely to prove that emission trading can function effectively in developing countries, taking into account the underlying, fundamental characteristics of such countries. It undoubtedly serves as a good starting point to foster sustainable industrialization and production, particularly through close involvement of the private sector, which could make significant contributions to the sustainable development goals (SDGs) to be achieved over the next 15 years. Undeniably, many challenges will still need to be overcome before China's national ETS and other schemes in developing countries can be operated smoothly. But during this process, China and such countries will not be alone. This will be a concerted effort to fight global climate change and embark on green growth.

UNDP promotes sustainable human development to help build resilient nations and to empower people to build better lives. As the UN's development network, UNDP draws on world-wide experience to assist China both in developing solutions to its own ongoing development challenges, and in its South-South cooperation and engagement in global development.

4 China carbon market online survey

This questionnaire based survey was completed via the online survey platform "Diaochapai". The specific operation was carried out by Environomist Ltd., and the media partners were as follows: **www.tanjiaoyi.com**, **www.ideacarbon.org**, **www.carbonmkt.cn**, and **carbon-pulse.com**. The main contents of the survey include basic information, business ability, market development, and the economy of carbon emission reductions. The six kinds of respondents were financial institutions (including carbon asset management, fund companies, banks, securities companies, futures companies), technical support units (including consulting companies and third-party agencies), regulated enterprises, voluntary emission reduction and carbon trading enterprises, research institutions or administrative institutions, and enterprises interested in and learning about the carbon market. Each kind of respondent answered a specific set of questions. From 16 November 2015 to 28 December 2015, a total of 273 respondents participated in the survey. This chapter mainly presents the results of the analysis and the qualitative and quantitative summary of the questionnaire survey. The original questionnaire can be found in the Appendix.

4.1 Basic information

1) Surveyed areas

Among the 273 respondents, the largest number of respondents from the pilot areas came from Beijing, Shanghai and Guangdong. Jiangsu, Zhejiang, Shandong and Sichuan had the largest number of respondents from the non-pilot areas.

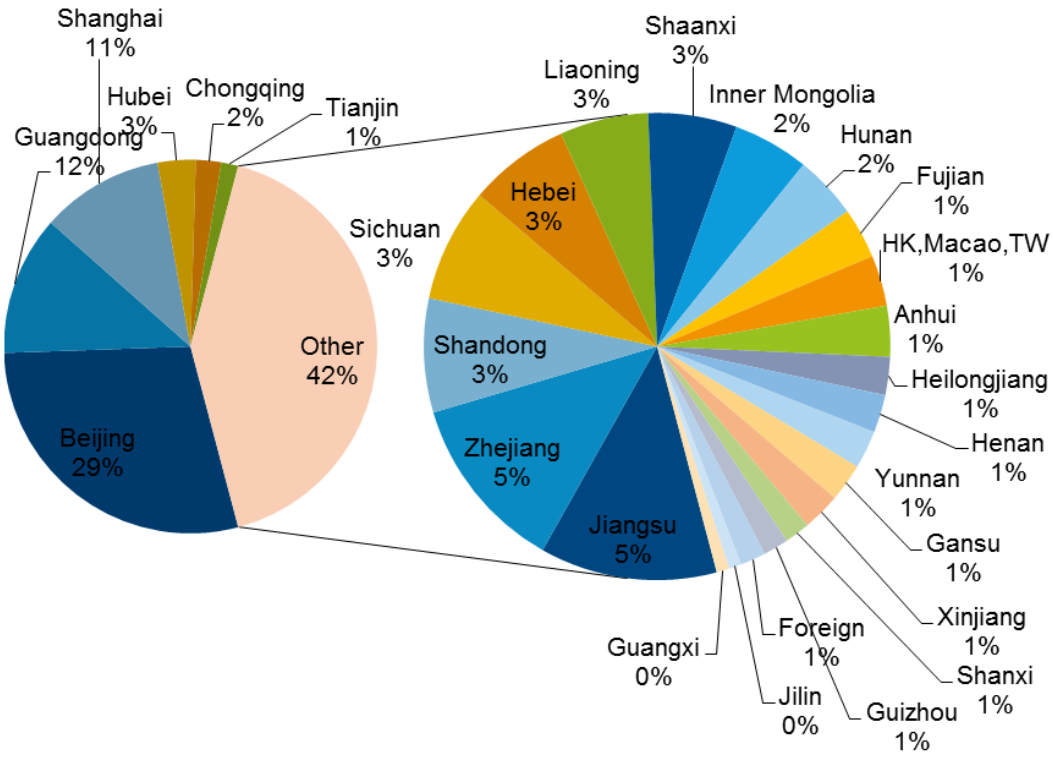


Figure 29: Respondent distribution by province

2) Surveyed industries

In general, respondents from technical support units and consulting service providers were best represented, accounting for about 30% of the total. Second were research institutions, accounting for about 14% of the total. In addition, the investment management industry and banking sector had the most respondents from financial institutions, while the electricity and heat production industry had the most from industrial enterprises.

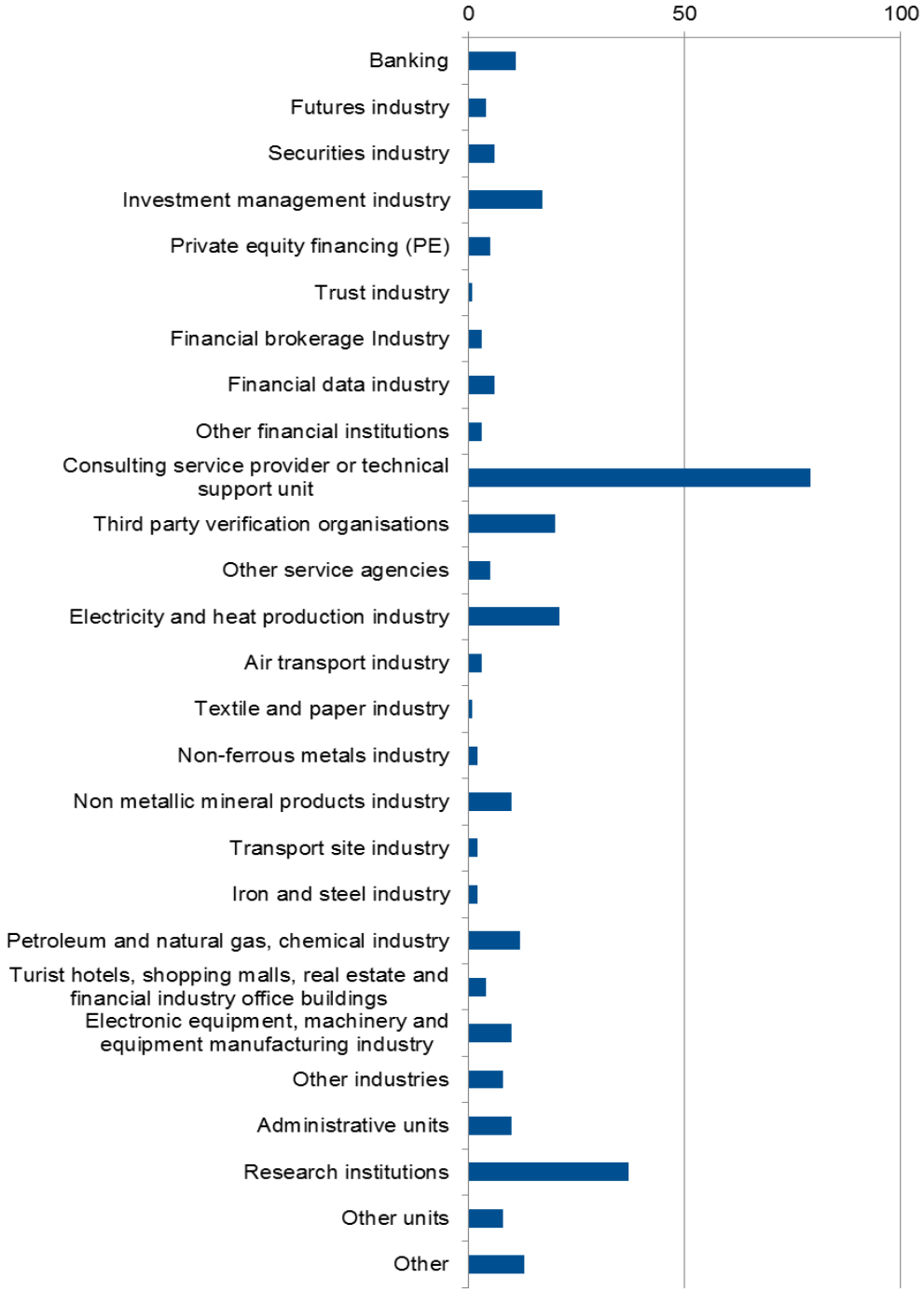


Figure 30: Number of respondents by industry

3) Surveyed roles

Of the six respondent types, the best represented was technology support units, accounting for more than 32%, followed by enterprises interested in learning about the carbon market, accounting for about 24%.

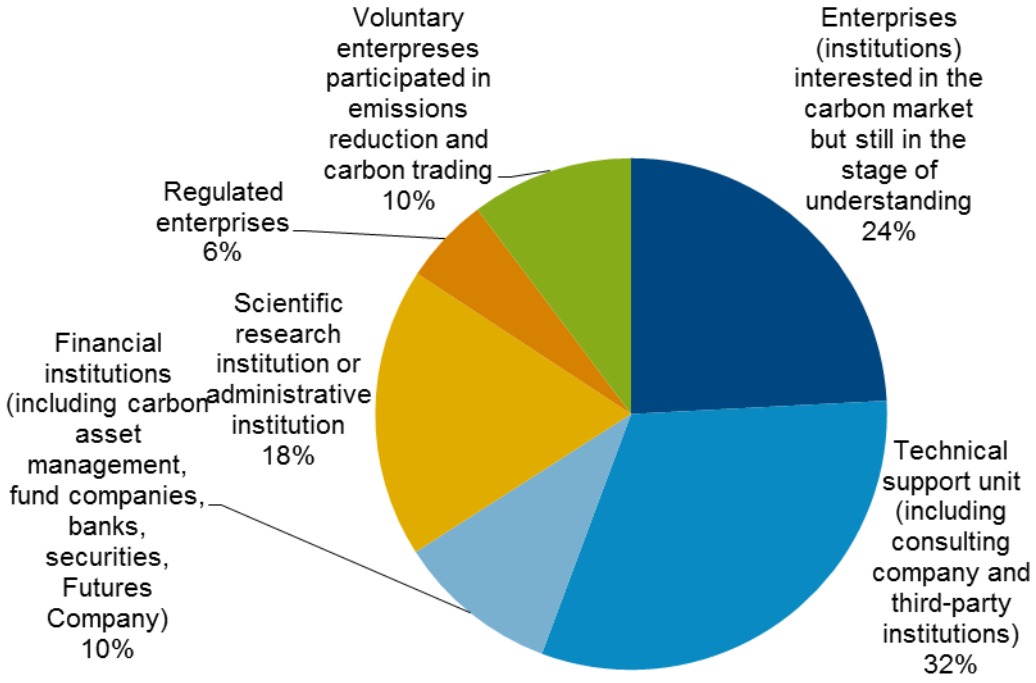


Figure 31: Proportion of each main role investigated

4.2 Business capacity

4) When encountering problems of deviation from the plan in the process of trading, is there any responsibility and authority given to traders?

Institutions whose traders can make autonneomous decisions account for approximately 10%, while those whose traders need to ask for department manager permission when encountering a problem account for about 17%. That is to say, institutions whose traders have some level of permission accounted for is about 27%. The institutions which have no clear stipulations on carbon trader's responsibility and authority account for about 30%, and more than 40% of the financial institutions did have clearly defined regulations.

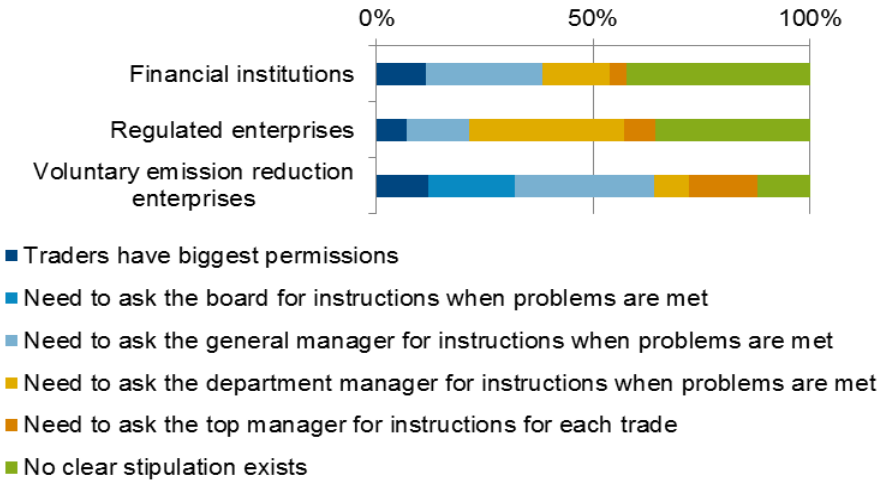


Figure 32: Duty and authority of traders

5) Performance indicators of carbon asset management

About 54% of the institutions surveyed do not set performance indicators. The main performance indicators of financial institutions and voluntary emission reduction enterprises are the annual trading profits and losses. The main performance indicators of regulated enterprises are annual carbon emission reductions.

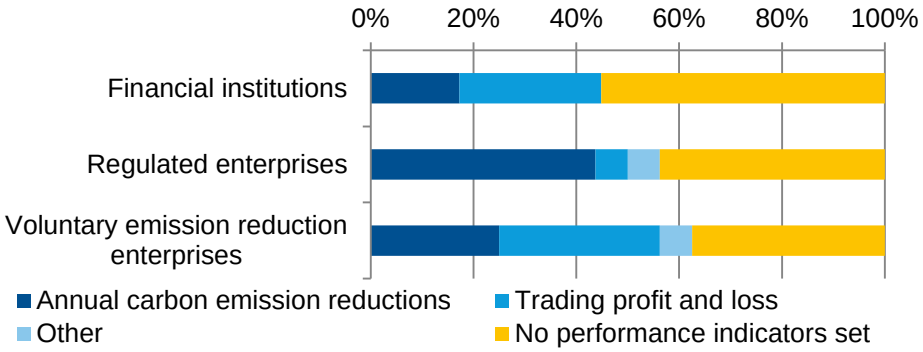


Figure 33: Performance indicators of carbon asset management

6) Incentive measures for carbon asset management or carbon trading

About 38% of the institutions surveyed do not have appropriate incentives, especially regulated enterprises, of which about 57% do not have any incentive measures. Material incentives are the main kind of existing incentive measures, accounting for 49% of the total.

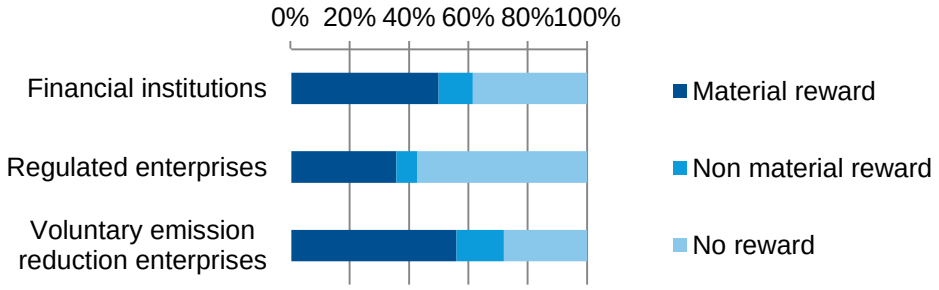


Figure 34: Incentive measures for carbon asset management or carbon trading

7) Beneficiary of carbon asset management or carbon trading

The main beneficiaries of the incentives include the managers and staff of the relevant departments, accounting for about 65% of the institutions who have incentives.

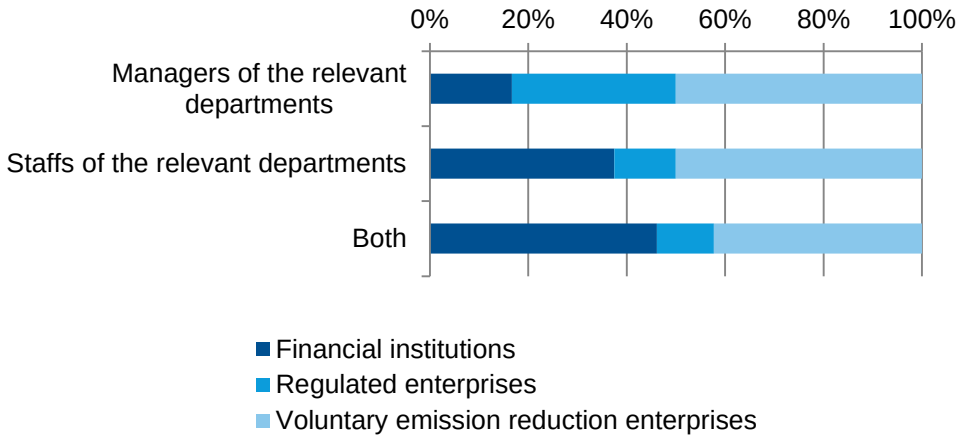


Figure 35: Beneficiaries of incentives of carbon asset management and carbon trading

8) Understanding of carbon trading pilot and national trading policy

Financial institutions, research institutions and administrative institutions best understand carbon market policy. The lowest level of understanding is amongst enterprises interested in and learning about the carbon market.

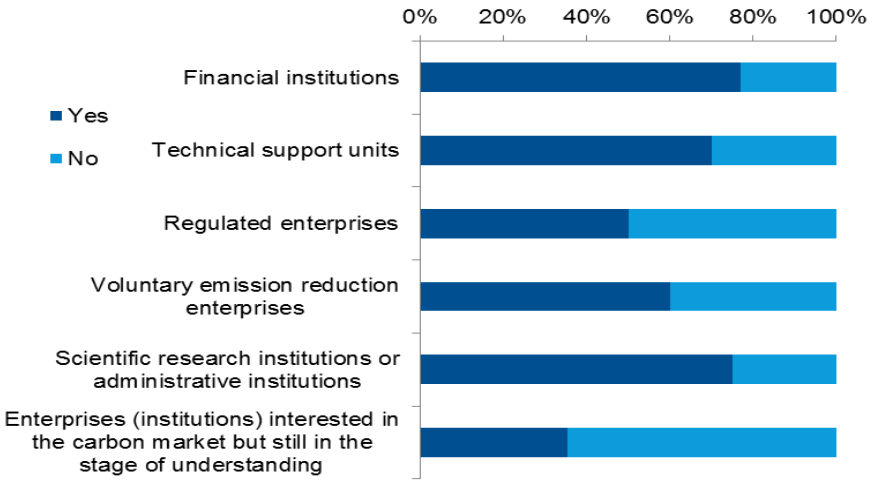


Figure 36: Understanding of carbon market policy

9) Channel for accessing carbon market policy information

The main channel is via government documents and media sites, followed by exhibition forums and advisory services institutions. For the technical support units, 20% accessed policy information through competitors.

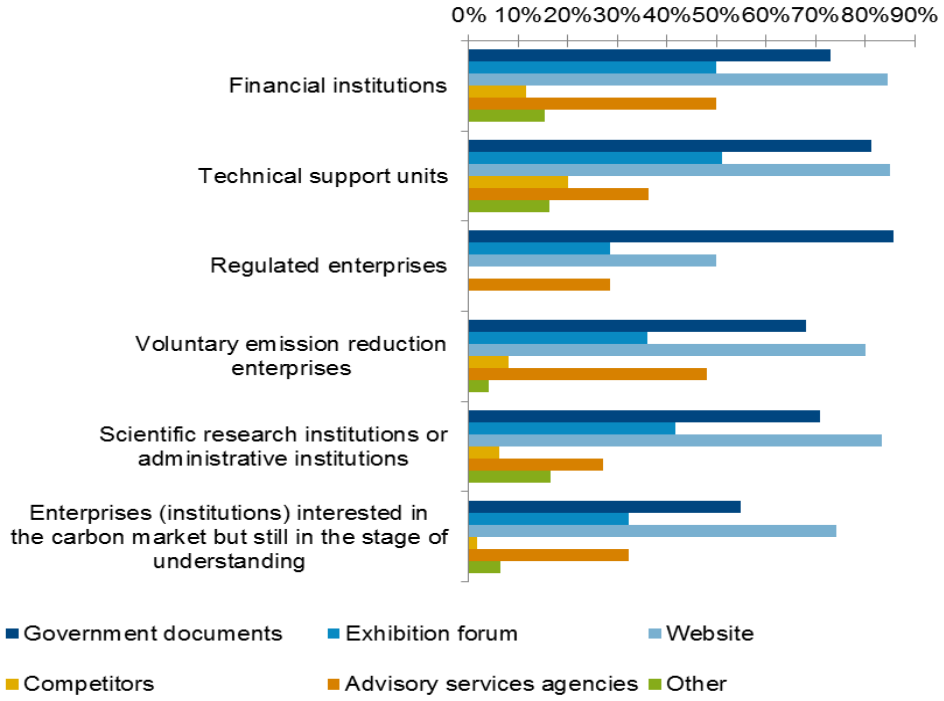


Figure 37: Channels for accessing carbon market policy

10) Training activities since 1 January 2013

The most active at conducting training activities were financial institutions, technical support units, voluntary emission reduction enterprises, research institutions, and administrative units, with regulated enterprises usually conducting training once per year. At present, the enterprises interested in and learning about the carbon market mainly just take an interest.

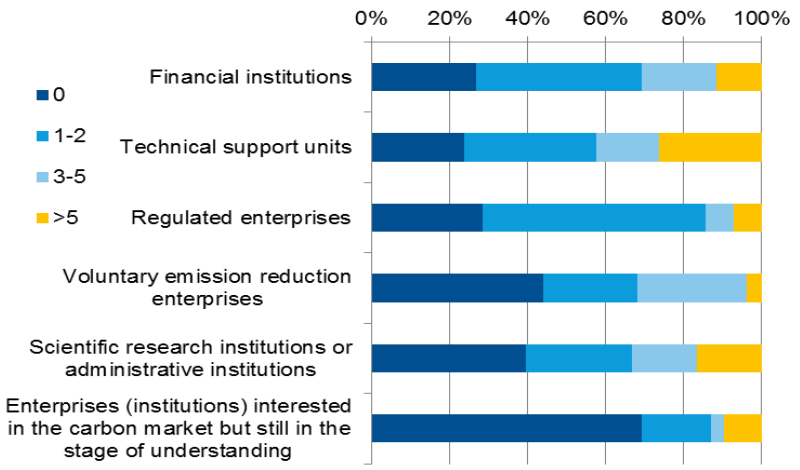


Figure 38: Training activities since 1 January 2013

11) The main training methods of each category

The most important training methods are training by domestic experts and self-learning. In particular, for the enterprises interested in and learning about the carbon market, the main method to obtain carbon market knowledge was through self-learning.

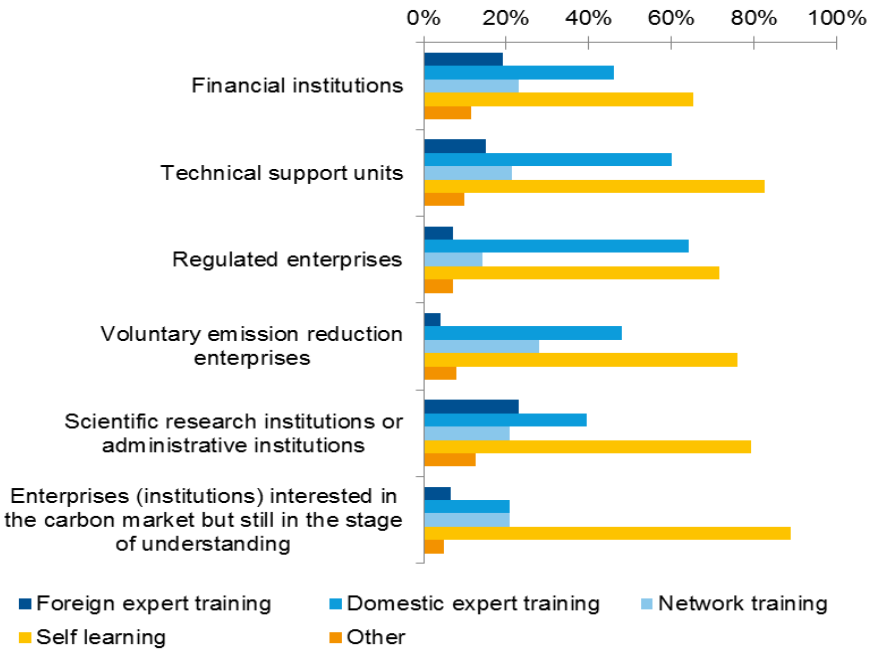


Figure 39: Main training methods

12) The main training content of each category

In general, all types of institution take carbon trading policies and regulations seriously. In addition, financial institutions pay more attention to carbon asset management, financial transactions and carbon trading. Technical support units pay more attention to emissions monitoring, emissions measurement, emissions report compilation, verification procedures and carbon asset management. Regulated enterprises pay more attention to emissions measurement, emissions report compilation and verification procedures. The voluntary emission reduction enterprises pay attention to the carbon trading mechanism, emissions measurement, verification procedures and carbon asset management. Research institutions or administrative institutions pay attention to carbon trading principles and emissions measurement. The enterprises interested in, and learning about the carbon market have a balanced range of training content.

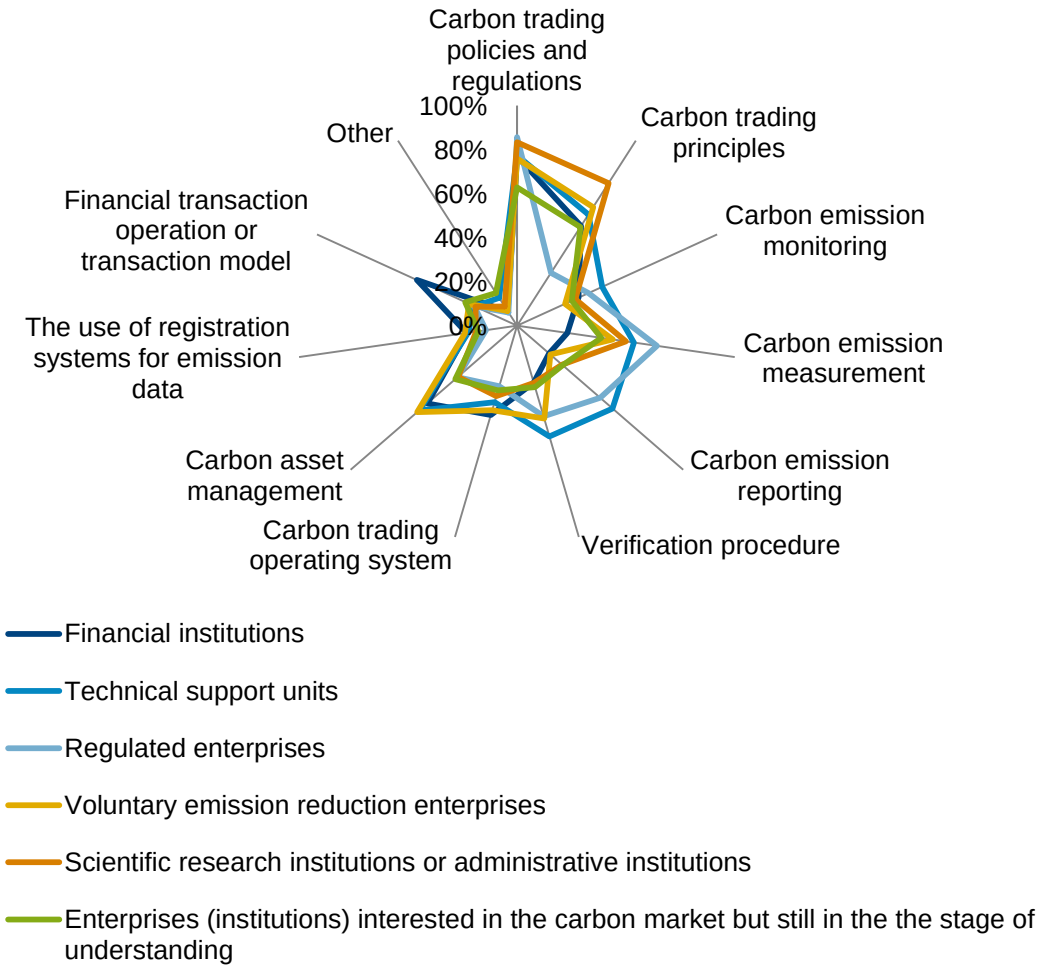


Figure 40: Main training content of each category

13) Participation in or plan to participate in commodity trading in the following areas

The institutions with commodity trading experience or a plan to participate in trading account for about 70% of the total, higher than our expectation. In particular, financial institutions were the most active in all kinds of commodity trading. Relatively speaking, the attention of the financial institutions to agricultural products is less than that of regulated enterprises and voluntary emission reduction enterprises.

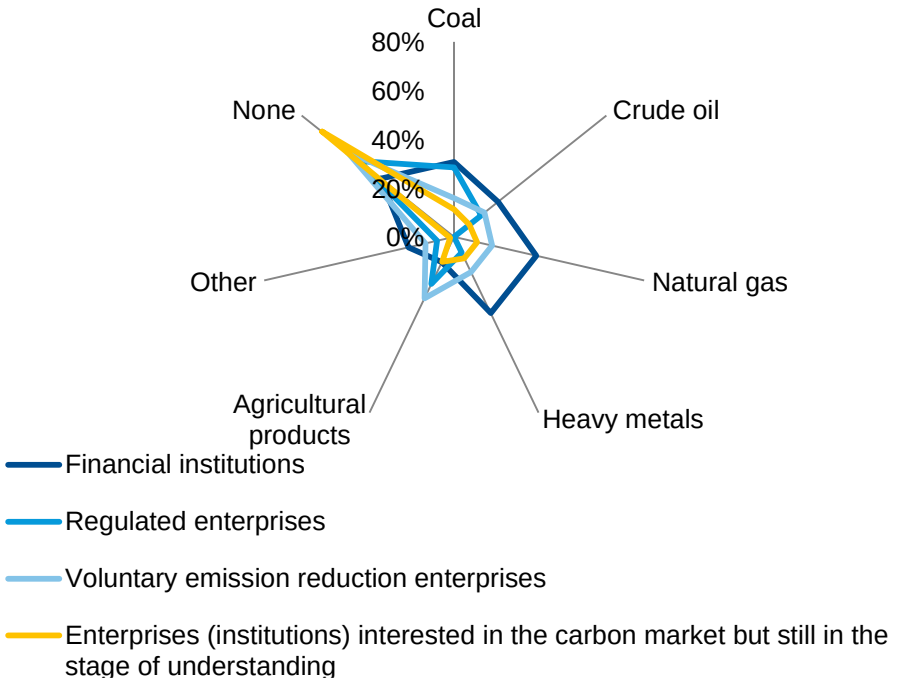


Figure 41: Participation or plan to participate in commodity trading

14) Professional work experience in carbon trading or other areas of environmental finance

The experience of carbon trading or other forms of environmental finance is generally low, especially with regulated enterprises and units interested in the carbon market.

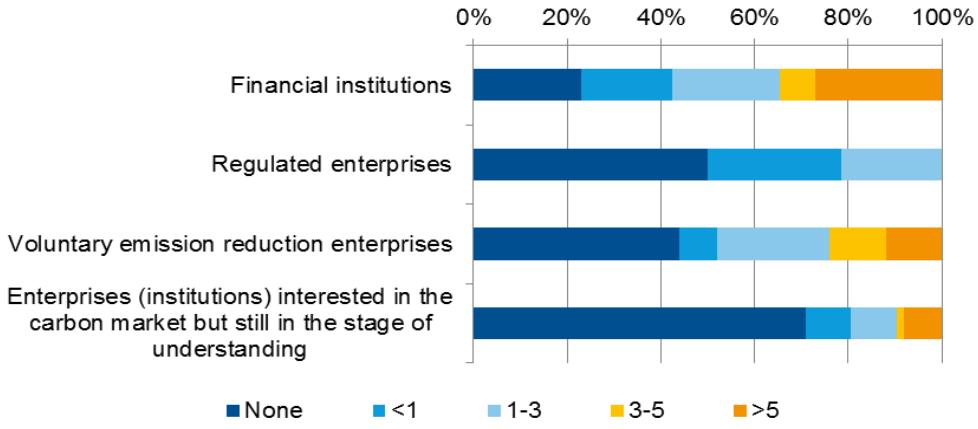


Figure 42: Professional experience of carbon trading or environmental finance

15) The maximum amount of carbon assets managed or developed by the responsible department

About 24% of the institutions surveyed managed or developed more than 100,000 tonnes of carbon assets overall, while 50% of financial institutions and 40% of voluntary emission reduction enterprises managed or developed assets of more than 100,000 tonnes of carbon.

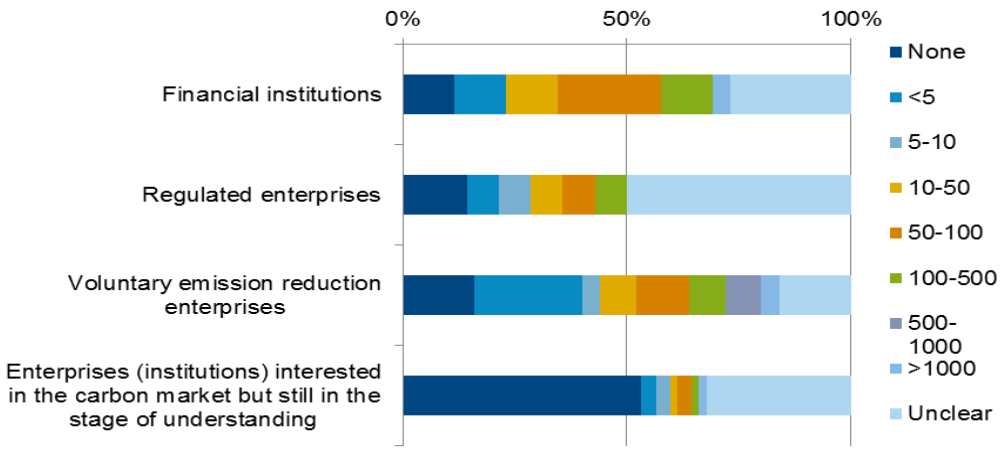


Figure 43: Magnitude of carbon assets managed by the carbon asset management department

4.3 Market development

16) The purpose of the institutions participating in carbon trading

Financial institutions mainly aim to expand their business, and see carbon trading as a means of investment.

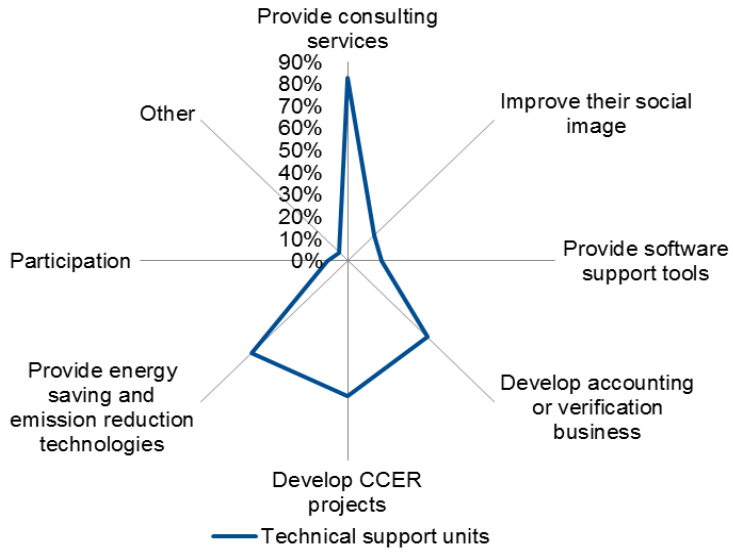


Figure 44: The aims of technical support units participating in carbon trading

Regulated enterprises mainly aim to improve their image in the community, and to complete emission targets. Voluntary emission reduction enterprises mainly aim to expand business, to invest, and to improve their social image. Enterprises interested in the carbon market mainly participate in order to expand business and to improve their social image. Technical support units mainly provide consulting services, and aim to expand their accounting and verification business, to develop CCER projects, and to provide energy saving and emission reduction technology.

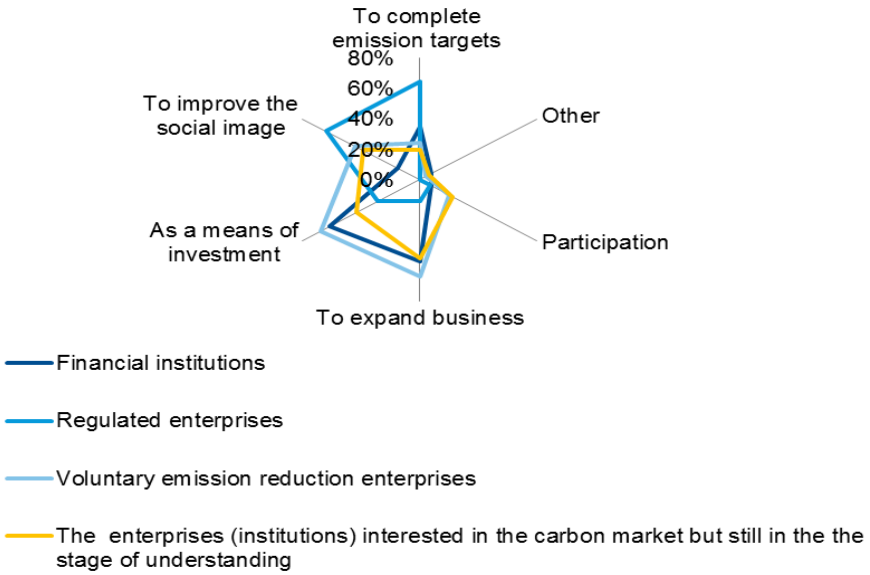


Figure 45: The aims of institutions participating in carbon trading

17) Purpose of the establishment of China's carbon market

The main driving force for the establishment of China's carbon market includes pressure from the international community, developing a strategic plan for the next ten years, industrial upgrading and transformation, adjustment of the energy structure and the achievement of emission targets. Meanwhile, financial institutions and research or administrative institutions are not very optimistic regarding a carbon tax, as well as carbon financial markets.

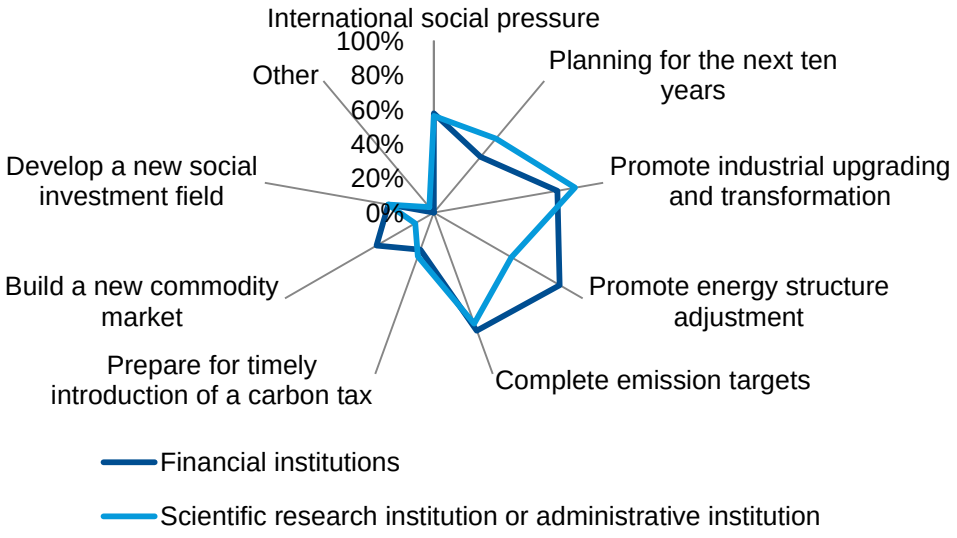


Figure 46: The purpose of the establishment of a carbon market in China

18) Target setting for carbon emission reductions in 2015-2016

Only about 14% of institutions surveyed have developed carbon emissions targets for 2015-2016. The top three are as follows: 36% of regulated enterprises, 28% of voluntary emission reduction enterprises, and 23% of financial institutions.

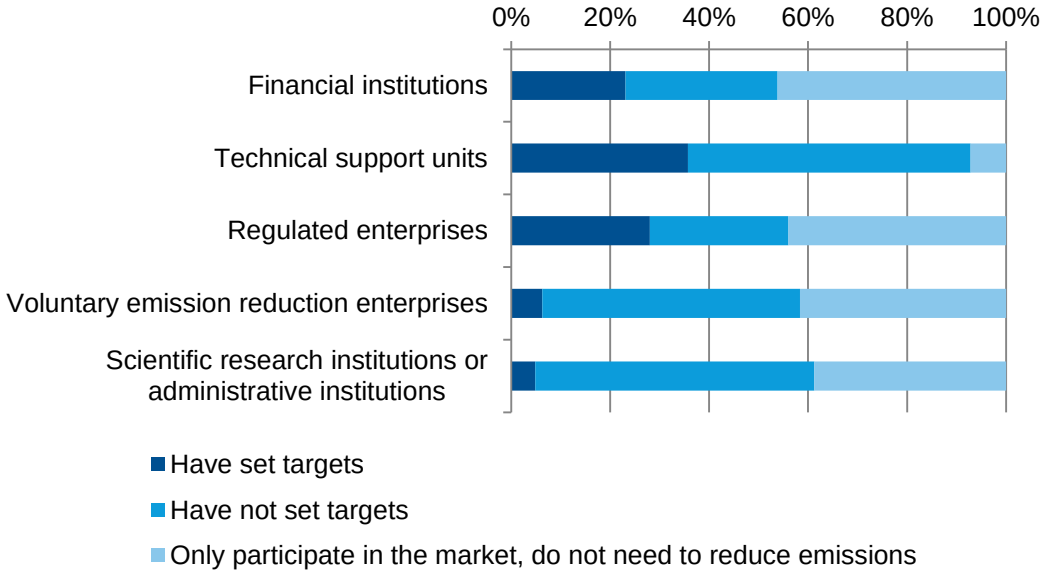


Figure 47: Target setting for carbon emission reductions in 2015-2016

19) Quota holdings expected by regulated enterprises

Most of the regulated enterprises have no realistic idea of their own holding of allowances, or even whether the quota holdings of the past three years were high or low.

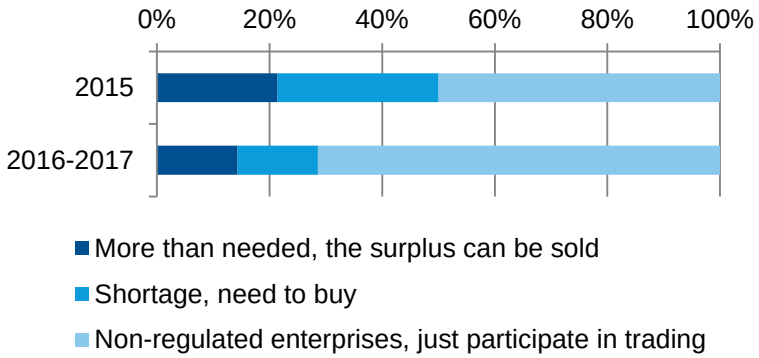


Figure 48: Predicted quota holdings of regulated enterprises

20) Need for a tool to predict the status of quota holdings independently

In general, each type of institution has about half which need such a tool, while the demand from regulated enterprises and voluntary emission reduction enterprises is slightly higher than the financial institutions and the enterprises interested in the carbon market.

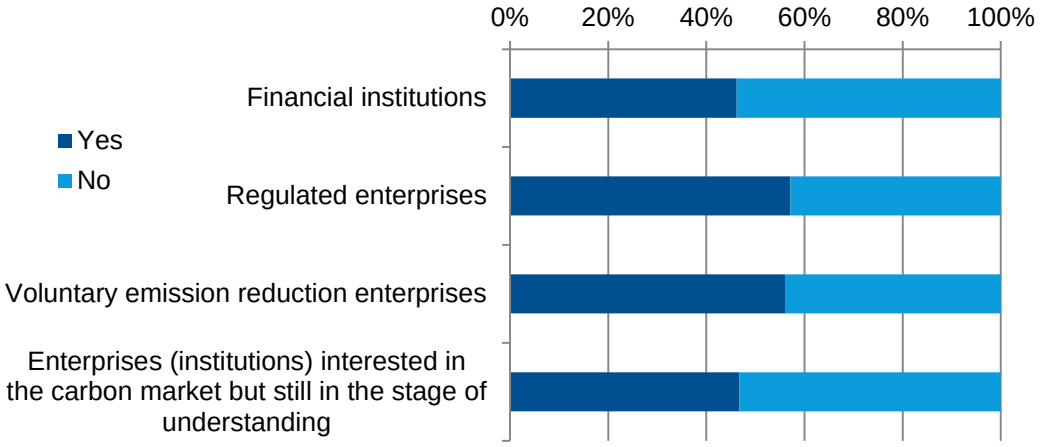


Figure 49: Need for tools to predict quota holding situation independently

21) Intention to sign with professional agencies to manage carbon allowances via entrustment or outsourcing

Voluntary emission reduction enterprises in this area have the highest demand, while 40% of the enterprises interested in the carbon market are not yet been clear on this issue.

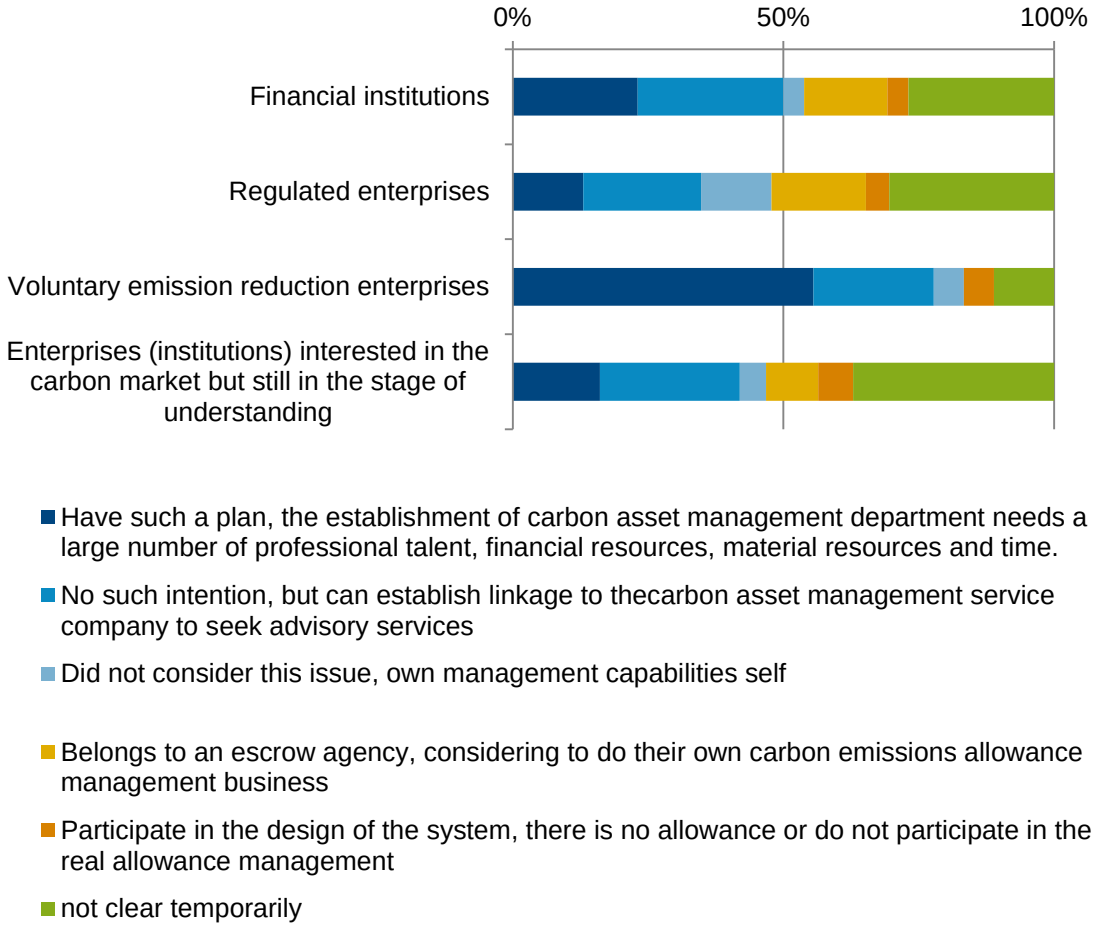


Figure 50: Intention to sign with professional institutions to manage allowances

22) The frequency of valuation of quota holdings before implementation deadline

The frequency of valuation or prediction amongst financial institutions and regulated enterprises is relatively higher, especially with regulated enterprises.

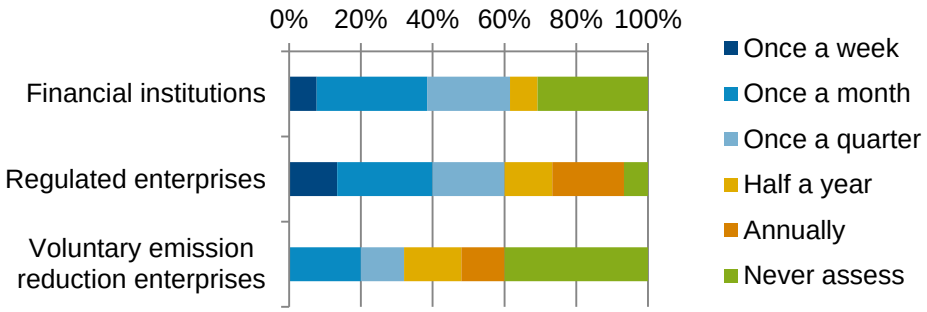


Figure 51: Allowance assessment frequency before the compliance deadline

23) Willingness to sell (or buy) residual allowances according to assessment (forecast) result

Nearly 78% of respondents were willing to buy and sell carbon market allowances.

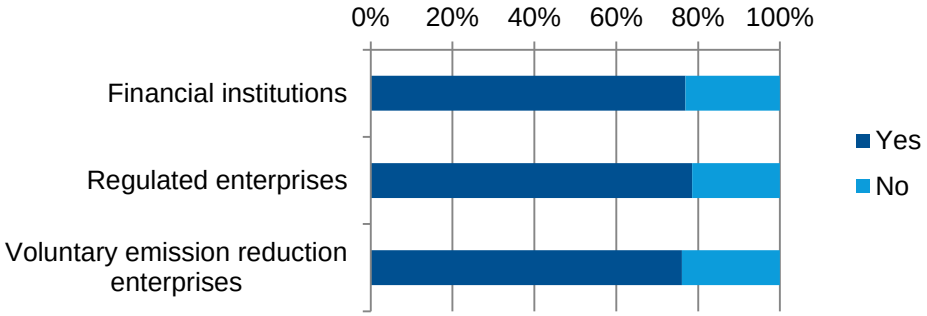


Figure 52: Willingness to sell or buy residual allowances according to assessment or prediction

24) Need for a tool that can lock in the price and amount of future carbon allowances

About 75% of the respondents have a need for tools to be able to lock in the future price and amount of carbon allowances.

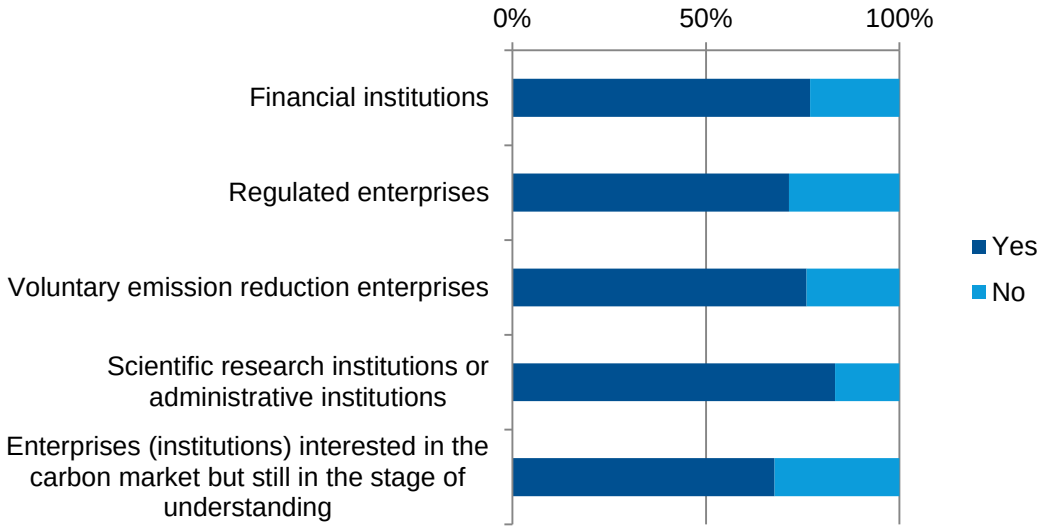


Figure 53: Need for tools which could lock in the price and amount of future allowances

25) Concern about lack of counterparts when carrying out allowance trading

About 70% of the respondents are worried about this problem. Relatively speaking, the proportion of regulated enterprises concerned is the lowest, of which only 58% worry about this problem.

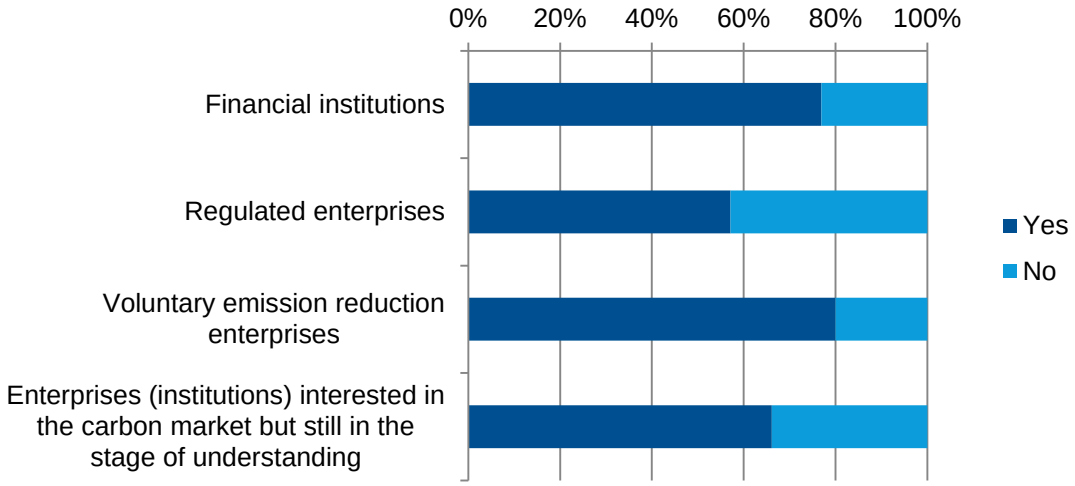


Figure 54: Concern about lack of trading counterparts when trading carbon allowances

26) What products are expected in the secondary market

At present, several of the main types of institution, including regulated enterprises, expect to see the option for CCERs and allowances. Apart from regulated enterprises, all are inclined to see

carbon futures on the exchange. Relatively speaking, financial institutions and research institutions and administrative institutions expect an OTC forward broker business.

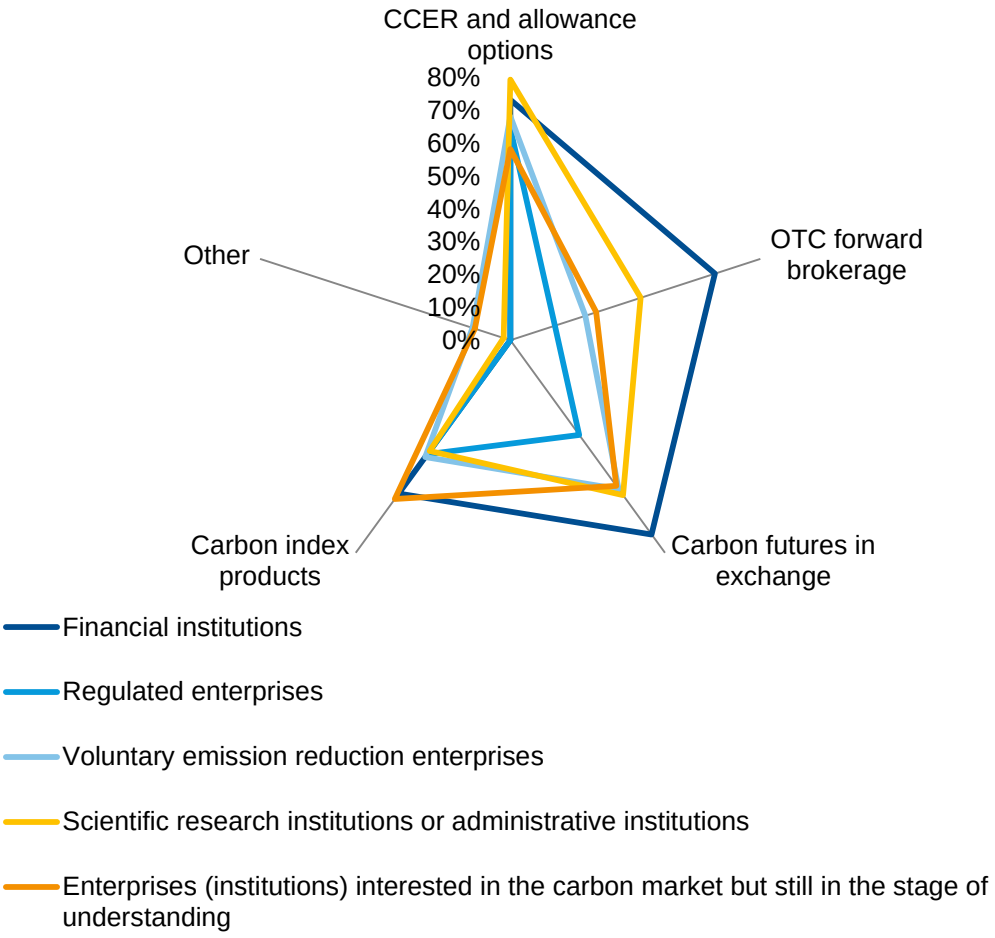


Figure 55: Expected products in the carbon trading secondary market

27) What is the future intention in relation to innovative carbon finance products

In general, the opinions of respondents on carbon asset mortgages and carbon bonds are consistent. Financial institutions are all interested in carbon funds, carbon asset forward contracts, carbon asset repurchasing, carbon emission OTC swaps and carbon finance credit extension, etc.

Voluntary emission reduction enterprises are more optimistic about carbon asset valuation. The proportion of undecided regulated enterprises is the highest.

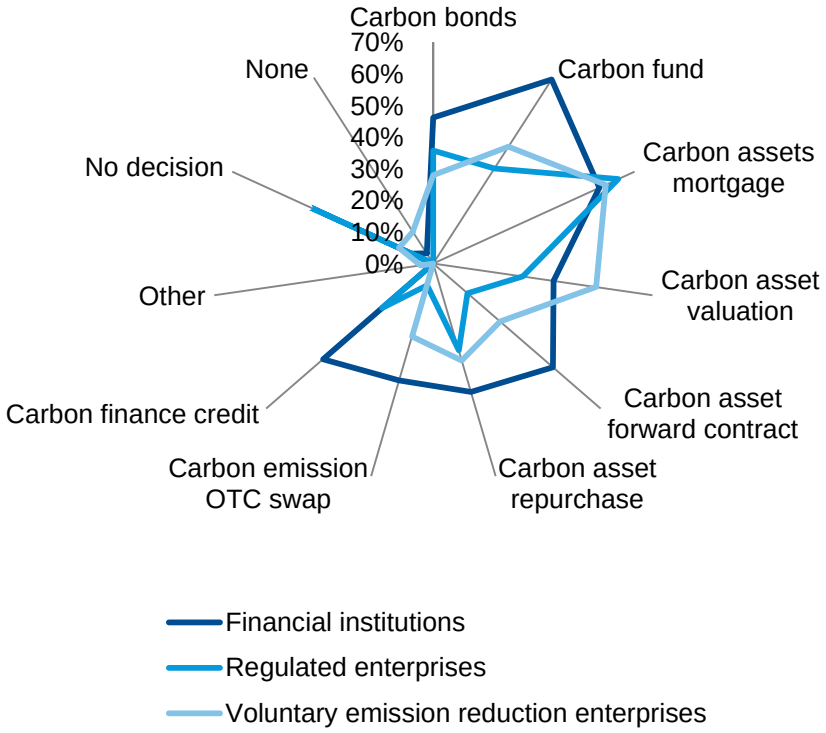


Figure 56: Intention in relation to future innovative carbon financial products

28) With the start of national carbon market in 2017, what would be the position of the market in the future

The largest group of respondents selected a more carbon finance driven market, at about 38%. 20% of the regulated enterprises believe it will just be an administrative tool to complete emission reduction targets. 30% of the regulated enterprises have no clear judgement. About 22% of the respondents believe that a carbon tax and carbon trading will coexist in the future.

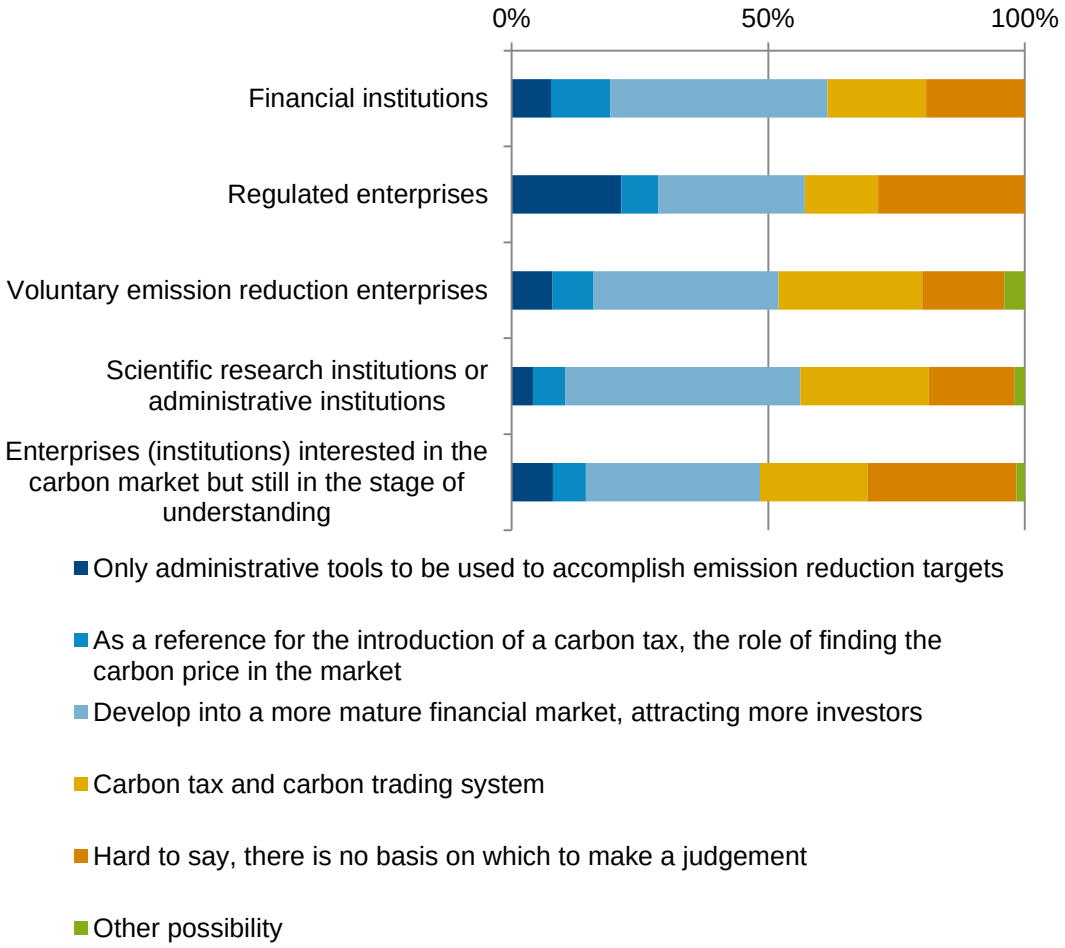


Figure 57: Carbon market positioning in the future

4.4 Carbon emission reduction economy

29) Preparedness to set aside a certain budget or capital amount for carbon trading

More than 71% of respondents will reserve a carbon trading budget or capital. The main method is a certain proportion of annual income.

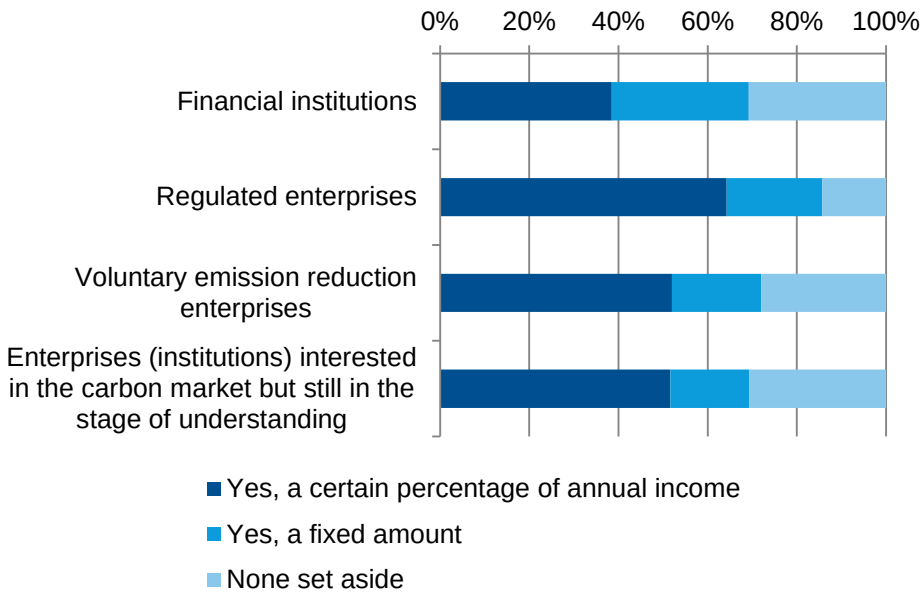


Figure 58: Preparedness to set aside a budget for carbon trading

30) Methods for budgeting for carbon trading

The level of trading budget and compliance budget preparedness is mostly consistent, except for the enterprises interested in carbon markets, a high proportion of which haven't budgeted yet.

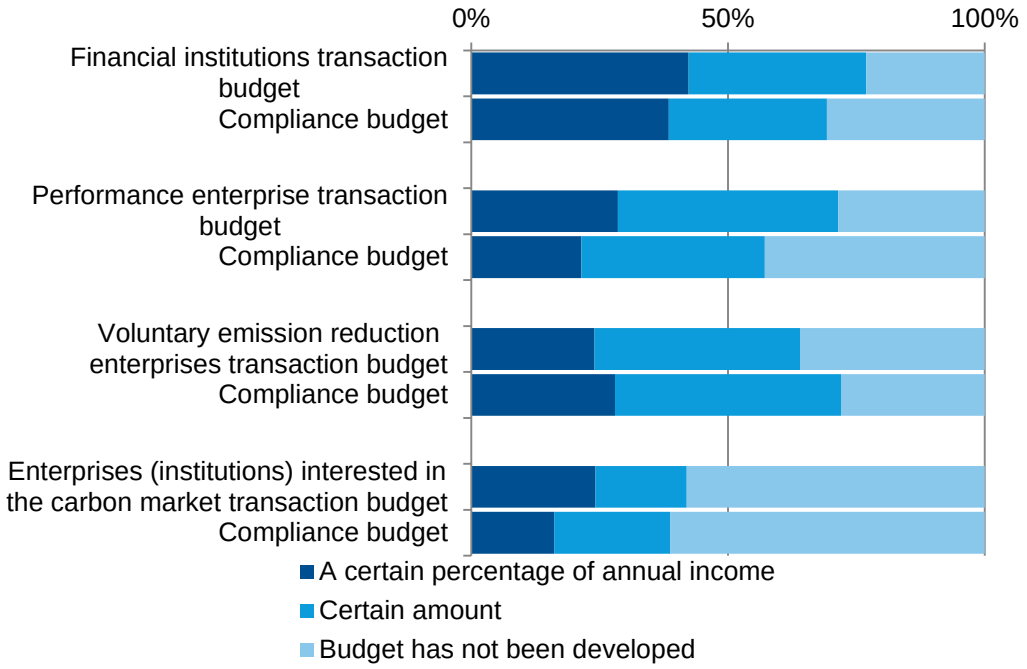


Figure 59: Budget formulation for carbon trading

31) Is there any action or intention for putting a certain amount of capital into low carbon technology this year or in the future?

In general, about 60% of financial institutions and enterprises interested in the carbon market have no input in terms of low carbon technology. About 70% of regulated enterprises have put, or will put, some capital into low carbon technology, of which half use a certain proportion of annual yield, while the other half use a fixed amount of funds.

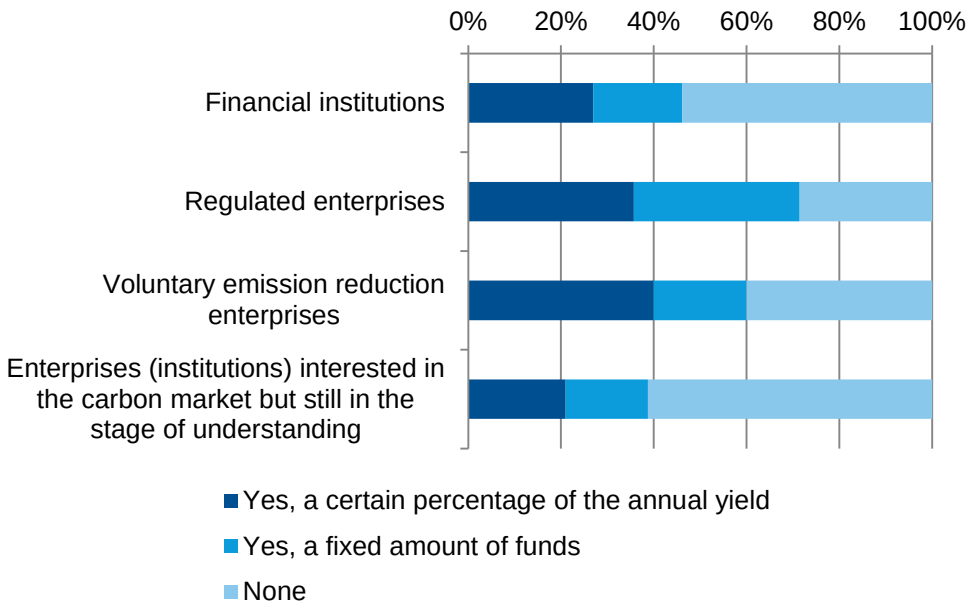


Figure 60: Is there any capital directed into low carbon technology this year or in the future

32) Against the background of energy savings, emission reductions, and low carbon investment, is there any impact on existing operations?

For financial institutions, about 38% said their enthusiasm for developing or investing in CCER projects improved, and more than 30% have prepared special capital for carbon trading funds.

For voluntary emission reduction companies, the enthusiasm for developing or investing in CCER projects increased, as did enthusiasm for old, energy consuming facilities to be gradually replaced. For regulated enterprises, the use of daily office supplies, or the use of electricity and heat etc. are beginning to be moderated, and the old, energy consuming facilities are gradually being replaced.

For the enterprises interested in the carbon market, more than 25% do not understand the specific impacts.

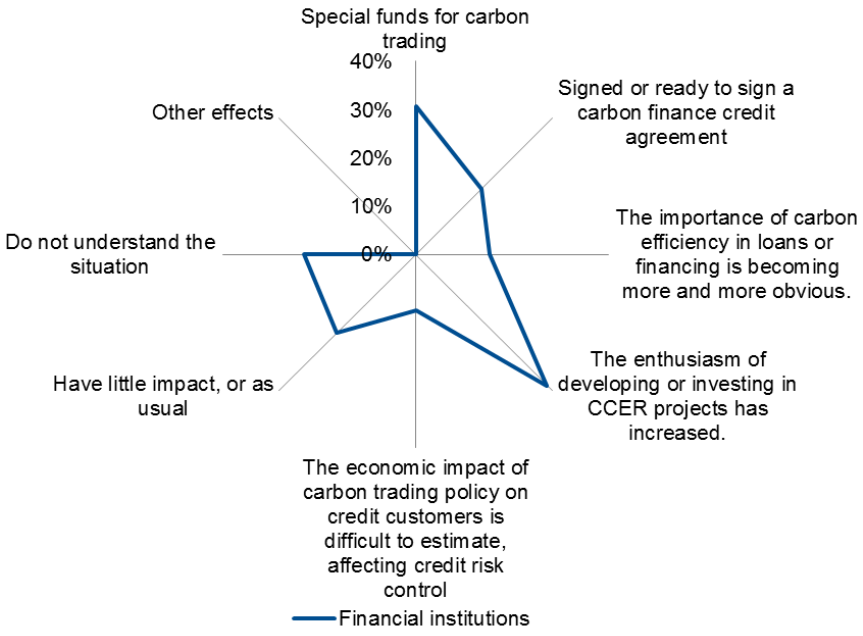


Figure 61: Effects on original operation of financial institutions under the background of encouraging energy savings, emission reductions and carbon reductions

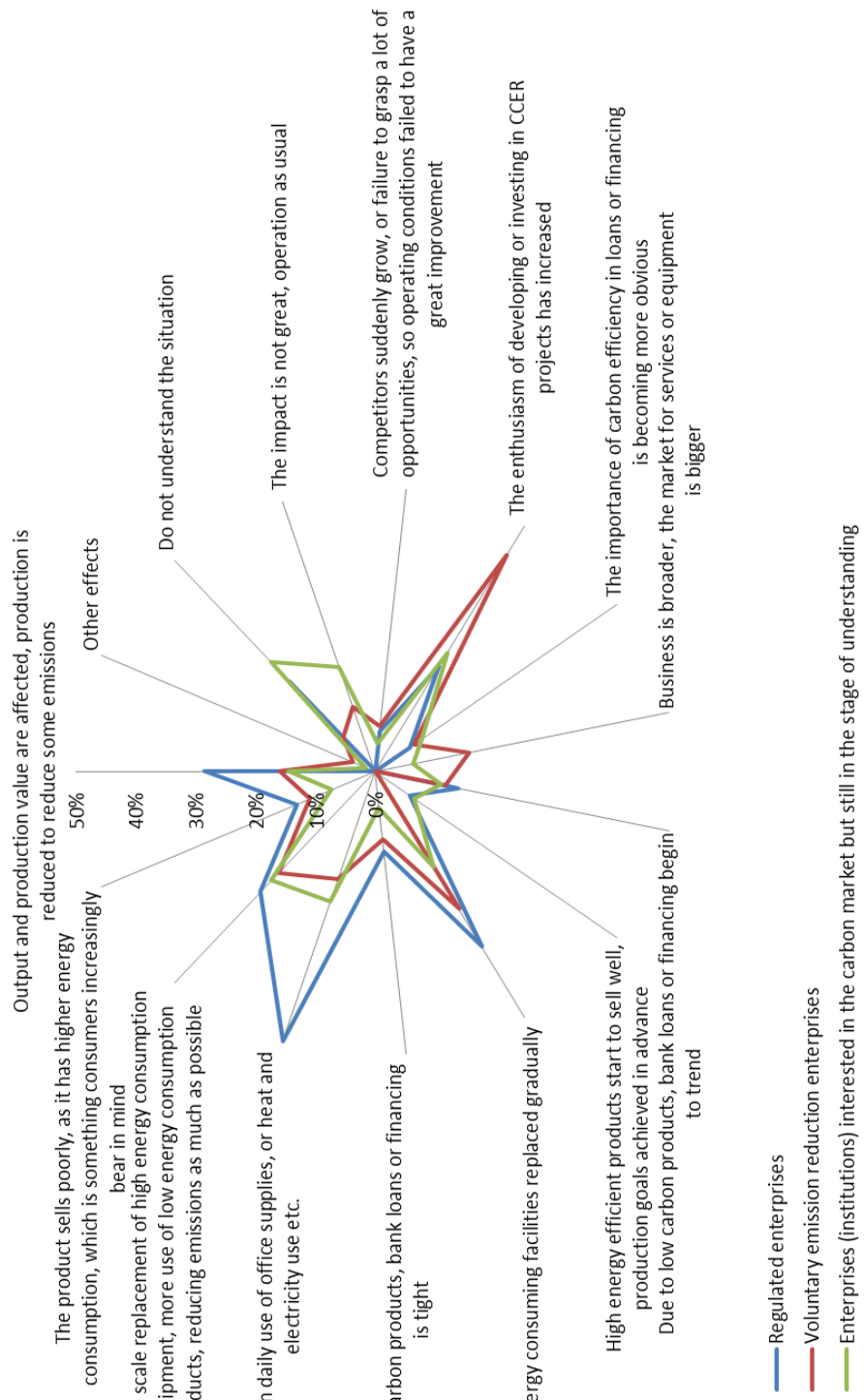


Figure 62: Effects on original operation of main roles under the background of encouraging energy savings, emission reductions and carbon reductions

33) The effect of setting a carbon asset management position on operating profit

About 56% of the enterprises interested in the carbon market do not set a relevant position for carbon asset management. For financial institutions and voluntary emission enterprises, the setting of a position increases the non-business income. For 43% of the regulated enterprises, although the position of carbon management increases the payload of the manager, the operating cost declines.

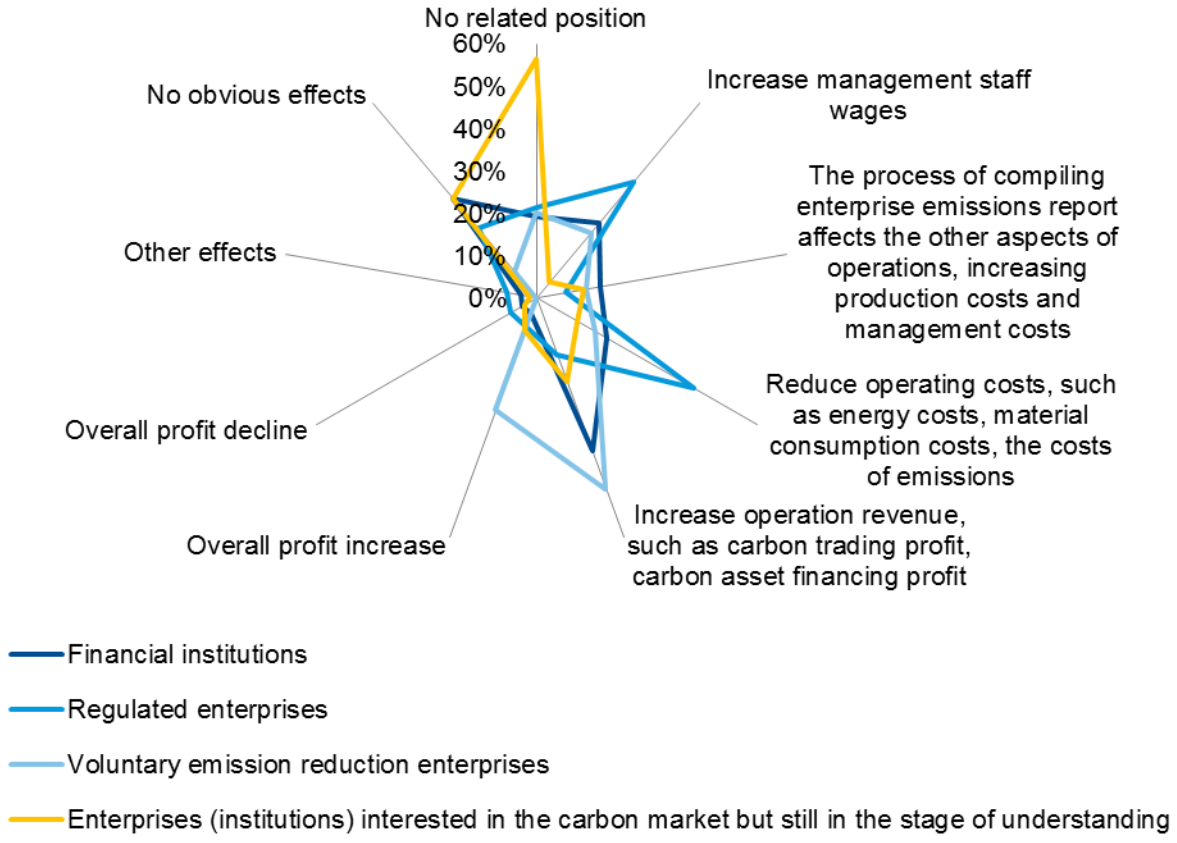


Figure 63: The effects of setting a carbon asset management position on operating profit

34) Cost of participating in carbon trading activities

Volume of allowance holding

Only about 8% of the financial institutions hold more than 10 million tonnes of allowances. In general, about 55% of the financial institutions and regulated enterprises hold less than 1 million tonnes of allowances.

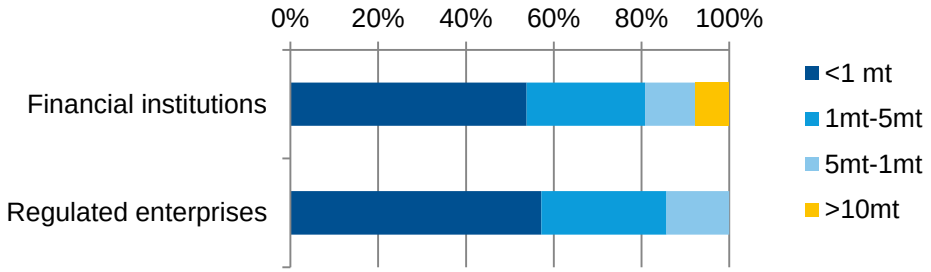


Figure 64: Quota holding of financial institutions and regulated enterprises

Transaction fees (including handling fees or commission fees), certification fees, and other related consulting fees

In general, the cost for regulated enterprises in carbon trading is lower than the cost for financial institutions. However, the true level of transaction costs per allowance cannot be perceived without the total amount of allowances involved.

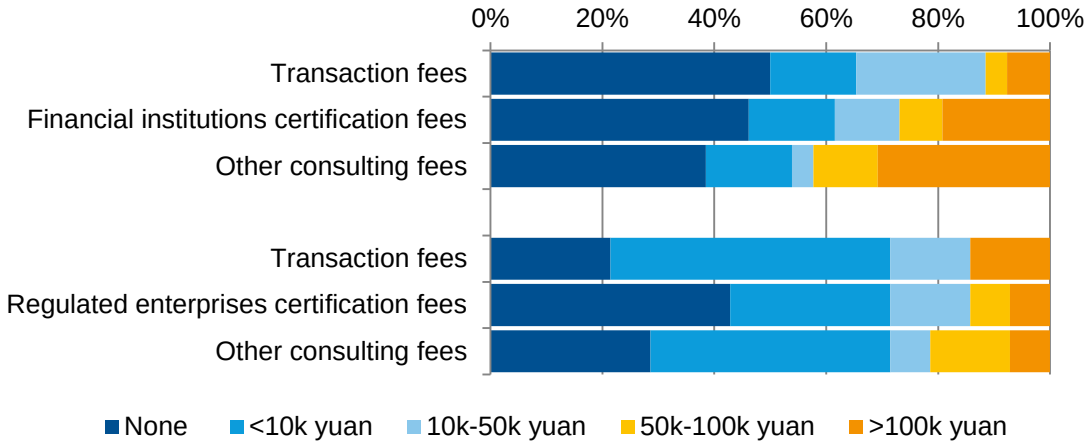


Figure 65: Costs of carbon trading activities

Looking further ahead, there is a proportional relationship to a degree between the fees of carbon trading activities and the level of allowance holdings of trading institutions, especially when the fees of carbon trading are more than 50 thousand Yuan. For the fees of the three different steps on the same volume of allowance holding, other consulting fees are slightly higher than the certification fees, and certification fees are slightly higher than the transaction fees.

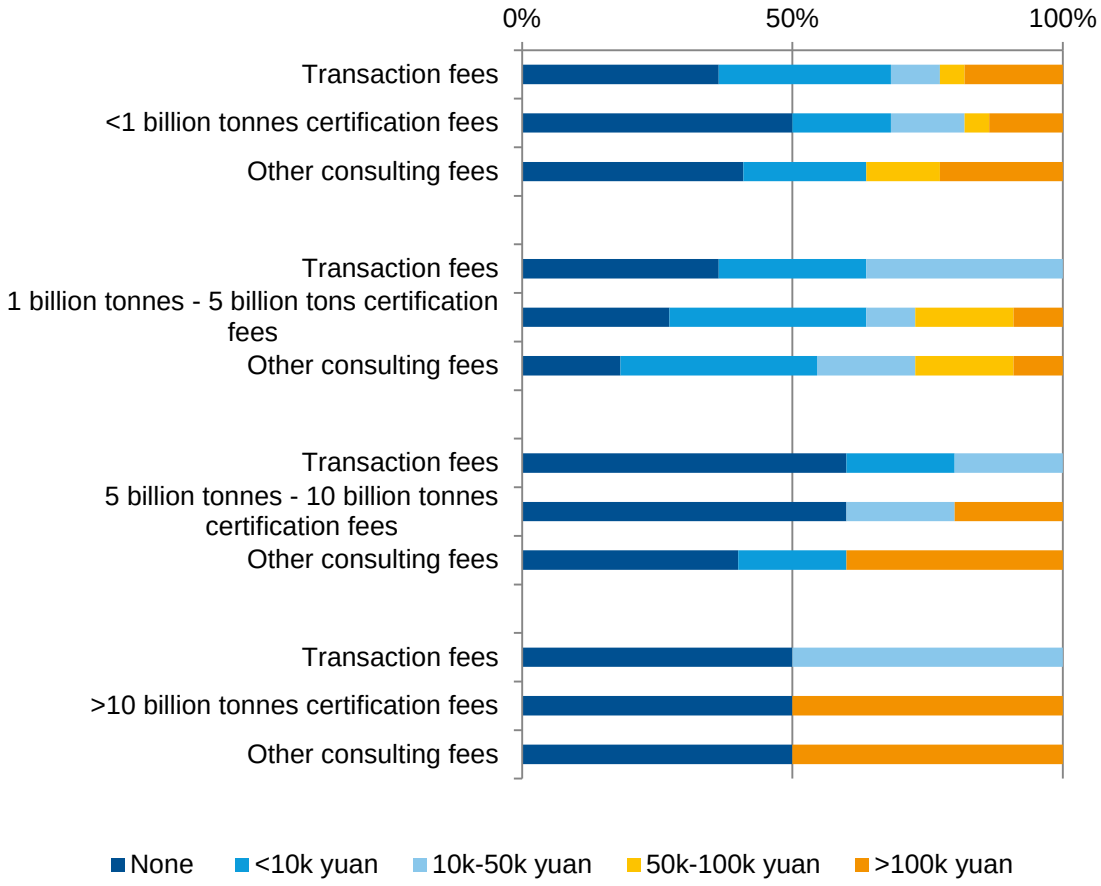


Figure 66: The relationship between allowance holding amount and carbon trading fees

35) Implement accounting of relevant fees for carbon trading

The main accounting methods for carbon trading fees are still internal. The other option is third party consultation agencies. For the regulated enterprises, more than 20% adopt government accounting methods.

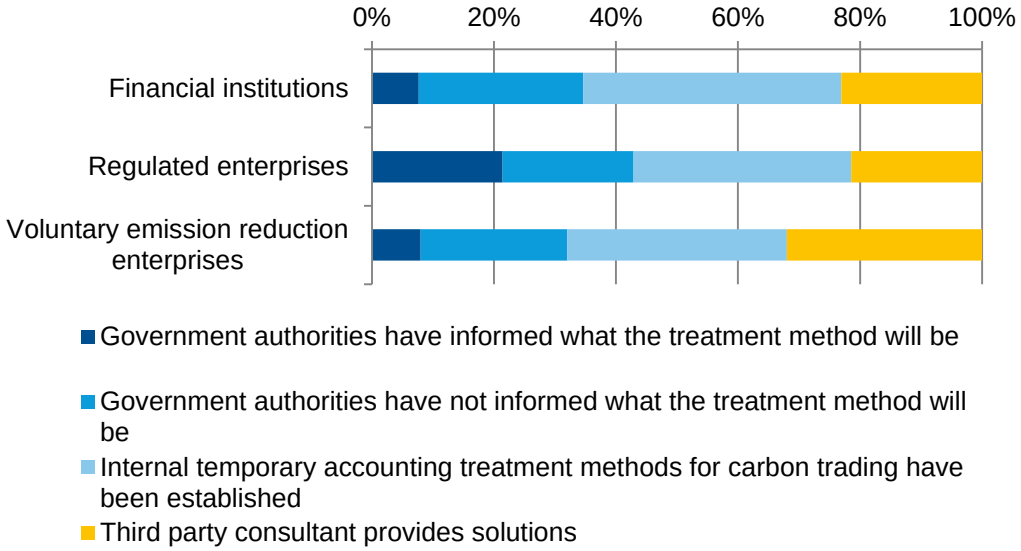


Figure 67: Accounting treatment on carbon trading fees

36) How to obtain revenue through the carbon market

57% of regulated enterprises mainly obtain revenue via trading allowances. About 56% of the voluntary emission reduction enterprises obtain revenue via developing and investing in CCER projects. About 45% of the financial institutions and voluntary emission reduction enterprises also earn revenue from the price difference by replacing CCERs for allowances.

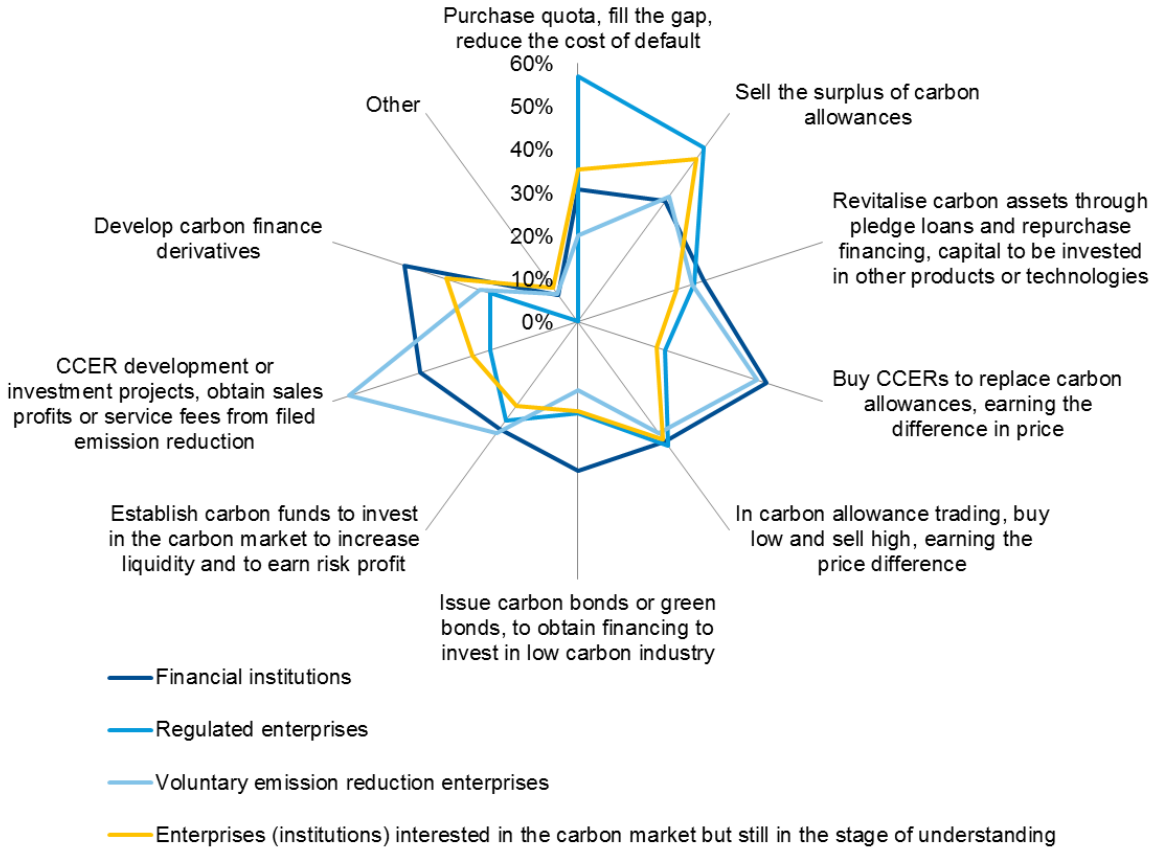


Figure 68: How to profit via the carbon market

37) Whether carbon emissions reduced from the previous year after participating in carbon trading

Carbon emissions of more than 70% of the regulated enterprises involved in carbon trading were reduced. The carbon trading system is conducive to achieving carbon emission reduction targets.

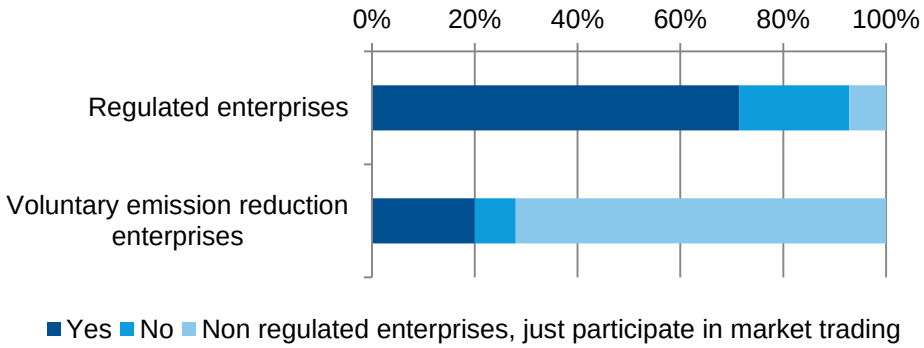


Figure 69: Whether carbon emission reduced after participating in carbon trading

5 Carbon finance in carbon management

During the process of tackling global climate change and environment problems, as well as the transition from a high-carbon economy to a low-carbon one, the important issue of environmental finance and carbon finance has received extensive attention. (Liu Liwei, 2013) Carbon finance refers to the various finance arrangements and financial trading activities formulated or adopted to facilitate reducing GHG emissions, which includes carbon emissions quota trading and financial derivatives trading related to carbon emissions, as well as direct investment and financing of activities for GHG emission reduction and financial intermediary services provided by enterprises or institutions to reduce GHG emissions.

This chapter focuses on carbon asset management, as shown in Figure 70, starting with each element of carbon finance throughout the industry chain, introducing the segments of carbon finance, what can be done through the carbon industry chain, the definition of each segment, what can be provided to each participant, etc. Under the policy framework of cap and trade, voluntary emissions trading, as well as a possible carbon tax policy, market support tools can help regulated enterprises and third party institutions to operate GHG emissions data monitoring, measurement, storage, help regulated industries to identify key aspects of their emissions, and to carry out monitoring. With a comprehensive view and analysis of GHG emissions data, and with the help of various carbon financial services, regulated enterprises can carry out technology implementation of carbon emission reduction at a targeted project level. The implementation of energy saving and emission reduction projects can lead to regulated enterprises developing a relative surplus of allowances. The surplus allowance can be packaged into various carbon financial derivative products in the carbon trading market for profit. Carbon assets can be revitalized and green and low carbon financing channels can be expanded. For regulated enterprises with a shortage of allowances, they can fill their quota in a timely manner via carbon financial market. Finally, while regulated enterprises in the carbon market can accomplish their emissions reduction tasks, they also assist government to accomplish emissions reduction targets with the help of these policy tools.

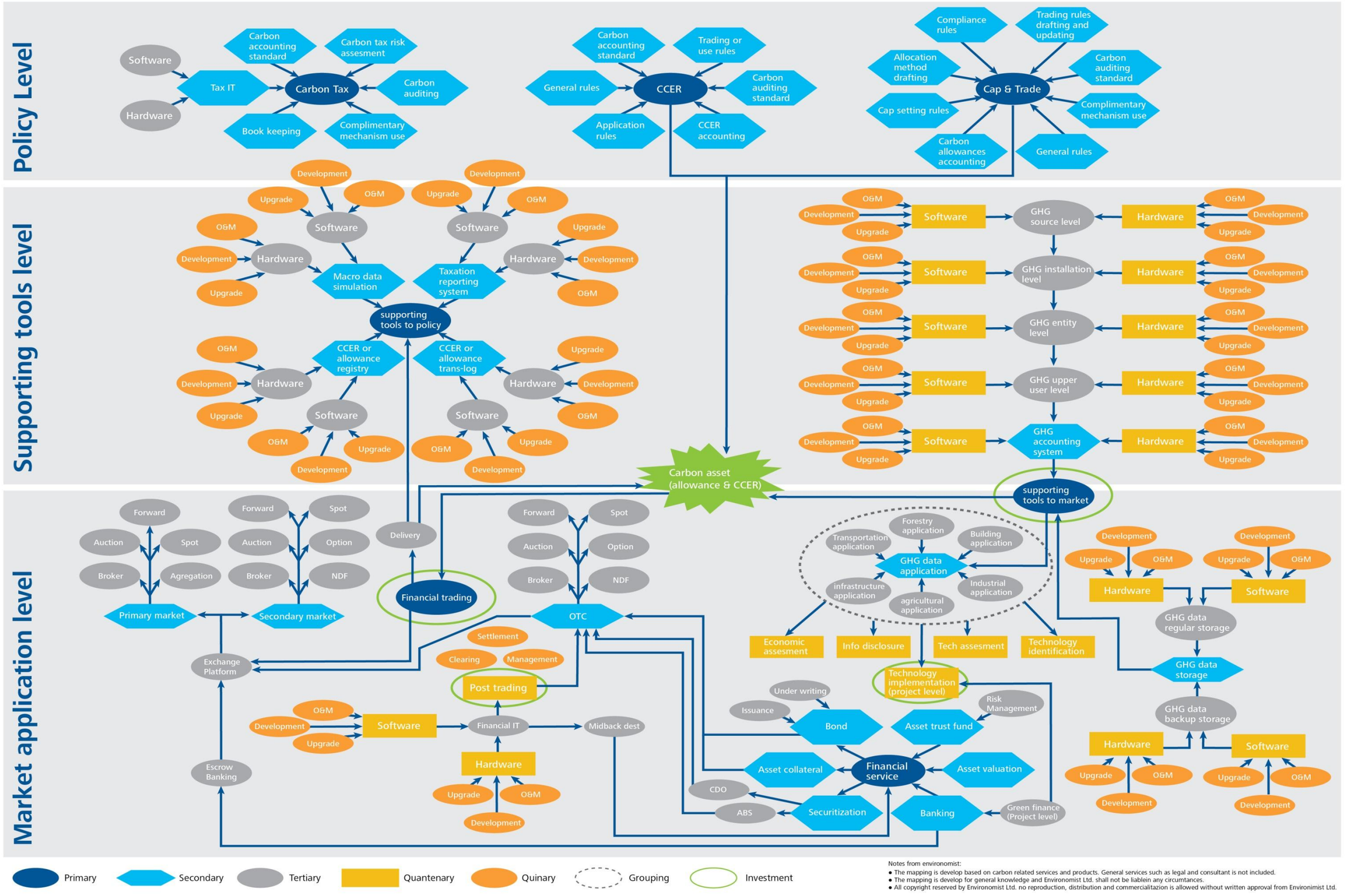


Figure 70 Carbon value chain mapping

5.1 Carbon finance services

Carbon finance services relate directly to carbon asset management (including carbon allowances and CCERs) and technological application on the project level of energy saving and emission reduction. He Jiankun said that, according to rough estimates, the demand for capital in new energy investment by 2030 will be more than 10 trillion Yuan. (Observer net, 2015) If coupled with energy conservation, forest carbon sinks and other measures, the total demand for funds could be about 40 trillion. It's clear to see that capital involved in carbon financial services is huge, so quality carbon finance services will directly influence the realization of China's emission reduction plan for 2030.

Commentary 10: Demand for climate financing for China's CO_2 emissions peak by 2030

Commentary 10: Demand for climate financing for China's CO_2 emissions peak by 2030

Special commentator: Mr. Chen Bo, Carbon Finance Lab of Research Center for Climate and Energy Finance (RCCEF), Central University of Finance and Economics (CUFE).

On June 30, 2015, the Chinese government made its formal submission to the UNFCCC Secretariat in relation to climate change policy: '*Enhanced Actions on Climate Change: China's Intended Nationally Determined C*ontribution'. According to this document, China has indicated its actions by 2030 as follows:

- To achieve the peaking of the carbon dioxide emissions around 2030 and making best efforts to peak early;
- To lower carbon dioxide emissions per unit of GDP by 60% to 65% from the 2005 level;
- To increase the share of non-fossil fuels in primary energy consumption to around 20%;
- To increase the forest stock volume by around 4.5 billion cubic meters on the 2005 level.

These commitments are not only China's responsibility as a party to the convention, but also reflect the determination of the Chinese government to walk a green, low-carbon, recycling-based, and sustainable development path characterized by an increasing transition of energy and consumption.

Since 2013, The Research Centre for Climate and Energy Finance (*RCCEF*) at the Central University of Finance and Economics has cooperated with other relevant institutions on estimating and calculating climate financing demand in China, and the Climate Financing Demand Analysis Model (CFDAM for short) has been developed with continuous improvements made in relation to methods and data. Follow-up research has been carried out and a series of new ideas have been proposed on several essential problems including the definition of climate financing, financing demand and supply, as well as the public spending mechanisms, etc.

The projection of emissions from 2000 to 2050 in China is shown in Figure 2. Under the conditions of BAU (Business as Usual), the emission of CO_2 in China will continuously rise to a peak of 12,936 million tons by 2040, and then slow marginally to 12,716 million tons by 2050. However, in the hypothesized scenario the emission of CO_2 in China reaches the peak in 2030 at the level of 10,003 million tons, and then drops considerably after that to 7,826 million tons by 2050.

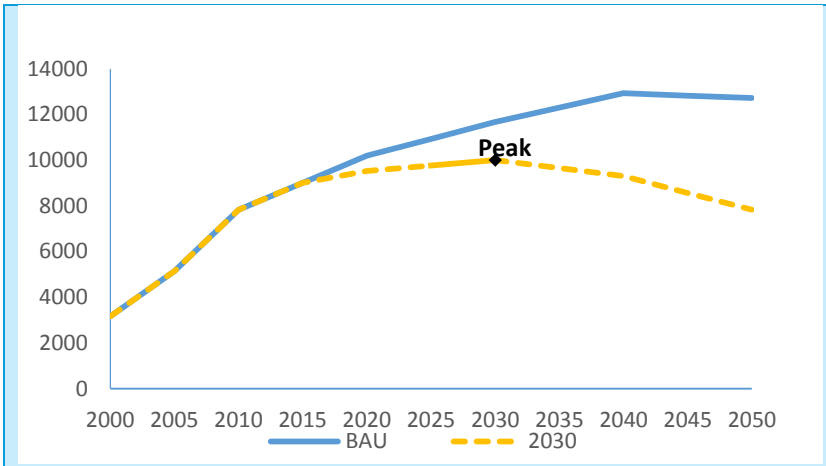


Figure 71: BAU emission and emission peak in 2030 (megatons CO_2)

The climate financing demand in China from 2010 to 2050 is illustrated in Figure 71.

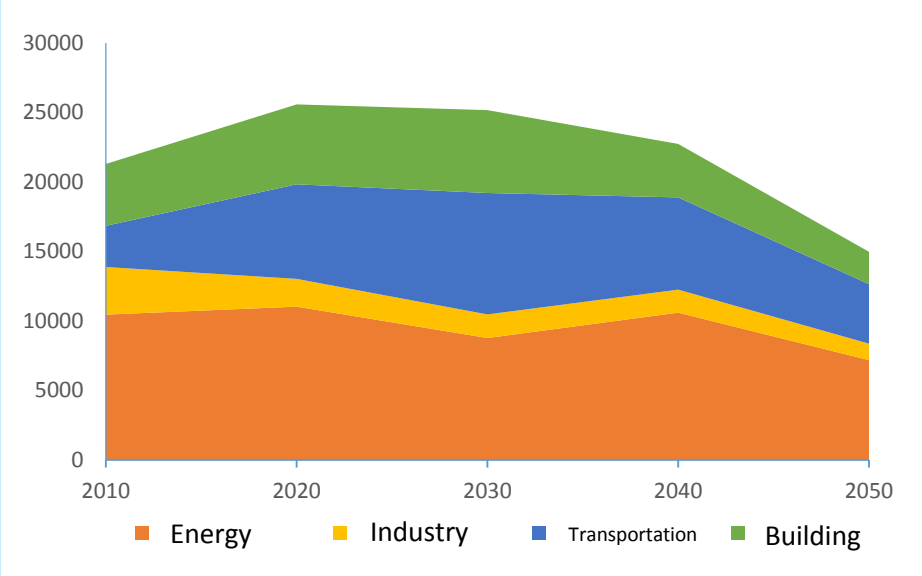


Figure 72: 2010-2050 Climate Capital Demand (100 Million Yuan)

From the model, it is predicted that financing demand corresponds to three phases in order to achieve the goal of an emission at peak by 2030:

- **Early investment stage (before 2020)**, it is necessary to increase investment rapidly. The growth rate of financing demand for each year should exceed 4% to the highest point of 2.56 trillion RMB, which is equivalent to 1.79% of the GDP in the current year.
- **Stable investment stage (2020-2030),** the financing demand remains stable, and the investment scale stabilizes around 2.5 trillion RMB every year till 2.52 trillion RMB by 2030, amounting to 1.8% of the GDP of the current year.
- **Profitable investment stage (2030-2050),** benefiting the long-term profits from the unremitting investment in the early stage, financing demand in this phase will decrease quickly to 1.50 trillion RMB by 2050.

Currently, the growth of climate financing development in China is in the initial stage, with urgency for rapid and additional investment to extend its scale until the amount accounts for around 1.8% of GDP in China, and this scale of investment should be maintained during the second stage. It is notable that financing demand will decline greatly after 2030 even under the conservative prediction; this is due to the early and sustained investment to 2030, which will allow China to benefit significantly from the lower costs of low-carbon technology innovation and large-scale application.

Mr. Chen Bo

Chen Bo is the Director of the Carbon Finance Lab of the Research Center for Climate and Energy Finance (RCCEF), Central University of Finance and Economics (CUFE). He holds a PhD in Economics from Renmin University of China and two Master degrees in Carbon Finance at University of Edinburgh and Control Engineering at Zhejiang University. He is at the forefront of the construction of China's ETS and Carbon Financial Market. Recently he led the Carbon Finance Lab to develop a series of guidances, standards and tools cooperating with industry. He concentrates on resolving key technical puzzles in the development of carbon financial market.

5.1.1 Carbon bond underwriting

Carbon bonds refer to debt obligations, issued by the government and enterprises to raise funds for low carbon economy project from investors, to whom they give a commitment to pay interest and principal repayments in a certain period of time. (Jiansheng, 2009) Carbon bonds are an important branch of carbon finance, whose essence is a bond that, according to the main issuing body, can be classified as either national carbon bonds or corporate carbon bonds.

The core feature of carbon bonds is bond interest rates linked with the CCER revenue from low carbon projects. Distinctive characteristics include their focus on investing in renewable energy, they can include fixed rate and floating interest rate products, CCER income for a certain proportion of floating interest payments, the realization of CCER revenue sharing by the project investors and bond investors. With the inclusion of carbon bonds in the CCER trading market, including new virtual trading market will have an expansionary effect. Their large-scale release will ultimately help promote the entire financial system and capital market to transform in a low carbon direction.

The main function of carbon bonds include: meeting the investment and financing demand of both sides; helping the government promote a demand-oriented, low carbon economy; meeting the demand of project investors to make up for the lower rate of return than the average level of the traditional market; meeting the demand of bond buyers who take the initiative to accept responsibility for tackling global environmental change.

Issuing place	Shenzhen	Hubei
Date of signature	8/5/2014	26/11/2014
Signatories	Shanghai Pudong Development Bank, China Development Bank, China Guangdong Nuclear Power Group (CGNPC) wind power, CGNPC finance and the CEEX	Huadian Hubei Power Generation Co. Ltd. and the Wuhan branch of China Minsheng

		Bank
Product name	China Guangdong Nuclear Power Corporation (CGN) wind power medium-term notes added carbon earnings	Carbon bond intention cooperation agreement
Monetary value of business	One billion Yuan	Two billion Yuan
Business term	Five years	N/A
Investment objective	The bond will be used to install 49500 kilowatts of capacity in Shangdu, Inner Mongolia, a project in Jimunai, Xinjiang, salt water wells project and in the second phase to install 35700 kilowatts of wind farms in Taishan, Guangdong (Wen Cun).	N/A
Expected yield	The bond interest rate has two parts – a fixed rate and floating rate, of which the floating rate has a positive correlation of carbon (CCER) trading gains of the 5 traditional power projects under issue implemented in the duration of the bond, and floating interest rate interval is set to 5bp (BPS) to 20bp. Issuing interest rate is 5.65%.	N/A
Remarks	The first single carbon bonds in China issued in the CEEX.	This is the first carbon bonds issued in Hubei, is currently the country's largest contract scale carbon bonds.

Table 30: Existing carbon bonds products

Source: Desk research by Environomist

Commentary 11: Introduction of the corporate carbon bond business

Commentary 11: Introduction of the corporate carbon bond business

Special commentator: Mr. Song Yifan, CITIC Carbon Asset Investment Management, Ltd.

The carbon enterprise bond is the first carbon financial product to be implemented in relation to China's climate change initiatives. Carbon bonds can be divided into two types: 1. Enterprise capital guarantee for the creditors. Enterprises replace or trade the carbon asset (allowance or CCER). The profit includes assured bond profit plus the non-assured floating carbon asset trading profits. 2. The primary corporate carbon assets (allowances or CCERs).

In May 2014, China General Nuclear Power (CGN) issued the first carbon bond, the opening prelude for carbon bonds in China, and several large financial institutions began to design and sell a wide range of products. CITIC Carbon Assets, after studying the substance of domestic carbon bonds, believes that they are still in their infancy compared with Europe and the United States. The speed of development is not fast. Going in to 2016, the preparation work for the central bank-led "Green Bond Support Project Directory" had basically been completed. In addition, preparation of green finance cases had made progress, and the Green Finance

Committee has also suggested amending the Securities Law to add a provision that "listed companies and corporate bond issuers must disclose environmental information". Guidance on green financial bonds will be officially announced, after which carbon bonds will receive systematic recognition and support.

During 2014 and 2015, domestic carbon bond product design usually used the first model, with profits including the assured return and non-assured floating carbon profit, in order to improve the expected revenue and attract investors. For example, for the CGN issued additional carbon asset return bonds, the issuing amount was 1 billion Yuan and the interest rate was 5.65%, used for investment in the construction of five wind power plants. After completion, part of the CCERs will be used as carbon trading assets, and the obtained profit will be added to the bond yields. The promised floating interest rate is 5bp-20bp 0.05%-0.20%, where the floating rate is calculated as:

Each carbon benefit project = (1 - income tax rate) * (current CCER delivery quantity x CCER delivery price - registered consulting fees - issuing advisory fees - examination fee - certification fee - transaction handling fee)

Accordingly, the core business of the bonds is still the traditional corporate bond, because the total amount of asset that enterprise owners can use for carbon trading, and the current carbon price, mean that the carbon asset profits will not seriously impact the enterprises' overall profits. So relying on a single enterprise, carbon trading will have difficulty in making ordinary corporate debt gains expand. The following table shows the current issuance of carbon bonds in China.

Name	Issuer	Issuing amount	Term	Fixed return	Floating carbon return	CCER directional buyer
Medium-term note additional carbon benefits	CGNPC	One billion	5 years	5.65%	0.05%-0.2%	Shenzhen Zhongtan Rongtong

Table 31: CGNPC carbon bond projects

2015 CITIC Carbon Assets and CITIC Securities Fixed Income Department signed a strategic partnership agreement for the joint development, design and improvement of carbon bond products. Also according to this model for seeking bond issuance, CITIC Carbon Assets have acted as investment advisers to assist CITIC Securities Fixed Income Department to expand the carbon bond market. After tracking a number of projects, design and analysis of CITIC Group's internal projects was carried out.

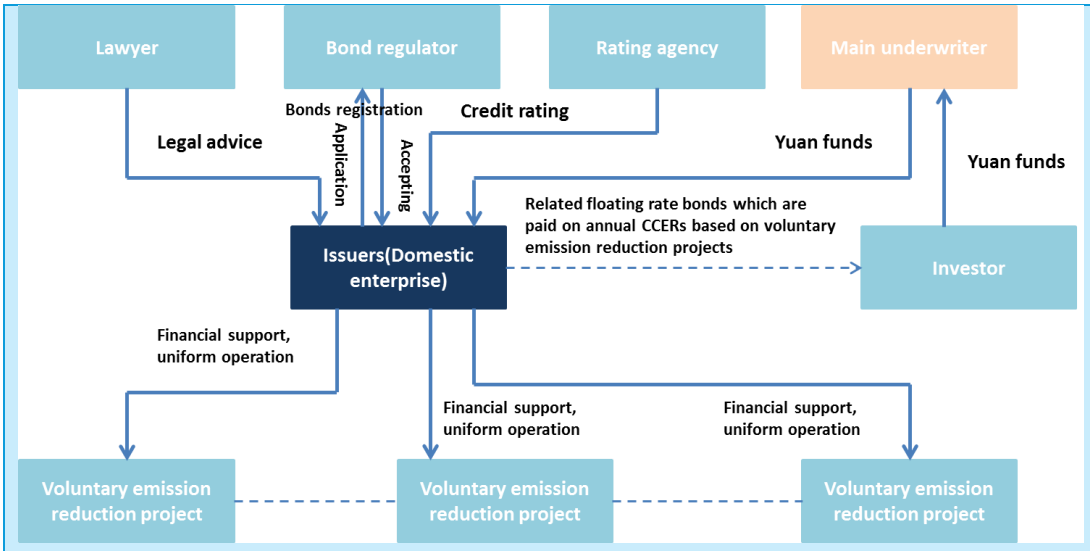


Figure 73: Carbon bonds product design of CITIC Carbon Assets

Analysis of carbon bonds by CITIC Carbon Assets shows that there is space for carbon bonds to develop, but there are also great limitations:

Carbon bonds, as a new form of traditional corporate bond, have a certain appeal to enterprises and investors. The additional floating carbon rate can help improve the attractiveness of the product by controlling interest costs.

The issuers of additional carbon revenue bonds can only be renewable energy enterprises that can achieve low emissions and high-yield CCERs, like wind power and PV enterprises. Traditional energy enterprise produce less CCERs for high input, making income difficult to guarantee.

Enterprises that meet the conditions for issuing carbon bonds are few.

Carbon bonds are based on general bonds, adding the main debt mode of interest products related to carbon financial asset profits. Usually they can only aid the financing of emissions reduction for highly-rated large and medium enterprises, making it "icing on the cake". It is very difficult to solve the problems of low-rated medium and small enterprises in financing emissions reduction, and to achieve timely implementation.

The mode of bond issuance seeing enterprises assets as creditors' rights can not support all of the actual capital needs, meaning in effect they are "a drop in the bucket".

But at the same time, carbon bonds have the following advantages:

Bonds with additional carbon trading revenue are more likely to attract investors in the market, and will gradually gain recognition by the state regulatory agencies and investors.

Given the current state of gradually increasing policy to control emissions intensity, carbon asset, as a kind of intangible asset, may be very important for emitting enterprises. The monetization of carbon assets is a new criterion to help resolve the scale and capacity of finance required.

Enterprises, through the form of carbon bonds, will have part of their carbon assets in the market for active trading, which is efficient and safe.

Mr. Song Yifan

Assistant to the General Manager of CITIC Carbon Asset Investment Management, he is a main executor of projects. He worked at the Xinhua news agency and Wanfang Investment Holdings Group, and has a wealth of experience in financial investment, real estate, carbon asset, public relations and other business. Song Yifan graduated from the Central University of Finance and Economics School of Government, and received a Master's degree in Public Administration (MPA). He is also Honorary Director of the Chinese Society for Management Modernization's Government and Public Policy Research Committee.

Introduction to CITIC Carbon Assets Management

CITIC Carbon Assets Management Co., Ltd. (CITIC-Carbon) is a subsidiary of China CITIC Group. It was established in early May 2010 in Hong Kong by CITIC International Asset Management Company, in conjunction with relevant shareholders. It is a provider of professional services in carbon asset management. CITIC-Carbon has participated actively in the development China's carbon asset market through allowance/CCER trading, CCER development, carbon finance business development, energy-saving and environmental protection technology stocks and other related work. At the same time, we participate in international carbon markets through VCS/VER development and trading. Over time, we have been committed to the development of China's low-carbon economy, and set a goal to promote national low-carbon environmental protection policy.

Domestically, CITIC-Carbon's work entails business development for carbon asset management with CITIC Group's industrial and energy companies as well as its large public buildings. With a focus on development of large-scale projects both inside and outside the group, we ensure that the CITIC Group fulfils its social responsibility in its annual report reflecting an important guarantee for work force.

Internationally, CITIC-Carbon together with the same industry organizations and financial institutions, has launched extensive joint cooperation, built a better technical team, including for carbon asset development, inventory and certification, and a carbon financial assets and trading team. CITIC-Carbon and CITIC Securities in 2015 entered into a strategic partnership. Collaborating with the CITIC Securities fixed income and commodities departments they partnered on the development and management of carbon asset trading, carbon trading funds, and carbon pledge fund business. At the same time, we helped the investment banking department of CITIC Securities Co., to an extent, to invest in equity of energy-saving and environmental protection enterprises. We have strong social resources and business development capacity in forestry, water treatment, biomass and other industries. During the 2015 trading season CITIC-Carbon completed a large volume of transactions through offline business matching, cooperation fund docking, etc. in a number of pilot markets around the country.

In terms of carbon finance, CITIC-Carbon works with departments, both internal and external to CITIC Group, and partners, to develop a variety of different forms of carbon financial products including for environmental protection enterprises, carbon asset development, and carbon trading. This includes, for example, carbon trading funds, additional corporate bonds, carbon pledges and other services.

5.1.2 Carbon funds or structured products

5.1.2.1 Carbon investment adviser

Carbon investment advisors refers to professionals or agencies engaged in providing paid advice for carbon asset investment management. (MBAlib, 2015) Carbon investment advisers, in the process of providing services to customers, need to provide adequate expertise and meet their customers' needs. A good carbon investment adviser should be familiar with carbon finance products, and fully grasp the application of relevant laws and regulations. Only with considerable expertise, keen insight, and continuously updating their knowledge, can carbon investment advisers provide valuable information for customers. Excellent carbon investment advice should use strong data and the supporting policy platform, to ensure that the formulated plan avoids potential risk for customers.

Commentary 12: Investment Consultants: Supporting enterprises and institutions involved in the carbon market

Commentary 12: Investment Consultants: Supporting enterprise and institutions involved in the carbon market

Special commentator: Mr. Zhang Xuhang, Beijing Karbon Energy Consulting Co., Ltd.

Currently, the major participants in the pilot regional carbon markets are steel making, construction material production, chemical industry, and power utility companies. In the main, there are only a few large-scale enterprises which need to manage a large number of subsidiaries in their carbon trading transactions, and these may be involved in different regional markets. Facing different policy restrictions on emission reductions, it has been necessary to establish external trading teams specialized in carbon trading. There is a lack of human resources with enough knowledge and experience of carbon trading for most enterprises. Transactions valued up to one million CNY have had to be executed by "traders" who have previously worked as engineers, accountants or production line managers, with little knowledge of commodity trading or financial product transactions and only simple training. Imperfect decision-making procedures have further resulted in poor trading strategy. Overly impulsive or conservative trading increases market instability.

Investment consultants, well experienced in carbon trading, have become good partners for industrial enterprises as well as financial institutions when participating in the carbon market. Some of the regional markets are exploring business models for custody of carbon assets involving external consultants for medium and small-scale enterprises. Large-scale companies who have their own trading teams are also interested in independent advice from external consultants for their carbon asset management and trading strategy. Accumulated trading experience in the ongoing regional markets will provide solid ground for the enterprises participating in the future national ETS.

The growth of the pilot regional ETSs provides opportunity for financial institutions to participate in the carbon market. Increasing capital and attention from the EU carbon market is turning to the emerging Chinese carbon market. Provision of mature services for investment strategy, portfolio management as well as risk control by carbon investment consultants would accelerate the process.

We have provided carbon market consulting services, including for carbon asset management, trading advice and capacity building, since 2007. In 2015, as an investment consultant, we joined the team for establishing first investment trust fund in the Chinese carbon market (Profit-Carbon No.1 Fund), and executed the trading business of the fund for emission allowances and CCERs in the primary as well as secondary market. A well-established trading strategy and risk control mechanism, based on the team's deep experience in the carbon market, have played a pivotal

role for the fund to promote its place in the market within a short time —accumulative trading volume of over 600kt and 900kt in the Hubei and Shenzhen markets within the first 3 month after establishment, meant that fund's performance is ranked highly amongst similar products.

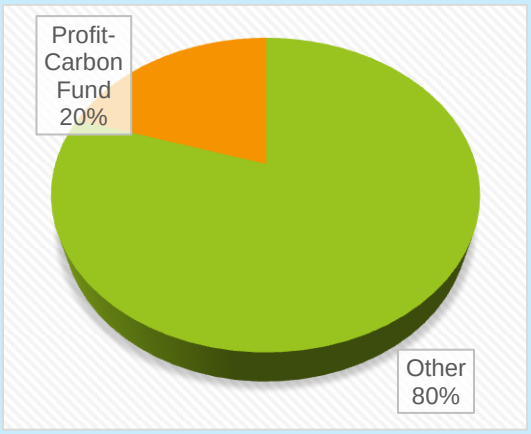


Figure 74: Market share of Shenzhen allowance trading

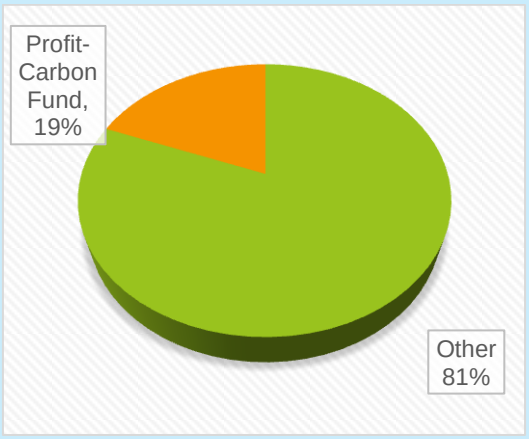


Figure 75: Market shares of Hubei allowance trading

Mr. Xuhang Zhang,

Deputy General Manager of Beijing Karbon Energy Consulting Co., Ltd., has much experience in GHG emission reduction project management and development, having worked in the climate change area since 2006. He now leads the investment and financing advisory team in Karbon. Before this assignment, Mr. Zhang worked for DNV in Beijing, Future Camp GmbH, and TÜV-SÜD Industrie Service in Munich. As the Chief Representative of Carbon Business in China of EnBW Trading, Mr. Zhang led its emission reduction project sourcing and management work in the Chinese market.

5.1.2.2 Carbon funds or structured product sales

Carbon funds invest in climate change-related projects and activities, aiming to promote the development of a low carbon economy. (Chengcheng, 2015) In the narrowest sense, carbon fund investment is a way for investors to obtain carbon credits or cash earnings through voluntary carbon emission reduction projects or equity investment. Essentially these are individual investors. In the broader sense, carbon fund investment is aimed to promote the development of a low carbon economy along with financial benefits. These investors are mostly international organizations and governments.

The carbon fund is an important tool of investment and financing of the international carbon market, and has played a very important role in the global market over the past ten years for energy-saving and emission-reduction. In China, the development of carbon funds is still in the initial exploration stage. At present, carbon funds have not been given full play to promote the development of a low carbon economy, but that should not impede financial institutions with long-term vision to take advantage of innovative carbon funding.

Issuing place	Shenzhen	
Date of signature	11/10/2014	
Signatories	Shenzhen Jiatan asset management Ltd. and CEEX	
Product name	Jiatan KaiYuan investment funds	Jiatan KaiYuan balance funds
Business amount	40 million Yuan	10 million Yuan
Operation period	3 years	10 months
Means of investment	Invest CCER projects in the field of new energy and environmental protection, produce the standardized carbon assets for the transaction. CCER project source mainly divide into two channels-direct purchase and open investment. The project side can pre-empt AAAA level issued CCERs in the primary market, or choice of a large number of high-quality CCER development projects. The fund's exit and realization takes a 'swap' model, namely the CCERs obtained exchange for corporate carbon emissions allowance, then sell assets, or direct sale or auction CCER, to realize guarantees a minimum income.	Three markets, Shenzhen, Guangdong, Hubei, as investment markets, buy cheap carbon credits and sell at high price, earn price difference.
Expected yield	Conservative revenue rate is 28%. In terms of swaps in exchange for allowances sold, according to the allowance price of 50 Yuan/tonne, optimistic revenue rate reaching 45%.	Conservative annualised yield of 25.6%, an optimistic estimate of 47.3%.
Subscription starting point	0.5 million	0.2 million
Trading subject	CCER	Allowance
Remarks	China's first private carbon fund was released the trading floor of the China Emissions Exchange.	Private equity based funds were successful in the pilot trading market, buying low and selling high was profitable.

Table 32a: Existing carbon funds products

Issuing place	Shanghai	Zhejiang
Date of signature	30/12/2014	19/3/2015

Signatories	Haitonneg Information Management Co., Ltd. and Shanghai Bao Carbon New Energy Environmental Protection Technology Co., Ltd. (Shanghai Environmental Energy Exchange)	Shenzhen Zhaoyinguojin Investment Ltd., Beijing Karbon Energy Consulting Co. Ltd.
Product name	Haitonneg Bao Carbon 1 Collection of Asset Management Plan	Zhongjiantou Trust - Yongquan Capital Trust Scheme No. 1 (Zhaojinyingtan)
Business amount	0.2 billion Yuan	Not more than 50 million Yuan, of which the ratio of priority funding and inferior grade funds is 3 (37.5 million): 1 (12.5 million). Priority funding raised from JIC Group; inferior grade funding raised by CMB Sinolink Investment.
Operation period	Null	Not more than 18 months
Means of investment	Haitonneg Baotan fund owned by Haitonneg to issue foreign, Haitonneg new energy and Shanghai Bao carbon as investors and managers, invest in nationwide CCERs.	Establish a limited partnership, to carry out the spread of arbitrage between the allowance and the state certified voluntary emission reductions.
Expected yield	Null	Priority beneficiaries expected basic income 9.5% years, there is a floating income.
Subscription starting point	Null	One million
Trading subject	CCER	CCER and allowance
Remarks	Haitong Baotan fund is the largest CCER carbon fund so far.	Product team: Hangzhou Trust Business, Department Five.

Table 33b: Existing Carbon funds products

Continued

Issuing place	Hubei	Hubei
Date of Signature	26/11/2014	8/4/2015
Signatories	China Huaneng Group and Lion Asset Management Co	Zhaoyinguojin
Product name	Lion Information Management - the record win No. 1 Carbon Special Asset Management Plan	Zhaojinyingtan No.1 Carbon Emission Investment und
Business amount	30 million Yuan	The first phase funds scale is 50 million Yuan. The second phase, 60 million Yuan, is expected to issue in

		May this year.
Means of investment	Null	Focus on carbon trading pilots allowance and CCER primary and secondary market, the fund will actively participate in the transactions of the carbon market.
Trading subject	Null	CCER and allowance
Remarks	The country's first carbon fund supported by regulatory authorities issued at CHEEX.	This is the first domestic Carbon Trust Investment fund raised publicly.

Table 34c: Existing carbon fund products

Source: Desk research by Environomist

Commentary 13 Carbon Funds – Financial Innovation, Opportunities and Challenges

Commentary 13: Carbon Funds – Financial Innovation, Opportunities and Challenges

Special commentator: Mr. Wang Zheng, CMB Sinolink Carbon Funds

When the entities regulated under the seven regional ETS pilots in China completed the annual compliance procedure by the end of July 2015, I had been working for three months for the newly launched CMB Sinolink ProfitCarbon No.1 Carbon Emission Fund. Market investigation, investment strategy development as well as risk management research had been started as early as the second half of 2014.

As the first trust fund focusing on the domestic carbon market, we had to confront many challenges: firstly, all the regional pioneer markets are cash products, standardised futures and options trading is still at research level, and capital turnover efficiency is a serious issue to be dealt with. Secondly, major players in the market come from traditional industrial sectors, far removed from commodity or security trading, with risk averse strategies being commonly adopted. Inexperienced trading leads to a market liquidity where it is difficult to implement flexible trading strategies. Finally, in a pioneer market with experimental policy, amendments need to be made when problems arise, and changing market regulation brings more uncertainty for making investment decisions. All market participants, including the funds, sometimes have to pay a high cost to respond to these changes.

Our fund has its business in both the emission allowance and CCER market, and although the basic mechanisms of CCER were developed from the CDM, Chinese regulators have learnt much from the negative impact of the flooding of CER on the EU-ETS. Measures were set up in order to regulate the supply and compliance. As with the CDM, CCER has primary and secondary markets, while more transparency between participants and more experienced project owners would reduce the profit between the primary and secondary markets A diversified will therefore be more and more important for funds and other traders in the market.

Emission allowance trading takes the major share of the market, which is similar with the EU-ETS, although there's still a long way to go for futures trading to be realised in the market. We found that demand for trading instruments that can reduce the occupation of capital or control market risk was widespread, which encourages us to participate in designing and implementing non-standard forward contracts with our counters. Along with the expansion of the business, this has become an important part of our trading, besides the major business in the spot market (see

below chart for the proportion). Meanwhile, we believe that the forward contracts, although non-standard, are still meaningful for accumulating necessary experience in order to make it possible for standard futures and options trading successful in the coming national ETS.

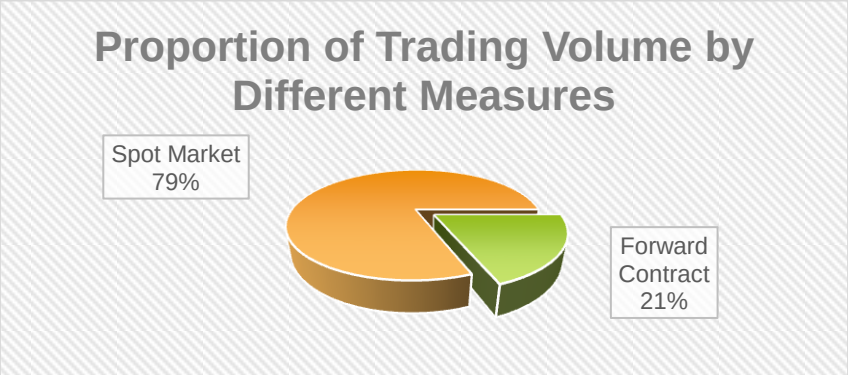


Figure 76: Proportion of Trading Volume by Different Measures

Although there are still a large amount of issues to be dealt with, the current pilot market makes it possible to move forward with the launch of the national ETS, where products can be unified and liquidity would be much better - within 1-2 years is realistic. On the other hand, with the development of regulations and policy, investors could have more stable prospects in the market. All of these factors would bring perfect opportunities for financial capital to participate in the carbon market. Structured design of the funds plays an important role for the risk control of investors, while more elaborate and mature investment strategies and diversified product combinations would form the real basis for balancing profit and risk.

Mr. Zheng Wang, Vice President of CMB Sinolink Carbon Funds, holds a Master degree from Renmin University of China. Mr. Wang has worked for Huatai Securities as an analyst, and a public valuer in Beijing Pan-China Assets Appraisal Co., Ltd., which is one of the top three asset assessment companies in China. He has significant experience in the financing of projects and the assessment of various types of assets. As the Vice President of CMB Sinolink Carbon Funds, he is in charge of allowance trading, as well as trading product design and development. Mr. Wang has been involved in carbon management and related work in many large domestic companies, and has lead the development of more than 40 CDM/CCER projects, involving renewable energy, fuel switch, waste treatment and other fields.

Structured financial instruments: financial instruments that share the common attribute of repackaging risks. (CFA Institute, 2015) Structured financial instruments include asset-backed securities, collateralized debt obligations, and other structured financial instruments such as capital protection, yield enhancement, participation and leveraged instruments. Structured deposits refers to a higher income financial product based on some degree of risk that depositors should bear, which is a kind of financial derivative tool (mainly various types of options) linked with interest rate, exchange rate, index, commodity price, fluctuation or linked with an entity credit. (MBAlib, 2015) Carbon finance structured deposits are a financial product that are linked to repayment of principal and (or) payment of interest of product with carbon emissions trading price fluctuation through financial derivatives products. Meanwhile introducing carbon allowances as a new payment

standard, the investment enterprise would bear some degree of risk to obtain higher income. (Si, 2015)

Financial products	Carbon finance structured products
Issuing place	Shenzhen
Date of signature	27/11/2014
Signatories	Industrial Bank Shenzhen Branch and Hui Electronics (Shenzhen) Co., Ltd.
Means of investment	The products are mainly for enterprises participating in the Shenzhen carbon market. Shenzhen carbon allowances are creative payment subject through a structured design. The profits are rearranged on the basis of conventional deposit. At the deadline of structured deposit, the profit would be not only general deposit interest but also not less than 1000 tonnes Shenzhen allowances.
Expected yield	Expected rate of return of 4.1%, of which 1.9% is a fixed interest rate, with no time limit and 2.2% rate for floating income, mainly from the revenue arising from transactions.
Remarks	Green structured deposits are designed by Societe Generale Bank, and in collaboration with Huaneng Carbon Asset Management Co., Ltd., Shenzhen CEEX of emission rights jointly launched innovative financial products, mainly for participating enterprises participating in the Shenzhen carbon emission rights market, through a structured design, on the basis of routine deposit products, to rearrange income composition, and introduce Shenzhen carbon allowances as a new payment standard.

Table 35: Existing structured carbon finance products

Source: Desk research by Environomist

5.1.3 Carbon asset collateral or pledge

Carbon asset collateral credit business is a carbon financial product providing short-term liquidity loans for customers, based on the collateral of CCERs or carbon emission allowances. (Songtao, 2012) Carbon emission rights mortgage financing is a product where the financing is achieved with CCERs or carbon emission allowances as a mortgage. (Southern Daily, 2015) The proceeds of mortgage financing not only can be used for purchases in the carbon trading market, enterprises can also deposit their own energy-saving, emission-reduction efforts. The fundamental difference between the collateral and the mortgage is that the, mortgagor is still responsible for guarantee of custody.

Therefore, carbon emissions mortgage financing not only increases financing channels for regulated enterprises to participate in carbon trading, but encourages regulated enterprises to manage the carbon asset more scientifically, and short-term idle carbon allowance will be revitalized to ease the financial pressure on carbon trading. The behaviour of enterprises in energy-saving, emission-reduction becomes a favourable condition for financing, which is an encouragement to the enterprise to carry out green production, as well as providing new ideas for the development of green finance in China.

Issuing place	Hubei	Hubei	Hubei	Hubei
Date of signature	9/9/2014	25/8/2015	26/11/2014	26/11/2014
Signatories	CIB Wuhan branch and Hubei Yihua Refco Group Ltd.	Chinese Import and Export Bank branch in Hubei province and Hubei Yihua Refco Group Ltd.	Hubei branch of Construction Bank and Huaneng Wuhan Power Generation Co., Ltd.	Everbright Bank Wuhan branch and Hubei Jin Ao Science and Technology Chemical Co., Ltd.
Business amount	40 million	0.1 billion	0.3 billion	0.1 billion
Investment object	All funds will be used for the enterprise's energy saving and emission reduction activities	Null	Saving enterprises' energy and reducing consumption	Saving enterprises' energy and reducing consumption
Collateral	Simply using Yihua group's own carbon emissions allowance as a pledge	Null	Collateral includes all of its own carbon emissions allowance and part of the enterprises' fixed assets, which accounted for the vast majority of collateral.	Collateral in the mortgage of carbon emissions allowance of about 10% of all collateral.
Remarks	Null	China's largest single amount of carbon emission rights pledge loan agreement was signed in Wuhan.	Null	Null

Table 36a: Existing carbon asset collateral or pledge

Issuing place	Guangdong	Shanghai	Shanghai
Date of signature	25/12/2014	28/5/2015	11/12/2014
Signatories	Huadian New Energy Company and Shanghai Pudong Development Bank	Shanghai Pudong Development Bank and Shanghai Zhixin Carbon Asset Management Ltd.	Shanghai bank and Shanghai Baotan new energy environmental protection technology

			Co., Ltd.
Business amount	10 million Yuan	Null	5 million Yuan
Collateral	Huadian new energy company in Guangdong obtained 10 million Yuan of carbon allowance mortgage financing and control of corporate account overdraft credit.	National CCER pledge financing loan.	Simply CCER as a pledge of security.
Remarks	China's first single carbon emissions mortgage financing business. The business by the Guangdong DRC issued by Guangdong carbon allowance ownership proof, by China Emissions Exchange (CEEX) for mortgage registration, freezing, publicity, Shanghai Pudong Development Bank in the loan after a week were staring at the city management.	The carbon asset pledge financing business is a national carbon trading system with online registration, which registered the country's first CCER.	China's first CERs CCER loans.

Table 37b: Existing carbon asset collateral or pledge

Source: Desk research by Environomist

5.1.4 Carbon asset valuation

Because the carbon asset is a new kind of asset, we can use asset valuation methods to evaluate them. At present, there is no authority of a third party for the relevant business in China. Assets valuation refers to the assessment and estimated behaviour of an asset, using scientific methodology and following statutory and fair procedure, to make an equity value calculation at a particular point in time. Valuation by asset-based approach: An asset-based approach values a company based on the value of its underlying assets less the value of any related liabilities. (CFA Institute, 2015) In effect, this approach arrives at the value of the company to the equity holders. This approach assumes that the value of a company is equal to the sum of the values of a company's assets minus its liabilities.

In the new environment of low carbon development, carbon assets will become a new asset that enterprises pay attention to, so there is a rare opportunities for development of the carbon asset valuation business. Carbon asset are not only assessed as traditional assets are, i.e. general assets, intangible assets, or enterprise valuation, but they also have some unique aspects in terms of object definition, selection of methodology, determination of parameters, use of the assessment conclusions etc. (Xiaohu, 2012) Carbon asset valuation cannot exist outside of the market, because the value of carbon assets exists because of transactions in the market . (Liu Hejuan, 2015) Carbon assets are not used for one-time consumption in the carbon market, but have the effect of continuous trading and creation of profits, so carbon asset valuation follows the most important assumptions of asset valuation, that is, trading assumptions, open market assumptions, and assumptions of sustainability.

In the face of the rising global green revolution, there is vital significance in the reasonable application of carbon assets, giving play to carbon asset value. (Sheng, 2015) We should make full use of carbon assets on the basis of reasonable assessment of the carbon asset value.

Commentary 14: Carbon Accounting Standards for Elements of the Carbon Trading System

Commentary 14: Carbon Accounting Standards for Elements of the Carbon Trading System

Special commentator: Mr. Jing Yao Chou, Ernst & Young Hua Ming LLP

Carbon credit trading accounting is an economic management activity that uses specific methods to confirm, measure and report companies' series of activities, including acquisition of carbon credits and trading in the carbon transaction market. It takes physical quantity and monetary value as measure units. Carbon credit needs accounting recognition in carbon allowance allocation, trading, delivery and other relevant economic activities. For example, the assets and liabilities or earnings generated at allocation, the allowance and changes of monetary assets, and costs due to excessive emissions or earnings from saved allowance selling in the final delivery. All of these economic activities not only affect the performance of a company's balance sheet, income statement and cash flow statement, but also make a difference to company's profitability, solvency, operation capability and sustainability, etc.

Owing to the complexity of carbon credit transactions, an agreement on carbon accounting operation has not been reached anywhere in the world. The accounting recognition of carbon credit is a base of carbon credit accounting. Most international organisations consider that carbon credits are an asset at present, considering they meet the definition of asset. Assets are defined as a resource that is created by past transactions and events, controlled or owned by a company and that will bring economic benefits in the future. There are three views about the asset type of carbon credit. Some think it should be regarded as an intangible asset, some think it is a financial instrument, while others believe that we should set up a carbon credit account which may have some sub-accounts, such as allowances and certified CERs, meaning that carbon credits could be a separate asset.

For asset measurement, there are two views. One is fair value measurement, for both allowances purchased in the open market and for allowances from government. The new accounting standard released in 2014 provided a new explanation for fair value. It means the payment price when a market participant sells an asset or transfers a liability in an orderly transaction on a measurement date. Compared with the old accounting standard, the new explanation no longer emphasises that the trade price must occur in an active market, meaning that the average price on a trading day of different pilot environmental exchanges could be regarded as fair value. The other is historical cost measurement. The purchased allowances require accounting measurement, but the allowances received from government do not require it.

For liability types, there are three views. According to *China Accounting Standard No.16: Government Subsidies*, a company should recognise deferred income when confirming carbon credit assets. However, another view says that carbon credits should be recognised as estimated liabilities. Finally, there is a view that suggests that carbon credits may be put into the subaccount named Payable Carbon Credit under Other Payables.

For asset and liability recognised timing, there are three views. The first considers that companies should recognise corresponding asset or liability when they obtain carbon allowances freely or by purchase them. The second thinks that companies may not recognise carbon credit asset temporarily when they obtain the allowance, and that at the end of the year, they can recognise liability on the basis of the difference between actual emissions and the allowances they hold. The last view is to manage carbon credits on a monthly basis. Companies make estimations monthly according to the emissions amount forecasted and emissions plan.

Companies have different accounting treatments. This diversity significantly affects the accuracy and comparability of accounting information, increases the carbon credit trading's information cost, and lowers efficiency in the carbon credit trading market.

To solve this problem, the Ministry of Finance says they will consolidate various views and publish an accounting standard in the carbon credit trading field, with related departments. The standard will align the carbon trading accounting treatment process, and meet theneeds of companies controlling emissions as far as possible. We hope a perfect carbon trading accounting standard will make a positive contribution to the development of a national market, comprehensive carbon trading, sustainable development and environmental development.

Ernst & young (EY) has researched relevant policies and documents and held discussions with stakeholders. There exist two accounting treatments at present, one is simple, and the other is complex. For most companies, the simple one could meet the compliance requirement. Our proposal is detailed below.

Economic activities	Accounting Treatment	
At beginning	No treatment required	
Ordinary purchase	Purchase Credit: Carbon emission allowance Debit: Cash Purchase cost	
Ordinary selling	Advance in price Purchase cost and balance Credit: Cash Debit: Carbon credit Investment income	Fall in price Credit: Cash Investment income Debit: Carbon credit
Reporting day forecast	Excessive emissions Credit: manufacture expense/administrative cost Debit: carbon emission payable Fair value	Emission reductions Credit: carbon credit Debit: other operating revenue
Declaration day	Fair value increase Credit: manufacture expense/administrative cost Debit: carbon emission payable Fair value change amount Excessive emissions Credit: carbon emission payable	Fair value decrease Credit: carbon credit Debit: manufacture expense/administrative cost Emission reductions

	Debit: Cash Purchase cost	Credit: Cash Debit: carbon credit

Table 38: Types of Carbon Finance Instruments

Jing Yao Chou

Climate Change & Sustainability Service – Director

Ernst & Young Hua Ming LLP

Jing Yao has years of working experience on research and consulting related to climate change and sustainability, providing services to leading enterprises in various industries with climate change strategy and management, GHG measurement and assurance, clean energy investment and other relevant services.

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Business description:

EY Climate Change and Sustainability Services has over 70 offices globally with more than 800 professionals. Established in 2009, EY Climate Change and Sustainability Services in Greater China is composed of three offices in Beijing, Shanghai and Hong Kong, supported by over 60 professionals. We are dedicated to providing environmental advisory services, including green bond second party opinion, climate bond third party assurance, GHG emission assurance, Environmental, Social and Governance (ESG) reporting and assurance, environmental due diligence, low carbon project investment assessment, risk assessment and low carbon strategy planning, sustainability assessment, and roadmap planning for sustainable development, etc.

5.2 Carbon finance trading services

Carbon trading services will be introduced respectively from the primary market and secondary market. In China's carbon market in the future, the primary allowance market will gradually transition from being dominated by free allocation, with supplementary auctioning, to being dominated by auctioning, with supplementary free allocation. Meanwhile, the secondary market will gradually transition from the current spot-trade dominated market to a more thorough carbon finance market.

Commentary 15: Third Party Carbon Finance Transaction Services

Commentary 15: Third Party Carbon Finance Transaction Services

Special commentator: Mr. Jing Yao Chou, Ernst & Young Hua Ming LLP

Since the carbon trading market was established, carbon assets have become the fourth new

type of assets ranked with cash assets, physical assets and intangible assets. According to the definition, carbon assets not only include today's assets, but also future assets. It contains the assets which carbon emission reduction programs bring, such as CERs, CCERs and Gold Standard, or the allowances which companies involved in national or local ETSs get from government, and year-on-year/month-on-month appreciation of physical and intangible assets due to a low-carbon strategy.

Carbon finance is defined as the financial institutional arrangements and financial transaction activities that aim to reduce the emissions of GHGs, including carbon credit and its derivatives, transaction and investment, low-carbon programmes developing investment and financing and other relevant financial intermediation activities. Along with the low-carbon economy, the carbon finance market was born as a new market. The key exchanges in the world provide many trading products, such as spots and futures, around the price of carbon assets. Financial institutions launch many carbon finance products which combine the features of carbon assets with financial products like bonds, notes, trusts, funds, banking products and structured products. These products are divided into original instruments, derivative instruments and innovative derivatives following the classification standard of financial assets.

Instruments	Products
Original instruments	Allowance Credit Spot Emission Reduction Credit Spot Carbon Bond Carbon Fund
Derivative instruments	Emission Reduction Credit Forward Allowance/Emission Reduction Credit Future Allowance/Emission Reduction Credit Option
Innovative derivatives	Carbon Pledge/Carbon Mortgage Carbon Hedge Carbon Trust Carbon Insurance/Guarantee/Assurance Emission Reduction Monetization/Securitization

Table 39: Types of Carbon Finance Instruments

The carbon finance market body comprises of government, companies and people who become involved in the market, financial institutions and intermediaries. The intermediaries build a bridge between companies and financial institutions, and provide professional technical guidance, management/finance/legal consulting and assurance/auditing services, etc. They also help each party in a carbon financial activity become familiar with the trade model, so as to reduce trading risk.

Carbon auditing is a new idea, a new method and a new measure to manage carbon emission issues innovatively in a way that complies with common auditing concepts. Because of the particularity of carbon trading, the traditional audit system, including the audit concept, audit principle, audit measure and audit subject and object, will face challenges from all directions. As an independent third party, the certified public accountant is different from third party verification firms. The differences are detailed below.

Content	Accounting Firm	Verification Firm
Verification object	All the carbon trading business unit	Key GHG emission enterprises
Verification points	Truth and accuracy of carbon credit trading amount Integrity and accuracy of carbon trading estimate Compliance of carbon trading authority management	Rationality of boundaries Completeness and accuracy of GHG emission amount measurement
Verification basis	China Accounting Standards Auditing Standards for CPAs of China	Verification guidelines in the pilot areas
Document issued	Auditing Report	Verification Report

Table 40: Differences between certified public accountants and third party verification firms

It is not hard to see that accounting firms pay more attention to making an independent, objective and even-handed supervision, evaluation and assurance to the truth, legality and effectiveness of financial information and balance in carbon trading and other relevant carbon finance activities. Because the financial value of carbon finance assets can affect carbon trading's basis and its derivatives, it becomes meaningful to make a carbon finance audit. Furthermore, accounting firms should make their contribution to climate change, ecological development and also contribute to the transformation of the economic developing pattern in this regard.

Jing Yao Chou

Climate Change & Sustainability Service – Director

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5.2.1 Primary carbon market trading

In theory, the market in which government allocates allowances to regulated enterprises via auctioning or free allocation is the primary market. (Yitanjia, 2014) Most of the world's carbon trading mechanisms do not allow financial institutions to directly participate in the allowance auctioning, but there is no constraint on market transaction behaviour after allowance allocation;

the market where projects can be invested in directly to obtain emission reduction quota is the primary trading market.

5.2.1.1 Carbon brokering

The business of the carbon market broker can typically include brokerage, brokerage services and other senior professional services (Dechun, 2014).

The typical brokerage business can include two parts: one is to find suitable buyers for developers of carbon credit. These developers include project developers in the voluntary emission reduction field. Carbon brokerage businesses can provide them with services and help to find suitable carbon credit buyers. The other is to help or act on behalf of the buyer in buying carbon credits. Carbon brokerage businesses can help or act on behalf of the mandatory emission reduction enterprises, investors and the enterprises with voluntary hedging requirements to purchase carbon credits.

Senior professional brokerage services for two target customers: one is carbon traders. Senior brokerage services can be provided to carbon traders, including carbon credits and carbon credit portfolio structured transactions based on the counterparty network. The other is any enterprise owned carbon assets. Carbon asset risk assessment, risk hedging strategies, including comprehensive utilisation of spot, futures and option of comprehensive risk avoidance strategies, as well as different strategies of trade execution services, can be provided to these enterprises.

As brokers of the carbon market, carbon brokers can profit through the commission profit model in the carbon finance field, namely obtaining benefits through charging a commission after helping or acting on behalf of clients in a deal.

5.2.1.2 Spot trading

Spot trading is a general designation of products related to futures, options and swaps and other derivatives. (MBAlib, 2015)

Spot trading refers to a trading activity which requires that the trading time, place, method, quality, quantity, price, etc., should be confirmed in the agreement by both sides of the transaction, before a deal is reached. (Carbon trading net, 2015) With the transfer of emission rights, the exchange and circulation of carbon emissions is completed. Spot trading can avoid high risk caused by manipulation of the market and can also save a lot of negotiating, contract disputes, capital settlement, delivery, marketing and other issues. The transaction cost will be reduced and the utilization ratio of the fund will be raised. Meanwhile, many other matters like facilitation time and costs, taxation and quality inspection, amongst others, will be eliminated.

At present, the trading products in the domestic pilot markets are spot trades. The primary market traders are regulated enterprises, owners of CCER projects, and first-time buyers of allowance or CCERs.

5.2.1.3 Auctioning

Carbon auctioning is the manner in which carbon emissions exchanges sell to regulated enterprises in public. (Carbon emission trading, 2015) Many companies bid to buy until no one bids a higher price, then the purchase is made, which is a final deal. Carbon auctioning is considered to be the most conducive allocation manner in order to find the carbon price. At the same time, the auction revenue can be invested into the low carbon field, so as to bring a "double dividend". (Yitanjia, 2014) As a result of auctioning, however, the compliance costs of enterprises in submitting allowances will increase, so its acceptability in the market at the early stage of development is low.

At present, Guangdong and Hubei have established an auction mechanism. Guangdong features a mixed model, where free allocation is the main instrument. Hubei sources auction subjects for a government quota reserve, but not for the allowance allocation. At the same time, the market is open to institutions and individuals, and Hubei auction bidders can also be social investors, not limited to regulated enterprises.

In addition, Shenzhen and Shanghai have tried to promote compliance via auctioning. Shenzhen even uses a reserve price which is nearly half of the market price. However, the intervention caused heated debate between insiders. The intervention resulted in a strange phenomenon that early compliers had higher compliance costs, contradicting participants' expectations of market supply and demand and price, causing some losses. Therefore, we have gained valuable experience of that reducing government intervention and respecting the laws of the market is important for future carbon auctioning. In addition, in relation to the use of auction revenues, although the Shenzhen and Shanghai pilots have indicated that the revenue should be used to support enterprises' carbon emission reduction, regulation and development of the market, the specific ratio, areas of support, technology and enterprise thresholds have not yet been detailed. So open, transparent, and reasonable use of auction revenue should also be explored further in Shenzhen and Shanghai.

Date	27/3/2015	10/6/2015	21/9/2015	21/12/2015
Total amount of planned bidding (tonnes)	1,000,000	3,000,000	300,000	300,000
Effective reporting capacity (tonnes)	422,461	314,643	1,041,657	468,067
Policy reserve price / competitive price (Yuan / tonne)	35	40	12.84	12.80
Highest offer (Yuan / tonne)	37.05	45	20	18.20
Lowest offer (Yuan / tonne)	35	40	12.85	12.80
Transaction price (Yuan / tonne)	35	40	16.10	15
Number of bidding agencies (unit)	7	2	19	9
Number of successful bidding institutions (unit)	7	2	4	7
Total transaction value (Yuan)	14,786,135	12,585,720	4,830,000	4,500,000

Table 41: Results of four auctions in Guangdong in 2015

Source: desk research by Environomist

5.2.1.4 Aggregator

Main existing forms of aggregator in carbon market are carbon funds, carbon assets managers, or large scale projects developers, etc. Aggregators can deploy a series of strategies for small to medium-sized carbon market participants, such as banking and borrowing, buying and selling futures, hedging transactions, managing and operating a diversified portfolio of different projects, engaging in primary and secondary markets etc. With the rich experience, professional teams, necessary management attention and access to buyers and risk-sharing mechanism, aggregators will amplify scale economies effect and extraneous earnings.

Commentary 16 How aggregators reduce mitigation costs and minimize risks

Commentary 16: How aggregators reduce mitigation costs and minimize risks

Special commentator: South Pole Carbon Asset Management Ltd.

Many small to medium-sized carbon market participants lack access to lowest-cost mitigation opportunities, as well as to optimal risk mitigation instruments. Aggregators such as carbon funds, carbon asset managers or large-scale project developers can provide access to both, playing an important role in a well-functioning carbon market.

Opportunities, risks and costs in project-based mitigation

Project-based GHG mitigation plays an important role in all major emission trading schemes. As soon as the ETS has established regional price for GHG emissions, compliance entities can analyse their operations and identify mitigation potential with positive returns against the carbon price curve. Successfully implemented emission reduction projects will require the compliance entity to turn in less allowances, freeing up surplus allowances which can be sold on the market.

At the same time, flexible mechanisms enable policy makers to aim for more ambitious reduction targets by accessing low-cost mitigation options outside of the scope of the ETS. Emitters can develop their own projects if they have operations which are not covered by the ETS, or they can partner up with other emitters who have such operations and purchase offsets from them at lower costs than purchasing allowances.

Such flexible mechanisms are a part of almost every ETS, but usually come with an upper limit on offset usage to ensure that the majority of emission reductions is realised within the scope of the ETS. The most famous example of such offsets are the CERs under the Kyoto Protocol's Clean Development Mechanism (CDM), which have been used very successfully by European emitters to lower their compliance costs in the EU ETS. China was the main exporter of CERs and many of China's compliance entities have already experience in developing and operating offset projects under the CDM.

Clearly, mitigation projects present a great opportunity for cost-savings or profits for both compliance entities, emitters outside of the ETS scope, as well as other market participants. Big emitters will analyse the risks and benefits of engaging in emission reduction projects, and will come up with a suitable mix of approaches to match their risk profile. As they are looking at large numbers of allowances or offsets, they can deploy strategies such as banking and borrowing, buying and selling futures, hedging transactions, managing and operating a diversified portfolio of different projects, engaging in primary and secondary markets etc.

Smaller entities however usually do not have access to these instruments, or they cannot reach the required scale so that the corresponding costs are prohibitive. The same goes for emitters who have the potential to implement offset projects: very often, they lack the experience, dedicated teams, the required management attention and, most importantly, access to buyers and risk-sharing mechanisms so that they can avoid the full risks associated with the time-

consuming process of bringing offsets to the spot market from a new project.

Aggregators address all these challenges and offer additional benefits for both buyers and sellers of allowances and offsets.

Lowering risks with a diversified portfolio

Buyers with a demand large enough that it makes sense to purchase credit in the primary market, directly from GHG mitigation projects, but not enough demand to build up a large, diversified portfolio with a balanced risk profile can achieve the same result by partnering with an aggregator who can grant them such access. Operating a well-balanced portfolio has numerous advantages over putting all eggs in one basket, that is, investing into a single offset project or reduction project to free up allowances.

A diversified portfolio of primary projects will first and foremost lower the delivery risk. If the risk of non-delivery (due to various reasons, such as technical failures, financial challenges, regulatory hurdles, etc.) is distributed across several projects, the likelihood that an investment into primary offsets or emission reductions does not return eligible credits is much smaller. Late deliveries of offsets or allowances become manageable as they will occur in a smaller number, and access to replacement via the portfolio is already secured. Especially in China's current fragmented market pilots with complicated eligibility rules, reducing the risk of non-eligibility for projects under development due to last-minute regulatory changes is very attractive for compliance buyers as well as institutional buyers.

Economies of scale and access to finance

The other important function of aggregators is bringing economies of scale to single mitigation projects. As the aggregator actively manages, implements and operates a large portfolio of such projects, he can deploy experienced experts from his dedicated staff to support the project operator with the time-consuming task of registering, monitoring and issuing emission reductions eligible in an ETS. Aggregators will have a firm understanding of the latest rules and regulations, a close relationship with third-party verifiers and regulators, enhancing the chances of a successful registration and reducing the time to bring the offsets or freed up allowances to the market.

The aggregator will have framework contracts in place with verifiers, lowering the unit cost of third-party audits for a single project participating in the portfolio. In certain cases and under certain standards, it is even possible that the portfolio aggregator operates program under a scaled-up mechanism (such as a PoA or a NAMA[5], or a grouped project for CCERs) with simplified registration procedures for project wanting to join the program, shorter registration times, and dramatically lower costs.

Most aggregators will also be able to provide risk-sharing mechanisms, co-finance, or in certain cases even equity and debt financing for the underlying mitigation action. Under a most basic model, they can usually take on the risks of project registration and issuance so that the project developer does not have to pay the associated costs. They can also pay in advance for part or all of the future allowances or offsets resulting out of a project to cover a part of the capital expenditure for implementing the project. In certain cases, they can even mobilize carbon finance by using future carbon credit as a collateral for securing loans with banks, on top of providing equity for implementation. Naturally, the more risk the aggregator takes on, the higher a discount he will be expecting on the transacted allowances or offsets.

[5] Programmes of Activities (PoAs) are bundles of projects under the CDM with simplified procedures for additional projects (CPAs) looking to join an already registered project. Nationally Appropriate Mitigation Actions are scaled-up GHG reduction initiatives (also under the framework of UNFCCC) with financial incentives in various domestic contexts.

These are just a few scenarios under which aggregators such as carbon funds, carbon asset managers or large-scale project developers can bring value to market participants both on the sell and buy side. They are an important partner for a well-functioning, healthy carbon market with equal opportunities for small and large entities alike.

Why south pole?

Access to the world's largest and most diverse carbon portfolio

south pole group is a sustainable solution and service provider with a global team and proven impact. As the leading global developer of both voluntary and compliance carbon projects, south pole group has unrivalled technical expertise in the field, and direct access to a portfolio that is second to none in terms of quality, scale and diversity.

south pole group currently has one of the largest portfolio of voluntary and compliance emission reductions in the world, with a pipeline of over 270 emission reduction projects. Around half of these have been developed under the leading international voluntary carbon standards, with the remainder being developed under the UN's Clean Development Mechanism. As today, these projects have prevented more than 50 million tonnes of greenhouse gases from reaching the atmosphere, while improving the lives of millions of people in developing countries. Thanks to our projects also more than 20,000 jobs have been created, more than 17,000 hectares of forest preserved and 35,000 of GWh of renewable energy enabled.

The portfolio covers 25 countries spanning most of the globe, including Latin America, Africa, Europe, the Indian sub-continent, China and South East Asia, and the Australia / Pacific region. The map below shows the geographical extent of part of our current CER and VER portfolio, as well as our global office footprint.

Figure 77: South pole group locations

SPC has a genuine global reach. With over 130 enthusiastic sustainability professionals from over 20 different countries, we span 6 continents with our experience on the ground.

Our team encompasses a wealth of in-house expertise covering all aspects of the carbon value chain including standard and methodology development, project implementation and financing, marketing and communications, and senior level policy and strategic insight.

Quality check

A cornerstone of our project origination activities is our robust due diligence procedure and associated risk assessment tools. This has allowed us to evaluate new project opportunities against a complex matrix of risks (market, politics, technology, regulation, reputation, legal, financial, counterparty, to name but a few) and focus our resources in areas where we have the highest chance of delivering successful projects for the provision of emission reduction and wider sustainability benefits.

Figure 78: Project development & Carbon offset development

Quantifying sustainability benefits

Our emissions reduction projects go beyond helping the climate. They do not only save greenhouse gas emissions (GHG); an emissions reduction project also generates an array of sustainability benefits in the environmental, social and economic domains, for example job creation, school construction or improvement of living standards. On top of fulfilling the basic criteria for an emissions reduction project, we are able to quantify the triggered sustainability benefits of the chosen projects. Based on this precise methodology, we are able to directly link carbon credits with the key objectives of our client's sustainability strategy.

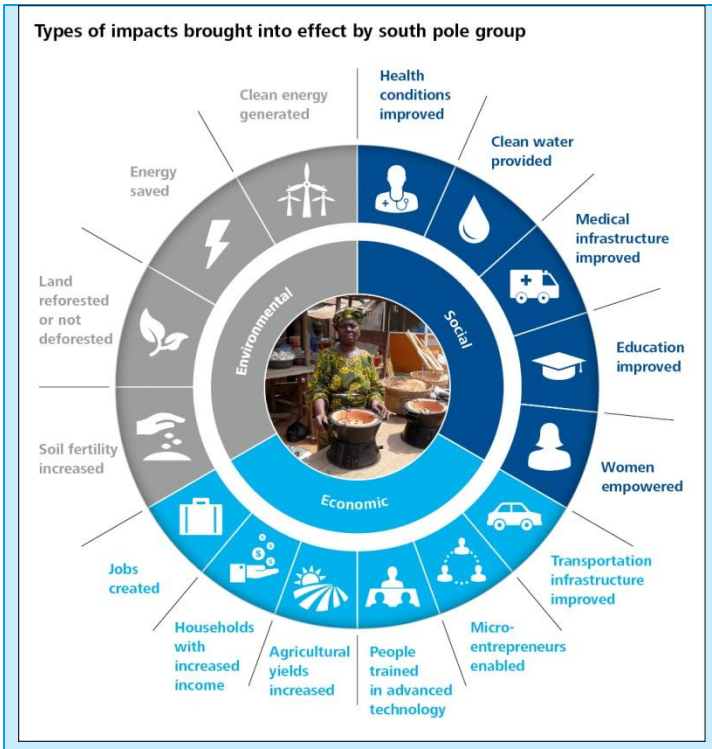


Figure 79: Types of impacts brought into effect by south pole group

south pole group develops projects according to a variety of standards

CCER (Chinese Certified Emission Reductions) China's domestic standard for voluntary offsets as set by the National Development and Reform Commission, can be used for compliance in China's ETS pilots as well as the upcoming national ETS.

GS (Gold Standard) A best practice methodology and a high quality carbon credit label for both Kyoto and voluntary markets.

VCS (Verified Carbon Standard) A robust global standard and program for approval of credible voluntary offsets.

Social Carbon (add-on Standard) A standard to certify voluntary emission reduction projects for their contributions to sustainable development.

CCBA (Climate, Community and Biodiversity) for forestry projects A standard aiming to promote integrated solutions to land management around the world.

Carbon Fix for forestry projects A climate forest standard which aims to increase the amount of sustainably managed forests and decrease global CO levels.

CDM (Clean Development Mechanism) including Programme of Activities PoAs. A mechanism defined in the Kyoto Protocol to assist parties not included in Annex I in achieving sustainable development

JI (Joint Implementation) Offers parties a flexible and cost-efficient means of fulfilling a part of their Kyoto commitments, while the host party benefits from foreign investment and technology transfer.

south pole group specialises in the following sectors

- Renewable energies: Hydro-, Wind-, Solar- and Biomass power

- Waste water treatment and biogas utilization
- Landfill gas recovery and energy production
- Forestry and REDD+
- Biofuels
- Energy efficiency projects
- Water purification

Added value

We help you grow your business with groundbreaking solutions for dealing with the environment and the needs of society.

Our range of solutions

south pole group operations are defined by the "sustainability value chain". It can be described as follows:

1 **Understand**: We measure and verify sustainability impacts of companies and their supply chains, products, investments, cities and buildings, as well as government policies.
2 **Design**: We provide powerful and effective corporate strategies as well as policy advice for low-carbon growth. Our expertise covers climate change, energy, forestry, agriculture, water and the built environment.
3 **Act**: We enable corporate and public clients to take sustainability action. We provide high-quality certificates for carbon neutrality, green power, energy efficiency as well as green supply chain solutions.
4 **Finance**: We provide fund advisory, due diligence services, climate-smart investment advisory and engage in Public Private Partnerships in order to leverage sustainability finance.

5.2.2 Secondary carbon market trading

Carbon credit trading is the primary product in an ETS, and can be referred to as the basic trading product. Derivative carbon financial instruments are based on the primary carbon credits, and include forwards, options, futures, swaps and structured products. (Wang Y. , 2010) The value of derivative carbon financial instruments depends on the prices of related primary carbon financial products. The main function of derivative products is not transferring the surplus and deficiency of funds and directly promoting savings to transform into investment, but managing risk exposure related to primary carbon financial instruments. Varied carbon trading tools cab greatly invigorate the carbon financial market, which would help to meet the different needs of enterprises and investors.

5.2.2.1 Forward trading

A carbon forward contract is a business contract in which the two sides of the contract agree to trade a certain amount at a certain time in the future at the agreed sale price. (CFA Institute, 2015) The attributes of non-standardised forward contracts make them especially suitable for hedging. In addition hedging, forward contracts can be used for speculation. Different from standardized futures contracts, forward contracts can be customized into contracts with any commodity, arbitrary number and arbitrary date of delivery. The forward contract settlement can be done in the form of cash or credit delivery. Forward contracts are not in the form of centralized trading, so it can be regarded as an OTC tools. The attribute of OTC transactions makes it easier to customize the terms of the contract. The lack of a centralized clearing house also involves a greater risk of default. Therefore, forward contracts are not as easy for retail investors to use as futures contracts.

At present, CCERs in the domestic market have the characteristics of forward contracts. The specific operation method of carbon forward trading is that, both the buyer and the seller according to the needs of the contract, agree to trade a certain amount of carbon emissions in the future at a particular time, at a specific price. The carbon pricing method of carbon credit forward contracts mainly include two ways - a fixed price and floating price. The former means that in the future carbon emission would be delivered at a specific price, and the latter means that the delivery price of carbon emission in the future is not fixed, or on the basis of a minimum guaranteed price, floating prices linked to allowance prices would be added, then the basic price and reference price should be listed in the contract at the same time.

Issuing place	Date of signature	Signatories	Product name	Key content
Beijing	27/8/2015	Zhongneng Tantou, Shanxi New Energy Company, China Carbon Trading Platform - Yitanjia	Guaranteed CCER forward contract	First domestic pen-backed CCER forward contracts signed in Beijing, the contract project is a new energy project in Shanxi Province, is expected to produce annual emission reductions of 30 million tons, through non-standardized contracts. The buyer of this guaranteed CCER forward contract is Zhongneng Tantou, who completed the first compliance CCER trading in Beijing before. The seller is a new energy company in Shanxi. The third-party guarantor introduced into the contract is Yitanjia-China carbon trading platform, millions tonnes carbon resources brought together by which would be integrated to be guarantee for the contract, to ensure the CCERs could be issued and delivered before compliance deadline in time. This guaranteed trading is the creative product “Carbon hedging baby”, the first-use.

Table 42: Existing carbon forward products

Source: Desk research by Environomist

5.2.2.2 Spot trading

At present, the form of spot trading in carbon market includes listed selection trading and block trading etc. The seven pilot carbon trading allowance spot and CCER spot transactions this year are detailed in section 3.2.

Explicit constraints on trading are detailed in the decision on rectification of all types of trading venues to effectively guard against financial risks, document no. 38, issued by the State Council in 2011 and the general office of the State Council implementation opinions on the clean-up and rectify all types of trading venues implementation opinions, document no. 37, issued in 2012.

The Document no. 37 does not allow the use of continuous auction, electronic matching, and other forms of centralised trading. Specifically, in the spot market, for trading participants, the supply and demand of commodities is not always the same, with personalised and non-standard features. So commodities in spot trading should also belong to non-standardized products, which mean it is not suitable to conduct centralised trading. The seven carbon trading pilots' online trading is therefore completed via listed selection mode, which meant that, in order to make a deal, the user should submit an independent trade declaration and then wait for the counterparty's response, or the user should select the intended transaction from the list. What calls for special attention is that, for a less liquid carbon market, the manner of listed selection would easily cause drastic volatility on clearing price in carbon market (Zhang Qing H. Y., 2014). The listed selection trading cannot guarantee the market trading is at the highest and most efficient price. Under the listed selection mode, before the end of closing, market participants can trade at the lowest cost within the scope of the ups and downs of stop, or deliberately choose a very high price on sell orders, to violently push the closing price upwards.

For the pilot carbon market exchange, there is no doubt that policy restrictions will affect the non-active carbon market to some degree. In particular, from the perspective of price risk control, for points listed selection trading mode, the possibility of market manipulation will rise and the difficulty of monitoring will increase.

Commentary 17: Coal-Carbon-Biomass THE NEW POWER GAME

Commentary 17: Coal-Carbon-Biomass THE NEW POWER GAME

Special commentator: Mr. Albert de Haan, Carbon Star Group Ltd.

Globally, we observe a very big change in the way we will change our way of generating power. We need power very badly to make our economies work and improve people's quality of life. In the last 50 years we have been focusing internationally on generating power by nuclear, coal and oil. This was a "normal" economical behavior as we needed fast and relatively cheap power.

No one was really interested in any other ways of producing power, as growth was needed in the Western world as our economies were growing fast and needed energy as quickly as possible.

Economic slowdown, a number of crises and differing views from some consumer groups led to a change in the way of thinking regarding how to generate power, as a number of things have happened that really made many people think about at what price we are using resources and at what cost. It is indisputable that nuclear has become risky after the Chernobyl nuclear disaster, with air quality being so bad in some places that many people suffered from air-borne diseases.

Since the 1980s, people have started to realise that risks caused by climate change would have a big financial impact on the world economy. Climate change will increasingly threaten wealth, as many weather related catastrophes can have a huge cost impact on economies.

According to state media reports, in the 13th Five-Year Plan, the government is taking drastic measures to initiate a transition that should lower CO_2 emissions in China. Lowering carbon emissions can be achieved by (1) energy efficiency; (2) using new technologies in power

generation; (3) alternative energy sources like solar hydro and wind; and (4) upgrading traditional power generating facilities.

While we have seen that many efforts and resources have been put into numbers (1), (2) and (3), (e.g. under the 11th Five-Year Plan Chinese utilities managed to close many smaller, inefficient coal fired power installations and built many super-critical and ultra-critical new coal fired power installations), due to China's high power demand, coal fired power generation is still urgently needed to keep the economy growing. Therefore, achieving low cost measures like number (4) are a key challenge requiring business solutions.

In my trading experience, I have witnessed:

UE starting to promote biomass as a low carbon alternative fuel for coal. In many cases, biomass was used as co-firing fuel along with coal. In extreme cases, such as with DRAX, they solely used biomass to produce 4% of UK power this year.

By using biomass, the carbon footprint of DRAX has been lowered by 13 million tonnes CO_2, representing a market value of just over 100 million Euros (800 million Yuan). This profit is used to finance the retrofit of the burners in the installation.

Given this background, in Europe, under the EU ETS, we have seen a growing demand for biomass, with a standard industrial wood pellets contract even being developed by the European Federation of Energy Traders (EFET) that is widely used as a base contract for biomass trading.

Lower emissions as a result of the use of biomass creates a surplus in grandfathered carbon allowances which can make it a very financially attractive source of fuel alongside existing coal installations.

In addition to the EU ETS, governments in the EU, especially in the UK, the Netherlands and Denmark, have special feed-in tariffs for dedicated biomass generated power, which has created an additional incentive on top of EU ETS revenues to promote biomass co-firing by utilities.

An energy producer should switch to biomass co-firing if:

coal price ≥ biomass price + carbon price + feed in-tariff + subsidy

Because an energy producer will use the maximum amount of biomass to generate power, it will need to sell the surplus allowances on the market, in order to secure a profit.

From a financial trading point of view, such a fuel switching equation will be the fundamental determining factor in trading biomass and coal in the secondary trading market.

In China I believe domestic biomass can be used in coal fired power stations and will not jeopardise the efficiency if only 5-10% of the biomass is co-fired with coal.

According to my calculations, this will reduce carbon emissions in China from coal fired power stations by at least 80million tonnes of CO_2.

China's national ETS can be a great incentive and stimulus which causes biomass to be considered as a source of fuel that emits no CO_2. This is a win-win opportunity for financial trading, capital markets and utilities to come together to create financially viable environmental assets.

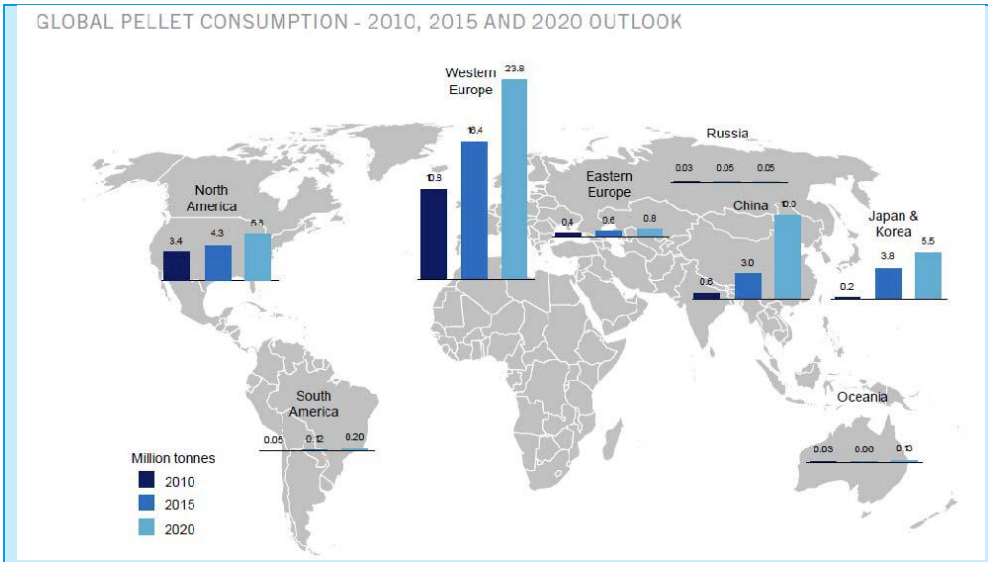


Figure 80: Global pellet consumption - 2010, 2015 and 2020 outlook

Source: IEA Bioenergy Task 40

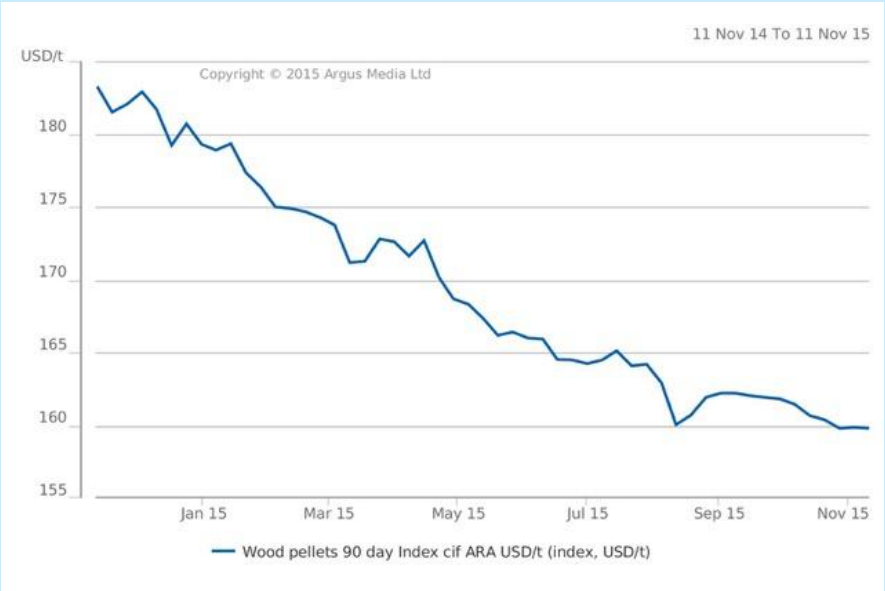


Figure 81: Wood pellets 90 day index cif ARA USD/t (index, USD/t)

Source: Argus Biomass Markets

Region	2012	2013	2014	2015	2016	2017	2018	2019	2020	2025	2030	2050
Western Europe	10.80	14.80	18.00	18.90	19.85	20.84	21.88	22.97	24.12	30.79	38.54	102.27
Eastern Europe	0.40	0.70	1.25	1.40	1.47	1.54	1.62	1.70	1.79	2.28	2.86	7.58
Russia	0.30	0.37	0.45	0.65	0.68	0.72	0.75	0.79	0.83	1.06	1.33	3.52
China	1.60	2.60	5.00	6.00	6.30	6.62	6.95	7.29	7.66	9.77	12.24	32.47
Japan & Korea	0.80	1.90	10.50	13.50	14.18	14.88	15.63	16.41	17.23	21.99	27.53	73.05
Oceania	0.70	1.40	2.50	2.90	3.05	3.20	3.36	3.52	3.70	4.72	5.91	15.69
North America	3.90	4.26	4.90	5.30	5.57	5.84	6.14	6.44	6.76	8.63	10.81	28.68
South America	0.50	0.97	1.80	2.20	2.31	2.43	2.55	2.67	2.81	3.58	4.49	11.90
Totals	19.00	27.00	44.40	50.85	53.39	56.06	58.87	61.81	64.90	82.83	103.70	275.15

Table 43: Industrial wood pellet consumption data

Source: BioXchange Int Ltd.

Albert de Haan,

MD Carbon Rooster Advisory Services BV

35 years trading experience in FX, interest rate products and energy related commodities.

Co-founded the European Climate Exchange in September 2004, the largest global trading platform in carbon and carbon related contracts.

Albert de Haan has a long track record working in the market for energy related commodities, including wood pellets and wet chips, and is familiar with all the major potential commodity buyers.

His past and present assignments include:

• Advisor to UNESCO MAB division

• Advisor to Dutch Government on Carbon Auction, member of Dutch Carbon Advisory Board

• European Climate Exchange (ECX) representative in EU ETS review 2007 for EU Directorate General (DG) Climate

• Senior consultant for IFC for *Shenzhen Province Guangdong* Chinese carbon pilot

• Co-structuring consultant in EFET biomass standard contract, used for wood pellets global trading

• Coach in Turkish Midseff European Bank for Reconstruction and Development (EBRD) programme training Turkish banks in carbon trading

• Managing Director and owner of the European Milk Exchange (2009-2010)

• President of Hong Kong Carbon Star Group

5.2.2.3 Futures trading

Compared with traditional futures contracts, the only difference for carbon futures contracts is the underlying asset. Futures are defined as standardized contracts traded in the exchange, where a certain amount of commodity is traded at a specific time in the future at an agreed price. (Kexijia, 2014). The meaning of "standardized" is that the provisions of contracts for buyers and sellers are established by the exchange. The "contract" is a contract for the future, which agrees on the price of a certain subject matter traded (delivered) in the future. In order to prevent a breach of the contract, both parties have to pay a deposit.

It should be noted that futures are traded in a formal exchange, and domestic futures exchanges include the China Financial Futures Exchange and the Shanghai Futures Exchange. There is no formal exchange in the carbon trading area, however the State Council said in a notice on the pilot Guangdong free-trade area that it "will study and establish an innovative Futures Exchange, and carbon emission futures will be the first variety". If this exchange is established, China's carbon market may develop very well.

A carbon emissions futures market is a low-cost means to achieve emissions reduction in both Europe and the United States. From the point of view of international experience, carrying out carbon emissions futures and derivatives trading can have a huge role in promoting energy-saving and emission reduction. Liu Yunfeng, the Deputy Inspector of the SFC Futures Supervision Department thinks that carrying out carbon emissions futures has two connotations: on the one hand, an efficient information exchange platform could be provided, and the trading price would be open and transparent; on the other hand, an effective hedging tool can be provided for related spot trading enterprises. (Carbon trading net, 2013)

Commentary 18: Futures – future for China

Special commentator: Mr. Jan Fousek, Virtuse Energy (Virtuse Group)

With a turnover of 45 billion Euros in 2014, global carbon markets are now the largest class of environmental or emissions trading markets in the world in terms of both volume and market value. The EU ETS is the world's largest carbon market. This fact can be changed soon, since the Chinese national market is set to become the world's biggest carbon market by 2020 in terms of CO_2 covered.

China's seven pilot schemes already captured the attention of the world this year, showing a significant growth in market volume. The trading volume from the seven markets continued to grow, potentially doubling to 40 million tonnes, and with an expected value of 146 million Euros by the end of 2015. Market volume says something about the number, size and kind of participants that a market can accommodate. A bigger market means more, larger and more diverse players. Importantly, a large market involves not only compliance buyers and sellers but also financial players, who will provide liquidity to the market.

Actually, Beijing can benefit from the subsequent implementation of an ETS scheme in China by finding inspiration in the successful aspects and learning lessons from the mistakes of European countries in the past. The EU ETS could be a benchmark for China regarding the formation of a national carbon market and the construction of its infrastructure.

Future is in Futures

About 80% of European ETS transactions are traded in futures markets and 20% in spot markets. There is still a lot of work ahead since China prohibits futures trading in many commodity markets to avoid major price fluctuations caused by speculative trading. The seven pilot carbon markets only allow spot trading, but the NDRC, the carbon market regulator, is pushing the financial markets regulator to make an exception for carbon. The introduction of futures trading in the emissions market can boost liquidity and provide a longer term price signal to help emitters make investment decisions. Futures trading could also make China's carbon market more attractive to foreign investors.

Let's summarise basic features and benefits of futures:

- They provide a transparent price.
- They play a risk management role. For some markets risk management without futures is not possible. Additionally, for every market it holds that futures discount risk management through decrease in capital demand.
- Cheap risk management and cheap speculative trading contribute to an increase of liquidity which decreases costs of mediation for end customers (through narrowing of bid/ask spreads, and increase of market flexibility and depth, which allow trade of big volumes without influencing the price).
- Access to the market through discounted trading leads to a higher number of participants and higher volume of risk capital which leads to market efficiency. An efficient market decreases costs for the commodity's end-customer not only for trading but also for a price analysis.
- Futures as exchange – trading able to be standardised on a proposed long term contract basis. Compared with OTC, futures trade is closed with the counterparty – exchanges and the financial settlement is provided on a daily basis. Profits and losses to the trader's account are assigned according to the price on the exchange. The trading is safe. According to the fact that it is a product traded on an exchange it complies with strict regulation and supervision.

Because of the abovementioned advantages, Virtuse Energy sees opportunities in futures trading in China. Indeed, futures trading in China has the same advantages as anywhere else in the

world.

Example of futures:

Specification of EUA futures – stock exchange ICE:

TRADING SCREEN PRODUCT NAME - EUA Futures

UNITS OF TRADING - One lot of 1,000 CO_2 EU Allowances. Each EU Allowance being an entitlement to emit one tonne of carbon dioxide equivalent gas.

MINIMUM TRADING SIZE - 1 lot

ALLOWANCE - Euro and Euro cent (c) per metric tonne

MINIMUM TICK - 0.01 Euros per tonne (i.e. 10 Euros per lot)

MINIMUM PRICE FLUX - 0.01 Euros per tonne

MAXIMUM PRICE FLUX - There are no limits

CONTRACT MONTHS

Contracts are listed on a quarterly expiry cycle such that the contract months of March, June and September are listed up to September 2016 and annual contracts with December expiries up to 2020. In addition, the nearest two monthly contracts will also be listed so that there are always three prompt contracts available to trade inclusive of the quarterly contract.

EXPIRY

Last Monday of the contract month. However, if the last Monday is a non-business day or there is a non-business day in the four days following the last Monday, the last day of trading will be the penultimate Monday of the delivery month.

TRADING SYSTEM

Trading will occur on the ICE Futures Europe electronic platform known as the ICE Platform accessible via WebICE or through a conformed Independent Software Vendor.

Example of market depth:

Product	Strip	+	-	Sell	Qty	Bid	Offer	Qty	Buy	Offer ...	Last
EUA Phase 3 Daily Futures	Futures Today		-	Hit	2	8,06	8,10	30	Lift		8,03
				Hit	5	8,01	8,15	50	Lift		8,02
				Hit	20	7,97	8,20	4	Lift		8,05
											8,05
											8,05
EUA Futures	Dec15	+	-	Hit	2	8,10	8,12	52	Lift		8,12
				Hit	39	8,09	8,13	100	Lift		8,11
				Hit	11	8,08	8,14	101	Lift		8,11
				Hit	13	8,07	8,15	178	Lift		8,11
				Hit	19	8,06	8,16	58	Lift		8,11
				Hit	39	8,05	8,17	70	Lift		8,11
				Hit	105	8,04	8,18	20	Lift		8,09
				Hit	253	8,03	8,19	195	Lift		8,09
				Hit	103	8,02	8,20	31	Lift		8,09
				Hit	309	8,01	8,21	7	Lift		8,10
				Hit	131	8,00	8,23	8	Lift		
				Hit	144	7,99	8,24	115	Lift		
				Hit	107	7,98	8,25	27	Lift		

Figure 82: Example of market depth

Carbon Futures in Europe

Today the futures markets in developed countries are benchmarks for trading commodities and often even securities, specifically bonds. That means those product spot prices are derived from more liquid futures.

In some articles concerns are discussed that futures and speculation lead to price manipulation and are additional sources of risk. For example, in 2009 Group of Eight (G8) ministers expressed their fears about price risk and volatility on energy and agricultural commodities markets during the financial crisis in 2008. In reaction to that, the International Organization of Securities Commissions (IOSCO) formed an operational group with commodity futures. The following is a quote from their study:

"Reports by international organizations, central banks and regulators in response to the above concerns that were reviewed by the Task Force suggest that economic fundamentals, rather than speculative activity, are a plausible explanation for recent price changes in commodities."

Source: https://www.iosco.org/library/pubdocs/pdf/IOSCOPD285.pdf

Virtuse Energy experience

Since the beginning of 2005 Virtuse Energy has traded tens of millions of tonnes of futures every year, out of which futures create the largest percentage of our volumes. Virtuse Energy uses futures for risk management of our own portfolio, settling prices for customers and speculative trading. Virtuse Energy also trades options. Options can be understood as bourse-exchangeable insurance contracts. If the price exceeds a settled price called a strike price, the buyer has the right to compensation. This compensation is equal to the price settled on the settlement day and the settled limit price (strike price). The contract allows a large space for flexible risk management and trading this contract on the exchange brings transparency of its price.

How do we trade options:

Market making: wide spreads but also high costs and low liquidity.

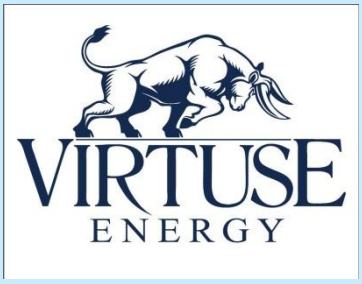
Option strategies

For example, "bull Call spread": current price is 7 Euros. Buy Call with strike 8 Euros and sell call with strike 9 Euros. You are paying less than just for 8 Call and still have a lot of upside potential.

Trading volatility: run a portfolio consisting of a combination of options and futures neutral to the market price. You may profit from low or high volatility despite the prices.

Mr Jan Fousek

Jan Fousek has worked in the emissions markets since 2008 and he is co-Founder of Virtuse Energy, an emissions trading, carbon brokerage and environmental advisory firm. He frequently speaks at prestigious emissions and energy conferences mostly in the region of Central Europe but he was also asked to deliver a speech related to the EU´s experience with its Emission Trading Scheme (EU ETS) at Euro Asia Economic Forum 2013 in Xi´An, China. In 2014, Jan was invited by several newly-launched Chinese emission exchanges to share Virtuse´s expertise in the field of trading with emissions allowances. His opinions are regularly sought by well-known domestic and international business media.



About Virtuse Energy

Virtuse Energy (Virtuse Group) is one of the largest emissions trading agents in Central and Eastern Europe and was the first foreign company involved in the development of the emissions market in China. Virtuse Energy is a member of the major energy exchanges in Europe and Asia and last year became the only company of its kind in the region, a member of the world's largest exchange ICE. In September 2014 Virtuse Energy became the first foreign company in the world that entered the newly formed Chinese emissions market, to the stock exchange in Shenzhen, and is now in the process of completing entry to the second Chinese exchange in Guangzhou. Since its inception in 2006, Virtuse has become a leading service provider in the field of green energy, particularly for industrial clients. In the wholesale markets it also trades electricity and gas for its customers and is a member of the major energy markets in Europe and Asia. The Virtuse Group also deals with investments in power generation, especially from renewable sources.

5.2.2.4 Options trading

Option: A financial instrument that gives one party the right, but not the obligation, to buy or sell an underlying asset from or to another party at a fixed price over a specific period of time, also referred to as contingent claim or option contract. (CFA Institute, 2015) The option is called the right of choice, which is a kind of derivative financial instrument. The option means the trading right in a certain period of time in the future. Specifically, the buyer pays a certain amount (premium) to the seller, then obtains a right to buy or sell a certain specific amount of commodity, during a period of time in the future (American option) or on a specific date in the future (European option), at a pre-agreed price (the strike price), without bearing the obligation to buy or sell.

Option trading complements the shortcoming of forward trading where forward trading only maintains the present value but not the future value. Option trading has greater flexibility. The holder of the contract, when the price is favourable, could take the measure of non-delivery, so that the price risk loss is less than or equal to the premium.

- The option is an effective kind of risk management tool. The subject matter of options is future contracts, which can be said to be derivatives of derivatives. Therefore, the option can be used for spot hedging, as well as maintaining the value of futures business.
- The option provides more investment opportunities and investment strategies for investors. In futures trading, the market would have investment opportunities only if the direction of price changes. If the price fluctuations are small during a period, the market would lack investment opportunities. In options trading, futures prices in either bull and bear markets or consolidation could provide the opportunity for investors to profit.
- The option can provide more leverage for investors. Compared with the futures margin, options with fewer rights can control the same number of contracts.

Commentary 19: Volatility and Options Trading in the Chinese ETS market

Special commentator: Mr. Pierino Ursone, Ursone Derivatives

Volatility is the measure of the variation (or the dispersion) of the returns of an underlying asset over a certain period of time. One could say, the riskier the asset, the higher the volatility (think of market crashes). The lower an asset's risk, the lower its volatility (think of the infamous summer lull). So, in highly volatile markets one could expect large moves of the underlying where at low volatile markets there might be days where the underlying hardly moves.

Volatility is expressed in percentage points. When referring to a volatility of 20%, it can be said that the chance that an asset, which is now worth 50 will be trading between 30 and 90 in a year's time, is around 99.999% statistically. When volatility would be double, i.e. 40%, this range will become approximately twice as large, as shown in the two charts below.

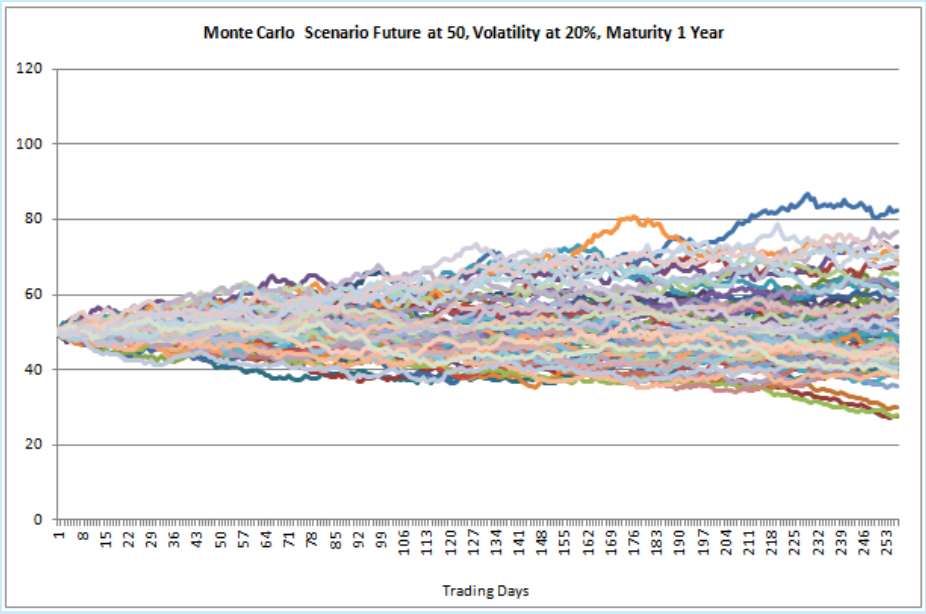


Figure 83: Monte Carlo scenario future at 50, volatility at 20%, Maturity 1 year

Volatility is a very important parameter in the pricing of options. Firstly, an at the money option at 40% volatility will be twice as expensive as compared with such an option when applying 20% volatility. Next to that, with the underlying at 50, the (statistical) likelihood of an asset trading above 100 when volatility is at 20% is nil, hence the 100 call will be worthless. At the same time, at 40% volatility, the 100 call has a fairly good chance to end up in the money, it has a theoretical value of 0.50.

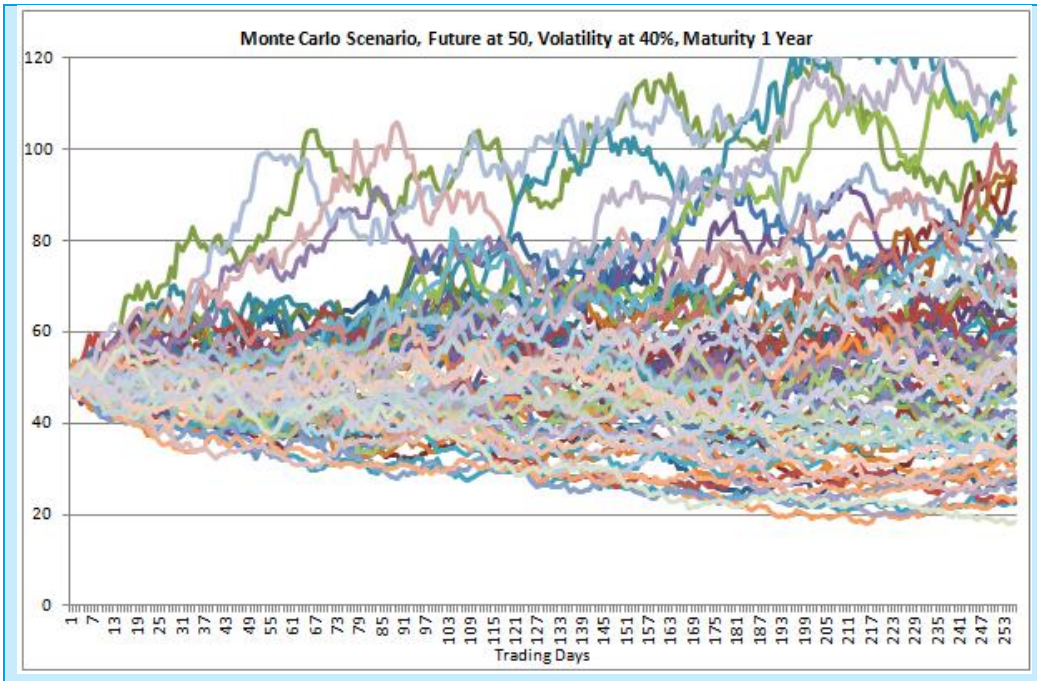


Figure 84: Monte Carlo scenario future at 50, volatility at 40%, Maturity 1 year

One can make a distinction between historical and implied volatility. Historical volatility is the volatility as measured on realised returns, implied volatility is a measure at what price level options are traded, a function of demand and supply and future expectations with regards to the market. Implied volatility is about market forecasting and things that we know and don't know.

"There are known knowns; there are things we know we know. We also know there are known unknowns; that is to say we know there are some things we do not know. But there are also unknown unknowns—the ones we don't know we don't know." (Rumsfeld).

Implied volatility is about putting a price on known unknowns and unknown unknowns.

In the past year we have seen a good development in trading in the seven pilot areas. A few markets are now looking fairly mature (for instance Shanghai, Guangdong and Hubei). Availability of historical data is a prerequisite when determining market behaviour and putting a price tag on options, currently it looks like China is on the right track.

All the regions are, based on historical data, trading around 60% volatility, with one exception, Shanghai, trading well over 100%. An example is Shenzhen 90 - day volatility as depicted below (end of October 2014 through August 2015).

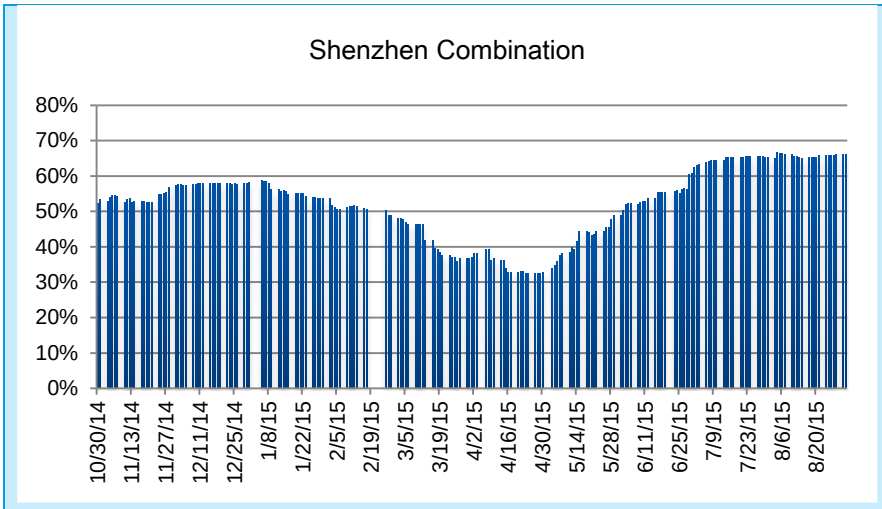


Figure 85: Example: Shenzhen combination

With an underlying level of around 30, a volatility of 60% represents an elevated level for options prices. When applying a maturity of one year, a volatility of 60% and an underlying level of 30 Yuan, the 30 call and put will each have a value of approximately 7 Yuan. Far out of the money options will obviously have good value as well; the 18 put and the 60 call for instance, will both have a value of around 1.50 *(when applying flat skew).*

The combination of a maturing market and availability of historical data is contributing to the knowledge of the known known and the known unknown (the unknown unknown will not be revealed) and therefore the Chinese ETS market has the potential to develop a viable options platform.

Pierino Ursone: Options Expert & Author

Pierino is author of How to Calculate Options Prices and Their Greeks (published by Wiley & Sons, Wiley Finance Series). He has been a Professional Options Trader in the Equity and Commodity business for twenty years. Amongst a large variety of products, Pierino traded Carbon Options in the European ETS market for several years. As Director of Ursone Derivatives, he organises seminars and options training, where he shares all the knowledge he has gathered in his long trading career.

5.2.2.5 Brokers

The business and function of carbon brokers has been introduced earlier in relation to the primary market, and will not be repeated here. Currently in the secondary market, carbon brokers mainly participate in the form of exchange broker members or comprehensive members. Brokerage (Agency) members refers to institutions, enterprises, or organizations providing carbon trading brokerage or agency service business in exchanges. Comprehensive members refers to

institutions, enterprises, or organizations obtaining exchange membership, fully participating in carbon emissions trading in exchanges, and that can carry out self-service, brokerage (agency) business, services business and exchange-designated business.

5.2.2.6 ETF

ETF, namely Exchange-Traded Funds, is an exchange-traded, open-end fund with variable shares. (Lan, 2014) In China, it is called exchange-traded index funds. ETF combines the various advantages of the open-end funds and closed-end funds, meanwhile it's a passive index fund. (CFA Institute, 2015) Compared to the traditional type of index funds, ETF has better replicating effect, cheaper, more mobile and simple modes of sale. In addition, it also has an arbitrage mechanism, which traditional index funds lack. Therefore, it is more attractive for investors. For investors, the first advantage of holding ETF is that you can get a variety of index funds, and the ability for short selling, short purchase, and buy just a share (no prepaid minimum deposit requirements) can be obtained at the same time. Another advantage is that the majority of ETFs expense ratio is lower than the average mutual fund. When selling the ETF, investors have to pay the same commission to the broker, but also periodically.

6 Conclusion

Due to society's demand for economic development, a large amount of fossil energy consumption has seen global atmospheric concentrations of GHGs grow significantly in the last 20 years, leading to global warming. The impact of climate-related issues on human economic and social life has become increasingly apparent. This problem was the focus of the international community at the Paris Climate Conference. Over the past 10 years, the average annual growth rate of global GHG has been 2.4%. However, according to the latest figures discussed at Paris, emissions increased by only 0.6% in 2014, and in 2015 emissions are expected to have declined by 0.6%. As a country with a large population, economy, and energy production, China's actions have a huge international impact, and the change in global GHG emissions are significantly influenced by China.

Facing the multiple pressures of international public opinion, industrial structural transformation, and energy structure adjustment, China has begun to seek the most effective measures to achieve the goal of reducing GHG emissions. Carbon trading systems have had a real effect on GHG emission reduction in the last ten years, and carbon trading is the most efficient way to solve the problem of GHG emissions within the framework of a market economy according to the 'Coase Theorem'. Therefore, in order to better guide enterprises to achieve emission reduction targets at the lowest cost, and encourage them to take the initiative to participate in energy-saving, and emissions reduction work, China has launched seven carbon trading pilot schemes since 2013.

The NDRC in December 2014 issued the "Interim Measures for Carbon Emissions Trading Management". Compared with 2014, the seven pilots have overall had greater policy guidance from higher levels of government in 2015. As a result, in general pilot areas operated increasingly effectively. The pilots achieved a compliance rate of more than 95% in the year 2015. The compliance of the five pilot regions completing the second compliance period was generally better than 2014. In terms of the trading, the data on allowance trading volume by time and magnitude both reflect the fact that vitality and liquidity of the carbon market in 2015 was higher than in 2014. Moreover, allowance block trading increased significantly in 2015, which also reflects the co-operation between the trading counterparts in 2015. An ETS is expected to help achieve emission reduction targets, however several pilots exposed a series of shortcomings to different degrees, such as postponed deadlines, high market trading concentration, low trading vitality and liquidity, etc.

From the results of the Chinese carbon market research survey, it can be seen that the attention of non-pilot areas to carbon trading in 2015 has increased compared to 2014, as the proportion of non-pilots participating in the questionnaire increasing by about 15%. The ability of businesses to work with the carbon market, increasing familiarity with policies, and trading, and of the six major features of the carbon market, has seen a certain degree of improvement. However, the overall lack of capacity for carbon trading continues to be a problem requiring attention.

How to solve the problems of carbon trading capacity building, market vitality, etc. has become the joint focus of pilot areas and the central government. Guangdong Nansha Carbon Futures Exchange is on the way, and the NDRC and CSRC have begun to discuss the feasibility of carbon futures trading. In order to further strengthen the role of the ETS in encouraging energy-saving and emissions reduction, the role of carbon finance in carbon asset management will be the key factor for the development of capacity in 2016. Professional carbon finance institutions and professionals, financial services providers and investors should be encouraged to participate actively in all aspects of the carbon market. With the improvement of laws and regulations, the appearance of more financial instruments, the establishments of carbon financial product trading exchanges, the future of the carbon market will be more attractive.

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