A Brief Overview of China's ETS Pilots

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Deconstruction and Assessment of Guangdong's Greenhouse Gas Emission Trading Mechanism

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Foreword

Carbon Emissions Trading Playing a Key Role in China's Ecological Construction

Guangdong Pilot ETS Offering Experiences for a Nationwide Carbon Market

Ecological construction is a strategic choice that tallies with the world development trends, while a green and low-carbon development pattern—a core content and top priority of ecological construction—has become a centerpiece that concerns the world sustainable development. Since the anthropogenic global warming has been intensively threatening the world ecological security and human survival, the different parts of the world have reached consensus to take concerted actions to handle the issue of climate change. In order to sustain socioeconomic prosperity while resolving the climatic challenge, all nations shall turn to a low-carbon and eco-friendly development pattern that harmonizes the relationship between mankind and nature, and ultimately transforms the human society from an industrial civilization to an ecological civilization. Under such circumstance, the environmental-bearing capacity seems to become an increasingly scarce resource, meaning that environmental capacity will become an indispensable production factor like labor force, capital, and land. In terms of the carbon Emissions Trading Scheme (ETS), it is a regime that treats emissions allowances as a scarce source and a production factor and exhibits their value by sales prices. Overall, the forging of carbon market is an essential part for China's ecological construction, because administration and transaction of emissions allowances will introduce revolutionary change upon the energy system, promote the transition of the social production and consumption patterns, and facilitates the popularization of a green and low-carbon socioeconomic growth pattern.

After the *Paris Agreement* was passed in 2015, all concerned nations, including China, were bearing an arduous task to cope with the pressing climatic issue. Being a nation of words and deeds, China has made great contributions in mitigating the global warming. From 2005 to 2017, China had lowered its CO_2 intensity of GDP by 45%, realizing in advance the reduction target of 40–45% in 2020 compared with 2005 that China pledged at the Copenhagen Climate Conference in 2009. With

the *Paris Agreement*, China stated to cut its 2030 CO_2 intensity of GDP by 60–65% from the 2005 level, indicating an annual average decrease at above 4%, outpacing the average drop at 2% among the developed nations over 2005–2014. Moreover, China will make efforts to culminate its CO_2 emissions around 2030, and during this period, the annual drop in CO_2 intensity of GDP needs to reach 4–5% for the annual GDP growth rate would be 4–5%. In order to perform the obligations included in the *Paris Agreement*, China shall work even harder to make more contributions, which calls for a systematic backup from both institutions and policies. Therefore, China shall, on one hand, let the government play a leading role, hold onto the long-term low-carbon development strategy, carry out the near-term low-carbon development plan, insert restrictive emissions indicators into both the provincial and national 5-year plans, improve the fiscal and financial policies, constantly strengthen low-carbon technical norms and raise industry entry threshold. On the other hand, China shall give full play to the role of carbon market in achieving energy saving and emissions reduction. By combining with diverse policy instruments, China will be able to create an all-win landscape where there will be prosperous economy, improved environment, secure energy supply, and less CO_2 emissions.

Both the 18th National Congress of the Communist Party of China (CPC) and the Third Plenary Session of the 18th Central Committee of the CPC explicitly stated to forge ahead with the ecological civilization construction, let market play a decisive role in resource allocation, and actively carry out the pilot program about carbon emissions trading. China shall, through marketization and interest-driven mechanism, motivate individuals, enterprises, and governments to give their subjective initiative into full play, actively seek for low-carbon development, and alter the old growth pattern that overly relies on government plans and directives, so as to create a situation where all citizens take part in saving energy and cutting emissions. In October 2011, the National Development and Reform Commission (NDRC) released the *Notice on Carrying out the Work about the Carbon Emissions Trading Pilot Program in China* (NDRC Climate Change Dept [2011] No. 2601), which designates seven Chinese provinces and municipalities (incl. Guangdong Province) to take the lead in carrying out the ETS pilot program. Guangdong carbon market, which is the largest one among the seven pilot carbon markets, was officially launched on 19 December 2013. Through constant explorations and innovations, and based on steady progress, an open, transparent, well-organized, and efficiently operated Guangdong carbon market has basically taken shape to take charge for administration and trading of emissions allowances. During the 12th Five-Year plan period (2011–2015), Guangdong had cut the CO_2 intensity of GDP by 23.9%, exceeding the nationally restrictive target at 19.5%. By the end of May 2017, Guangdong carbon market had traded around 58.10 million tons of emissions allowances, holding 35.4% of the total of the 7 markets; earning total revenue at around 1.42 billion (bln) yuan, accounting for 36.9%. Thus, Guangdong carbon market was the first one of this type in China that broke the benchmark value at 1 bln yuan.

Guangdong is a fairly developed province in China, it is characterized by imbalanced regional economic growth, arduous task for cutting emissions, complete variety of industrial sectors and diversified emitters, which imply that Guangdong ETS design and operating experiences are worth of imitation and promotion, even its institutional layout and administrative accountability may inspire the building of a national carbon market. In a word, an all-round analysis of the seven pilot carbon markets, particularly Guangdong, will be of far-reaching significance for China's emissions reduction undertaking. At the time, when the pilot carbon markets are about to dock with the unified national carbon market, Guangzhou Institute of Energy Conversion (GIEC)—subsidiary to Chinese Academy of Sciences (CAS)—deliberately reviews and evaluates Guangdong ETS, decomposes the regime into several factors for revealing their designs, and for introducing the supporting policies behind the designing process. Filled with rich content, detailed cases and complete data, this book is able to transmit the ETS-related knowledge to the institutions, organizations, government officials, researchers, or corporate managers that are interested in carbon trading, or used as a textbook for training the talents in China carbon market.

Beijing, China
July 2018

He Jiankun
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Preface

Addressing Climate change is today's common challenge in front of the mankind. In joining the global endeavor in mitigating climate risks, China helped concluding and enforcing the Paris Agreement, and delivered its Intended Nationally Determined Contributions (INDCs) to the UNFCCC[1] Secretariat in 2015, committing to form a national unified carbon Emissions Trading Scheme (ETS) steadily based on the pilots ETS programs, which is a crucial step in fulfilling its INDCs targets.

China launched the program of pilot ETS mechanism[2] in 2011, marking an official start of the nation's carbon market construction campaign. Guangdong Province—one of the two pilot provinces—opened its carbon market in 2013. To date, it has fulfilled three compliance periods with 100% of compliance rate for 2 years in a row, realizing smooth market performance and remarkable emissions cutbacks. As of 2016 end, Guangdong spot carbon market has traded 47.35 million tons (Mt) of emissions allowances, earning total turnover of 1261 million (mln) yuan, thus rising to China's largest and the world third largest carbon market. More than 70% of Guangdong-based covered enterprises lowered carbon intensity,[3] marking a prominent contribution in overfulfilling Guangdong's emissions reduction target, and in advancing industry transformation and upgrading during the 12th Five-Year-Plan period (2011–2015). Being China's first operated pilot carbon market at the provincial level, Guangdong has made several pioneering explorations by incorporating its characteristics, e.g., setting up a total allowances administration system under the emissions reduction target; managing the allowances to covered enterprises and new entrants in a separate manner; emissions from covered enterprises are under hierarchic (provincial/municipal level) administration; and integrating free allowances allocation with paid allocation. As a "pace setter, foregoer

[1] United Nations Framework Convention on Climate Change.

[2] In October 2011, the National Development and Reform Commission (NDRC) released the *Notice on Carrying out the Work of Carbon Emissions Trading Pilot Program in China* (No.2601 [2011]).

[3] "Carbon intensity" refers to carbon dioxide emissions per unit of GDP.

and tester," Guangdong ETS fully exhibits the characteristics of a provincial ETS in both framework and administration hierarchy.

In light of its carbon market construction agenda, a China-wide emissions trading scheme is about to be launched in 2017. However, unlike the seven pilot carbon markets, most of China's provinces and cities have little experience in this regard. They shall at first resolve several urgent questions before making such an attempt. For example, what are the interrelations between all elements under the ETS? What are the foremost questions under the framework of nationwide ETS? How to assess the ETS mechanism design? Guangzhou Institute of Energy Conversion, Chinese Academy of Sciences (GIEC, CAS)—is a leading think tank for building Guangdong ETS, sponsored by Guangdong ETS Pilot Program of China Clean Development Mechanism Fund (CDMFUND), Guangdong ETS Impact Assessment of UK Strategic Prosperity Fund (SPF), and Special Funds for Low-carbon Development of Guangdong Province. Under the guidance and elaborate organization of the NDRC and Guangdong Provincial Development and Reform Commission (GD DRC), GIEC joined in the formation of Guangdong ETS at the outset. It is deeply impressed that the ETS design is a fairly practical and systematic project. It involves multiple links as forming a management framework, defining covered enterprises, establishing emissions reduction targets and carbon offset rules, setting a cap on total allowances, determining allowances allocation methodologies, putting in place of a registration system, and guarding against market risks. Each link is separate but closely interacted. Therefore, a scientific analysis and assessment of each link and their effect is indispensable before an ETS is officially launched.

This book is an outgrowth of the joint efforts of GIEC's Energy Strategy Research Center and Non-carbon Energy Research Center. In this book, the authors share their thorough understanding of Guangdong ETS, exchanges with other pilot areas and new thoughts that were inspired by their peers. They break down the entire Guangdong ETS pilot program, dissect the macropolicies into the ideas for designing each link, and unfold the theoretical research process behind policy-making. Such an in-depth analysis will enlighten other provinces/cities that are interested in ETS, and promote smooth construction of a national uniform carbon market. We hereby send our gratitude to GD DRC's Department of Addressing Climate Change for their trust and support. Our thanks also go to other research institutions that have been working with us in building Guangdong ETS.

Guangzhou, China Daiqing Zhao
December 2016

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Abbreviations

BAU	Business as Usual
BCRC	Beijing Climate Change Research Center
BP	British Petroleum
CAR	Climate Action Reserve
CARB	California Air Resources Board
CAS	Chinese Academy of Sciences
CCER	Chinese Certified Emission Reduction
CCR	Cost Containment Reserve
CCS	Carbon Capture and Storage
CDMFUND	China Clean Development Mechanism Fund
CEEX	China (Shenzhen) Emission Exchange
CER	Certification Emissions Reduction
CGE	Computable General Equilibrium
CNPC	China National Petroleum Corporation
CPC	Communist Party of China
CPI	Consumer Price Index
CR Power	China Resources Power Holdings Co., Ltd.
CSET	Chinese Society of Engineering Thermophysics
DEA	Data Envelopment Analysis
DID	Difference-in-Differences
DMU	Decision Making Unit
EEI	Energy Efficiency Index
EF	Energy Foundation
EIS	Electronic Information System
ETS	Emissions Trading Scheme
EU ETS	European Union Emissions Trading Scheme
GD LCPA	Guangdong Low-Carbon Economy Promotion Association
GDDRC	Guangdong Provincial Development and Reform Commission
GHG	Greenhouse gases
GIEC	Guangzhou Institute of Energy Conversion

GOF	Global Opportunities Fund
ICAP	International Carbon Action Partnership
IETA	International Emission Trading Association
IOU	Investor Owned Utilities
IPTS	Institute for Prospective Technological Studies
IRR	Internal Rate of Return
J-VER	Japan Verified Emissions Reduction
KETS	Korea Emissions Trading Scheme
KNN	k-Nearest Neighbor
KVAP	Keidanren Voluntary Emissions Action Plan
LSE	London School of Economics and Political Science
MGGRA	Midwestern Greenhouse Gas Reduction Accord
MRV	Monitoring, Reporting and Verification
NAP	National Allocation Plan
NAPCC	The National Action Plan on Climate Change
NDRC	National Development and Reform Commission
NZ ETS	New Zealand Emissions Trading Scheme
OTN	Obligation Transfer Numbers
PAT	Perform, Achieve and Trade
POLES	Prospective Outlook on Long-Term Energy Systems
POU	Publicly Owned Utilities
PPS	Production Possibility Set
PRIMES	Partial Equilibrium Model
REC	Renewable Energy Certificate
REDD	Reducing Emissions from Deforestation and Forest Degradation
RGGI	Regional Greenhouse Gas Initiative
ROI	Return on Investment
SAM	Social Accounting Matrix
SIC	Standard Industrial Classification
SPF	Strategic Prosperity Fund
TFP	Total Factor Productivity
UNFCCC	United Nations Framework Convention on Climate Change
VER	Voluntary Emission Reduction
WCI	Western Climate Action Initiative

Abstract

Deconstruction and Assessment of Guangdong Pilot Emissions Trading Scheme is a rich fruit of researchers' 5-year efforts in document compilation, surveys and studies, data analysis, consultations and discussions, and practical work in carrying out the pilot program. It covers all crucial factors that shall be considered for forming an ETS, ideas for designing each link, potential problems and difficulties as well as solutions. In addition, this book offers a quantitative assessment of Guangdong ETS from its operational efficiency, macro-and micro-influences, and draws some conclusions and inspirations that will benefit the formation of a nationwide ETS. Some relevant policies about Guangdong ETS are attached in the appendix for readers' reference.

This book consists of four parts: Part I introduces the global experiences in constructing carbon market, and analyzes the characteristics of Guangdong energy consumption and carbon emissions, in an aim to clarify the background for initiating ETS in the province. Part II elaborates on the formation and operation of Guangdong ETS and interprets the crucial elements during the pilot period (2011–2015), e.g., defining covered enterprises, calculating total allowances, developing allocation plans, designing the MRV[4] regime, and evaluating carbon market performance. In Part III, the authors use ICAP/CGE-GD and DEA models[5] to assess the macro- and micro-impact of Guangdong ETS, and find out that it lowers emissions reduction cost remarkably, but not efficient enough. Moreover, we also noticed that all elements involved in the ETS are closely interrelated, implying that when judging the input of an element is appropriate or not, we should take account of the input of other elements, instead of a cross-wise comparison of this single element or have it normalized. There is also an analysis of the factors that affect the ETS administration efficiency, including the regulated emissions quantity, total

[4] MRV: Monitoring, Reporting, and Verification.

[5] ICAP: International Carbon Action Partnership; CGE: Computable General Equilibrium; DEA: Data Envelopment Analysis.

amount of allowances, companies' profitability, and potentials in emissions cutbacks. Part IV (appendix) introduces the key policies that are unleashed while Guangdong ETS pilot program is implemented. They are listed in a chronological order for readers' convenience.