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The allowance mechanism of China's carbon trading pilots: A comparative analysis with schemes in EU and California

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HIGHLIGHTS

- Analysis framework from two aspects – allocation and distribution – is originally developed.
- Allowance mechanism of China's pilots is internationally compared with EU ETS and CA CAT.
- Different stages of development and economic environment led to a different design of allowance mechanism.
- Identify challenges facing China's carbon trading pilots and recommendations for addressing these challenges.

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ABSTRACT

The allowance mechanism is one of the core and sensitive aspects in the design of a carbon emissions trading scheme and affects the compliance cost for each entity covered under the scheme. By examining China's allowance mechanism from two aspects-allowance allocation and allowance distribution, this paper compares China's carbon trading pilots with the EU Emissions Trading Scheme and California Cap-and-Trade Program. The comparison identifies the unique features in allowance mechanism and particular issues that affect the efficiency of the pilots. The paper also recommends courses of action to strengthen China's existing pilots and to build valuable experiences for the establishment of the national cap-and-trade system in China.

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1. Introduction

Due to its rapid economic expansion over the last decade, China has become the world's largest energy consumer and greenhouse gas (GHG) emitter. With growing resources and environmental constraints domestically and the need to meet international commitments for GHG emissions abatement, China's National Development and Reform Commission (NDRC) launched a series of local carbon emissions trading pilots in seven provinces and cities including Shenzhen, Beijing, Tianjin, Shanghai, Chongqing, Guangdong, and Hubei [1], which started operation between 2013 and 2014.

The world's oldest carbon trading scheme is the European Union Emission Trading System (EU ETS), which came into effect in 2005. One of the most widely debated aspects of the EU ETS has been the emissions allowances mechanism for covered installations. Sijm et al. [2] has pointed out that where companies pass on the opportunity costs of pollution licenses into consumer prices, 100% free allocation leads to windfall profits for polluting industry. Benz et al. [3] has argued that a higher share of initial auctioning is better for aggregate welfare, because it pre-empts rent-seeking lobbying costs over the initial division of allowances. Furthermore, Pahle et al. [4] and Golombek et al. [5] have found that the combination of grandfathering and windfall profits in the power sector was distortionary for investments in new power plant capacity. For the decentralized National Allocation Plan (NAP) approach in Phases 1 and 2 of EU ETS, free allocation methodologies under the NAPs were also found to be poorly harmonized across the EU due to the high degree of discretion exercised by its Member States [6]. Sartor et al. [7] provided an analysis of the new allocation rules

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based on historical production multiplied by benchmarks in Phase 3, which showed that the new rules had reduced the scope for windfall gains by participating firms in the EU ETS while also effectively mitigating carbon leakage risks.

California's Cap-and-Trade program (CA CAT) is the only economy-wide carbon trading scheme to be enacted so far in the US and is set to become the world's second largest carbon market behind the EU ETS [8]. Shen et al. [9] reviewed the California scheme and drew insights for China's pilots from various perspectives including the legal basis, institutional arrangement, program structure and allowance mechanism. Zuckerman et al. [10] identified barriers to cost-effective abatement by industrial firms under the Cap-and-Trade Program in California, and policy levers that could address those barriers. Schmalensee and Stavins [11] examined the design and performance of California's Cap-and-Trade system and argued that the system has demonstrated that an initial free allowance allocation aimed at fostering political support can be successfully transitioned over time to greater auctioning of allowances.

The design of the Chinese carbon trading pilots has been studied by a number of researchers. Han et al. [12] and Lo [13] assessed the preparation of the pilots and argued that due to the great difficulties and large scale there would be tremendous challenges, both practically and theoretically, for emissions trading in China. Jotzo and Löschel [14], Zhang et al. [15], and Liu et al. [16] conducted a general assessment of China's seven carbon trading pilots, while several other researchers examined specific pilots including their institutional structures and design features, such as Jiang et al. [17] for Shenzhen, Wu et al. [18] and Liao et al. [19] for Shanghai, and Qi et al. [20] for Hubei. To investigate the impact of carbon allowance rules, Zhang et al. [21] used the multi-stage profit model and proposed that under the rules of grandfathering, enterprises covered by an ETS may maximize current profits; however, under the rule of benchmarking, those enterprises may care more about the effect of current decisions on the future profits. Tang et al. [22] formulated a multi-agent-based model and argued that the grandfathering rule is relatively moderate, while the benchmarking rule is more aggressive. To further discuss the issues about China's national carbon market, Zhou et al. [23] and Cui et al. [24] have constructed an interprovincial carbon emissions trading model to evaluate its economic performance and the cost-saving effects. Hong et al. [25] developed a decision support model for establishing benchmarks as a tool for free allocation in the construction industry, and Xu et al. [26] proposed an alternative method derived from Boltzmann distribution to estimate the allowances in the power generation industry.

Except for Pang and Duan [27], the existing literature has seldom focused on the design details of the allowance mechanism in China's pilots. Despite a detailed introduction to the methods for allowance allocation adopted by the pilots, Pang and Duan [27] has neither made a comparison with allowance allocation strategies in the international trading schemes nor given a discussion pointing out the problems and challenges facing China's pilots. As one of the core components in a carbon trading scheme, however, the allowance mechanism affects the compliance responsibility and cost of each covered entity. It is always the most sensitive topic that attracts great attention from the research community, policy makers, and covered entities. Therefore, this paper sets out to address the gap by conducting a comprehensive and in-depth analysis of the allowance mechanism in China's carbon trading pilots. Through comparing China's pilots with the EU ETS and CA CAT, our analysis will focus on the allowance cap, allowance composition, allowance allocation method, and distribution and dynamic management of allowances.

This paper is organized as follows. In Section 2, we summarize the analysis framework and methodology used in this study on allowance mechanism of China's seven ETS pilots. In Section 3, we provide a comparative analysis of the allowance allocation mechanism of China's ETS pilots with the EU ETS and CA CAT. In Section 4, we examine the allowance distribution mechanism of China's ETS pilots. In Section 5, we discuss some key issues facing the allowance mechanism of China's pilots and provide a set of recommendations. The conclusions are given in Section 6.

2. Framework and methodology

The analysis of the allowance mechanism of China's carbon trading pilots focuses on two aspects – the allowance allocation and distribution of allowances. The allowance allocation determines how the total emission cap and composition of emission allowances is set and how emission allowances under the total cap are calculated for covered entities. The distribution of allowances deals with the allotment of calculated allowances to participating entities and the dynamic management of these allowances in the post-distribution period. They are the two essential and interconnected parts of the carbon allowance system. In this study, we compare the allowance systems in terms of both allowance allocation and distribution in China's pilots with those in the EU ETS and CA CAT. Fig. 1 shows the analytical framework we developed to guide the analysis of the carbon allowance mechanism in the China ETS pilots.

Our analysis is based on the information we obtained from government documents, research literature and expert interviews. The government documents include the EU directives and related explanatory documents about the EU ETS, the California state law and Air Resource Board files posted at its web-site on the cap-and-trade scheme, and China's NDRC regulations and local DRC administrative measures governing the seven carbon trading pilots. In addition to the desk-top research, we conducted 25 in-person interviews with policy makers and emission-trading experts from the EU, California, and China pilot provinces and cities. The interviewees include four experts at the California Air Resource Board (CARB), two policy officers at Directorate-General for Climate Action of European commission, two managing consultants at ECOFYS and two consultants at the Center for Clean Air Policy (CCAP), two policy officers at DRC of China's Hubei Province, two managing experts at Hubei Emission Exchange, two researchers at Tsinghua University in Beijing, one policy officer at DRC and two managing experts at Environment and Energy Exchange in Shanghai, one policy officer at DRC and one researcher at Guangzhou Energy Strategy Research Center in Guangdong, one researcher and one managing expert at Tianjin Emission Exchange, one managing expert at Shenzhen Emission Exchange, and one managing expert at Chongqing United Assets and Equity Exchange Group. The interview for CARB experts was conducted when the authors visited CARB, and the interviews for EU, ECOFYS and CCAP experts were conducted during their visit in Beijing and Hubei. For the expert interview of China's carbon trading pilots, it was conducted when the experts visited Hubei or authors visited the pilot.

3. Comparative analysis of allowance allocation between EU ETS, CA CAT and China's pilots

3.1. Comparative analysis of emission caps and composition of allowances

3.1.1. The emission caps and composition of allowances in EU ETS and CA CAT

The EU ETS has decreasing total emissions caps over its three phases. From the first (2005–2007) phase to the second (2008–2012), the total cap declines from 2181 million allowances to

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