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The evolution of China's emission trading mechanisms: From international offset market to domestic Emission Trading Scheme

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Abstract

With the decline of the international market under the Clean Development Mechanism, China is establishing a national Emission Trading Scheme by setting up emission cap and trade rules for high emission industries in seven pilot areas. The shift from the international to domestic market and from an offset program to a true cap and trade mechanism requires several significant changes. This paper reviews the development and evolution of China's carbon trading market policy instruments. We find that there are substantial changes in both structure and policy. First, Emission Trading Scheme is a broad cap-and-trade mechanism with many new stakeholders added to those already involved in China's Clean Development Mechanism. Second, the administrative structure is decentralized compared to that of the Clean Development Mechanism. Third, while the Emission Trading Scheme is best thought of as a new policy, China's experience with the Clean Development Mechanism influences that policy. A large number of Clean Development Mechanism projects are being converted into offsets for the national Emission Trading Scheme market, and many institutional stakeholders that emerged during the Clean Development Mechanism are now involved in the Emission Trading Scheme. The combination of new policies and stakeholders, a decentralization of structure and the conversion of Clean

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Development Mechanism projects raise questions regarding the integrity of the cap and the enforcement of compliance as the Emission Trading Scheme is expanded into a nationwide system.

Keywords
China, carbon emission policy, Clean Development Mechanism, Emission Trading Scheme, cap and trade

Introduction

China, as the largest developing nation in the world, has experienced thirty years of rapid economic growth. The total energy consumption of the country has increased tremendously. Consequently, China has become the largest greenhouse gas emitter by far with 30% of the world's total greenhouse gas emissions in 2014, twice as large as the second-largest country, the United States (PBL Netherlands Environmental Assessment Agency, 2015: 4). At the 2015 21st Conference of Parties (COP21[1]) in Paris, the Chinese government declared its first binding target for emission reduction peaking GHG emissions by 2030 or earlier and reducing carbon emissions per unit of GDP by 60–65% below 2005 levels by 2030 (Gov.cn, 2015). Part of the target may be accomplished as a consequence of an overall slowing of economic development since 2014, which President Xi Jinping has called the "new normal for economic growth" (Xinhua News, 2014). Fulfilling the overall emission target, however, will require that the central and local governments develop and deploy powerful and effective policy instruments. As a result, the Chinese government is establishing a national Emission Trading Scheme (ETS), starting with ETS pilots in seven locations. A full cap and trade ETS is a new policy tool for China, but it is not China's first attempt at an emission trading mechanism. China has participated in the Kyoto Protocol's Clean Development Mechanism (CDM) for more than ten years, acting as the biggest host country and establishing a substantial domestic infrastructure for administering the CDM.

Since 2012, there has been a significant decline in the CDM market as the first commitment period of the Kyoto Protocol came to an end. While Chinese stakeholders continue to register some new CDM projects, the international market for emission reduction offsets produced in China is clearly in decline. China is now evolving away from the CDM and toward the domestic ETS. As a result, all stakeholders, including governmental line agencies with emission reduction responsibilities and high-energy consumption industries are facing substantial changes in three areas. First, there is a shift in the policy itself, most importantly in the establishment of China's first caps on emissions. Second, there is a substantial change in the administrative structure of the carbon market, with an apparent decentralization of several administrative functions from the central government to local governments. Finally, existing CDM projects are being absorbed into the ETS through an ancillary offset market known as Chinese Certified Emission Reduction (CCER) projects. The aim of this paper is to analyze changes as China shifts from participation in the international CDM to its own domestic system in order to assess the potential significance of these changes for implementation, effectiveness and future study.

We find that, while the ETS is a significant departure from emission trading as undertaken during the CDM, the lessons and experience of the CDM raise important concerns. The transition to a hard cap on emissions is a significant step for China, even as the actual practice of determination and allocation of allowances remains underspecified. The

experience of the CDM is most clearly seen in the CCER offset program which, for now, relies on stakeholders, modalities and even specific projects established under the CDM. The greatest outstanding question is in the implementation and impact of a more decentralized approach than China had under the CDM. Shifting the locus of authority somewhat from the National Development Reform Commission (NDRC) to Local Development Reform Commission (LDRC) could lower transaction costs and increase enforcement capacity, but it could also enable local governments to prioritize goals other than emission reduction.

We begin with a brief review of the literature on carbon ETSs in China. We then describe the development of emissions trading in the Chinese policy context with particular attention to China's experience under the CDM and the development of the ETS pilot areas. In the subsequent three sections, we investigate the significant changes in policy, administrative structure, and the offset market involved in the shift from CDM to ETS. We conclude with a discussion of potential concerns and areas for future study as the ETS is expanded to all of China.

Research on Emission Trading Schemes in China

A substantial amount of research has been carried out on emission trading in China. This literature has focused on either the CDM or the ETS, but not the transition from one system to the other. Much of the research on the CDM has focused on CDM projects as a framework for technology transfer to promote renewable energy (Dechezleprêtre et al., 2009; Schroeder, 2009; Wang and Chen, 2010), or on the impact of specific projects on carbon intensity (Zhang and Wang, 2011; Zhang et al., 2005). A few scholars have described the institutional structures and stakeholders involved in the Chinese CDM system (Bayer et al., 2013; Maraseni, 2013; Maraseni and Gao, 2011). The most important research for the present study has critically assessed the track record of the CDM in China, in the aggregate or in specific sectors (Bayer et al., 2016; Haya, 2007; Thiers, 2015).

Unsurprisingly, given its recent inception, scholarship on the Chinese ETS has concentrated primarily on description of the policy design itself both at the national level and within the pilot areas. The ETS pilots simply do not have the track record to allow for the kinds of assessment that have begun to be done on the CDM. Several scholars have described the construction and ETS markets in specific pilot areas (Jiang et al., 2014; Qi et al., 2014; Wu et al., 2014); others have focused on the mechanisms for allowance allocation in one or more pilot area (Li et al., 2015; Shi et al., 2014; Yu et al., 2014); increasingly, scholars are focused on the future, including the important topic of transitioning from the ETS pilots to the full nationwide system (Liu et al., 2015; Zhang, 2015; Zhang et al., 2014).

No scholarship has looked to China's multi-year experience with the CDM for indications of possible strengths and challenges as China develops a nationwide ETS. Similarly, the impacts of the existing CDM infrastructure on the ETS have not been considered. This study recognizes that China's more than ten years of extensive participation in the CDM has created institutional arrangements, processes, stakeholders and even specific projects that can be expected to hold lessons for, and have an impact on, China's ETS.

Emission trading policy instruments applied in China

The policy framework for China's emissions trading

Since signing the Kyoto Protocol in 1998, China began to establish a policy framework for regulating emission trading to reduce greenhouse gas emissions. This evolving process can be divided into two stages: first, from 2004 to 2012 China's participated in the international

carbon trade under the CDM; second, since 2013 China started to develop a domestic carbon market through the ETS, at the same time, CDM projects continue to exist and the experience of the CDM is still significant. So, the two systems are best seen as overlapping in this transition period.

The CDM came into operation as one of the Flexible Mechanisms defined in the Kyoto Protocol under the United Nations Framework Convention on Climate Change (UNFCCC). Under the CDM, developed countries that had made emission-reduction or emission-limitation commitments within the Kyoto Protocol were allowed to purchase Certified Emission Reduction (CER) credits from validated emission-reduction projects in developing countries. Accordingly, the Chinese government established Measures for Administration of CDM Projects in China to produce CERs for sale to the international market. The NDRC was the Chinese government institution with authority to regulate and administer the CDM in China (NDRC, 2005). A substantial, domestic institutional framework was established to administer the CDM, including domestic evaluation and registration procedures. This domestic framework was primarily coordinated by NRDC but included participation by other agencies such as the Ministry of Science and Technology as well as provincial and local governments.

By contrast, the Chinese ETS is a specific policy initiative intended to reduce China's domestic emissions. The origins of China's own ETS are found in the Twelfth Five-Year Plan (State Council of the People's Republic of China, 2011), which established an emission intensity reduction target, a milestone in China's policy evolution toward capping and reducing emissions (Cao and Karplus, 2014). The Twelfth Five-Year Plan specifically declared that China will gradually establish a carbon trading market and proposed steps for establishing ETS pilots. Flowing directly from the Twelfth Five-Year Plan, seven ETS pilots were established following guidelines stipulated in the Notice on Launching Pilots for Emissions Trading Scheme enacted by NDRC (NDRC, 2011). In subsequent documents, NDRC announced that it would set up a national ETS market by 2017, based on the results of the seven pilots, to cover eight industries including petrochemical, chemical engineering, building, iron and steel, nonferrous metal, papermaking, electric power and air transportation (NDRC, 2016a).

The development of China's first emission trading mechanism under the CDM

The CDM was an important step for China's participation in the international emissions trading market and for the development of carbon pricing mechanisms in China. It provided the Chinese government with experience in carbon markets as a flexible mechanism to promote emission reduction. Many Chinese stakeholders were able to gain experience in project design, monitoring and verification. For implementation of CDM projects in China, NDRC established a CDM center which is responsible for the management and research of Chinese CDM projects as well as an evaluation and registration process independent from the UNFCCC process. This formed a domestic CDM framework allowing projects to register and been announced domestically prior to the international trade process.

According to the latest data from NDRC, as of August 2016, 5074 Chinese CDM projects had been approved by NDRC (2017). By April 2017, 3763 Chinese projects were registered with the CDM Executive Board (EB) of the UN, 1547 of these Chinese CDM projects had been issued, or were pending issuance of CERs by the EB. By this time, the total CERs issued from registered Chinese CDM projects had reached about 1.04 billion tons of CERs, about 57 percent of the worldwide total (UNFCCC, 2017a).

However, the success of the CDM in China was short lived. The first commitment period of the Kyoto Protocol expired on December 2012, making it unclear whether there would be

an enduring international demand for CERs (Stephan and Paterson, 2012). This created uncertainty for the future of the CDM program. As a result, there was a significant decline in both registered projects and issued CERs. In addition to the drop in demand, there was an oversupply of CERs in countries such as China, which, having not made commitments of their own to the Kyoto Protocol, had no incentive to use CERs themselves. In essence, the CDM removed the "cap" from the Kyoto Protocol's carbon trading system, eroding the value of CERs.

China, as the biggest host country of CDM projects, was severely impacted by these adverse conditions in the CDM market. Both the amount of registered CDM projects and the price for CERs has dropped rapidly since 2013. From January 2013 to April 2017, only 81 new Chinese CDM projects were registered, a sharp decline compared with 634 and 1819 projects in 2011 and 2012, respectively. The number of CERs issued from Chinese CDM projects also fell from about 225 Mt CERs in 2012 to about 62 Mt in 2016 (UNFCCC, 2017a).

In addition to the instability of the international CDM system, there is evidence that the CDM in China has come up against its own internal contradictions. The most significant of these is high transaction costs. The registration, verification and monitoring processes in the Chinese CDM are extremely time-consuming and costly. Some project managers report that they abandoned the CDM process because these costs were eroding the potential profitability of participating in emission trading (Thiers, 2015). A second major problem has been uncertainty around additionality. Additionality in an offset market mechanism refers to the assurance that emission reduction would not have taken place without the payments provided by offset buyers. About 70% of all CDM registered hydropower projects are in China. Haya (2007) found that the majority of the Chinese hydropower projects are planned and financed, and in some cases well under construction, before being registered with the CDM, raising serious concerns over additionality.

The problems encountered in China's development and operation of the CDM have important implications for China's ETS. Unstable and declining carbon prices encountered in the CDM highlight the importance of the firm cap on allowances. The high transaction costs of registration, verification and monitoring are as likely to plague the ETS unless a more efficient system can be implemented. While additionality is not theoretically a problem in a true cap and trade system, the incorporation of an offset market into the ETS (through the CCER project) means that additionality could be a continued concern, particularly if the option to use CCER's is expanded in the nationwide system.

Development of China's ETS pilots

With the decline of CDM projects, China started to transfer its attention into the domestic emission trading market. The Chinese government has initiated seven pilot projects as the first step in establishing the domestic ETS market. From 2013 to 2014, pilots were launched in the cities of Beijing, Shanghai, Tianjin, Chongqing, Shenzhen as well as the provinces of Hubei and Guangdong. The Chinese ETS is designed as a cap and trade mechanism. In the pilot period, more than 2000 entities are covered by caps on emissions (Zheng, 2014).

Covered sectors and enterprises. In the Chinese ETS pilots, local governments have specified the targeted industries according to their economic structures and emission reduction goals. Each location selects specific sectors to participate in the ETS market covering 30–60% of its total emissions (Zhang et al., 2014: 12). Several high energy-consuming industries, such as the electric power industry and chemical industry, are covered by all the pilots. But the

coverage of entities in the seven pilot areas differs according to their regional industrial structure. In industrial oriented provinces and cities, such as Guangdong, Hubei and Tianjin, the ETS is mostly concentrated in industrial enterprises. However, in Beijing and Shenzhen, where tertiary industry contributes a considerable percentage of total GDP, many government and service sector entities are covered (Table 1).

Table 1. Policy design and coverage in ETS pilots (2014–2015 compliance period).

Pilot area	Covered industries	Threshold for covered entities (annual)	Allowance amount (Mt)	Offset restriction
Beijing	Energy sector, industrial sector, commercial enterprises, public service sector	CO_2 emission >10,000 t	Approx. 50 Mt	CCERs should be less than 5% of the initial allocated allowances; 50% of CCERs should be from local projects
Shanghai	Energy sector, industrial sector, commercial enterprises, public service sector	CO_2 emission in industrial sector > 20,000 t; CO_2 emission in non-industrial sector >10,000 t	Approx. 160 Mt	CCERs should be less than 5% of the initial allocated allowances
Tianjin	Energy sector, industrial sector	CO_2 emission >20,000 t	Approx. 160 Mt	CCERs should be less than10% of annual emissions
Guangdong	Energy sector, industrial sector, commercial enterprises, public service sector	CO_2 emission in industrial sector > 10,000 t; energy consumption in services sector >5,000 tce	408 Mt	CCERs should be less than 10% of annual emissions; 70% CCERs should be from local projects
Shenzhen	Energy sector, industrial sector, manufacturing industry	CO_2 emission >3000 t; government building >10,000 m^2	Approx. 33 Mt	CCERs should be less than 10% of annual emissions
Hubei	Energy sector, industrial sector	Energy consumption >60,000 tce	324 Mt	CCERs should be less than 10% of annual emissions; CCERs may come from several cooperating regions
Chongqing	Energy sector, industrial sector	CO_2 emission > 20,000 t; energy consumption >10,000 tce	126 Mt	CCERs should be less than 8% of annual emissions

Source: Data in the table are compiled from the People's Government of Beijing Municipality (2014), People's Government of Chongqing Municipality (2014), People's Government of Hubei Province (2014), People's Government of Shanghai Municipality (2013), People's Government of Shenzhen Municipality (2014), People's Government of Tianjin Municipality (2013), People's Government of Guangdong Province (2013) in seven pilots; Tanjiaoyi.com (2014), Qi et al. (2014) and Zheng (2014).

tce: ton of standard coal equivalent; ETS: Emission Trading Scheme; CCER: Chinese Certified Emission Reduction.

Allowance allocation. Allowance allocation plays a significant role in an ETS market. First, specific allocation determines the emission reduction requirements of individual covered entities. Second, the total allocation determines the size of the total cap on supply and likely price of permits.

According to the Interim Measures for the Management of Carbon Emission Trading (NDRC, 2014), NDRC is the administrative department in charge of determining a national uniform allowance allocation strategy and the total volume of allowances in the seven pilots. NDRC is to do so with consideration of national and local emission reduction targets as well as the economic development, industrial structure, energy structure and covered entities within each pilot area. The LDRCs are in charge of allocating the specific volume of free allowances for the covered entities. LDRCs have the power to allocate allowances more strictly and to reserve a limited amount ($\leq$5%) of the total allowances for sale by auction or other method.

Initial allocation is carried out for a one-year compliance period. Most of the pilots conduct initial allocation for free using a combination of Grandfathering[2] and Benchmarking[3] with auction activities taking place only after the initial allocation (Shi et al., 2014: 58–59).

There is some lack of clarity about the definition of the cap within China's ETS market. All areas have carbon intensity targets allocated from the central government based on national emission control targets, but these do not appear to be binding. Jotzo and Löschel (2014: 6) describe the caps as structured by a "bottom up" process in which local governments consider several factors including local development plans and sectoral growth rates. The total number of allowances issued in this way add up to the cap for a given sector. Whatever the formal process, it appears that there is at least a degree of negotiation between government stakeholders. As a result, the total cap for a given pilot area is probably best defined by summing up the allowances issued for each sector (Table 1).

Offset mechanism. As a supplement to the allowances, an offset market has been set up to provide the covered entities with CCERs. Both entities and individuals are able to develop CCER projects. By July 2016, 254 CCER projects had been issued with credits (NDRC, 2016b).

Offset mechanisms have the potential to negatively impact cap and trade schemes if they are available in sufficient supply to depress the demand for allowances. This concern is salient in China where an offset delivery infrastructure and a substantial supply of potential offset credits was built up under the CDM. To avoid a decline in the price of allowances, every pilot has set restrictions for the use of offsets. In all pilot areas, the use of offsets by each covered entity is restricted from 5% to 10% of allowances or actual emissions in that year. Moreover, while some pilot areas allow CCER projects from anywhere in the nation to be used, others require that CCERs come from local or regional projects (Table 1).

While the data on the use of offsets within the pilots are still limited, there is evidence that offsets may play a larger role than anticipated with an impact on carbon price. In Beijing, for example, CCERs were restricted in the initial design to constitute no more than 5% of total allowances used by a specific entity. In 2016, the total allowances in the Beijing pilots were about 50 million tons while CCER trading reportedly totaled 8.27 million tons which is far more than 5% of total allowances. Because the 5% limit applies at the individual covered entity and these data are in the aggregate, no firm conclusion should be drawn at this point. But comparing the price between CCER trading and allowance trading: the average price for allowances traded in the Beijing pilot in 2016 was RMB 37.3 per ton while the average price for CCERs was RMB 7.3 per ton (CBEEX, 2017). It appears that at least in the case of

Beijing, abundant and cheap offset credits are playing a larger role in the market than intended. The volume and price of offset credits implies that the design and implementation of China's offset mechanism needs to be improved to ensure that the ETS fully incentivizes individual emission reduction.

Summarizing the differences between CDM and China's ETS

To summarize, China's CDM mechanism and China's ETS scheme differ significantly in concept, design and the stakeholders involved (Table 2). The CDM was entirely conceptualized as an offset scheme while the ETS is primarily a cap and trade scheme with a secondary offset component. While the NDRC was heavily involved in establishing the rules and institutions needed to administer the CDM within China, the CDM's overall design and administrative expectations were developed by the UNFCCC as part of the Kyoto Protocol. The ETS, by contrast, is an entirely new mechanism designed by NDRC without any international influence. Finally, while many of the domestic stakeholders involved in the CDM will seek to play rolls in the ETS, many additional stakeholders will be part of the ETS. In the section below, we explore these differences as well the potential influence of China's CDM in areas such as administrative structures and stakeholders.

The evolution from CDM to Chinese ETS

Changes in pricing mechanisms

There was no equivalent to the ETS in the CDM as China had made no carbon reduction commitments under the Kyoto Protocol. The demand for CERs was entirely in the hands of

Table 2. Comparison between CDM mechanism and Chinese ETS.

System characteristics	CDM	Chinese ETS
Implementation period	2004–2012	Pilots initiated in 2013 Nationwide to begin 2017
Market location	International market	China's domestic market
Trading parties	Developed countries with emission reduction commitments under Kyoto Protocol and developing countries with no commitments	Covered Chinese entities with emission threshold under Chinese ETS and uncovered entities with CCER projects
Emission trading mechanism	Offset mechanism	Cap and trade; offset mechanism
Trading platform	CDM Executive Board in the United Nations	LDRCs; environmental exchanges in Chinese ETS pilots
Seller	Chinese firms and entities	Chinese firms and entities
Buyer	Foreign firms	Chinese firms
Traded items	CERs	Allowances; CCERs
Policy designer	UNFCCC; domestic rules and infrastructure established by China's NDRC	China's NDRC
Administrative authority	UNFCCC; NDRC; LDRCs	China's NDRC; pilot area government; LDRCs

Source: UNFCCC (2017b), NDRC (2005) and NDRC (2014).
CDM: Clean Development Mechanism; ETS: Emission Trading Scheme.

the European Union and other developed countries that had made such commitments. As a seller into the CDM market, China itself lacked pricing power within the trading mechanism. As a result, the Chinese CDM projects produced CERs for sale into a chronically oversupplied market.

In moving from CDM to ETS market, China is experiencing a change to its first true cap-and-trade system, which will provide the first example of emission pricing set by a functional trading mechanism. The Chinese government sets a limit on emissions through allowance allocation and enforcement. Because of the scarcity of allowances, the ETS itself will determine the price of emissions.

According to data from the China Carbon Trading Platform, where the latest policy and transaction information is published, from July 2013 to May 2017, the price for allowances in seven pilots fluctuated from RMB 1.2 per ton to RMB 99.8 per ton. The price differed significantly between different pilots, but all of the pilots saw an increase in allowance price by the end of the compliance period (Tanjiaoyi.com, 2017).

From voluntary participation to mandatory participation

Chinese entities participated in CDM projects voluntarily. The Chinese ETS market is dominated by mandatory participation by covered industries. At the pilot stage, obtaining allowances is mandatory for the covered entities in the seven pilots. Each pilot area government has established rules to punish noncompliant entities, such as financial penalties, reduction of allowances for next year, etc. In Shenzhen for example, non-compliant enterprises will be required to pay the equivalent value of three times their emissions reduction shortfall at the average allowance price in the last six months. Allowances equivalent to the reduction shortfall will also be deducted during the allowance allocation in the following year (Tanpaifang.com, 2014).

This is a dramatic change in regulation and implementation from the voluntary CDM market. As a policy instrument therefore, the ETS raises the stakes for both regulators and participants. If allocation is too strict, it could negatively impact local economies or even reduce compliance. On the other hand, over allocation of allowances or weak penalties will reduce participants' incentives to reduce emissions.

Changes in stakeholders

The transition from CDM to ETS has expanded the number and diversity of stakeholders involved including more governmental departments and economic entities. First, high emission entities are required to participate in the Chinese ETS market in the seven pilot areas, including state-owned enterprises, private companies, foreign invested enterprises and even some entities in the service sector. For most covered entities, this is the first time they have participated in carbon trading. It has been noted that this change has the potential to initiate a restructuring of the entire industrial sector with an eventual shift from power-hungry manufacturing industries to more service oriented businesses (Liu et al., 2015). At a minimum, carbon trading will incentivize innovation and efficiency improvements among these new stakeholders motivated by financial incentive to save energy and increase their competitiveness.

Second, local governments will now be primary stakeholders in the new carbon market system. In every ETS pilot, both allowance allocation and transaction activities are being undertaken by the LDRC. While this department is subordinate of the NDRC, it is also embedded within local governments.

Third, to provide a platform for emission trading activities, exchanges have been established in the pilot areas. These exchanges are established with the approval of local governments. In most of the ETS pilots, in addition to transactions, these exchanges also play an important role in designing CCER methodologies as well as developing new CCER projects. For example, within the China Beijing Environment Exchange (CBEEX) there is a department called the Low Carbon Transition Service Centre, which is responsible for organizing and developing CCER projects. In this center, some new CCER methodologies have been approved for CCER projects. These methodologies are based on methodologies originally developed for the CDM. In fact, some of these exchanges, or their staff, used to be participants in CDM projects (CBEEX, 2016).

A final set of stakeholders is emerging in the Chinese ETS to promote the development of a domestic monitoring, reporting and verifying (MRV) system. Under the CDM system, the emission reductions of CDM projects were certified by foreign Designated Operational Entity (DOE). In the ETS, a domestic MRV system is being set up for monitoring and verifying the emission reductions of covered entities and providing emission reports to local governments in the pilot areas. Independent MRV institutions, designated by the local governments, are responsible for the examination of enterprises' emission reports, on-site verification and the preparation of verification reports. Most of the domestic MRV institutions are governmental institutions as well as private enterprises. Each pilot has established its own criteria for approval of a MRV institution including work experience in carbon verification, the number of professional staff, etc. In addition, the MRV institutions also play a role in verifying CCER projects (NDRC, 2016c).

Changes in administrative structure

Decentralization of administrative power

The shift from the CDM to the Chinese ETS system includes a significant change in government administrative structure. The structure of the CDM market (Figure 1) was administered by the central government of China. All CDM projects had to be approved through a domestic evaluation process by NDRC before they could register with the CDM EB. The related local government departments only participated in project coordinating and monitoring with limited administrative power.

However, the ETS system (Figure 2) represents a partial decentralization of authority. Executive power within the ETS is partly in the hands of the local governments in the seven pilot areas. NDRC and LDRCs work as national and local administrators. While NDRC is in charge of designating the covered sectors and determining the allowance amounts for the seven pilots, the LDRCs are given the power to expand the coverage and to adopt detailed allocation strategies within the pilot area. Moreover, the LDRC is permitted to reserve a small amount of allowances for later sale by auction to covered entities. The revenue from this allocation is used to promote local emission reduction activities (NDRC, 2014). The LDRC is also the chief administrative unit in MRV activities, receiving both the emission reports submitted by covered entities and the emission verification reports provided by the independent MRV institutions.

Besides the LDRC, some other local governmental departments are also included in the administrative structure, such as the local department of statistics, finance, transportation, etc., coordinating with the LDRC to manage and supervise the ETS (Figure 2).

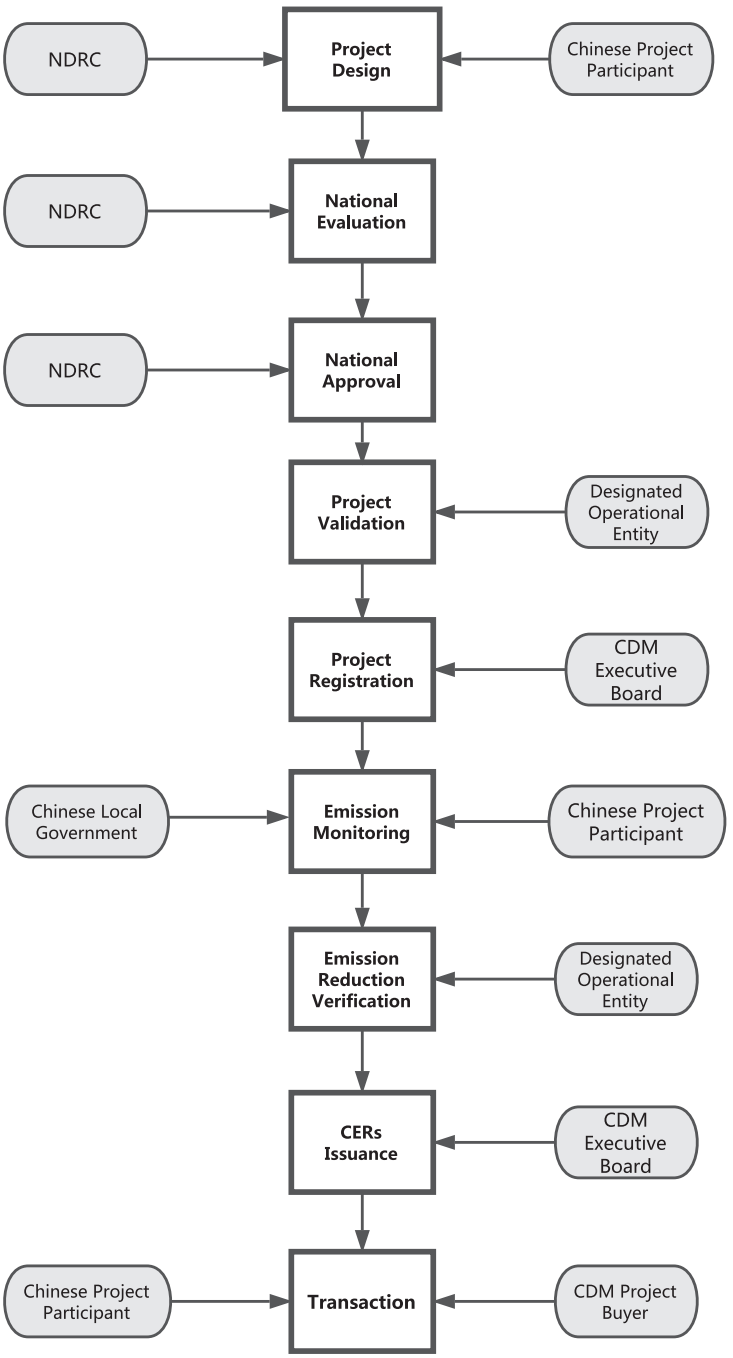

Figure 1. CDM project and stakeholder structure.
Source: Modified from NDRC (2005) and UNFCCC (2017b).
CDM: Clean Development Mechanism.

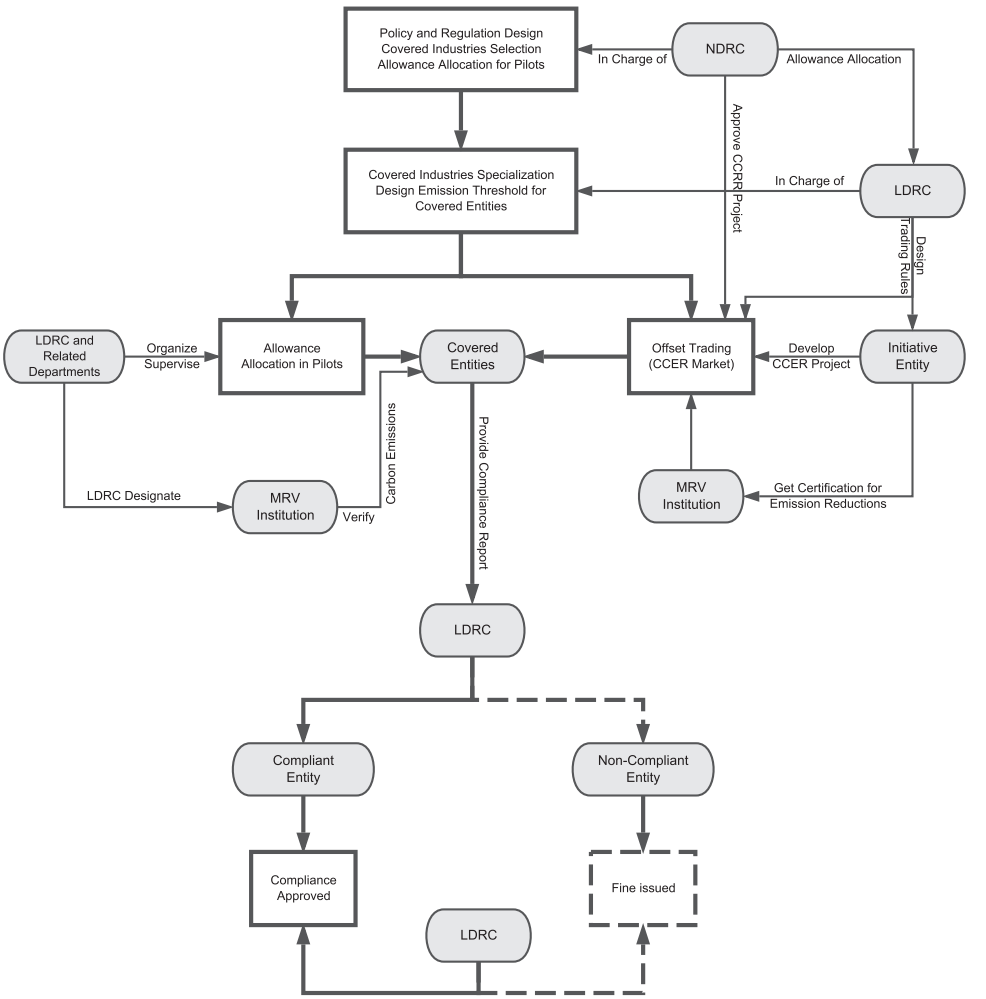

Figure 2. Trading mechanism of China's ETS market and stakeholder structure.
Source: Modified from NDRC (2014).
ETS: Emission Trading Scheme.

Potential risks of decentralization of administrative power

The decentralization of administrative power started at the beginning of the ETS pilots in order to explore a more flexible emission reduction market. However, the localized administrative structure also brings risks and shows some potential barriers for setting up the national ETS market. First, the industrial sector accounts for most of the entities covered by the ETS. Because the primary goal of local governments is still to promote local economic development, local administrators may be inclined to be more generous in the allocation of allowances, which would lead, over time, to a suboptimal allowance price and a lack of incentive to reduce emissions from the industrial sector.

Second, the decentralization of administrative power may lead to difficulties in setting up the national ETS market. If emission caps, allowance allocation practices, trading prices, and verification standards all differ by region, it could lead to unbalanced

development and collective action problems as local governments seek to keep local enterprises competitive.

As the expansion of the ETS nationwide approaches, there is increasing debate about regulation and policy. This has concentrated primarily on whether allowances should be allocated by the central government based on uniform standards or if local governments should be authorized to adjust allowance allocation (Chen et al., 2015; Duan and Pang, 2014; Xu, 2012). Although the full allowance allocation strategy for the national ETS is still undeclared, it has been announced by NDRC that the central government and local governments will cooperate to administer the national ETS market: the central government is in charge of designing regulations and standards for the whole market and the local governments are responsible for allocation of allowances and monitoring (Tanpaifang.com, 2016). It seems clear that the decentralization of administrative power will remain in the national ETS market.

This compromise, which recognizes but does not resolve conflicts of interest between the central and local government, is familiar to China scholars. The *fragmented authoritarianism* of the Chinese bureaucracy has long been cited as a major cause of regulatory conflict and implementation deficit since it was first documented by Lieberthal and Lampton (1992). The implications of fragmented authoritarianism for the ETS in areas such as allowance allocation and compliance validation will be considered more systematically in the discussion section.

The evolution of China's voluntary emission reduction and offset market

China's CDM projects and CCER projects are both developing as offset mechanisms in order to provide a flexibility mechanism for compliance with the emission trading system. The differences between the CDM and the CCER within the ETS have been summarized in Table 2. However, during the ETS pilot period, CDM projects and CCER projects are not developing independently. Instead, they are overlapping, with many CDM projects becoming CCER projects. In this section, we will consider the implications of these direct linkages between the two systems.

Links between CDM projects and CCER projects in China's ETS

On a design level, the development of CCER projects is built on the experience of CDM projects, especially in regards to methodology and the framework for project development. On a more practical level, the ETS market provides a transaction platform for Chinese CDM projects in the post-Kyoto period. In the ETS, three kinds of CDM projects are allowed to be transformed into CCER projects: (1) CDM projects approved by NDRC without registration with the United Nations CDM EB; (2) CDM projects approved by NDRC, which had achieved verified emission reductions before registering with the CDM EB; and (3) CDM registered projects without issue from the EB (NDRC, 2012). Effectively this means that as long as emission reductions have not yet been sold to the international market, they may be transformed into CCERs. Exploiting this opportunity, a number of CDM affiliated enterprises have targeted the ETS offset market where there is a larger potential for profit. These converted CDM projects have a distinct comparative advantage over CCER projects starting from scratch, because the CDM projects have already finished the project design stage. Some of them have even already achieved verified emission reductions. As a result, CDM projects are still playing an important role in the ETS offset market

during the pilot period. According to data from NDRC, of the 254 CCER projects registered by NDRC with certified CCERs as of July 2016, about 120 of them were originally CDM projects (NDRC, 2016b).

The shift from CDM projects to CCER market

China's high level of participation in the CDM means that a large supply of carbon offset projects already exist in China that could provide flexibility in the ETS. However, it is not sustainable for the ETS to depend on CDM projects for its offset market. The development of a robust offset market to supplement the Chinese ETS will require more diverse types of projects with a greater regional distribution. This process has already begun with some improvements over the CDM experience during the ETS pilot period.

There have been no regional restrictions on CDM projects. As a result, CDM projects are distributed unequally across various provinces. Because Chinese CDM projects have mostly taken place in the field of new energy and renewable energy, the projects have tended to concentrate in a few interior and northern provinces which have abundant energy resources, such as Yunnan, Sichuan and Inner Mongolia. For example, data from China CDM Platform show that 192 CDM projects were issued with CERs by the CDM EB in Inner Mongolia as of December 2016, 20 times the number of CDM projects in Beijing by that time (NDRC, 2016d). This is problematic because most ETS pilots have regional restriction rules stipulating that the majority of offsets may only be purchased from projects in or near the local ETS pilot area. This is intended to encourage local emission reduction projects even in enterprises not covered by the ETS. For example, in the Beijing and Guangdong offset markets, at least 50% and 70% respectively of emission reductions offset through CCERs are required to be purchased from local projects.

These rules on local sourcing under the ETS pilots are already leading to a shift in the location of voluntary emission reductions in China. CCER projects have started to converge on some pilot areas where CDM projects were not very common, such as the Hubei and Beijing pilot areas and Fujian province which is close to the Guangdong pilot (NDRC, 2016b, 2016e).

The types of projects undertaken through the CDM are poorly matched with the requirements for CCERs under the new ETS. There are a limited number of CDM projects with very large emission reduction potential and few with the sustainable development characteristics favored under the CCER rules. To encourage new CCER projects and achieve more immediate emission reduction effects, in some pilots, the CCER projects are required to be developed in specific fields. In Chongqing, for example, the CCER projects should be in the field of energy conservation, energy efficiency improvement, carbon sequestration, waste processing, etc., hydroelectric projects and other renewable energy projects which are common under the CDM may not be used in Chongqing's ETS market (Chongqing Development and Reform Commission, 2014).

In sum, although the CCER market has been established as an independent initiative offset market in China, it still depends on CDM projects. The geographical location and type of most CDM projects are not well suited to the goals and requirements of the CCER system, particularly because of the location and type requirements in each ETS pilot. There are two possible ways that this contradiction can be resolved as the ETS becomes a national system. If the locally sourced and project type offset rules are maintained, the shift away from CDM projects is likely to accelerate. However, if the national ETS allows CCERs to be sourced from anywhere in China, the offset market may revert to the distribution found under the CDM. It should be anticipated that local governments will want offset demand

generated by their local ETS to be used to support local renewable energy and efficiency projects of their own choosing. This will potentially put them in conflict with existing CDM stakeholders who will push to get their existing projects into the ETS.

Discussion and implications for future study

Although it is influenced by the CDM, the ETS is a significant departure from previous attempts at carbon pricing in China. However, allowances are allocated in practice, as long as they are finite in number, this will be China's first experience with a hard cap on emissions within a mandatory system. This will also be the first entirely domestic carbon market with the price of emission subject only to domestic policy and market forces. These are clearly substantial structural improvements over the CDM and, judging from the limited data available from the seven pilot areas, the ETS seems to be functioning as designed. The real test will come with time, following the expansion of the ETS to a nationwide system in 2017. Based on our analysis, we believe that several issues will be worth studying in the future.

First, under the ETS, carbon pricing activities will shift away from international actors, including those intensively involved in China such as the World Bank. New stakeholders are emerging with very different motivations and resources. Politically and economically powerful, high emissions industries now have a stake in the system for the first time. Sectors such as power generation and the chemical industries, some of which are still concentrated in state owned or quasi state owned enterprises, have political influence at the national level. Such stakeholders could ignore the CDM, but the ETS will be a real concern in their calculations. Local governments themselves will be more prominent stakeholders in the ETS as the trade-offs between carbon market enforcement and local economic development become sharper. One theoretical advantage of a market mechanism over command and control regulation should be the emergence of enterprises and localities with comparative advantage in emission reduction becoming advocates for a rigorous ETS. Future stakeholder analysis will reveal if this theoretical potential is realized in China's unusual political economy.

The change in administrative structures in the ETS raises important questions about the impact of decentralization and the role of the LDRCs in allocating allowances and monitoring compliance. The *Fragmented Authoritarianism* model, which has been used to explain implementation deficit in China's bureaucracy for several decades, highlights the conflicts of identity and interest that emerge when central government policy is implemented by local government offices that simultaneously represent both central and local interests (Lieberthal, 2003; Lieberthal and Lampton, 1992; Saich, 2001). Targets and quotas allocated from the center but administered by the local create collective action problems as each locality acts in its own self-interest by defecting from national policy. Over several decades, fragmented authoritarianism has been documented to undermine implementation of national environmental policy when it conflicts with local economic development goals (see, for example, Economy, 2010; Sinkule and Ortolano, 1995; Thiers, 2002). In the case of the Chinese ETS, the dual role played by the LDRC as both the local representative of the NDRC and as a branch of the local government with responsibilities for local economic development is a classic example of fragmented authoritarianism. Under these circumstances, we might anticipate, and should watch for, implementation deficit with regard to allowance allocation and emission verification.

On the more positive side, administrative decentralization has the potential to reduce transaction costs, a major problem under the CDM. If verification and monitoring can be

effectively carried out by local, independent MRV institutions with administrative oversight and enforcement by LDRCs, it should prove simpler and cheaper than the complex registration and validation system that evolved under the CDM in which projects had to pass review by both the NDRC in Beijing and the international CDM office within the United Nations. Capacity and independence in these local institutions across China will be key in the success of the ETS.

The influence of the CDM is most apparent in the offset portion of the ETS, and it is here that the Chinese government may face some challenging choices. Institutions, stakeholders and projects established during the CDM phase are understandably attracted to the market potential of the ETS. Many CCERs currently available on the pilot ETS offset market are converted CDM projects. It seems likely that the observed phenomenon of Chinese projects continuing to register under the CDM despite the collapse of the Kyoto system is actually because project managers are speculating that they will be able to convert to CCERs when the nationwide ETS is established. And institutional stakeholders, such as those involved in CDM validation are already becoming active in ETS monitoring and verification.

This reliance on CDM projects to initiate the ETS offset market is problematic. Most CDM projects are of the wrong type or in the wrong location to be used as offsets under the current ETS pilot rules. Limits on the proportion of emission reductions that can be covered by offsets will also constrain the ability to convert CDM projects. As the ETS is expanded across China, there may be pressure for rules changes to accommodate vested interests built up during the CDM phase. Because offsets create an inherent level of leakage in a cap and trade system, an expansion of the location, volume or types of acceptable offset projects to accommodate CDM stakeholders has the potential to erode the effectiveness of the Chinese ETS.

Conclusion

In this paper, we investigated the development of China's ETS. In particular, we focused on the shift from the internationally oriented policy and market of the CDM to the emerging domestic ETS policy and market as exemplified by the seven pilot areas. We find that China's emission trading is experiencing shifts in policy and stakeholders, administrative structure and the scope, distribution and role of the Chinese offset market. These shifts are significant as new stakeholders and incentives come into play. The lessons and experience of the CDM indicate areas of concern as the ETS is expanded into a nationwide system. The most important of these is the integrity of the cap on emissions. The decentralized structure and participation of additional stakeholders will create new pressures and opportunities for political and economic power to impact the volume and allocation of allowances as well as policy compliance and enforcement. The continued significance of the CDM may lead to pressure for a greater use of offsets, again threatening the integrity of the cap. Future study should focus on these concerns to assess the effectiveness of the nationwide ETS.

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Notes

1. COP21 is also known as the 2015 Paris Climate Conference. The annual Conference of Parties (COP) sets out a framework for action aimed at limiting atmospheric concentrations of greenhouse gases (SIF, 2015).
2. In the context of an ETS market, the "Grandfathering Method" is a method for the free allocation of emissions allowances based on historical emissions information. This term is also used in the European Union's ETS (European Commission, 2007).
3. In the context of the ETS market, the "Benchmarking Method" refers to the use of a common emission factor (or related factor, such as an energy efficiency factor) to determine emission allocations (European Commission, 2007).

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